October 2015
Online Print Version

International Journal of Scientific and Research Publications

Print Version, Volume 5, Issue 10
October 2015 Edition
ISSN 2250-3153

IJSRP
www.ijsrp.org

International Journal of Scientific and Research Publications

GENERAL INFORMAION:
IJSRP, International Journal of Scientific and Research Publications publish monthly journal under ISSN 2250-3153.

ONLINE VERSION
http://www.ijsrp.org/e-journal.html

ONLINE PRINT VERSION
http://www.ijsrp.org/print-journal.html

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Dominator Coloring Number of Some Graphs

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Abstract- Given a graph G, the dominator coloring problem seeks a proper coloring of G with the additional property that every vertex in the graph dominates an entire color class. In this paper, as an extension of Dominator coloring some standard results has been discussed and the solutions for some of the open problems in [2] are also found out.

Index Terms- Coloring, Crown graph, Domination, Dominator Coloring, Dutch Windmill graph, Middle Graph, Windmill graph.

I. INTRODUCTION

In graph theory, coloring and dominating are two important areas which have been extensively studied. The fundamental parameter in the theory of graph coloring is the chromatic number $\chi(G)$ of a graph G which is defined to be the minimum number of colors required to color the vertices of G in such a way that no two adjacent vertices receive the same color. If $\chi(G) = k$, we say that G is k-chromatic.

A dominating set S is a subset of the vertices in a graph such that every vertex in the graph either belongs to S or has a neighbor in S. The domination number is the order of a minimum dominating set. Given a graph G and an integer k, finding a dominating set of order k is NP-complete on arbitrary graphs. [5, 6]

Graph coloring is used as a model for a vast number of practical problems involving allocation of scarce resources (e.g., scheduling problems), and has played a key role in the development of graph theory and, more generally, discrete mathematics and combinatorial optimization. A graph has a dominator coloring if it has a proper coloring in which each vertex of the graph dominates every vertex of some color class.
The dominator chromatic number $\chi_d(G)$ is the minimum number of color classes in a dominator coloring of a graph G. A χ_d (G) -coloring of G is any dominator coloring with χ_d (G) colors. Our study of this problem is motivated by [3] and [4].

Terminologies

We start with notation and more formal definitions. Let G = (V(G), E(G)) be a graph with n = |V(G)| and m = |E(G)|. For any vertex v ∈V(G), the open neighborhood of v is the set N (v) = {u| uv ∈ E (G)} and the closed neighborhood is the set N[v] = N(v) ∪ v. Similarly, for any set S⊆V (G), N(S) = ∪ $_{v\in s}$ N (v) -S and N[S] = N(S) ∪ S. A set S is a dominating set if N[S] = V (G).The minimum cardinality of a dominating set of G is denoted by γ(G).

The distance, d(u ,v), between two vertices u and v in G is the smallest number of edges on a path between u and v in G. The eccentricity, $e(v)$, of a vertex v is the largest distance from v to any vertex of G. The radius $\mathrm{rad}(G)$ is the smallest eccentricity in G. The diameter $\mathrm{diam}(G)$ is the largest eccentricity in G.

A graph coloring is a mapping $f: V(G) \to C$, where C is a set of colors. A coloring f is proper if, for all $x, y \in V(G)$, $x \in N(y)$ implies $f(x) \neq f(y)$. A k-coloring of G is a coloring that uses at most k colors. The chromatic number of G is $\chi(G)$ = min {k | G has a proper k –coloring}. A coloring of G can also be thought of as a partition of V(G) into color classes $V_1, V_2, \ldots, V_q$, and a proper coloring of G is then a coloring in which each $V_i, 1 \leq i \leq q$ is an independent set of G, i.e., for each i, the subgraph of G induced by V_i contains no edges.

Dominator coloring was introduced in [7] and motivated in [3].

Definition

The Middle graph of G, denoted by $M(G)$ is defined as follows.The vertex set of $M(G)$ is $V(G) \cup E(G)$. Two vertices x, y in the vertex set of $M(G)$ are adjacent in $M(G)$ in case one of the following holds.
1. x, y are in $E(G)$ and x, y are adjacent in G.
2. x is in $V(G)$, y is in $E(G)$ and x, y are incident in G [8].

Definition

The windmill graph $w_n^{(m)}$ is the graph obtained by taking m copies of the Complete Graph k_n with a vertex in common.

Definition

The Dutch windmill graph $D_n^{(m)}$, also called a friendship graph, is the graph obtained by taking *m* copies of the Cycle Graph C_n with a vertex in common.

Definition

The crown graph S_n^0 for an integer $n \geq 3$ is the graph with Vertex Set $\{x_0, x_1, \ldots, x_{n-1}, y_0, y_1, \ldots, y_{n-1}\}$ and edge set $\{(x_i, y_j): 0 \leq i, j \leq n-1, i \neq j\}$. S_n^0 is therefore equivalent to the complete bipartite graph $K_{n,n}$ with horizontal edges removed.

Proposition

(1) The star $k_{1,n}$ has $\gamma_d(k_{1,n}) = 2$.

(2) The complete graph K_n has and $\gamma_d(K_n)$ = n.

(3) The path P_n of order $n \geq 3$ has

$$\chi_d(P_n) = \begin{cases} 1 + \left\lceil \frac{n}{3} \right\rceil & \text{if } n = 2,3,4,5,7 \\ 2 + \left\lceil \frac{n}{3} \right\rceil & \text{otherwise} \end{cases}$$

(4) The cycle C_n has

$$\chi_d(C_n) = \begin{cases} \left\lceil \frac{n}{3} \right\rceil & \text{if } n = 4 \\ \left\lceil \frac{n}{3} \right\rceil + 1 & \text{if } n = 5 \\ \left\lceil \frac{n}{3} \right\rceil + 2 & \text{otherwise} \end{cases}$$

(5) The multi-star $K_n(a_1, a_2, \ldots, a_n)$ has

$$\gamma_d(K_n(a_1, a_2, \ldots, a_n)) = n + 1$$

(6) The wheel $W_{1,n}$ has

$$\chi_d(W_{1,n}) = \begin{cases} 3 & \text{if } n \text{ is even} \\ 4 & \text{if } n \text{ is odd} \end{cases}.$$

(7) The complete k-partite graph $K_{a_1,a_2,\ldots,a_k}$ has $\gamma_d(K_{a_1,a_2,\ldots,a_k}) = k$

(8) The middle graph of cycle [1],G = $M(C_n)$ with $n > 3$ has

$$\chi_d(G) = \begin{cases} \chi(G) + \gamma(G) - 1 & \text{if } n \text{ is even} \\ \chi(G) + \gamma(G) - 2 & \text{if } n \text{ is odd} \end{cases}$$

(9) The middle graph of path[1], G= M(P_n) with $n > 2$ has $\gamma_d(G) = \chi(G) + \gamma(G) - 1$.

(10) Let G be a connected graph of order n. Then $\gamma_d(G) = n$ if and only if $G = K_n$, for n ∈ N.

Main Results

Theorem 3.1 Let G be any graph, then $\gamma_d(K_n \times G)$ = n if and only if G is K_1 or K_2.

Proof

Let $K_n \times G$ is a connected graph. Suppose G is K_1 or K_2.
We claim that, $\gamma_d(K_n \times G)$ = n
If G = K_1, then $K_n \times G$ is itself a K_n.

Therefore $\gamma_d(K_n \times G)$ = n. If $G = K_2$, let the vertex set of K_n be $\{v_1, v_2, \ldots, v_n\}$ and in $G = \{u_1, u_2\}$.

Then the vertex set in $K_n \times G$ will be $\{(v_1,u_1),(v_1,u_2),(v_2,u_1),(v_2,u_2),\ldots,(v_n,u_1),(v_n,u_2)\}$ and any two vertices (u,u') and (v,v') are adjacent in $K_n \times G$ if and only if either $u = v$ and u' is adjacent with v' in G, or $u' = v'$ and u is adjacent with v in K_n. Now the dominator color class partition is given by

$\{(v_1,u_1),(v_2,u_2)\},\{(v_2,u_1),(v_3,u_2)\},\{(v_3,u_1),(v_4,u_2)\},\ldots,$
$\{(v_n,u_1),(v_1,u_2)\}$, clearly each vertex in the color class dominates atleast one color class. Therefore $\gamma_d(K_n \times G)$ = n.

Now let $K_n \times G$ is a connected graph with $\gamma_d(K_n \times G)$ = n.
We claim that, G is K_1 or K_2.

On the contrary, let $G \neq K_1$ or K_2. Suppose the order of G is $m \neq 1,2$. Then $K_n \times G$ contains m copies of K_n such that $1K_n, 2K_n, 3K_n \ldots mK_n$ and some edges between iK_n, jK_n for $i,j = 1,2,3\ldots,m$ and $i \neq j$. Hence there will be mn vertices. Since the dominator coloring number is $\gamma_d(K_n \times G)$= n, then the mn vertices can be partitioned into n color classes in such a way that each vertex from each copies. Also by the definition of product graph, there exists atleast one vertex which will not dominate a color class. This contradicts the fact of dominator coloring number. Hence G will be K_1 or K_2

Theorem 3.2 Let G be any graph, then $\gamma_d(K_n[G])$ = $n\gamma_d$(G).
Proof

Let G be any graph. Then the composition of two graphs $K_n[G]$ is a graph such that, the vertex set of $K_n[G]$ is the Cartesian product $V(K_n) \times V(G)$ and any two vertices (u,v) and (x,y) are adjacent in $K_n[G]$ if and only if either u is adjacent with x in K_n or $u = x$ and v is adjacent with y in G.

Also by the definition of composition of graph $K_n[G]$ contains n copy of G with each vertex in one copy is adjacent to all other vertices in the remaining n-1 copies. Since K_n is complete. Then the minimal dominator color class partition of $K_n[G]$ contains n copies of the minimal dominator color class partition of G.

Suppose if the vertex in any two copies of G was in same dominator color class partition, then it contradicts the coloring property. Since each vertex in each copy is adjacent to all other vertex in all other copies. And also each vertex in color class partition dominates atleast one color class. Hence $\gamma_d(K_n[G])$ = $n\gamma_d$(G).

Cheracterization of graphs with Dominator Chromatic number equals Chromatic number

Lemma 4.1.1

Let G be a connected graph. Then $\max\{\chi(G),\gamma(G)\} \leq \gamma_d(G) \leq \chi(G) + \gamma(G)$.The bound is sharp.

Lemma 4.1.2

For any graph G, $\chi(G) \leq \gamma_d(G)$

Theorem 4.1 Let G be a $(n-2)$ regular graph with even n, then $\gamma_d(G) = \chi(G)$

Proof

By lemma 4.1.2, we have $\chi(G) \leq \gamma_d(G)$
Also $\gamma(G) = 2$, for $(n-2)$ regular graph and $\chi(G) > 2$.
Hence by lemma 4.1.1,

$\max\{\chi(G), \gamma(G)\} \leq \chi_d(G) \leq \chi(G) + \gamma(G)$.
That is, $\chi(G) \leq \chi_d(G) \leq \chi(G) + 2$.
Suppose $\chi_d(G) = \chi(G) + 2$ and $\chi_d(G) = \chi(G) + 1$,

we have more color class in the dominator coloring partition compared to the chromatic coloring. Also each vertex in G is non adjacent to only one vertex; hence each pair of vertex receives different colors. If there are n even vertices in G, then there will be $\frac{n}{2}$ color classes, each with two vertices.

And clearly each vertex dominates atleast one color class. Hence increase in the dominator coloring number than chromatic number will not have proper dominator coloring class.

So $\chi_d(G) = \chi(G)$.

Theorem 4.2 Let G be a graph with $\Delta(G) = n - 1$, then $\chi_d(G) = \chi(G)$.

Proof

By lemma 4.1.2, we have $\chi(G) \leq \chi_d(G)$. Also $\gamma(G) = 1$.
Hence by lemma 4.1.1,
$\max\{\chi(G), \gamma(G)\} \leq \chi_d(G) \leq \chi(G) + \gamma(G)$.
That is, $\chi(G) \leq \chi_d(G) \leq \chi(G) + 1$
Suppose $\chi_d(G) = \chi(G) + 1$,

We have more color class in the dominator coloring partition compared to the chromatic coloring. Also there exists a vertex in G is adjacent to all vertex; hence that vertex alone receives a color.

And clearly that color class is dominated by the all other color classes. Hence increase in the dominator coloring number than chromatic number will not have proper dominator coloring class. So $\chi_d(G) = \chi(G)$

Theorem 4.3 Let G_1 and G_2 be any two graphs, then $\chi_d(G_1 + G_2) = \chi(G_1 + G_2)$.

Proof

Let G_1 and G_2 be any two graphs. Then the sum of two graphs $G_1 + G_2$ has all the edges joining the vertices of G_1 to the vertices of G_2.
Also we know that, $\chi(G_1 + G_2) = \chi(G_1 + G_2)$.

And also each vertex in the color class of the G_1 chromatic coloring dominates the color class in the G_2 chromatic coloring. Hence the color class of the chromatic coloring is itself acts as the color class for the dominator coloring.
Therefore $\chi_d(G_1 + G_2) = \chi(G_1 + G_2)$.

Corollary 4.1.3

Let G be any graph, then $\chi_d(G + K_n) = \chi(G) + n$.

Proof

Since $\chi(G_1 + G_2) = \chi(G_1) + \chi(G_2)$,
we have $\chi(G + K_n) = \chi(G) + \chi(K_n)$.
Also we know that $\chi(K_n) = n$.
Hence $\chi(G + K_n) = \chi(G) + n$

By theorem 4.3, $\chi_d(G + K_n) = \chi(G + K_n) = \chi(G) + n$.

Theorem 4.4 Let $G = W_n^{(m)}$ be a windmill graph, then $\chi_d(G) = \chi(G)$.

Proof

Let $G = W_n^{(m)}$ be the Windmill graph. By the definition of Windmill graph, there exist m copies of K_n with a vertex x in common.

Hence, the vertex x alone posses a color class. Clearly, $\chi(G) = n$. And each vertex in the color class partition dominates the vertex .
Hence $\chi_d(G) = n$. Therefore, $\chi_d(G) = \chi(G)$

Corollary 4.1.4

If $G = D_n^{(m)}$ is a Dutch windmill graph with $n = 3$, then $\chi_d(G) = \chi(G)$.

Theorem 4.5 Let G be a crown graph, then $\chi_d(G) = \chi(G) + \gamma(G) = 4$.

Proof

Let G be the Crown graph. By the definition of Crown graph, it is clear that $\chi(G)$=2 and $\gamma(G) = 2$.

Let the vertex set in the crown graph be $\{x_0, x_1, \dots, x_{n-1}, y_0, y_1, \dots, y_{n-1}\}$.

Now the dominator color class partition is given by $\{\{x_i\}, \{y_i\}, \{x_0, x_1 \dots x_{i-1}, x_{i+1}, \dots x_{n-1}\}, \{y_0, y_1, \dots y_{i-1}, y_{i+1}, \dots y_{n-1}\}\}$
Clearly each vertex in the color class partition dominates atleast one color class.

Hence $\chi_d(G) = 4$.
Also, $\chi(G) + \gamma(G) = 4$. Therefore, $\chi_d(G) = \chi(G) + \gamma(G) = 4$.

REFERENCES

[1] T.Ramachandran, A.Naseer Ahmed, "Dominator Coloring Number of Middle Graph", IOSR Journal of Mathematics, Vol. 10, Iss. 6, Ver. IV, pp 38-40, December 2014.,

[2] Ralucca Michelle Gera, On Dominator Colorings in Graphs, Department Of Applied Mathematics, Naval Postgraduate School, Monterey, CA 93943, USA.

[3] E. Cockayne, S. Hedetniemi, and S. Hedetniemi, "Dominating partitions of Graphs", Unpublished manuscript.

[4] S. M. Hedetniemi, S. T. Hedetniemi, and A. A. McRae, Dominator Colorings of graphs, (2006). In preparation

[5] T. W. Haynes, S. T. Hedetniemi, and P. J. Slater, "Domination in Graphs: Advanced Topics", Marcel Dekker, New York, 1998.

[6] Marcel Dekker, "Fundamentals of Domination in Graphs", New York, 1998.

[7] R. Gera, S Horton, C. Rasmussen, "Dominator Colorings and Safe Clique Partitions", Congressus Numerantium , 2006.

[8] E. Sampathkumar and L. Pushpa Latha, "Strong, weak Domination and Domination Balance in a Graph", Discrete Math. 161 (1996) 235-242.

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Assessment of Selected Heavy Metals in Soil and *Cassia Occidentalis* in Rural Area of Jega Local Government, Kebbi State, Nigeria.

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***Abstract*-** The soil and *Cassia occidentalis* of selected rural area of Jega Local Government were collected, digested, and analysed for some heavy metals using flame atomic absorption spectrophotometer (AA6500). The rural areas were labeled as DNG, KMB, LNG and GND for Dunbegu, Kimba, Langido and Gindi respectively. The results showed no significance difference ($p>0.05$) between the soil samples with respect to Cr, Cd and Pb and high significance difference ($p<0.05$) was observed in DNG with regards to Cu concentration. Similarly, no significance ($p>0.05$) difference was observed between plant samples in terms of Cr, Cd, and Co concentration. Cd and Co were not detected in GND and DNG respectively. Pearson correlation coefficient between plant and soil samples shows significant negative correlation between Cu and Cd at 1% and positive significant correlation between Co and Pb at 5%.

***Index Terms*-** Cassia occidentalis, Heavy metals, Jega, Soil

I. INTRODUCTION

Soil pollutant understanding and its dependence on soil's physico-chemical properties has provides a basis for careful soil management that limits as far as possible, the negative impact of the pollutant on the ecosystem [1].

Soil contaminated with heavy metals is poor in nutrients and contribute to sub-optimal plant biomass accumulation [2]. Soil, whether in urban or rural areas, represent a major sink for metals released into the environment from a variety of activities [3]. Heavy metals are persistent contaminants of soils, coastal waters and sediments [4].

Many sources of soil pollution have been identified to include; emission of fumes and dusts containing metals that are transported in the air and eventually deposited onto soils and vegetables, effluents (industrial, domestic, etc), agricultural fertilizers and pesticides, organic manure, atmospheric pollutant from motor vehicular exhaust, industrial machines etc [5].

It is believed that greater percentage of man and animal are exposed to Heavy metal through environment, [6]. Due to their non-biodegradability; they accumulate in living organisms, thus causing various diseases and disorders even in relatively lower concentrations [7].

Cadmium accumulates in the kidney of mammals and cause kidney dysfunctions [8]. The most severe form of cadmium toxicity in humans is called "Itai-Itai" a disease condition which causes pain in the bones [9]

Lead (Pd) is a relatively stable nevertheless, when released in the air, it stays airborne for a short period, then falls to the soil and enters the food chain [10]. It (Pb) can affect many biological systems, especially nervous system [11].

Chromium (Cr) is use in melts alloys and pigments for paints, paper, rubber, tanning and other materials. Low-level exposure can irritate the skin and cause ulceration. Long-term exposure can cause kidney and liver damage and damage to the circulatory and nerve tissue. It often accumulates in aquatic life adding to the danger of eating fish that might had been exposed to highest levels of chromium [6]. It may also cause congestion and inflammation of organs [12].

Copper is an essential elements to human life but in high doses it can cause anemia, liver and kidney damages, stomach and intestinal irritation [8].

Zinc is also an essential element for the growth of much kind of organs in both plants and animals. Zinc and its compounds taken orally are relatively non-toxic, although its soluble salts in a very large doses can produced an acute gastroenteritis characterized by nausea, vomiting and diarrhea [13].

Air borne nickel pollution has been reported to cause of plants wilting and deterioration of livestock [14]. Too much nickel can be toxic. It has been reported to increased risk of respiratory infections, asthma and *sinusi* problems [15].

Nickel is an essential element for a person's health; excessive levels are considered poisonous and can cause significant health problems or even death. Cobalt dermatitis may occur but the condition is more likely from associated chrome or nickel [8].

Plants uptake of heavy metals depends on certain parameters such as; the concentration and chemical speciation of the metals in the soil solution, the movement of the metals from a bulk soil to the root by diffusion or convection, metals absorption by the root, metals translocation within the plants, pH, soil organic matter (SOM), cat ion exchange capacity (CEC) etc. [16].

II. MATERIALS AND METHODS

Materials

All the reagents used were of analytical grade (Analar) and all the glassware used, containers and tools were washed with liquid detergent first, rinsed with 20% (v/v) nitric acid and finally rinsed with deionised water. The containers and glassware were kept in an oven at 105 ^{0}C until needed. Deionised water was used throughout the work.

III. Description of the Study Area

Jega town is the head quarter of Jega local government of Kebbi state. The local government is located in the Sudan and Guinea savanna zone of the central part of the state. Jega was relatively bounded by Birnin Kebbi local government to the north, Kalgo local government to the west, Aliero local government to the east and Maiyama local government to the south.

Geographically, the areas are located within the latitude of 12^0C 11^I 24^{II} N and longitudes 40^0 23^I 50^{II} E with inhabitants that are predominantly Hausa, Gimbanawa and Fulanis. Their major occupations of the inhabitants are farming (Crop production and Animal rearing), blacksmithing, trading and other modern activities like welding, carpentering, automobile repairing with very small percentage as civil servants [17].

IV. Sampling and Sample Treatment

Soil Sampling

Stratified random sampling method was used. Each sampling area was divided into ten smaller units and from each unit; ten (10) samples were collected randomly at a depth range of 10-15 cm, the sample were mixed and homogenized. Cone and quartered method was used until a required (representative) sample was obtained. Clean polythene bags were used to transport the sample for Laboratory analysis [18]. The sampling areas were labeled as follows:

DNG =Dunbegu
KMB = Kimba
LNG = Langido
GND = Gindi

Plant Sampling

The plant (*Cassia occidentalis*), was also collected from the same site where the soil samples were obtained using a method described in [18,19].

Sample preparation

Soil was air dried for 5 days. Foreign and non-soil materials were removed and the soil was crushed using pestle and mortar, passed through a 1.5mm mesh sieve. Phosphorus, calcium and magnesium were determined using the methods adopted in [20, 21]. The pH was determined using the 1:2.5 soil-distilled water ratio using EL model 720 pH meter, The Walkley-Black wet oxidation method was used to determine organic carbon while ammonium acetate extraction and saturation techniques both as described in [22] were used in determining CEC, Na and K that were determined using flame photometry.

Sample digestion for heavy metals analysis

2g of air-dried and sieved soil was placed in a $150cm^3$ beaker. $10cm^3$ 1:1HNO_3 (ie $5cm^3$ water +$5cm^3$ conc. HNO_3) was added. And the beaker was covered with a watch glass and reflux on a hot plate for 15 minutes. The mixture was allowed to cool and $5cm^3$ conc. HNO_3 was added, heated for 30 minutes. The content of the beaker was heated again for another 30 minutes without covering the beaker after adding $5cm^3$ of conc. HNO_3 until the volume was reduced to $5cm^3$. 2 cm^3 of deionized water + 3 cm^3 of 30% H_2O_2 was added and heated gently until effervescence was vigorously evolved. And 1 cm^3 of 30% H_2O_2 repeatedly added until effervescence subsides. 10 cm^3 of deionized water +$5cm^3$ of conc. HCl were also added and re-heated for 15 minutes. The contents were allowed to cooled, filtered into a $50cm^3$volumetric flask and diluted to the mark with distilled water [18, 19, 23]. The filtrate was used for analysis.

The plant samples were washed several times with deionized water and oven dried at 80^0C to constant weight. The plant waslater homogenized using pestle and mortar and passed through a1.5mm sieve. 2g of the sieved plant was digested in the same way as the soil [4, 19]. The digested samples were used for metals analysis using flame atomic absorption spectrophotometer (AA6500).

The concentration of the metal was calculated using the relation below:

$$concentration\ of\ the\ metal\ (mgkg-1 = C \times V/m \times 1000)$$

Where C is the concentration in the sample extract (μgL^{-1}),V is the volume of the sample extract, and m is the weight of the sample

V. Statistical Analysis

Data obtained were statistically analyzed using one-way analysis of variance (ANOVA) with SPSS version 10.0 statistical packages and reported as mean ± standard error of mean of six and three replicate analysis for soil and plant respectively. The direction of the differences between the mean values was determined using LSD test at 5% level.

VI. Results and Discussions

The results for physicochemical parameters and mineral elements of the soil is presented in the table 1.

Table 1: Physicochemical parameters and mineral elements of the Soil

Parameters	DNG	KMB	LNG	GND
% OM	1.48±0.01	1.69±0.00	1.41±0.03	1.45±0.06
Moisture (%)	1.5±0.01	1.5±0.02	2.0±0.09	1.0±0.05

pH	5.58±0.04	6.46±.01	6.35±0.08	6.0±0.00
CEC(%)	4.68±0.11	4.12±0.05	4.18±0.05	4.32±0.01
%N	0.042±0.00	0.035±0.00	0.028±0.00	0.039±0.00
P (mg/kg)	0.65±0.00	0.57±0.01	0.53±0.01	0.61±0.00
K (mg/kg)	1.13±0.02	1.00±0.00	1.03±0.03	1.36±0.05
Na (mg/kg)	0.70±0.00	0.43±0.01	0.35±0.01	0.65±0.02
Ca (mg/kg)	0.60±0.00	0.50±0.01	0.50±0.00	0.55±0.00
Mg (mg/kg)	0.7-±0.01	0.40±0.00	0.45±0.02	0.35±0.01

- Values were presented as mean± standard deviation of three analysis

OM = Organic Matter
CEC = Cation Exchange Capacity

The results of the heavy metals content in soil of Kimba, Gindi, Langido and Dunbegu are presented in table 2. The result indicated that there was significance (P<0.05) difference between the samples in terms of their heavy metals contents.

Table 2: Results of Heavy Metals Contents of Soil in Kimba, Langido, Gindi and Dumbegu Villages
Metals Concentration (mg/Kg)

Sample	Cr	Cd	Pb	Cu	Co	Ni	Zn
KMB	22.61 ± 2.63^{ab}	2.23 ± 0.67^{ab}	8.63 ± 0.91^{abc}	0.59 ± 0.14^{a}	23.49±1.67	4.63 ± 0.93^{abc}	124.37±3.78
LNG	16.18 ± 3.76^{a}	2.43 ± 0.35^{ab}	9.51 ± 2.01^{abc}	1.75 ± 0.17^{a}	21.44±1.39	7.35 ± 1.16^{bc}	48.08±0.88
GND	16.85 ± 1.20^{a}	2.56 ± 0.41^{ab}	8.00 ± 0.99^{abc}	1.24 ± 0.14^{a}	19.87±1.72	3.28 ± 1.12^{ab}	35.72±1.85
DNG	18.96 ± 2.90^{a}	3.07 ± 1.00^{b}	3.09 ± 1.03^{a}	7.70 ± 3.11^{c}	10.68±2.46	7.57 ± 1.33^{c}	18.18±1.13

- Values were presented as mean ± standard error of mean of six replicate analysis
- Values within the same column with different superscripts are significantly (P<0.05) different

Table 3: Results of Heavy metals Contents in Plant of Kimba, Langido, Gindi andDumbegu Villages

	Metals Concentration (mg/Kg)						
Sample	Cr	Cd	Pb	Cu	Co	Ni	Zn
KMB	3.97 ± 1.61^{a}	1.56 ± 0.45^{ab}	3.75±0.14	4.55±0.01	12.60 ± 4.16^{ab}	BDL	66.63 ± 13.08^{c}
LNG	4.31 ± 2.46^{a}	2.14 ± 0.28^{ab}	0.23±0.00	4.12±0.11	11.87 ± 3.87^{ab}	$11.87\pm o.43^{c}$	50.28 ± 0.27^{ab}
GND	6.85 ± 1.19^{a}	BDL	0.17±0.06	5.83±0.19	11.29 ± 3.02^{ab}	7.61 ± 2.10^{b}	48.41 ± 0.21^{ab}
DNG	5.67 ± 0.90^{a}	1.94 ± 0.21^{ab}	0.42±0.00	4.60±0.19	BDL	0.75 ± 0.07^{a}	59.26 ± 0.20^{bc}

- Values were presented as means ± standard error of men of three replicate analysis
- Values within the same column with different superscripts are significantly different
- BDL = Beyond Detection Limit

Table 4: Pearson Product Moment Correlation Coefficients between Metals Levels in Soil and Plant (*Cassia occidentalis*).

	Cr	Cd	Pb	Cu	Co	Ni	Zn
Cr	1						
Cd	0.137	1					
Pb	0.045	0.215	1				
Cu	0.290	-0.608**	-0.128	1			
Co	-0.162	-0.171	0.435*	0.114	1		

Ni	0.341	0.220	0.090	0.123	0.063	1	
Zn	-0.161	-0.316	-0.006	0.272	-0.188	-0.282	1

* Correlation is significant at 5% level
** Correlation is significant at 1% level

VII. Discussion

The percentage moisture contents of the soil ranges from 0.95 to 2.09. This could be attributed to the time of sampling (March/April). pH values indicated that the soil is mildly acidic. This could results in significant increases in Cd content of the soil [24]. Soil organic matter (SOM) and nitrogen content were low in all the samples and falls within the range of low fertility class. Cation Exchange Capacity (CEC) represents the total exchangeable cation held in soil. The values obtained in this work ranged between 4.08 – 4.94. Available phosphorus in the soil was very low with highest value of 6.67±0.02mg/kg. High value of P reduces the heavy metals uptake by plants [25]. The exchangeable K, Na, Ca and Mg were low in all the samples.

The chromium content was not significantly ($p>0.05$) different between KMB, LNG AND GND but the different is significant ($p<0.05$) with respect to DNG. All the samples concentration were higher than 5.02 mg/kg reported in drilling cutting dump site at Ezeogwu – Owaza, Nigeria and 230 mg/kg adopted by US EPA for soil requiring clean-up [26].

Cadmium concentration in soil was significantly ($p>0.05$) indifferent between the samples apart from DNG and also higher than 0.43 and 0.86 mg/kg set by New-York State Department for Environmental Conservation(NYS DEC) for unrestricted and residential use soil [27].

The lead concentration follows similar pattern with cadmium in the entire samples. But the values reported here are higher when compared with <0.01 mg/kg reported in literature [24].

The concentration of cobalt ranges from 8.22 to 25.16mg/kg. The high concentration of cobalt was recorded in KMB. The sources of this metal could be as a result of wearing a way of cobalt alloys, tyres, and exhaust from vehicles and generating set [28]. All the values were above the values reported [27, 31] in similar work.

The heavy metals copper, nickel and zinc in soil were within the acceptable limits set by NYS DEC [29].

The chromium concentration in *Cassia occidentalis* of all the samples are similar ($p>0.05$), but the values are lower than the corresponding values obtained from soil in each area. Congestion and inflammation of organs have been associated with chromium toxicity[30].

Cadmium is naturally non-essential toxic element and it interferes with the metabolism of some essential elements such as zinc, calcium and iron [31]. Cadmium concentration was also found to be no significance ($p>0.05$) between the samples but it is either absent or beyond the detection limit of the machine in DNG despite the excessive use of fertilizer in the area. The result was in agreement with the finding of Ozores-Hampton, *et. al.*, [32] and deviated from the results obtained by Howard *et. al*, [33] in similar works. However, cadmium has been reported to affect kidney, liver and various organs due to its ability to displaced zinc in many metallo-enzymes [34]

The concentration of lead was found to range between 0.11-3.89mg/kg in plant samples. Sample GND has the lowest concentration of 0.17±0.06mg/kg of lead despite the fact that the area is very close to the busy Jega-Yauri road. The values obtained in this work were far greater than the value obtained by [33] in similar works. Accumulation of lead in the body has been linked to several disease which includes; anaemia, kidney and CNS dysfunction [35]. The lead concentration in the range of 100 – 1000mg/kg is required to causes visible toxic effects in plants [36].

Copper concentration shows no significance ($p>0.05$) between the samples. Unlike cadmium, copper is an essential element required for the synthesis of phospholipids essential for the formation of myelin sheath in parts of respiratory enzymes. Nevertheless, copper can be harmful when taken in excess[37].

Cobalt concentration ranges from 8.00-16.76mg/kg with the highest concentration observed in sample KMB. While the cobalt was either, absent or beyond the detection limit of the machine in DNG. In addition, there was no significance ($p>0.05$) difference between the samples.

The nickel concentration is significantly ($p<0.05$) different between the samples. Comparing the results with that of the soil, it is higher. This could be due to deposition of nickel on the leaves from the vehicular exhaust.

Zinc concentrations are significantly different ($p<0.05$) between KMB and DNG with KMB having the highest concentration of 66.63±13.08mg/kg.

Results of correlation studies between the metals in soil and plant uptake showed positive correlation between the metals in almost all the metals. However, Cu and Cd showed significant negative correlation at 5%, but the correlation is not significant with Pb even though is negative. The Co correlated negatively with Cr and Cd, but significantly correlated positively with Pb at 1%. Zinc also correlated negatively with all the metals apart from Cu.

VIII. Conclusion

This work revealed that all the metals analysed were present in most of the samples both soil and plant (*Caccia occidentalis*). In addition, they metals were distributed differently in soil and plant of the samples. Also, the results revealed that there were significant ($p<0.05$) different in the distribution of some metals. While some of the metals were either, absent or beyond the detection limit of the machine in GND, DNG and KMB. The research also revealed that the area was moderately polluted when compared with the US EPA maximum concentration of the heavy metals in soil. With all the metals having lower concentration compared with the US EPA standard.

REFERENCES

[1] Dawaki, U.M., Dikko, A.U., Noma, S.S. and Aliyu, U. (2013).Heavy Metals and Physicochemical Properties of Soils in Kano Urban Agricultural Lands. Nigerian Journal of Basic and Applied Science. 21(3): 239-246

[2] White, P. M., Wolf, D. C., Thoma, G. J. and Reynold, C. M. (2006). Phytoremediation of Alkylated Polycyclic Aromatic Hydrocarbons in Oil Contaminated Soil. Water, Air, and Soil Pollution.169:207-220

[3] Nwajei, G.E. and Iwegbue, C.M.A.(2007). Trace Metal Concentrations in Soils in the Vicinity of Uwelu Motor Spare Parts Market, Benin City Nigeria". Journal of Chemical Society of Nigeria. 32(2): 282-286.

[4] Osakwe,S. A. (2009): Heavy Metals Distribution and Bioavailability in Soils and Cassava (Manihot esculenta GRANTZ) along warri-abraka expressway, delta state, Nigeria. Journal of Chemical Society of Nigeria. 34(1): 211-217

[5] Obahiagbon,F. I., Uwumarongie, E. G., Asemota, O., Edigie, E. E. an d Uwumarongie, H. O. (2007). Heavy Metals Concentrations in the Leaves Elaeis guineesisof and Intercopped Nigerian Leafy Vegetables. Chemclass Journal. 3: 420-430

[6] Umar U.I.N. and Ebbo, A.A. (2005): Toxicity and Hazards of Heavy Metals on Man and Animals. A Review. Bulletin of Science Association of Nigeria. 4th Annual Conference UDUS. 27th April, 2005.

[7] Pehlivan, E., Ozkan, A. M., Dinc, S. and Parlayici, S. (2009). Adsorption of Cu2+ and Pb2+ ion on dolomite powder. Journal of Harzadous Materials. 167(1-3):1044-1049

[8] Lenntech, (2008). Heavy Metals Toxicology. Retrieved from; http://www.lenntech.com on 8th June, 2008.

[9] Yasuda, M., Miwa, A. and Kitagawa, M. (1995). Morphometric Studies of Renal Lesion in "Itai-Itai" Disease; Chronic Cadmium Neurophathy. Nephron. 69:14-19.

[10] Inuwa, M, (2004): Analytical Assessment of Some Trace Metal in Soils of Sodan Apple (Calotropis procera) Around the Major Industrial Areas of North West Zone M.Sc. Dissertation. Submitted to Post Graduate. School U.D.U. Sokoto

[11] Ang, H.H. Lee, E.I and Matsumato, K. (2003). Analysis of Lead Contents in Herbal Preparation in Malaysia. Human and Experimental toxicology. 2(2):Thompson Publishing Company LTD. U.K. Pp.445-451.

[12] Liman, M. G., Muhammed, A. B. and Dogon Daji, A. H. (2007). Potential Risks of Heavy Metals Poisoning from Locally used Potash (Kanwa): A chemical Assessment. Nigerian Journal of Pure and Applied Sciences. 15(1and2):94-102

[13] Parker, P.S. (1987). McGraw Hill Encyclopedia of Science and Technology. 6th edition, Vol. 19. McGraw Hill Book Company New York Pp.136and 620-623.

[14] Bockris, J. O. M. (1978). Environmental Chemistry, Plenum press. New York. pp. 47-469

[15] Balch, P., James, F and Balch, M. D. (2012). Prescription of Nutritional Healing. 3rd Edition.

[16] Abubakar, S. M., Yaro, S. A. and Galadanci, M. (2004). A study of Copper and Zinc Pollutants in surface Soil and Components of Balanite Aegypticae in a Semi-Arid Urban Area of Nigeria. Nigerian Journal of Scientific Research. 4(2): 93-94.

[17] Yandaki, A. I. and Suleiman, I. (2008). Jega. Its People, Topography, Economy and Society. Jega, a Social, Economy and Political History. Crafts book limited. ibadan

[18] Radojevic, M. and Bashkin, V. N. (2006). Practical Environmental Analysis. Royal Society of Chemistry. Cambridge. UK.

[19] Onomrerhinor, R. O. (2010). Lead pollution of road side soils and plants in Ibadan, Nigeria. International Journal of Physical Sciences. 5(2)

[20] Ademorati, C. M. A. (1996). Standard Methods for Water and Effluent Analysis. Foludex Press Ltd. Ibadan.

[21] Agbenin, J. O. (1995). A Laboratory Manual for the Analysis of Soil and Plants. Department of Soil Sciences, Faculty of Agriculture. ABU Zaria.

[22] Adepetu, J.A., Nabhan, H. and Osinubi, A. (Eds) (2000). Simple soil, water and plant testing techniques for soil resource management: proceedings of a training course held in Ibadan, Nigeria. 16-27 September 1996. IITA, Ibadan.

[23] Orhue, R. E. and Uzu, F. (2010). influence of some Soil Properties on the Uptake of Lead and Chromium by Telfaria accidentasis, International Journal of Physical Sciences. 5(2).

[24] Mathe-gaspar, G. and Anton, A. (2005). Phytoremediation study: Factors influencing heavy metal uptake of plants. Proceeding of the 8th Hungarian congress on plant physiology and the 6th Hungarian conference on photosynthesis. 49(1-2):69-70. Available @ http://www.sci.u-szeged.hu/ABS

[25] Hamel, S., Heckman, J. and Murphy, S. (2010). Lead Contaminated Soil: Minimizing Health Risks. Fact sheet FS336. Rutgers, the State University of New Jersey, New Jersey Agricultural Experiment Station. http://njaes.rutgers.edu/pubs/publication.asp?pid=FS336

[26] US EPA. (2002). Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites. Office of Solid Waste and Emergency Response, Washington, D.C. http://www.epa.gov/superfund/health/conmedia/soil/index.htm

[27] NYS DEC, (2006). New York State Brownfield Cleanup Program Development of Soil Cleanup Objectives Technical Support Document. New York State Department of Environmental Conservation and New York State Department of Health, Albany, NY. http://www.dec.ny.gov/chemical/34189.html

[28] Adams, A. (2011). The Natural Recovery Plan News Letter. Issue 19. Available @ http://www.thenaturalrecoveryplan.com/

[29] Marjanovic, D. M., Marija, M.V, Dušan, G. A., Suzana, I. D., Đorđe, M. J., Milan, N. M. and Mirjana, Đ. R.(2009). Heavy Metals Concentration in Soils from Parks and Green Areas in Belgrade. J. Serb. Chem. Soc. 74 (6): 697–706

[30] Harrison, V. L. and Staples, E. L. J. (1995). Chromium Toxicity, N. Z. Vetrinary Journal. 3: 63-65

[31] lnaba, T., Kobayashi, E., Suwazono, Y., Uetani, M., Oishi, M., Nakagawa, H. and Nogawa, K. (2005). Estimation of cumulative cadmium intake causing "itai-itai" disease. Toxicology Letters. 159: 192-201

[32] Ozores-Hampton, M., Stansly, P. A. and Obreza, T. A. (2005). Heavy Metal Accumulation in a Sandy Soil and in Pepper Fruit Following Long-term Application of Organic Amendments. Compost Science & Utilization. 13(1): 60-64

[33] Howard, I. C., Gabriel, U. U. and Nduka, J. O. (2009). Bioaccumaulation of Heavy Metals in Periophthalmus papillio and Tympanotonus fuscatus from the Mangroves Swamps of an Oilfield in the Niger-Delta. Journal of Chemical Society of Nigeria. 34(1):160-168

[34] Linder, M. (1985). Nutritional Biochemistry and Metabolism. Elservier Science publishing Co., inc New York.

[35] Chilsholm, J. J. (1971). Lead Poisoning Science. American Journal. 224:15

[36] Aksoy, A., Salin, U. and Duman, F. (2000). Robinia pseudoacacia L. as a possible biomonitor of heavy metals pollution in Kayseri. Turkish Journalnof Botany. 24: 279-284

[37] Bindewell, C. A. (2002). Copper toxicity in dairy cows; a case history. Research in veterinary science. 72:19

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Institutional Actors Role in the Pillar Regulative Spatial Policy Implementation in District Wangi-Wangi Wakatobi

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Abstract- The study aims to determine how the role of institutional actors concerning regulative system in the process of policy implementation of spatial Wangi-Wangi Wakatobi. This study was conducted in Wangi-Wangi of Wakatobi with case studies Sombu and Coastal Protected Forest (indigenous forest and protected forest land motika Matahora), this study used a qualitative approach with case study design. The main data sources are the actions of the actor/implementers spatial policy in the context of its work. Author retrieve data through interviews, observation and document study then presents a report using narrative text and tables. The results showed that the actor is the parties who have a particular interest in the system and/or who have some ability to influence the system, either directly or indirectly. The role of actors concerning the system of regulative can be seen from the perspective of Marine and Fisheries who viewed coast Sombu as local fishing harbor and ice factory, while the Department of Tourism and Culture saw it as a zone designation tourist attraction sea especially for diving and snorkeling. Office via DPA each budgeted programs and activities in order to optimize the achievement of goals intended to involve formal and informal organizations (NGOs and Indigenous Institutional).

Index Terms- Public Policy, Public Policy, Institutional Actors

I. INTRODUCTION

Decentralization gave ample opportunity to the local government in the countries are to adopt and implement the Appropriate policies area. Side of preferences, the area has problems with *"implementation capacity"* so that the implementation of policies rarely Achieve the expected outcomes. This is compounded by the character of implementation a complex policy, namely "multi-level and multi-locus", which tends to create competition and conflict between an actor y g involved in the process.

The way this new explanation of the process of public policy implementation in developing countries tend to converge on institutional factors. Institutional defined as a social structure that contains elements of symbolic, social activities, and material resources. Institutional has three pillars, namely the system of regulative, normative system, and cultural-cognitive system (Scott, 2001: 49)[1].

Analytical framework of Scott (2001: 77)[1] states that the three pillars are embedded in e four types of institutions *(institutional carriers)* namely: system symbol, system Relational, it as routine (habit), and artifacts. Among the four types of institutional spreader, this study focuses on relational systems based on system roles. In the pillar regulatory, institutional actors are expected to show the entire structure *of governance* that is the formulation of priorities, coordination, control and accountability, the implementation of which refers to standard operating procedures. In the normative pillar institutional actors are expected to show a bureaucratic authority system according to professional standards, details of responsibility and moral obligation. In cognitive-cultural pillar, institutional actors are expected to be able to create and develop the organizational structure of a general nature or develop structural identity that is unique.

The role of institutional actors in the implementation of spatial policy in the City of Wangi-Wangi Wakatobi according to the author can be explained using employment pillar-pillar framework and institutional spreader *(institutional pillars and carriers)* from Scott (2001: 51-57)[1]. Judging from the ***regulatory system,*** the spatial policy implementers are required to behave in harmony with a number of provisions in laws, government regulations, local regulations, and the regulation of regional heads. Judging from ***the normative system,*** the spatial policy implementers are required for capable formulate program objectives-oriented public interest; make the details of responsibility and liability; provide and adhere to standard operating procedures in the implementation of the responsibilities and obligations, as well as provide and achieve the maximum performance standards. Judging from the ***cultural-cognitive system,*** the spatial policy implementers are required to have the ability to define and classifying the interests of society; submit those interests in a formal forum; negotiate the proposal with the various parties involved in the forum; and the interests of the wider community through budget support and the implementation of concrete actions were structured.

Based on the theoretical background and empirical phenomena described above, the authors tried to describe and analyze the institutional role of actors concerning the stem regulative in the process of policy implementation spatial-Wangi Wangi City Wakatobi.

II. REVIEW OF LITERATURE

A. Public Policy and Implementation Studies

Recent studies public policy is characterized by at least three of the following characteristics: problem-oriented (problem-oriented); multi-disciplinary, the intellectual and practical approach that is multidisciplinary; and normative or value-oriented (DeLeon & Vogenbeck, 2007: 4-5)[2].

Public policy involves the key role of public actors, but not exclusive (Hill & Hupe, 2002: 4)[3]. In a democratic society, public policy reflect the collective aspirations of the political community, and is generally formulated in the name of public interest. This means that what is contained in public policy is a consensus about what constitutes the public interest (Levin-Waldman (2009: 519)[4]. Individuals in the private sector also affects public policy (McKinney & Howard, 1998: 89)[5].

Based on the above opinion can be concluded that public policy is a statement of the patterns of action or inaction of government officials based on regulation or legislation in order to solve public problems. Public policy can follow directly by the government or through government agencies. The implications of the definition of public policy mentioned above is that the goal-oriented public policy or always purposeful, deliberate public policy is made by government officials and intended to respond to the problems perceived by the public, and can be either action or inaction.

B. Role of Actors in the Implementation System

Dynes (1986: 1-2)[6] explains that when first introduced, the term refers to the role of "the behavior associated with the position." meaning further in relation to the role of the actor Hanberger (2001: 45)[7] states that public policy in developing general in the context of multi-actor. Cahn (2012: 203)[8] states that public policy is a result of the processes of institutional influenced by actors non-institutional. Scharpf in Pancaldi (2012: 4)[9] states that the outputs of public policy is the outcome of interactions between actors that have a specific purpose.

Based on the above concluded that the public policy process involves many actors. Actors can come from within the government *(state actors),* the formal actors in the executive and legislative branches, as well as from outside the government *(non-state actors),* the interest groups. Actors outside government *(non-state actors)* are often not directly involved in the filing and determination of policy choices but it provides incentives and constraints that influence the behavior of *state actors.* Judging from the strength of its contribution to achieving the objectives of the public, the actors in the policy process can be a player, subject, context providers, and cheerleaders.

C. Institutional Theory in Public Administration

1. Institutional Concept

Institutional in this study is defined as a social structure that contains elements of symbolic, social activities, and material resources. This definition refers to Scott (2001: 49)[1]. Institutional is a social structure because it includes social order pattern, ie, regulations, norms, and cognitive-cultural. This social order limit and regulate behavior; filed a prescription, evaluation and social obligations; and conceptions of the nature of social reality and a framework to interpret that reality. Institutional is a social activity, the activity of the actors in producing and reproducing these elements. Rule, norms and the meaning of it all appeared in social interaction and modified through social behavior. Institutional include resources due to streamlining the social structure he needs to be fortified with resources and legitimacy as well as authorization for their use.

2. Institutional Analytical Model of Richard Scott: Pillar-pillar and Institutional Spreader

Pillar-pillar framework and spreader institutional Scott (2001)[1] categorize special pillar-pillar institutions that have a big effect on the stabilization and meaning of the social structures. Framework intended to enter two-dimensional traditional institutions *(old institutionalism),* the regulatory and normative dimension, as well as a new institutional dimensions *(new institutionalism),* namely the cultural dimension of cognitive.

Pillar regulative function to restrict and regulate social behavior. Regulatory processes include the determination of activity rules, monitoring, and sanctioning. **Pillar regulative** marked with the laws, rules, regulations, and standard operating procedures are intended to influence the behavior (Scott, 2001: 51-53)[1]. **Pillar normative** refers to rules which introduce normative prescription, evaluation, and bonds (obligations) actors in social life. This normative system includes the values and norms. Value refers to the conception of what is the most preferred or desirable. **Pillar** pointed to the creation **of cognitive-cultural** identity of individuals and groups as well as the meaning of the work of the participants in a given environment (Scott, 2001: 56-58)[1].

Scott (2001: 77)[1] states that the three institutional pillars, namely regulative, normative, and cultural-cognitive embedded in various types of institutional spreaders. Scott spreader identifies four types of institutions, namely: symbolic systems, relational systems, routines (habits), and artifacts. This relational system rests on a system role. With the intended role of the system is patterned expectations associated with social positions. This role gives the system limitations but also reinforce the behavior of social actors. The rules and belief systems formalized in positions and roles are different. This relational fabric can be held together in many organizations so as to form a structural isomorphism (similarity of structural forms) in many organizations, or a structural equivalence (similarity relationship between the structural forms). However, the relational structure can also take a particular form in a particular organization so as to form the unique character of the structure within the organization.

III. RESEARCH METHODS

This study will use qualitative approach to Investigate the role of institutional actors in the implementation of governance policies of space. Design be used in this research is the case. Data studies were analyzed to obtain thematic categories that can answer the problem of research. The author uses qualitative descriptive analysis procedures interactive models as proposed by Miles and Huberman (1994: 10-12)[10]. This interactive model includes the analysis of data from *before* the data collection phase, *during the* process *of* data collection and

analysis while early, and *after* the end of the data collection phase.

IV. RESULTS AND DISCUSSION

In this study the role of the actor in a pillar regulative, focused on the implementation of the activities of *governance* that includes how they formulate decisions about social priorities, how to coordinate the various interests involved, how to exercise control over its implementation by applying rewards and sanctions, and how they show accountability of their actions and decisions to the public, as well as compliance with standard operating procedures. Scott (2001: 51-57)[1].

a). How formulation of priorities made

Sea coast Sombu rich in biological resources under the sea *(biodiversity)* in the direction of spatial utilization is primarily a zone designation tourist attraction sea especially for *diving* and *snorkeling.* Today most of the area concerned has shifted its allocation to *the ice factory* and *Cold Storage* and harbor fisheries.

Differences interest in seeing the allotment of coastal Sombu the more pointed because of the emergence of local government policies that support the development of the power plant in the village Sombu by offering harbor *"dispute"* between the Department of Tourism and Culture with the Department of Fisheries and Maritime Affairs as the port of loading and unloading of coal that will fuel the power plant.

Consideration of Tourism and Culture Wakatobi develop coastal Sombu *First* this area has the potential of biodiversity (byodiversitas take coastal marine) *Secondly,* there are zoning Marine Protected Areas (MPAs) ± 200 ha as the initiation of environmental groups local communities group name "Nusa Sombu". *Third,* the proposed actors services tourism businesses and environmental NGOs in Development Planning Meeting, both the village level mapun districts that agencies develop programs and activities that the overarching aim to maintain the underwater ecosystem Sombu. *Fourth,* the Department of Tourism and Culture guided by the directives Layout Plan Wakatobi space (RTRW) that coastal zone designation Sombu included in the tourist area of the sea, especially for *diving* and *snorkeling*

Consideration of the Department of Fisheries and Marine Wakatobi in seeing the development of coastal Sombu:

1. RTRW landing on development plans Fish Landing Sites (TPI), Nusantara Fishery Port, *Cold Storage,* and fisherman village in each district.
2. *Factory Ice and Cold Storage and* Port Fishing has existed since 2008 in coastal Sombu
3. Support power of PLN
4. Proposed actors fisheries through Development Planning Meeting, services at the village level to the district.

The findings of the authors in this case is one of the activities carried out by the Department of Tourism and Maritime not through such mechanisms as stipulated in Law No. 25 of 2004 on National Development Planning. Regardless of the outcomes of activities that bring a positive impact on society, the birth of the activity is not through proper mechanism. Local governments have to find the right solution how to capture the aspirations of members of the legislature/parliament so that the proposals of their constituents through a mechanism that has been regulated by law.

The findings of the author follows is one of the activities carried out by the Department of Tourism and Maritime not through such mechanisms as stipulated in Law No. 25 of 2004 on National Development Planning. Regardless of the outcomes of activities that bring a positive impact on society, the birth of such activities are not through the mechanism correct. Local governments have to find the right solution how to capture the aspirations of members of the legislature/parliament so that the proposals of their constituents through a mechanism that has been regulated by law.

b). How to coordinate the various interests covered

Department of Fisheries and Marine Resources in town a the position of confusion, if continued operation of the harbor and ice factory as original intention then it would clash with the tourism development plans, if not proceed regions will lose money due to the abandonment of the buildings that are already established. In this case illustrated how the two agencies to formulate a different decision regarding social priorities right thing to do in the coastal Sombu.

Differences in priorities makes these two offices need to coordinate the various interests are included in the planning of programs and activities each with actors who benefit from this policy and will look for solutions amid much as possible meet the expectations of both parties.

According to the author interviews with several sources who attended the meeting said that the meeting would revive their kinship ties and the spirit of unity that used / old people they hold as a philosophy of life in the social interaction in the community.

The tradition among others:

1. *Mawaka* or *poawa-Awai*, which means that all the activities of life are related to public interest or which involve a lot of people, not least the ongoing life at sea, must be taken with deliberation.
2. *Gau Satoto*, which means the union of feelings, thoughts, words, and deeds in a single unified whole. This means showing the principle of constancy and firmness establishment attitude and honesty are very high.

The forum resulted in points of agreement as follows :

1. Fishing boats that will dock at the port Sombu should only left his boat in the harbor area (areas that are not living coral reef);
2. Ships banned throw garbage in either the port area of plastic waste and residual materials machinery lubricants;
3. Diving and snorkling business operators may only perform activities of loading and unloading activities while being silent, time is conditioned;
4. Business operators Diving / Snorkeling, ice plant manager perpetrators fisheries services and village governments shall together maintain cleanliness, security and order factory area;

5. EIA study will be done to see how far the impact of special coal port development;
6. For anyone who violates this agreement both individual and group will be followed up criminal and civil;
7. This agreement will be followed back if there is a mistake in it.

The conclusion that the author can take from the above presentation is that the coordination of the various interests performed by actors (stakeholders) with diverse interests able turns giving influence or enrich purpose of the policy that was created Earlier. As the Enserink et al. (2010: 80) the actor as a social entity, individual or organization, able to give effect to a decision. In other words, the actors are Reviews those who have a particular interest in the stem and / or who have some ability to influence the system, either directly or indirectly. Enserink further stated that the use of the term "actor" is exchanged with "stakeholders".The coordination is also described how the role of traditional institutions in reconciling differences in perception between state actors and non-state actors in conflict. Role as a mediator capable of playing well is because people who become members of the institution are those who in everyday interactions is considered still to have integrity. That role still played at the level of control of the implementation of ongoing programs and activities.

This conflict also opened the eyes of all parties that the planning is very good technically would not be of much use if it is not implemented. Many organizations tend to devote so much time, money and effort to develop a good plan, so it tends to regard the implementation as a secondary thing to think about later, when the change takes place through implementation and evaluation, not through the plan. A plan is not perfect technically, but it is implemented properly will be more successful than a perfect plan that never practiced beyond what is written or typed on a piece of paper.

c). How to exercise control over its implementation

A great destination *(out comes)*, which became the meeting point between the Department of Tourism and Culture with the Department of Fisheries and Marine Resources in the implementation of programs and activities in SKPD each is how coastal use Sombu can improve the welfare of society both tourism businesses, businesses fisheries and population Sombu in the region itself.

Benefits (Outcomes), which is expected to be achieved from the internship activities and plant operations assistance is increasing public welfare around the ice plant operation or maintenance of the sustainability of marine resources. The operation of the port and ice plants can serve the needs of fishermen, fishing businesses and can generate local revenues. Preservation of coastal and marine areas Sombu benefit businesses submarine tour, meet the needs of tourists as well as being a source of revenue for local communities.

Factory Ice and Cold Storage can operate properly if the security infrastructure plants awake besides the activities of loading and unloading of fishing vessels do not damage the coral reef ecosystems around the port is also businesses ships do not pollute the sea area to dispose of waste both household waste and residual fuels, Control of all that is done jointly by the managers of the factory (the service), business tourism, business and community economic and tourism lovers snorkeling dive. Violation of all the good done by individuals and groups will be reported to the authorities.

In addition to the control carried out by law enforcement officials, there is also done olek groups / non-state actors (NGOs), they managed to mobilize citizens for their own interest form and map the area / region into a sea of fishing activities of citizens. This area should they keep to the survival of their children and future generations. This area is called zoning Marine Protected Areas (MPAs) covering an area of ± 200 ha, Marine areas are included in this area are required to be preserved, and adhere to the rights and obligations that have been agreed. Rights of fishing communities, among others, by not using equipment or tools/methods that have an impact on the marine ecosystem damage. Obligations include preserving the marine ecosystem by engaging in conservation and restoration of marine life and do not perform activities destruction of marine life. Furthermore, the residents formed a group in charge of monitoring and evaluating the DPL, the group called "Nusa Sombu".

There was also the involvement of traditional institutions that provide the label "kaombo" in places that became the center of the reef. The values of local wisdom "Kaombo" means maintaining the natural environment for the common good, *"Ara ufila imawi fired nabawae sabaane nanei futahuu, Ara nufila difutahuu coals nubawae sabaane nanei numawi "*. If the sea should not take all the proceeds of the land otherwise if kedarat also do not take all of the contents of the sea. This wisdom me n reflect the understanding that the heritage values of the precursor to the development of environmentally sustainable and maintain the carrying capacity of the region.

Society is caught in violation of DPL and the "kaombo" in addition to reported kepolisi will also be given social sanction by the traditional institutions, the level of sanction varies according to the level of guilt, of given warning to not cared for a celebration of family, for example circumcision or marriage. These penalties proved enough effective with no reports of fish bombing activities or fishing gears dipesisir Sombu large community.

d. How to demonstrate the accountability of the actions and decisions to the public

Disclosure of information in the present era has become a necessity, no information escapes the public monitoring, as well as coastal zone management Sombu. For example apprenticeship *supporting* staff *ice plants and cold storage*, this kind of information about the requirements and quotas dibutuh easily obtained / obtained at the office of the Department of Fisheries and Marine Resources.

Residents can also see the physical work arrangement parking areas and the rehabilitation of the pier because the agency requires the contractor and planning to make project information boards around the project area. Business tourism dives are also encouraged to empower citizens around both premises by hiring a boat as well as providing logistics / needs of the residents.

The conclusion from this section is that when the policy implemented by opening a faucet profuse information /

transparency settlement of the issue carried out by actors in the policy will facilitate the completion of the following problems. As Cahn (2012: 199) states that policy actors are individuals and groups, both formal and informal, are trying to influence the formation and implementation of policies. In the context of real, public policy can be understood as a public solutions implemented in an attempt to solve public problems that will appear next.

V. CONCLUSION

Based on the results of research and discussion that has been done on the Role of Institutional Actors in the Implementation of Spatial Policy In Wangi-Wangi concerns the *regulatory system* in the process of policy implementation spatial-Wangi Wangi City Wakatobi *governance* consists of the following activities :

1. How to formulate a social priority. At this stage, the activities of the Department of Tourism and Culture is not through planning mechanisms as required by the Act - Act No. 25 of 2004 which Sombu pier rehabilitation.
2. Coordination of the various interests performed by actors (stakeholders) with diverse interests were able to provide enriching effect or purpose of the policy that was created earlier.
3. Control over the implementation of the policies carried out by applying rewards and sanctions. Any control carried out by the Department of Fisheries and Marine Resources and the Department of Tourism and Culture in the implementation of spatial planning in coastal Sombu by applying supervision tiered ie in addition to involving the organization formal (police, military and Pol PP) also involve non-formal / ie non-governmental organizations and traditional institutions.
4. How do they demonstrate the accountability of their actions and decisions to the public. This stage is marked when the policy implemented by the disclosure. Therefore, the public policy process involves many actors. Actors can come from within the government (state actors), the formal actors in the executive and legislative branches, as well as from outside the government (non-state actors), the interest groups. Actors outside government (non-state actors) are often not directly involved in the filing and determination of policy choices but it provides incentives and constraints that influence the behavior of state actors.

REFERENCES

[1] Scott, W. Richard. 2001. Institution and Organizations (2nd). USA: Sage Publications Inc.

[2] DeLeon, P., and Vogenbeck, Danielle M., 2007. "Back to Square One: The History and Promise of the Policy Sciences". In Handbook of Public Administration, edited by Jack Rabin, W. Bartley Hildreth, and Gerald Miller. Boca Raton, FL. : Taylor & Francis Group, LLC., Pp. 504-540

[3] Hill, Michael, and Hupe, Peter, 2002. Implementing Public Policy. London: Sage Publications.

[4] Levin-Waldman, Oren M., 2009. Policy Studies, in Phillip Anthony O'Hara (Ed), International Encyclopedia of Public Policy-Governance in a Global Age, Volume 3: Public Policy and Political Economy. Perth: GPERU, pp. 519-532, http://pohara.homestead.com/Encyclopedia/Vo lume-3.pdf.

[5] McKinney, J. B., and Howard, G., 1998. Public Administration: Balancing Power And Accountability. Westport: Praeger Publishers.

[6] Dynes, Russell R., 1986. "The Concept of Role in Disaster Research". Chapter in Russell R. dynes and Carlo Pelanda (eds), Sociology of Disaster: Contributions of Sociology to Disaster Research. Milan, Italy: Franco Angeli.

[7] Hanberger, A., 2001. What is the Policy Problem? Methodological Challenges in Policy Evaluation. Evaluation,Vol. 7(1): 45–62

[8] Cahn, Matthew A., 2012. Institutional and Noninstitutional Actors in the Policy Process. In Public Policy: The Essential Readings. Second edition. Edited by Stella Z. Theodoulou and Mattew A.Cahn, California: Pearson, Prentice Hall Humanities. Pp. 199-206

[9] Pancaldi, F., 2012. The Turn to Real Actors: Achievements and Challenges for Actor-Centered institutionalism in the Comparative Political Economy. Paper for the XXVI Convegno SISP, Rome 13 to 15 September 2012, the Panel 11.1. 'La Metodologia dei Giovani Politologi in Italy'.

[10] Miles, M.B. & Huberman, A.M. (1994). Qualitative data analysis: An expanded sourcebook. New York: SAGE Publications

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Model Corporate Social Responsibility (CSR) Rehabilitation House not Worth Habitation (Rtlh) Perspective in Governance

(Case Study CSR Sinarmas in the Regional Military Command VII / WRB Makassar)

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Abstract- The purpose of this study was to describe the application of the principle of economic responsibility, legal, ethical and philanthropic responsibilility in execution Corporate Social Responsibility (CSR) in regional military command VII /WRB, analyze the role of government (public sector), the private sector and the public (civil society) in the implementation of Corporate Social Responsibility (CSR) Sinarmas in the regional military command VII /WRB viewed from the perspective of Governance. Find alternative model of Corporate Social Responsibility (CSR) Sinarmas RTLH rehabilitation program at the regional military command VII/WRB Makassar in terms of Governance Perspective. Sinarmas research was conducted in Jakarta and the regional military command VII /Wirabuana as the party that receives the program as corporate social responsibility (CSR) Rehabilitation RTLH Sinarmas. The study was conducted using a qualitative approach that emphasizes the natural background characteristics which researchers act as instruments of research. The focus of research is directed towards obtaining descriptive data in the form of the written word and analyzed inductively. Overall, the study was conducted in several stages with the data collection, data reduction, data presentation, conclusion and verification. The results showed that : Model Implementation of Corporate Social Responsibility (CSR) Sinarmas in the regional military command VII/Wirabuana yet been implemented according to the principles governance, it can be seen from the lack of involvement of other actors, supervision sert a involve answer a defense mechanism accountability, transfarency, Responsibility and fairnes still found irregularities in executing. Role of Government (Public Sector) in promoting Corporate Social Responsibility (CSR) is not yet fully able to carry out its role, the role Mandating can be performed with the Law while the role Fasilitating, Partnering, endorsing not yet done, it can be seen from the lack of government capture the opportunities that exist to cooperate in the utilization of funds Corporate Social Responsibility (CSR) by involving other actors such as the private sector and Civil Society Governance according outlook.

Index Terms- CSR, Roles of the public sector, Governance.

I. INTRODUCTION

Corporate Social Responsibility (CSR) constitute a commitments must carried by *private sector (*private */companies)* to guard existence and as *feedback* between the *private sector* environment and public *(stakeholders)* who are region company mentioned standing in side of the wheel using a tyrelever.

On the other hand the government too in firm already oblige every corporation for implement responsible social and regulate activity *Corporate Social Responsibility* (CSR) into Constitution and regulation government Other. By because It has been become obligation *private sector* for implement.

Implementation of *Corporate Social Responsibility* (CSR) is currently developing rapidly, as the response of business (private sector) who see environmental and social aspects as an opportunity to improve competitiveness *(competitiveness)* as well as part of the management of risks to the *sustainability of* its business activities. Substance *Corporate Social Responsibility* (C SR) is in the framework of the corporation's ability to adapt to its environment, the community and *stakeholders* associated with local, national and global. In short, CSR implies that the company has a moral duty to be honest, obey the law, upholds integrity (Ardianto, 2011: 35)[1] and Mc Williams and Siegel (2001)[2].

In addition the company has economic and legal obligations to *shareholders,* the company is also expected to have attention to its *stakeholders.* This is done Sinarmas. As one of the national companies Sinarmas has been quite a long time to implement various *Corporate Social Responsibility* (CSR), such as education, health, economic, social, religious, social order and environment. Sinarmas running programs of corporate social responsibility on an ongoing basis with the approach that the company's relationship with the community is an equal relationship where both parties need each other. One program *Corporate Social Responsibility* (CSR) provided by Sinarmas namely Home Rehabilitation Program Unlivable (RTLH) for members of the military, civil servants and their families throughout Indonesia. The program is contained in a

memorandum of understanding (MoU) between the Army and PT Sinarmas No. 01 / SMART-Army / II / 2013 and No. Memorandum /5/III/2013, which was signed by Assistant Planning Army on name Force Chief of Staff Army (Army Chief of Staff) and managing director Sinarmas. After the program start until the second phase of activities at the end of December 2014, the problems now emerging that the program no longer exists. In fact, should have *Corporate Social Responsibility* (C SR) runs continuously and sustainably *(suntainable)* as claimed by Elkington (1994) that corporate sustainability is the keyword *The Triple Bottom Line.*

Sustainability *Corporate Social Responsibility (CSR)* can be achieved by involving the *stakeholders,* not just once completed *its Corporate Social Responsibility* (CSR) has been finished responsibility, so there is a *gap* between what is supposed to implementation. *Stakeholder* involvement in the implementation of CSR is indispensable where *stakeholder* approach to *Corporate Social Responsibility* (CSR) refers, Freeman (1984)[3] defines *stakeholders* as a group or individual who can affect or be affected by the achievement of organizational goals. Based on the back above, the researchers interested in studying with emphasis role the Government, *private sector* and the public *(civil society)* in the implementation of *Corporate Social Responsibility* (CSR) Sinarmas in regional military command VII/WRB viewed from the perspective Governance and models of implementation of *Corporate Social Responsibility* (CSR) Sinarmas in regional military command VII / WRB Makassar through program Rehabilitation Home Unlivable (RTLH) in the perspective of *Governance.*

II. LITERATURE REVIEW

Theory Of Governance

In essence the concept of *governance* describes the meaning of rule changes that refer to: 1) a new process of governing *(a new process of governing);* 2) changing conditions in the rules governing *(a changed condition of ordered rule);* and 3) The new method of public participation in government *(the new method by the which society is governed)* (Rhodes, 1996)[4]. The use of rule *(governance),* in accordance with the standard meaning, has been widely defined and formulated. Although there are many formulations, one of the most widely cited formulation is the opinion of Rhodes (1996)[4], who found the so-called "six separate use of government" *(Six separate uses of Governance),* namely:

a) *Governance as the minimal state.* As a minimal state, in this case the size of the structure and role of government bureaucracy streamlined so that the process of organization of government more effective and efficient.

b) *As governance Corporate Governance.* As corporate governance, the organization of government with manually-over or mimic or imitate prinsif-prinsif that exist in the *private sector* into the *public sector* such as information disclosure, the integrity of the individual, the role clearer, transparency, accountability, and justice renposibolity *(Fairness).*

c) *Governance As the New Public Management.* As the new public management, the organization of government that emphasizes the role of government as the likely role of manager in business companies, with management processes stylish *private sector* is thick and kept up-to guard against competition, market mechanisms, efforts to customer-focused, service options and impact business valued) *Governance As Good Governance.* As a *"good governance",* the organization of better governance, namely in the sense of trying to achieve the government's performance more effective, efficient and economical and also once more responsive, refresentatif, resposible, accountable to the public interest which is very diverse.

e) *Governance As a socio-cybernetic system.* As socio-cybernetic system, government organization of the process involves the interaction and interrelation many actors/perpetrator of bureaucratic government and non-government (legislative, private sector, NGOs, academics, Press /Media) and responsible simultaneously. The results of public policy is not a product of what is produced by the Government alone but is a product of intervention efforts, interdependence, and interaction and interrelation of many actors.

f) *As self governance-organizing networks.* As a self-organizing network, the organization of the Government which is based on the formation of networks between organizations and between actors in a strong where all parties sharing mutual exchange *resourches* either in the form of funds, information, expertise, and access to his net asset governance mechanisms.

Corporate Social Theory *Responsibilit* y (CSR)

According to Wood (1991), *Corporate Social Responsibility* (CSR), which is also known by various terms such as *corporate responsibility, corporate citizenship, responsible business, sustainable responsible business* (SRB) and *corporate social performance* is basically a form of regulation of companies *(corporate self- regulation)* are integrated into a business model. Magnan & Farrell (2000)[5] which defines *Corporate Social Responsibility* (CSR) as a *"business acts in a socially responsible manner when its decisions and actions account for and balance diverse stakeholder interest".* This definition emphasizes the need to give equal attention to the interests of various *stakeholders* are diverse in every decision and action taken by businesses that socially responsible behavior.

According Caroll (1979)[6] there are four part model of *Corporate Social Responsibility.* Carroll considers *Corporate Social Responsibility* (CSR) as a concept of *multi-layered,* which can be divided into four interrelated aspects include : economic responsibility, legal, ethical and philanthropic. These four aspects of *Corporate Social Responsibility* (CSR) The Carroll described as follows: ***First :*** *Economic responsibilities.* The main corporate social responsibility is the responsibility of the economy, because business organization comprised of economic activities that produce goods and services for society as profitable. **Second:** *Legal responsibilities.* People expect the business is run in compliance with applicable laws and regulations, which is essentially made by the public through the legislature. Legal liability companies demanding that businesses comply with the law and "playing by the rules". **Third :** *Ethical responsibilities.* People expect companies conduct business ethically. Business ethics indicates that moral reflection is done by business people individually and institutionally to assess an issue where the assessment is an assessment of the growing value in society. **Fourth:** *Philanthropic responsibilities.* Aspects *Corporate Social Responsibility* (CSR) to discuss various issues, including

such things as charitable donations, construction of recreation facilities for employees and their families, support for local schools, or sponsoring the arts and sports events. According to Carroll (1991)[6], the *philanthropic* responsibility unwanted or expected by the corporation, "is less important than other third-responsibility".

Corporate Social Responsibility *Corporate Social Responsibility* (CSR) in the Perspective *of Good Governance* and *Corporate Governance.*

In line with the era of globalization and competition so *governance is* widely applied in the context of the company with the aim to ensure effective achievement of targets dit etapkan by a company known as *corporate governance* (Enrique et al, 2006)[7]. *Corporate Governance* is more focused on corporate governance related to internal systems and processes that provide direction and accountability for each organization. In the case of public service is a concern among policy makers or representatives of public organizations and senior managers were given t duties as create a policy (Cornporth, 2003)[8].

In an effort to improve the quality of corporate governance board and improve corporate accountability to shareholders and improve the effectiveness of the system of *corporate governance*, it established the concept of *good corporate governance*. ADB *(Asian Development Bank)* explained that *Good Corporate Governance* (GCG), containing four (4) main value : *Accountability, transparency, predictability* and *participation.* Another notion comes from the *Finance Committee on Corporate Governance of Malaysia*, where the *Good Corporate Governance* (GCG), is a process and structure used to direct at the same time managing the business and affairs of the company toward increased growth in the business and corporate accountability.

The Objective of the end of *Good Corporate Governance* (GCG), is to raise the value of the stock in the long term but taking into account the interests of other *stakeholders.* Then, *"Good Corporate Governance* (GCG)," is defined as a pattern of relationships, systems and processes used by the organs of the company orders to provide added value to shareholders on an ongoing basis in the long term, by taking into account the interests of other *stakeholders*, based on rules laws and norms. The principles contained in the *Good Corporate Governance* (GCG), in general there are four (4) main principles (Asian Development Bank, 2000)[9], namely: 1) *Transparency* (information disclosure), that transparency in the decision making process and openness in expressing information material and rele van of the company. 2) *Accountability* (accountability), namely clarity of function, structure, systems and accountability of the company so that the management company are effective. 3) *Responsibility* (accountability), namely compliance (compliance) in the management of the company to the principles of healthy corporate and applicable legislation. 4) *Fairness* (equality and fairness), which is fair and equal treatment in fulfilling *stakeholder* rights arising under the agreement and applicable laws and regulations.

III. RESEARCH METHODS

For could understand how a *model of Corporate Social Responsibility* (CSR) Rehabilitation Home No Worthy Huni from presspektif *governance* between the regional military command VII / Wirabuanan Army and Sinarmas then approaches used is qualitative the level of exploratory analysis. Data required in this study were obtained through interview techniques to the informant who was selected to obtain information on how the implementation of *Corporate Social Responsibility* (CSR) Rehabi litasi Home Unlivable (RTLH) between Sinarmas with the regional military command VII / Wirabuana in Makassar and Jakarta.

The next technique is the technique of field visits in order to see first hand how the results and outcomes of *its Corporate Social Responsibility* (CSR) which is already taking place, that the last observation techniques and collecting secondary data from documents in each unit of implementation *of Corporate Social Responsibility* (CSR). The data were obtained later by referring to the interactive model of data collection or data collection to data analysis according to Huberman and Miles in Bungin (2003)[10].

IV. RESULTS AND DISCUSSION

To see the implementation of *Corporate Social Responsibility* Model (CSR) SINARMAS in regional military command VII/WRB Makassar through rehabilitation programs RTLH in the perspective of Governance, this can be done through the disclosure of various facts on the ground relating to dig up information on: How the decision-making mechanism that RTLH program is realized, how the functions of each party (Sinarmas and the regional military command VII/WRB) regarding the structure, systems and mechanisms, whether in the implementation of the existing redress mechanisms RTLH program accountability. How the company's efforts and the Government in fulfilling the rights of beneficiaries of the program. All this will be discussed as follows :

1. CSR Program Decision-Making Mechanism RTLH

RTLH program decision-making mechanism is realized starting with the leadership of the Army's request would be the role of the private sector to help address the problem of lack of adequate housing for soldiers due to lack of support from the state budget to repair a state-owned social infrastructure facilities. Then held a meeting initiated by Sinarmas and 14 other private companies from eight major groups such as: 1) PT. Djarum, 2) PT. Adaro, 3) Sinarmas, 4) PT. Wings, 5) PT. Indofood. 6) The Supreme Sedayau Group 7) PT. MSJ 8) Rajawali Corps. Eighth large group t ersebut subsequently conducted Mo U with Assistant Planning Army on Behalf KASAD with Mo U No. 01 / B US-Army / II / 2013, No. Nota / 6 / III / 2013. Subsequently followed up with M o U between the Pangkotama (military commander) with the company that will provide grants *of Corporate Social Responsibility* (CSR) RTLH programs existing for each territory and the eventual realization of this mechanism RTLH program.

If we look from the perspective of the theory of *governance*, decision-making mechanism to perform *its Corporate Social*

Responsibility (CSR) RTLH rehabilitation at the regional military command VII / WRB not involve many *actors* in the implementation. According to the theory of *governance* should *governance* refers to a process of policy-making and the process by which the policy is implemented involving both the state (government), private sector (private sector), and civil society (civil society) in the process of making and implementing ijakan steel material. As (Rhodes 1996)[11] *Governance As a socio-cybernetic system.* As socio-cybernetic system, government organization of the process involves the interaction and interrelation many actors /perpetrator of bureaucratic government and non-government (legislative, private sector, NGOs, academics, Press / Media) and responsible simultaneously. The results of public policy is not a product of what is produced by the Government alone but is a product of intervention efforts, interdependence, and interaction and interrelation of many actors.

From the perspective of this theory should the implementation of *Corporate Social Responsibility* (CSR) RTLH rehabilitation program conducted with the involvement of the three actors, not only the government, and the private Sinarmas the process of making the mechanism of the program but beneficiaries *of Corporate Social Responsibility* (CSR) namely the Community in this regard (soldiers, civil servants and their families) must be involved. So it can be concluded from the perspective of governance theory the implementation of *Corporate Social Responsibility* (CSR) Rehabilitation RTLH yet fully involves actors as described in the concept of governance.

2. The Function Of Each Party Regarding The Structure, Systems And Accountability Mechanisms.

The function of each party regarding the structures, systems and mechanisms everything is done on the basis of the MOU. Each party functions in the program RTLH Sinarmas given to military command acts as the contracting authority *of Corporate Social Responsibility* (CSR) n yes that gives funds to the Army through the financial directorate of the army which is distributed to the respective military command throughout Indonesia. While regional military command VII / WRB in this case Regional Military Commander VII / WRB as Head of Activities (Kagiat), Zidam VII / WRB as (Head implementation activities) Kalaksgiat, representatives of the unit as (Implementation Project Organization) POP as well as members of soldiers and civil servants of the army of beneficiaries of funds *Corporate Social Responsibility* (CSR).

But s complement system and mechanism for the planning, implementation, reporting, evaluation and a defense response, is still done unilaterally by Z are craving to military command. Regional military command then report to me Sinarmas and Mabesad. This reporting process without meli k bat's society as a recipient of funds benefit *Corporate Social Responsibility* (CSR) and Sinarmas involvement in supervision. POP and community pene not accept the benefits given RTLH implementation plan document in which there is no explanation budget plan (RAB), Material Requirements, Needs work equipment, technical specifications and requirements of building materials, as well as images bestek (detail). So that when viewed from the implementation of the concept good *governance* has not been implemented regarding the function of each party (Sinarmas and the regional military command VII / WRB).

3. Redress Mechanisms RTLH CSR Program Accountability.

Accountability mechanism takes the form of physical filing reports (Lapjusik) development. Sach week reported to Zidam POP in stages. Zidam to the Regional Commander VII / WRB UP then to As long Chief of Staff of Military Region VII /WRB. As long Chief of Staff of Military Region provide reports to funders CSR companies (Sinarmas) as well as to the Army Headquarters (Mabesad) in Jakarta, and the last in the form of comprehensive reports and news handover between the two parties, namely companies funders *Corporate Social Responsibility* (CSR) the Military Command.

For reporting findings gradually implemented properly and according to the rules benefits a defense response (Wabku) so there is no budget deviations. But indications discrepancy report between a written report with the results of field observations and studies on the implementation document regarding technical specification and interviews with implementation as well as beneficiaries of the field discovered anomaly or deviation. The deviation is the budget that is not based on the program, the material is not suitable bestek, The transfer of the budget, as well as utilizing mode of beneficiaries *of Corporate Social Responsibility* (CSR) to increase the completeness of his own house in accordance with the guidelines. It can be concluded for the first phase of the CSR program RTLH deviations occur budget while in Phase II *Corporate Social Responsibility* (CSR) RTLH program can be carried out according to plan and budget and appropriate reporting.

4. **Corporate And Government Efforts To Fulfill The Rights Of Beneficiaries Of The Program.**

The efforts of government and private /corporate *(private sector)* to fulfill the rights of beneficiaries of the program is still not maximized in terms of both regulation and involvement as well as in terms of supervision. This means that in the implementation of CSR programs RTLH there must be a guarantee for the achievement of the objectives *of Corporate Social Responsibility* (CSR) without prejudice to the rights of beneficiaries of the program since its implementation is not *governance*.

Based on the research results, we conclude the empirical model of the implementation *of Corporate Social Responsibility* (CSR) Rehabilitation Program RTLH Sinarmas regional military command VII/Wbt in Makassar that no community involvement as beneficiaries of *Corporate Social Responsibility* (CSR) RTLH rehabilitation. Pr ogram implemented through MOU Groups Company and Mabesad the which dealt up by MOU between regional military command VII/WRB d an Sinarmas while community (prajuri, civil servants and their families) as beneficiaries excluded from the dam implementation, but received the results of CSR that is so in the form of rehabilitation RTLH results development by Zidam as executor and POP formed by regional military command VII/WRB.

When viewed from the perspective *of governance*, implementation RTLH not in accordance with the paradigm of governance theory and the concept of thought. Due to the

implementation of *Corporate Social Responsibility* (CSR) required the involvement of the three pillars of governance: government *(public sector)*, Private / corporate *(private sector)* and society *(Civil Society)*. From the perspective theory of *governance*, decision-making mechanism to perform *its Corporate Social Responsibility* (CSR) RTLH rehabilitation at the regional military command VII / WRB up to terw intention not involve many ak tor in practice. The function of each party (Sinarmas and regional military command VII / WRB) regarding the structure, system and answers a defense mechanism is not optimal and governance within their theory because it does not involve actors other. System and mechanisms of planning, implementation, reporting, evaluation and accountability, still carried the one hand namely by Zidam. Zidam make a report to the military command, from kodam reported to Sinarmas and Mab Esad without the involvement of the community as beneficiaries of funds *Corporate Social Responsibility* (CSR) as well as involvement in supervision Sinarmas. Everything is reported in administration but for the field pengecekanya not involved. There POP units and beneficiaries are not given how document execution plan RTLH by the method of self-managed run in which no explanation budget plan (RAB), Material Requirements, Needs equipment work, technical specifications and material requirements for building materials, as well as images bestek (detail), So that when viewed from the implementation of which should not be implemented with good *governance* for the function of each party (Sinarmas and the regional military command VII/WRB) regarding the structure, system and answers a defense mechanism is not optimal and sesuia Governance theory because it does not involve other actors.

A defense mechanism answers the implementation of *Corporate Social Responsibility* program (CSR) RTLH should be done in an accountable, transparent, responsibility and fairness. In the model empiri now very difficult to do that as a defense response report the results of *its Corporate Social Responsibility* (CSR) Rehabilitation RTLH Sinarmas in the regional military command VII/ WRB has not put forward the principle of transparent and accountable governance especially Tarutama at the level of implementation and reporting of a defense response still found differences in the budget which is not in accordance with the plan to the implementation of the Rehabilitation RTLH is the standard conduct of *its Corporate Social Responsibility* (CSR) Rehabilitation RTLH caused by only one party, namely the Implementation of *Corporate Social Responsibility* (CSR) RTLH implemented by Zidam from planning, implementation, reporting and evaluation is what violates the concept of governance. Recipient community *Corporate Social Responsibility* (CSR) can not supervise all reporting policies are made Zidam. Private sector only receive less supervision reports *lapjusik* per week administration form and acceptance of the system after completion so that the implementation of Corporate Social Responsibility (CSR) can not be optimal in this model.

In this model the government is only acting as Mandataing, fasilitang course no role as partnering and endorsing as expressed by (Fox, Ward, and Howar, 2002)[12] in *the role of the public sector to strengthening Corporate Social Responsibility* (CSR) that the government should have a role Mandating, Fasilitang, Partnering and endorsing. Mandating the role of the government only implement it by law, especially Law No. 47 on PT. *Corporate Social Responsibility* obligations (CSR) and facilitated by Regulation Other like the Ministry of Finance Regulation on the provision of tax incentives for companies that implement *Corporate Social Responsibility* (CSR) well, and the role of the private sector has run a government regulation alone which serves as the government partnering to run a program mandated by the Act, while the public only as beneficiaries without involved in its implementation.

V. CONCLUSION

From the description of the explanation model of implementation of *Corporate Social Responsibility* (CSR) in regional military command VII / WRB can be concluded that:

1. RTLH program decision-making mechanism through the MOU between the Army with partner companies. Especially for regional military command VII/ Wirabuana done with Sinarmas followed up with the creation of organizations implementing development RTLH rehabilitation program.
2. The function of each party regarding the structures, systems and mechanisms everything is done on the basis of the MOU. Organization formed for the implementation and supervision. Answers a defense report of activities carried out in a hierarchical manner to both the funders *Corporate Social Responsibility* (CSR) namely Sinarmas or on units on which Mabesad. Reporting gradually implemented properly and according to the rules a defense response finances (Wabku) no budget deviations, so that those who received the report believe that the funds have been used According designation and appropriate mechanisms and systems a defense the answer. But research findings, there is no compliance to an tar reports a plan to conduct and POP with the beneficiaries of the program. Incompatibility concerns differences in budgets, the difference in technical specification incompatible with the image bestek, material and facilities made by the recipient of the funds the benefits of Corporate Social Responsibility (CSR).Government efforts and private sec tor to fulfill the rights of beneficiaries of the program is still not maximized in terms of both regulation and involvement as well as in terms of monitoring its implementation thus allowing the program can be distorted or manipulation adverse occur beneficiaries *governance programs.*

REFERENCES

[1] Ardianto, 2011: 35) Ardianto, Elvinaro. 2011. Metodologi Penelitian Untuk Public Relations. Bandung : Remaja Rosdakarya Bandung.

[2] Mc Williams and Siegel (2001). Wc Williams, A and D. Siegel. 2001. Corporate Social Responsibility. A. Theory of the Firm Perspective. Academy of Management Review. 26 (1): 117-127

[3] Freeman, R. E. 1984. Strategic Management: A Stakeholder Approach, Boston, Pitman

[4] Rhodes, R. 1996. "The New Governance: Governing without Government." Political Studies, No. 44: 652-657.

[5] Maignan, I. and Ferrell, OC (2000), Measuring Corporate Citizenship in Two Countries: The Case of the United States and France, Journal of Business Ethics, Vol. 23 No. 3, pp. 283-297.

[6] Caroll (1979) Carroll, AB 1979. A three-dimensional conceptual models of corporate performance. Academy of Management Review, 4 (4): 497-505.

[7] Enrique et al, 2006). Enriques, Luca and Matteo Gatti, 2006. "EC Reforms of Corporate Governance and Capital Markets Law: Do They Tackle Insiders' Opportunism?". Mimeo

[8] Cornporth, 2003). Cornforth, C. (ed.) (2003) The Governance of Public and Non-profit Organisations. What Do Boards Do?, London: Routledge

[9] Asian Development Bank, 2000), Asian Development Bank, anual Report, 2000.

[10] Bungin (2003 Bungin, Burham.2003. Analisis Data Penelitian Kualiatif, Pemahaman Filosofis Dan Metodologis Ke Arah Penguasaan Model Aplikasi. Jakarta : PT. Raja Grafindo Persada.

[11] Rhodes, R. 1996. "The New Governance: Governing without Government." Political Studies, No. 44: 652-657.

[12] Fox, Ward, and Howar, 2002) Fox, Tom. , Halina Ward, and Bruce Howard. 2002. Public Sector Roles in Strengtening Corporate Social Responsibility: A Baseline Study, World Bank 2002.

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Collaborative Management Model Public Sector

(Study Support Achievement of Two Million Ton Surplus Rice between the Government of South Sulawesi Province with the Military Regional Command Vii /Wirabuana)

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Abstract- The purpose of this study was to describe the implementation of the management of public sector collaboration and the management model of collaboration between the Government of the province of South Sulawesi with the regional military command VII / Wirabuana in order to support the achievement of overstock rice 2 million tons sustainable. The research was conducted within the scope of the Provincial Government of South Sulawesi and the regional military command VII/Wirabuana as the parties conducting collaborative management. The study was conducted using a qualitative approach that emphasizes the characteristics of the scientific background in which researchers act as an instrument of research. The focus of research is directed at efforts to obtain descriptive data in the form of written data and analyzed inductively. Where overall the research has been carried out in several stages of data collection, data reduction, data presentation, and conclusion and verification. From the research results have shown that : 1) Management collaboration undertaken between South Sulawesi Provincial Government and the regional military command VII/Wirabuana by mutual agreement the central government has followed orders in this case the Minister of Agriculture and the Army Chief of Staff. Then developed by the South Sulawesi provincial government along with regional military command VII/Wirabuana form overstock program to achieve the above two million tonnes of rice. Context collaboration can generally be adequately understood by both parties, but in particular have not been prepared together with a good strategy, goals, objectives, vision, policy and arrangement of personnel specifically in charge of the MoU and not to involve non-profit organizations and the private sector in the management of collaborative public sector. 2) collaborative management model used was Jurisdiction-Based Management Model and little in common with the collaborative management model Top-Down Model.

Index Terms- Collaborative Management, temporary task force, jurisdiction-based management and top-down models.

I. INTRODUCTION

The Central Statistics Agency in April 2014 suggested that Indonesia still have to import rice from other countries as much as 31.145 tons. This is due in addition to the ways farmers planting is still not too modern as well as the rise of the shift utilization of agricultural lands were converted to development other than agricultural sectors. Productive land farming in Indonesia has experienced a deficit of fifty thousand to one hundred thousand hectare one year(Ministry of Agriculture RI, August 2014). Likewise with the weather conditions and climatic circumstances that lately more and more difficult to predict, has contributed to the number of crop failure in some areas in Indonesia. Efforts to increase agricultural production continues to be done by government and society through efforts to print new fields as well with increased technical capabilities to farmers so as to make efforts towards intensification of agricultural land at their disposal. But these efforts still have not shown optimal results.

The various problems facing the government can basically overcome by collaborating with various parties. In doing collaborations, there are various options such as by partnering with the private sector, non-governmental organizations, or with other government organizations late. One model of cooperation improving government performance by performing the collaboration in the field of public management where by O'Leary and Bingham (2009)[1] have called *"The Collaborative Management"* and Agranof and McGuire (2003)[2] have called *"The Collaborative Public Management " or* the management of public collaboration. Model public sector collaboration is seen is one effective approach used by the government, especially in overcoming the lack of resources of the organization. The forms of collaboration can be in the form of cooperation between the government and the private sector *(public private partnership),*the relationship between government *(Intergovernmental Relations/IGR);Intergovernmentanl Management (IGM),* or invite the private sector to use its funds to assist the government in addressing the problems of development in their respective areas, the so-called form of

collaboration with *Corporate Social Responsibility (SCR)* and various other forms of partnership.

Conditions lack of resourcesownedSouth Sulawesi provincial government in achieving the program a surplus of 2 million tonnes of rice to be handled by management collaboration with the the regional military command VII /Wirabuana. In the period 2014-2015, collaboration management have shown results do not fit the expected target. In the case of support from the financial ceiling set in 2014 in South Sulawesi is large enough Rp. 359 007 678, - and realized only Rp. 173 142 400 (48.23%); physical realization in which the target of 214.823.00 and eventuate only at 65083.12 (30.29%). Optimization of the targeted land area of 70.785.00, but realized only area of 33488.85 (47.25%).

Conceptually, if the management of the collaboration undertaken between the provincial government of South Sulawesi with the regional military command VII /Wirabuana implemented consistently, the problems that arise in the context of joint collaboration program that should not happen. Departing from the phenomenon then that becomes a problem in this research is how the implementation and management model of collaboration that took place between the governments of South Sulawesi province with the regional military command VII / Wirabuana in order pen achievements surplus of 2 million tons sustained in South Sulawesi province.

II. LITERATURE REVIEW

A. Management Collaboration

Collaborative management of the public sector is an idea that has resonance in various fields, but have not had the lenses and the same definition. So that in this study had a clear definition of the notion of public management collaboration used a definition proposed by Arganof and McGuire (2003)[2] and also from O'Leary, Gerard and Bingham (2006)[1] which states that *"the collaboration of public management is a concept that describes the process of facilitating and the implementation of multi-organizational arrangements to solve problems that can not be resolved or easily solved by one organization".*

Collaboration management according Arganof and McGuire (2003)[2] is currently the main activities of the leaders or public manager. The interdependence of government and non-government sectors, and domain complexity of horizontal and vertical relationships between governments, bringing new challenges and potent man to have to partner. Actor purpose, to link, and the strategic choices vary from jurisdiction to jurisdiction.

According to Alter and Hage (1993)[3],needs to collaborate arise because of the interconnections between the players (actors in the organization), as well as each actor has a type, level of technology and resources are different, but they need to carry out his duties. Interconnections will encourage an increase in the frequency and intensity of communication between organizations, where each force cooperated in the form of action and collectivity on several levels.

B. Collaborative Management Model

Collaborative management model has a variety of models in public management. Each model has a different type of management when implemented. Activity trusted and most collaborative - jurisdiction based management - caused leadership strategy and program design consultation program are horizontal and vertical, and pointed in the direction of the adjustment program that can meet local needs rather than desires external parties. Jurisdiction based management geared to the strategic priorities for the region that includes a set of managerial skills and processes across the organization that are substantially different from the standard approach in the core public administration texts.

Collaborative management model like being the crossroads of two-dimensional variable dimensions; 1) the level of activity of the organization collaboration and 2) the extent to which the activity is strategic. Many different types or styles of management may be in hypothetical collaboration. For example, an organization may choose to exploit a complex governance environment by looking for opportunities, and actively operating with vertical and horizontal actors. Instead, organizations can choose to be inactive and passive collaboration, for various reasons. Organizations can also consider the situation in which the organization acting as a moderate, even very moderate, collaborating actively with the main vertical actor but still very passive, does not see the environment as an opportunity but rather viewed as a burden. The same thing organizations can become active and sometimes to bargain with vertical actor, while collaborating with the actors horizontal.

The dominant style of collaborative management of an organization can be measured by the level of cooperation in the form of the dimensions of activity and strategy. Arganoff and McGuire (2003[2] dividing the collaborative model that is (1) based management jurisdiction *(jurisdiction-based management)*, which is believed to be the dominant orientation in various organizations, (2) Model abstinence *(abstinence model)* occupy positions other extreme (low activity and passive). (3) *top-down* model, and (4) the recipient donors *(donor-recipient)*, occupying various levels of activity and strategic else. (5) Management of reactive *(reactive management)*,represented as the value of floating/hanging. Finally, the management has been satisfied *(contented management)* which represented as an extreme value (low activity and opportunistic)

III. RESEARCH METHODS

This study uses qualitative approach, where the unit of analysis is the organization in both government conduct collaborative management namely South Sulawesi Provincial Government and Military Command VII / Wirabuana. For reasonsregiondistricts in South Sulawesi too much then the next chosen region considered can represent a picture of the implementation of the program a surplus of 2 million tons in South Sulawesi the Bone district (representing the products of rice reach the target of 2 million tons), Takalar District (reach half the target of 2 million tons), and Toraja Regency (production below average). Data was collected with interview techniques resourcesis: Governor of South Sulawesi; regional military commander VII /wirabuana, head of agricultural and horticultural crops south sulawesi, regent, district commanders, head, commander kodim, the agricultural extension and NCO village builder in areas sedadi sample of the study area.

IV. RESULT AND DISCUSSION

Conceptually, collaborative management is an alternative approach for effective use by all levels of local and central government. Resources are scarce or less controlled by one of the parties can be covered by cooperating with partners that are outside the organization so that excellence can be achieved. The benefits will be felt by both sides can form a symbiotic mutual benefits as well as benefits solely to support one of the parties.

A. Collaboration Implementation Of The Provincial Government Of South Sulawesi With The Regional Military Command VII / Wirabuana

Management practices of collaboration undertaken by the Provincial Government of South Sulawesi with the regional military command VII / Wirabuana after investigation it turns out is not due to the initiation comes from South Sulawesi Provincial Government but because of the presidential instruction through the Ministry of Agriculture which then perform *Memorandum of Understanding (MoU)* with the Indonesian republic army particularly the Army where focus on the management of collaboration in the field of food security. Departing from the MoU of the central government further by South Sulawesi Provincial Government modified in accordance with the conditions of the region with special focus on increasing surplus of 2 million tons which has become a target of the policy since 2008. Therefore, this policy is typical of an initiation South Sulawesi Provincial Government.

In the implementation of collaborative management between the Government of South Sulawesi with the regional military command VII /Wirbuana done how the government of South Sulawesi utilize the network to succeed the program agreed through the steps to make decisions together a network of its (the regional military command VII / Wirabuana),sustainable relationshipintroducing tasks and objectives shared networks, as well as to manage jointly the impact of policies made . The process in building this collaboration is in line with what is meant by Leary and Gazley (2009) that the management of the collaboration is to facilitate the process and conduct multi-organizational arrangements to solve problems that can not be solved by one organization.

Collaboration done between the two government institutions are driven by the interests of both parties. forSouth Sulawesi Provincial Government interest is to improve the position of South Sulawesi as barns in the country and even reached 2 million tons of rice *overstock* sustainable. As for the the regional military command VII / Wirabuana to realize universal security defense system through real devotion of the military to create oneness between the military and the people. Both interests collaboration in achieving self-sufficiency in rice is in line with what was stated by Han, Hijern and Porter, 1978[4] and Hull in Hjern, (1987), and O'Toole, (1985)[5].

In the implementation of collaborative management are some aspects are not optimal in the implementation of the right, among others, the lack of organization that specifically handles collaboration management, the absence of a shared vision that is designed, there is no policy specifically created in order management collaboration, and the collaboration has not involving nonprofit organizations, and private, aspect elements and nature resources combined shows resources used in the management of collaboration to succeed the rice self-sufficiency and a surplus of 2 million tons in the form of human resources. Parties the regional military command VII/Wirabuana providing resources called NCO village builder and of the Provincial Government in the form of Agricultural Extension agricultural extension field. Only the use of resources experienced problems mainly related to the quantity and quality of resources. Field data indicates that the number of villages and villages in South Sulawesi province totaled 3037 while NCO village builder available agricultural extension field still 2226 people and 2037 people. There should every village and village supervised by one person NCO village builder and one person agricultural extension field. Thus there is still a difference between the number of non-commissioned officer andagricultural extension field with village / urban villages. It is undeniable that the shortage NCO village builder and agricultural extension field affect less effective extension activities, supervision and assistance to the farmers. Moreover, according to information in the field of the quality of the knowledge and skills ofagricultural extension field in providing engineering-related aspects of agriculture and education is still lacking. This condition is regarded as one of the causes less maximal achievement of targets in some areas.

The elements of resource management thatexchanged in collaboration by the two parties relevant to the resource element characteristics proposed by Barbara Gray (1989)[6] of which there is interplay between the stakeholders in realizing the achievement of the objectives of the program, created cooperative ownership of decision done, and there is a collective responsibility for keep doing partnerships in the future. Similarly, if analyzedof the relevant dimensions of collaboration undertaken with what was raised by Seleden, Sowa, and Sandfort (2002)[7] also elements of existing resources in collaboration among those who collaborated, among others the organizational structure is used; there is a common goal; to bear the risk of joint as well as the award for the parties involved and man. Where collaboration management conductedcollaboration dimension in public service. There by aged to reach the target. This is relevant with a view Thomson and Perry (2006)[8]. Similarly, the elements the existence of inter-personal trust; there are shared norms; resources involved requires quality; Formal agreements as a factor in forming collaborations and influencing its *outcome* and this is in line with the view Thomson and Perry (2006)[8].

The resource propertiescharacteristiccollaborated characterized as proposed by the experts.Betweenthe characteristics of the resources that are easily interchangeable namely human resources in such matters, is NCO village builder where relatively available and alreadyskilled (O'Leary and Bingham (2009)[1]. Similarly, the views Provan and Milward (1995)[9] which states that once a collaboration developed then then collaboration can further be improved by providing the necessary resources for those who collaborate.

B. Management Model Collaborative Provincial Government of South Sulawesi with the regional military command VII / Wirabuana

Agranoff and McGuire (2003)[2] provides a classification model that is often used by the government in conducting inter-governmental collaboration. The classification is a) *yurisdiction-based management models; 2) abstinence models;3) top-down models;4) donor-recipient models.* The four models of collaborative management have differences when applied. The fourth type of this model can be either horizontal collaboration can also be vertical in the sense that government leaders can invite local partners (horizontal) or partner from the top level of government (vertical) in order to overcome the scarcity of their resources. The options available for local governments to collaborate depends views on the environment facing and internal conditions.

Result studies done show that collaboration between the Government of South Sulawesi province with the regional military command VII / Wirabuana classified as management model of collaboration *"Jurisdiction-Based Management model"* as proposed by Agranoff and McGuire (2003)[2]The reason, after MoU signed between a Ministry farm with Army Chief of Staff, then immediately followed up by regional leaders to take action with a variety of other government organizations. First of all internal SKPD immediately coordinate with the Provincial Government of South Sulawesi among others Department of Agriculture and Horticulture, Secretary coordination counseling, local staffing agencies, utilization of water resourcesand regional development planningAfter coordinating with the internal local work unitSouth Sulawesi province immediately MoU with theregional military command VII / Wirabuana with a number of points of understanding. So that the main drivers of this collaboration is the regional leaders.

What did the South Sulawesi Provincial Government to encourage collaboration the regional military command VII / Wirabuana as a follow up of the MoU level, the central government is considered very strategic and done with jurisdictional boundaries that exist. It's just that the decision to collaborate was not based on calculations and negotiations but more because mutual accommodation over the use of resources owned by the military command. Therefore this collaboration in the form of vertical and horizontal is correct. Collaboration conducted between the two government agencies is an instruction from the central government (vertical), and after elaborated the instruction becomes a collaboration between South Sulawesi Provincial Government with the regional military command VII / Wirabuana for collaborate in accordance with the agreed MoU is a form of collaboration that is horizontal. Collaboration that took place between the Government of South Sulawesi province with military command can also be said to be a little VII. Wirabuana meet the elements of a model of collaboration management top-down model, because this collaboration occurs as a result of orders from the central government, which is hierarchy South Sulawesi Provincial Government is a government of the central government sub.

V. CONCLUSION

Based on the results of research and discussion that has been done, following conclusion of the study are described as follows:

1. Implementation management collaboration that took place between the Provincial Government of South Sulawesi with the regional military command VII / Wirabuana achieve self-sufficiency in rice surplus of 2 million tons sustainable in the province of South Sulawesialreadylasted from 2010 to 2015. Management collaboration that occurs not merely because of instructions from the central government, but a continuation of the policy of the Government of South Sulawesi existing and proclaimed since 2008,instructionof the central government into momentum for the Government of South Sulawesi province in order to get a new energy policy that has existed for this can be upgraded more quickly and sustainably. In the implementation of Risk Management n collaboration there are still some aspects of the characteristics of collaborative management is not optimal in its implementation, among others, the lack of organization that specifically handles collaboration management, the absence of a shared vision that is designed within the framework of collaboration management, specific policies were issued as part of an agreement to conduct collaborative management does not exist, no direct involvement of other organizations as part of a collaborative management as nonprofit organizations, and private.
2. Collaborative management model used by the Provincial Government of South Sulawesi the regional military command VII / Wirabuana in achieving self-sufficiency in rice surplus of 2 million tons of sustainable resembles the model proposed by Agranoff and McGuire (2003)[2] the *Jurisdiction-Based Management Model* and little in common with the collaborative management model *Top-Down Model.*

REFERENCES

[1] O'Leary, Rosemary, and Bingham, Lisa Blomgren. 2009. The Collaborative Public Manager: New Ideas for the Twenty-first Century. Washington, DC: Georgetown University Press.

[2] Agranoff, Robert and McGuire, Michael. 2003. Collaborative Public Management: New Strategies for Local Government. Washington, DC: Georgetown University Press.

[3] Alter,C. dan Hage, 1993. Organizations Working Together. New Burry Park. CA : Sage. Dalam Jones, Candace,dkk. 1997. A general Theory of Network Governance : Exchange Conditions and Social Mechanisms. Academy Of Management. The Academy Of Management Review : Proquest.

[4] Hanf, Kenneth.,Hjern, Benny., And Porter, David O. 1978. Local Networks of Manpower Training in the Federal Republic of Germany and Sweden. In Interorganizational Policy Making: Limits to Coordination and Central Control, ed. Kenneth Hanf and Fritz W. Scharpf. London: Sage.

[5] O'Toole, Laurence J. Jr ,. 1985. Diffusion of Responsibility: An Analysis Interorganizational. In the Policy Implementation in the Federal and Unitary Systems, ed. Kenneth Hanfadn AJ Toone n. Dordrecht: MartinusNijhoff

[6] Gray, Barbara. 1989. Collaborating: Finding Common Ground for Multiparty Problems. 1st ed. San Francisco: Josey-Bass.

[7] Selden, Sally Coleman., Sowa, Jessica.,AdnSandfort, Jodi. 2002. The Impact of Nonprofit Collaboration in Early Childhood Education on Management and Program Outcomes. Paper presented at the Annual Meeting of Association of Nonprofit and Voluntary Organizations Act ion, Montreal, 14 to 16 November.

[8] Thompson, Ann Marie., And Perry, James L. 2006. Collaborations Processes: Inside the Black Box. Public Administration Review 66, No. 6 (Supplement): 20-32.

[9] Provan, Keith G., and H. Brinton Milward. 1995. A Preliminary Theory of Interorganizational Effectiveness: A Comparative Study of Four Community Mental Health Systems. Administrative Science Quarterly 40, No. 1: 1-33.

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Continued Multiparty Collaboration Model in Crab Fisheries Management

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Abstract- This paper highlights the importance of managing collaboration crab fishery, which is an asset of development, so it can be used together to maximize the participation of all stakeholders. Collaboration includes a complex and multidimensional relationship which includes the social, economic, cultural and technical management of the run from upstream to downstream. Altogether seen in a unity mutually crochet hooks. Based on the concept that it is necessary to design a model of collaborative management in an integrated manner that can run in a dynamic and continuous process which will benefit all stakeholders which include fishing communities, government and the business world (employers swasta). Several studies have stressed the importance of sustainable crab fishery management based multi-stakeholder collaboration within the framework of the system. Several important issues in the management of crabs is the exploitation that goes beyond the biological limits of the maximum, which is not optimal arrests resulting in lower catches of fishermen in terms of both quality and quantity. This raises the systemic impact indirectly on businesses crab and indirectly on the government. If this situation continues then the losses will be borne by the Indonesian nation is not only socially but also economically and politically.

Index Terms- models, management of sustainable fisheries, crab, based collaboration

I. INTRODUCTION

So far studies on sustainable crab fishery management based multi-stakeholder collaboration within the framework of the system has not been done. Similarly, the mapping of the degree of influence and interests of the parties involved in the management of crabs, as well as the multi-stakeholder contribution to the collaborative effort crab fishery management. The study on the sustainability of small crab fishery-based multi-stakeholder collaboration, will contribute in resolving social conflicts and an increasingly alarming conditions crab.

Based on the research report Sulistiono, et al. (2009)[1] reported that the optimum level of arrests carried out in the waters north of Java (Panimbang, Labuhan, Serang, Cirebon, Rembang), western Sulawesi (Barru, Maros), Nusa Tenggara Barat (Gulf Bima) has exceeded a limit of about 113.68 percent, whereas the level of resource utilization optimization crab in these waters amounted to 43.10 percent. This phenomenon is real perceived by the decline in catches of fishermen in terms of both quality and quantity.

A decrease in the catch of the impact on the decline in the supply of raw materials to be processed into export products. Overall, the production of crab in Indonesian waters began to show a decline in 2004 (Juwana, et al., 2009)[2]. Statistical data of fisheries South Sulawesi province showed an increase crab production in 2007 - 2009, but the year 2010 - 2012 decreased despite increased production values (Table 1). According to the chairman of the Indonesian crab Management Association (APRI), scarcity of raw materials has forced some crab processing plants closed. Of the 24 crab processing company in the country, now lives 12 companies that are still operating. This figure continues to decrease with continued reduction in sea crab population.

Systemic effects arising from this situation will directly concerning businesses crab and indirectly on the government. Therefore the experts (conservationists) marine and fisheries make efforts to resolve this issue. Appears various alternative fisheries management models developed. One of them is the collaborative management model.

Collaborative Management refers to a mix of formal rules of government and the traditional rules of society, and therefore the co-management of fisheries can be interpreted as the division or distribution of responsibility and authority between the government and local communities in managing fishery resources. Based on this definition, the government and society are responsible together in conducting all phases of fisheries management. With this model the expected conflicts between fishing and the degradation of fisheries resources as one of the descendants of the problem of centralizing the management of fisheries - an imbalance between the state's role and the role of communities in fisheries management can be overcome (Adrianto 2011; Alains, et al., 2009)[3,4].

During the regime of management of fishing is likely to be open (open access) that anyone, anywhere and anytime fishermen can freely exploit marine fishery resources, without there among users (stakeholders) is responsible for its preservation (Christy 1987; Christy and Scott 1986)[4,5]. With practices that are free so it was causing pollution and damage to coastal ecosystems, which marked the occurrence of symptoms of overexploitation (overfishing) in several areas of coastal waters, destruction of coral reef ecosystems as a result of fishing practices that damage (bombing), the destruction of forest ecosystems mangrove, the use of fishing gear that is not environmentally friendly such as trawling, and other coastal environmental pollution (Dahuri 2003; Bengen 2002)[6,7].

According Alains (2009)[8] management and utilization of fishery resources tend to dwindle due to the interaction between

people more expressed in the form of mutual competition rather than cooperation. Mutual competition in the use of fish resources is the reason for the failure of fisheries management shown by the destruction of resources and the existence of poverty. However, mutual interaction between people can be seen as well as the potential that can be developed to formulate a mechanism for the effective management of fisheries resources.

Crab fishery own collaborative management to address the issues that the crab fishery as a development asset can be utilized together with maximizing the participation of all stakeholders. Collaboration includes a complex and multidimensional relationship which includes the social, economic, cultural and technical management of the run from upstream to downstream. Altogether seen in a union that is intertwined. Based on the concept of the system that it is necessary to design a model of collaborative management in an integrated manner that can run in a dynamic and continuous process which will benefit all stakeholders which include fishing communities, government and business (private employers).

II. SOME PROBLEMS IN CRAB FISHERIES MANAGEMENT

Crab fishery management that has lasted more than a decade, has involved many parties with diverse interests. In the interaction of the parties consciously or not, do the competition in the fight for its interests. It encourages the exploitation of crabs. Currently crab already in a state of overfishing, but exploitation continues to occur even more worrying when the various parties (state, private, and community groups fishermen) has sought to overcome them, in order to realize a sustainable crab fishery.

The main problem appears in the management of crabs which are less obvious the process of participation and cooperation among stakeholders involved in the crab fishery management (state, private entrepreneurs, and community groups of fishermen). Management visible only by Department of Marine and Fisheries so impressed is top down, one-way, less motivating people to participate and less integrated.

Such conditions if explored more deeply through the focus of the problem is: **first**, during this multi-stakeholder involvement uncharted properly according to the interests and influence on the sustainability of the crab fishery. Stakeholder interests can be seen from the motive behind his involvement in the management of crabs, the benefits of what is expected, how close the stakeholders on the management of crabs, means whatever is important to be applied to fulfill his desire in this management, and how the position of stakeholders in the management of small crab fishery. While the influence of stakeholders can be seen from the ability to build stakeholder opinions / ideas, the ability of stakeholders to give sanctions / threats or power coercive stakeholders, how high the level of legitimacy / stakeholder leadership in the management of crabs, the ability to compensate in the form of material / incentive or utilitarian power stakeholders. Similarly, the network of stakeholders, such as the number of networks, form a network, the network level and the functioning of the network. **Secondly**, it is not clear what kind of competition among the parties involved in the crab fishery management. Is that a form of competition in the process of multi-stakeholder interaction leads to conflict or collaboration. **Third**, information on the role of stakeholders in the crab fishery management is not clear. Similarly, regarding the sharing contribution of stakeholders in the crab fishery management has not been portrayed.

Observing this, we need a model of management strategies crab integrated, which blends harmoniously inter-element (the) community of fishermen, the fishery, and the government in order to: (1) Increasing public awareness of the importance of resources crab to support life, (2) Increase knowledge and ability of people, so that they can participate in each phase of the management of crabs in an integrated manner, (3) Increase the income of the people with other forms of utilization of fishery resources crab optimal and sustainable through fishing activities so as to provide benefits to people in the present generation and that will come, without losing its ecological function

III. MULTIPARTY COLLABORATION BASED SUSTAINABLE CRAB FISHERY MANAGEMENT

a. **Multiparty Competition**

In the context of fisheries, seafood is a source of natural wealth for grabs in order to meet the demands of public life. Efforts greater exploitation of the sea and into the economic chain as the natural wealth of the land that is thinning. Thus, the competition to be able to exploit the sea was not inevitable. The diverse interests of the various stakeholders consulted in Exploiting marine areas. Of stakeholders in that it covers all parties involved in the management of marine resources. Stakeholders include everyone from local and national politicians and community leaders, rulers, paramilitary groups, NGOs and international agencies. If related to the management of the crab fishery stakeholders involved include local authorities, Department of Marine and Fisheries, entrepreneurs (exporters) crab, collectors (baskets), crab fishermen, NGOs in the field of environment and consumer services, as well as financial institutions. According to Karl Marx in Poloma (2007)[9], that (stakeholders) that is different is the decisive factor for the creation of social conflict. Fahmid (2013)[10] states that social conflicts due to competition among actors to control the political and economic power, there is a conflict in the form of open and covert conflict.

Referring intensively on Knight, et al. (2002), identifies at least there are four kinds of conflict fishermen based factors. First, class conflict, namely the conflict between social classes of fishermen as a result of the dominance of capital enterprises and traditional businesses, such as conflict or a mini trawl fishing in the local language known pattarik or pa'renreng (upscale) with small fishing (lower class), which is similar the category of conflict its war gear Charles (1993).[11]

Second, the conflict orientation, is the conflict between fishermen who have different orientations in resource utilization, namely between fishermen who have concern for the ways of resource use environmentally friendly (long-term orientation) by fishermen who use activities that are damaging the environment, such as the use of bombs, potassium, etc. (short-term orientation).

Third, the agrarian conflicts (fishing area), a conflict that occurs as a result of the struggle for control of areas to fishing (fishing ground), that may occur between classes of fishermen, as well as inter-class fishermen. It can also happen between fishermen and non-fishermen of other parties, such as between fishermen and other businesses, such as aquaculture, tourism, mining, the Charles (1993)[11] termed the allocation of external conflict.

Fourth, the primordial conflict, a conflict that occurs as a result of differences in identity, like ethnic, regional origin, and so on. Anatomy of conflict above illustrates how complex the conflict fishermen. The fourth type occurs both before and after the regional autonomy.

b. Multiparty Collaboration

In some cases the conflict resolution efforts utilization of fishery resources mostly settled in court, but through negotiation and mediation between parties in conflict with the local government mediators. Therefore, the role of local authorities and local institutions in the social and political context can affect the conflict solution process and fishermen in coastal areas (Daris, 2004)[12].

To empower fishing communities amid multiparty conflict of interests in order to achieve maximum benefit, it would require collaboration strategy that allows communities empowered in earnest. Himmelman explains that the strategy of empowering collaborative consisting of: (1) organizing a community to support the cooperation objectives set people concerned, and (2) facilitate the process that brings together external parties to support the achievement of community goals intended (Tadjudin, 2000)[13]. Furthermore Salman (2010)[14], explains that in order to realize the collaborative community empowerment and sustainable, then the relationships between the major parties in particular communities, governments and employers must be in a position equal or balanced.

c. Sustainable Fisheries Management

If it is associated with the concept of sustainable fisheries, the Satria (2009)[15] mentions three important dimensions that are empirically experience the tug reaches equilibrium processes, namely: the dimensions of the ecological, social, and economic. Sustainability and balance the three dimensions of sustainable fisheries is an ideal type. According to Charles (1993)[11], views the development of sustainable fisheries must contain aspects :

1) Ecological sustainability. In this view sustaining stock / biomass that do not pass the carrying capacity, and to improve the capacity and quality of ecosystems become major concerns.

2) Socio-economic sustainability. This concept implies that fisheries development should pay attention to the sustainability of the welfare of the fishery on an individual level. In other words, maintain or reach a level higher people's welfare is a concern in terms of sustainability.

3) Community sustainability, implies that the sustainability of the welfare of the community or society should be a concern to build a sustainable fishery.

4) Institutional sustainability (institutional sustainability). Within this framework, the institutional sustainability concerns the financial and administrative aspects of maintaining a healthy is a prerequisite of the three sustainability

IV. CONCLUSION

Sustainable crab fishery management is basically a management concept that synergize three aspects of development, ie environmental, social, and economic. In the implementation should be done in an integrated and intertwined. It requires the participation of all stakeholders involved in the utilization of crab, directly or indirectly. To build synergy or collaboration among all stakeholders is needed overall picture of the role and interests of each stakeholder. Stakeholder itself consists of three main groups namely fishing communities, businesses / enterprises and government.

REFERENCES

[1] Sulistiono, T Nugroho, M Zahid. 2009. Ekobiologi dan Potensi Pengembangan Perikanan Rajungan Indonesia. Departemen Manajemen Sumberdaya Perairan Fakultas Perikanan dan Ilmu Kelautan, IPB. Bogor.

[2] Juwana, Sri, Aznam Aziz dan Ruyitno. 2009. Evaluasi Potensi Ekonomis Pemacuan Stok Rajungan Di Perairan Teluk Klabat, Pulau Bangka. Oseanologi dan Limnologi di Indonesia (2009) 35(2): 107-128

[3] Adrianto, Luky. 2011. Konstruksi Lokal Pengelolaan Sumberdaya Perikanan di Indonesia. Penerbit IPB Press. Bogor.

[4] Alains, A. Muluk, Seprianti Eka Putri, Prilia Haliawan. 2009. Pengelolaan Sumberdaya Perikanan Berbasis Masyarakat (PSPBM) Melalui Model Co-Management Perikanan. Jurnal Ekonomi Pembangunan, Edisi Desember 2009, Vol. 10, No.2, hlm. 172 – 198.

[5] Christy FT. 1987. Hak Penggunaan Wilayah pada Perikanan Laut: Definisi dan Kondisi dalam Ekonomi Perikanan dari Pengelolaan ke Permasalahan Praktis. Smith IR dan F Marahuddin (editor). Jilid 2. Penerbit Gramedia. Jakarta. 360 hlm.

[6] Christy FT and A Scott. 1986. Sifat Dari Sumber Daya Alam Milik Bersama dalam Ekonomi Perikanan dari Teori Ekonomi ke Pengelolaan Perikanan. Smith, IR dan F Marahuddin (editor). Jilid 1. Penerbit Gramedia. Jakarta.

[7] Dahuri R. 2003. Keanekaragaman Hayati Laut, Aset Pembangunan Berkelanjutan Indonesia. Penerbit PT Gramedia Pustaka Utama. Jakarta.

[8] Bengen DG. 2002. Sinopsis Ekosistem dan Sumberdaya Alam Pesisir dan Laut Serta Prinsip Pengelolaannya. Pusat Kajian Sumberdaya Pesisir dan Lautan (PKSPL) IPB. Bogor.

[9] Poloma, Margaret. M. 2007. Sosiologi Kontemporer. Raja Grafindo Persada. Jakarta.

[10] Fahmid. Imam Mujahidin. 2013. Transformation and interaction in elite formation between ethnics. Developing Country Studies Vol.3, No.2, 2013.

[11] Charles, A. T. 1993. Towards Sustainability: the Fishery Experience. Ecological Economics Vol 11 pp 201 – 211.

[12] Daris, Lukman. 2004. Konflik Nelayan Dalam Pemanfaatan Ruang Wilayah Penangkapan (Kasus Nelayan Pangguna Alat Tangkap Trawl Mini dan Nelayan Pengguna Alat Tangkap Jaring Klitik di Kecamatan Bontoa Kabupaten Maros). Tesis. PPs-UNHAS. Makassar

[13] Tadjudin, Djuhendi. 2000. Manajemen Kolaborasi. Penerbit Pusat

[14] Salman, Darmawan. 2010. Pemberdayaan Masyarakat Petani. Bahan Kulian Program Doktor Ilmu-Ilmu Pertanian. Tidak Dipublikasikan. Program Pascasarjana UNHAS. Makassar.

[15] Satria, Arif. , 2009. Ekologi Politik Nelayan. Cetakan I. Penerbit LkiS Yogyakarta.

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Internal and External Intensification of the Strategies Used for Expressing Explicit Emotional Gratitude in Macedonian and English

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Abstract - This paper deals with the strategies used for expressing explicit emotional gratitude (SEEEG) in Macedonian (*fala* and *blagodaram*) and English (*thanks* and *thank you*). More precisely, it investigates the process of intensification of SEEEG with internal and external intensifiers which affect both the syntactic and pragmatic structures of these expressions, respectively. The intensification of SEEEG is analyzed in the context of expressing gratitude for favors in particular.

The study is based on a DCT questionnaire, which depicts various situations in which the respondents are prompted to express gratitude for favors. What distinguishes the selected situations one from another is the types of favor which vary according to three parameters: *size* (minor vs. major favor), *status* (potential vs. realized) and *initiator* (speaker-initiated vs. interlocutor-initiated favors).

The study reveals that, in both Macedonian and English, the structure of SEEEG, i.e. the number of internal and external intensifiers, is heavily dependent on the type of favor the speaker is thanking for. In the case of minor already realized favors which were initiated by the speaker, the process of intensification of SEEEG is very mild or non-existent; whereas, in the case of huge favors, irrespective of whether they are realized or potential, and whether they are speaker or interlocutor-initiated, the structure of SEEEG is manifestly modified and extended with different internal and external intensifiers.

Index terms: explicit emotional gratitude, external and internal intensifiers

I. INTRODUCTION

The speech act of expressing gratitude is a universal phenomenon which is of paramount importance in human interactions. Failing to express gratitude sometimes can permanently mar human relations, and, vice versa, expressing gratitude properly can assist significantly in maintaining relationships[1]. People feel obliged to be polite and express gratitude in many different occasions. Gratitude is mandatorily expected when someone has done somebody a favor or a service, or, when one has received compliments or good wishes; when one has been invited to go somewhere or do something; or, simply, when one has been offered something.

Even though there are many different ways of expressing gratitude (Aijmer, 1996), this paper is concerned only with expressing explicit emotional gratitude[2] which in English is realized by means of the expressions: 'thank you' and 'thanks', which are also known as strategies for expressing explicit and emotional gratitude (SEEEG). According to dictionary definitions[3] the main difference between these two expressions is the fact that the former is normally used in formal, whereas the latter in informal context.

Similarly, two separate strategies for expressing explicit emotional gratitude, 'blagodaram' and 'fala', exist in the Macedonian language. What distinguishes them is the fact that 'blagodaram' is considered the formal variant, whereas 'fala' - its informal counterpart.[4]

The studies on SEEEG in English have revealed that SEEEG are, in fact, much less frequently used on their own, i.e. without any additional elements. This means that very often they are treated as 'stems' which could be further modified, i.e. intensified, to make the speech act of thanking more effective. Blum-Kulka, House and Kasper (1989) have identified two types of intensifiers: internal intensifiers (II) and external intensifiers (EI). The role of II, according to them, is normally allocated to word classes such as adverbs and emotional/interpersonal expressions (exclamations, vocative, terms of address) whose usage normally contributes to creating a slightly more complex syntactic structures of SEEEG. The category of EI is much more diverse and it comprises a wide variety of different types of expressions. More precisely, Eisenstein and Bodman (1986: 180), and Schauer and Adolphs (2006: 127) have conducted a more profound investigation of EI and discovered that, in most cases, EI are sentential intensifiers which, in fact, represent different types of speech acts such as: promising, complimenting, convincing, refusing, expressing surprise, saying goodbye, offering compensation, complimenting interlocutor, stating reason, confirming

[1] Searle (1969: 67)

[2] Apart from the explicit emotional gratitude, there are also: explicit unemotional gratitude ('*I owe you a debt of gratitude'*); implicit emotional gratitude ('*That's kind/nice of you!')* as well as implicit unemotional gratitude when the speaker is self-deprecating ('*I am an ingrate/so careless'*).

[3] *English Dictionary for Advanced Learners.* (Third Edition), Glasgow: Harper Collins Publishers, 2001.
Merriam-Webster Online Dictionary (www.dictionary.com).
Oxford Advanced Learner's Dictionary (Fifth Edition), Oxford: Oxford University Press, 1995.

[4] Big English-Macedonian Dictionary (Second Edition), printed in Macedonia, 2001.
Big Macedonian-English Dictionary (Third Edition), Skopje: Cobiss, 2006.

interlocutor's commitment, stating intent to reciprocate, stating interlocutor's non-existent obligation, etc. Logically, when the speech act of thanking is enhanced by another accompanying speech act, which is directed at intensifying the expression of gratitude, we are no longer dealing with the syntactic, but the pragmatic structure of SEEEG which becomes much more complex as it contains diverse speech acts.

Taking all these contentions into consideration, the purpose of this research is to look closer at the different types of internal and external intensifiers of SEEEG in Macedonian and English when SEEEG are used for expressing gratitude for favors which could be either already realized or potential; minor or major; and speaker or interlocutor-initiated. Thus, in fact, the study seeks to analyze the syntactic and pragmatic structures of SEEEG which could vary from very simple to very complex. In fact, the study aims at establishing a connection between the process of intensification of SEEEG and certain combinations of the above mentioned types of favors.

As both formal and informal SEEEG are part of the linguistic and cultural legacy of both Macedonian and English native speakers, this study conducts a parallel analysis of this universal linguistic phenomenon, with intent to detect certain similarities and differences in these two languages.

II. METHODOLOGY

In order to achieve the aims of the study, a DCT (Discourse Completion Task) questionnaire[5] was designed and conducted. All the situations described in the questionnaire prompt thanking for favors and are very diligently select as to fit the mind frame of both Macedonian and English native speakers. There are 10 different situations (see Appendix) depicted in the questionnaire and all of them include a different combination of the following social parameters:

1) The size of the favor (small favor (SF) vs. huge favor (HF));
2) The initiator of the favor (interlocutor-initiated favor (IIF) vs. speaker-initiated favor (SIF)) and
3) The status of the favor (realized favor (RF) vs. potential favor (PF)).

Some of the situations included in the questionnaire depict formal whereas some informal contexts. In other words, the first set of the 'incidents' presented in the questionnaire, allegedly, take place in an office, in class at university etc.; whereas the second set include interactions which supposedly occur at home, in the local supermarket, in the street etc. In both types of situations respondents' verbal reactions are expected to be in accordance with the formality of the context.

Table I: The situations in the DCT questionnaire

	situation	**combinations of the social parameters**
FAVOURS	S1 (dinner)	(SF)+(RF)+(SIF)
	S2 (supermarket)	(SF)+(RF)+(SIF)
	S3 (wallet)	(HF)+(RF)+(IIF)
	S4 (time)	(SF)+(RF)+(SIF)
	S5 (weekend house)	(HF)+(PF)+(IIF)
	S6 (computer)	(HF)+(RF)+(SIF)
	S7 (headache)	(HF)+(PF)+(SIF)
	S8 (seminar paper)	(HF)+(PF)+(IIF)
	S9 (promotion)	(HF)+(RF)+(IIF)
	S10 (police)	(HF)+(RF)+(IIF)

The questionnaire was distributed among and filled in by 40 Macedonian and 40 English native speakers. This implies that the analyzed corpus encompassed 400 Macedonian (40 respondents x 10 situations) and 400 English (40 respondents x 10 situations) expressions of gratitude. The equal number of respondents and expressions in both languages was to ensure obtaining optimally objective results which would eventually lead to drawing relevant conclusions.

III. THE RESULTS OF THE ANALYSIS

The analysis of the results with regard to the usage of SEEEG led to several major inferences concerning the process of intensification of SEEEG in Macedonian and English. Thus, for instance, the first striking observation was that in both languages, SEEEG were much more frequently used with intensifiers than without them. Moreover, in some situations, in both Macedonian and English, there were many similarities in the way in which the internal and the external intensifiers were combined with the stems. Thus, for instance, both groups of respondents, used the smallest number of II and EI in the situations which included expressing gratitude for small realized favors initiated by the speaker (C4a (time) and C2 (supermarket); and, understandably, the highest percentage of intensifiers was noted in the situations which depicted huge realized favors initiated by the speaker (S4 (computer)) as well as huge potential favors initiated by the interlocutor (S9 (promotion), S10 (police) and S8 (seminar paper)).

[5] Traditionally, DCT questionnaires were used in doing research on the functions of certain pragmatic speech acts within strictly determined parameters, thus, for instance, Blum-Kulka et al. (1989) employed it in their analysis of the speech act of requests.

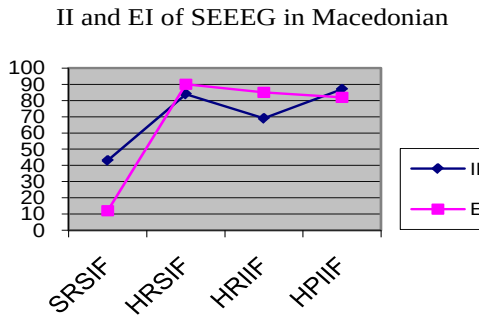

Chart 1

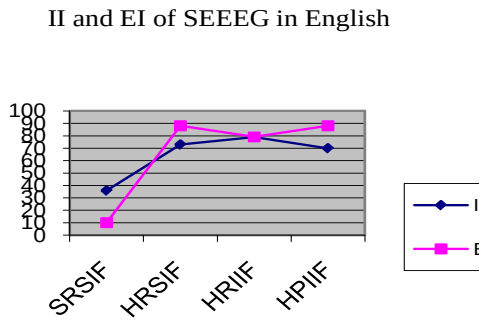

Chart 2

SRSIF – small realized speaker-initiated favor; HRSIF – huge realized speaker-initiated favor; HRIIF – huge realized interlocutor-initiated favor; HPIIF – huge potential interlocutor-initiated favor

In the following two sections we provide a more detailed presentation of the results concerning the internal and external intensifiers of SEEEG, respectively.

A. The Internal Intensifiers of SEEEG

The analysis of the results reveals that almost in all of the situations in the questionnaire which included expressing gratitude for favors with SEEEG, there were additional linguistic elements, i.e. internal intensifiers and this was the case in both Macedonian and English. The only exceptions to this in both analyzed languages were the situations in which SEEEG were used for small favors, as in these situations the respondents preferred using only their 'stems'. In other words, being aware that in these situations it did not take interlocutors much time or effort to perform the favor on speakers' behalf, speakers did not feel much indebted to interlocutors and rarely used II to modify their SEEEG.

On the other hand, the bigger the favor, i.e. the more time and effort it took interlocutors to realize the favor, the more obliged speakers felt towards interlocutors. Consequently, willing to show their appreciation they opted for increasing the level of politeness by intensifying SEEEG with additional linguistic elements, i.e. internal intensifiers, thus, transforming the syntactic structure of SEEEG into a more complex one.

Once the II of SEEEG were detected and singled out, the next step of the analysis was to classify them into common categories. Hence, the following 3 main categories of II of SEEEG have emerged:

1) lexical II (nouns, pronouns, exclamations and adverbs);
2) phrasal II (prepositional phrases) and
3) sentential II (dependent and independent clauses).

Table II: The number of internal intensifiers of SEEEG

No. of II	**lexical**				**phrasal**	**sentential**	
	много so/very much	pronouns	exclamations	nouns (terms of address)	prepositional phrases	dependent clauses	independent clauses
фала/ благ.	154	95	17	75	28	24	6
thanks/ thank you	129	/	15	88	32	2	3

The most frequently used II of SEEEG in both Macedonian and English SEEEG were the lexical intensifiers. In Macedonian, the respondents preferred using the adverb 'многу' ('a lot') (e.g. *Благодарам многу/Thank you very much*) and 'ви', the short pronominal form of the indirect object 'вам ви' (e.g. Ви благодарам многу/ Thank you very much) when they addressed a person superior in rank or age in order to signal marked politeness and respect and to add to the formality of their expression of gratitude. The other short pronominal form of the indirect object in Macedonian 'ти' ('тебе ти') (e.g. Фала ти!/ Thank you!), which is used in informal speech when the speaker addresses an interlocutor with an equal status, was much less present in the syntactic structure of SEEEG.

The English informants also preferred intensifying their SEEEG with adverbs. The most frequently used adverb in their expressions of gratitude was 'so/very much'. Only rarely did they resort to using other adverbs such as: 'a lot'; 'indeed', 'a bunch' etc. (e.g. 'Thanks a lot/ a bunch!').

In both Macedonian and English, the nouns, i.e. the terms of address were also quite frequently used to intensify the syntactic structure of SEEEG. Within this category, the terms of endearment whose purpose was obviously to increase the level of politeness were particularly noticeable (e.g. '*Фала душо/драги/мили*'; '*Thanks honey/sweetie/babe...*').

Although the number of phrasal II was not very big, yet they were also present in the structure of SEEEG especially when the speaker wanted to state the reason why he was expressing his gratitude towards the interlocutor (e.g. '*Фала на љубезноста*'; '*Thanks for your help*').

Although very infrequently, yet both groups of respondents sometimes opted for intensifying their SEEEG with sentential (dependent and independent clauses) II. In fact, the sentential II were slightly more frequent in Macedonian (e.g. '*Ох,*

благодарам и извинете што не забележав дека е на таа полица' (independent clauses); '*Еее, Ви благодарам многу што ми помогнавте*' (dependent clause), in comparison to English, where they were extremely rare ('*Thank you and I am at a loss for words*!').

In sum, despite the fact that the respondents, whose SEEEG were analyzed in this study are, in fact, representatives of two completely different cultures, the similarities detected with regard to their usage of II of SEEEG, decidedly, by far outnumbered the detected differences.

B. The External Intensifiers of SEEG

The most frequently used EI were definitely the sentential intensifiers, although, occasionally, the respondents employed some lexical EI as well (e.g. '*Супер*' /'*Super*'; '*Одлично*'/'*Excellent*' (in Macedonian); and '*Great*', '*OK*' (in English)).

The intensification of the 'stems' of SEEEG with sentential EI, in fact, entails alterations in their pragmatic structure as the final outcome is the creation of long and elaborate speech events made up of several different speech acts, whose sole purpose, despite the differences in their pragmatic function, is to enhance the expression of gratitude itself. To put it differently, in this case, speakers wish to express a higher level of politeness towards their interlocutors, and, consequently, they resort to using EI of SEEES which results in creating evidently prolonged expressions of gratitude.

Table III: The Number of External Intensifiers of SEEEG

	Promise	**Compliments**	**Offers / Suggestions**	**Surprise**	**Expressing appreciation for the deed of the**	**Saying goodbye**	**Advice**	**Apology**	**Lack of obligation**
total no. of EI 136	68	10	12	20	63	5	5	8	9
фала/ благ.									
thanks / thank you	34	6	13	32	82	7	4	6	4

The thorough inspection of the EI of SEEEG in the corpus, yielded results which are definitely in compliance with some of the previous findings regarding the different types of EI (Eisenstain & Bodman, 1986: 171). More precisely, this study confirms the contention that the speech acts represented by the sentential EI, are rather diverse and encompass: expressing surprise (e.g. '*Боже, не можам да поверувам. Фала Ви многу*'*!/ 'Ohhhh, my goodness. Thank you! Quite refreshing to see some good people out there these days*'); making offers or suggestions ('*Многу Ви благодарам. Дали би прифатиле да Ве почестам едно кафе или слично?*'*/ 'Thank you so much … Here's $10. Buy yourself something!*'), making promises (e.g. '*Ви благодарам шефе! Ќе продолжам со добрата работа!/ Thank you for having confidence in my abilities. I will not disappoint you!*'), expressing compliments (e.g. 'Ептем фала! Срце си!'), expressing a lack of obligation (e.g. '*Thank you so much! You did not have to put yourself into such a trouble on my account!*'), expressing apologies (e.g. '*Thank you so much! Sorry to bother you*!') etc.

Nevertheless, the analysis of SEEEG in both languages also resulted in identifying one additional type of EI which has not been mentioned in the previous classifications of EI. The term that we believe accurately describes this EI is *expressing appreciation for the deed of the interlocutor* who did something very beneficial to the speaker (e.g. '*Ви благодарам многу! Ова е навистина убаво од Ваша страна!*'/'*Thank you very much! This is really very nice of you!*'). As it is shown in Table 3, expressing appreciation for the deed of the interlocutor was, in fact, the most frequently used external intensifier of SEEEG in both languages.

With respect to the usage of EI of SEEEG in the different types of favors depicted in the situations in the questionnaire, the every first striking insight is that, in both Macedonian and English SEEEG, EI were not present at all in the situations which included thanking for small favors. Obviously, in those situations, the respondents did not deem it necessary to prolong the length of their SEEEG with EI. In contrast, their presence was strongly felt in the case of huge favors irrespective of whether they were already realized speaker-initiated favors (S(computer)) or potential favors initiated by the interlocutor (S5 (weekend house), S7 (headache), S8 (seminar paper), S9 (promotion), S10 (police)).

The reason for resorting to more intense usage of EI in these situations could be attributed to the extremely pronounced feeling of indebtedness on the part of the speakers towards their interlocutors. What is particularly interesting about EI of SEEEG in these situations is the fact that, more often than not, the structures of SEEEG are enriched not just with one EI, but with combinations of two, three and sometimes even more EI concurrently (e.g. '*Ова е нов предизвик и голема мативација за мене. Во иднина би се трудела уште повеќе да ги задоволам вашите очекувања. Ви благодарам многу!*'*/ 'This is a new challenge and a great motivation for me. In the future I would try even harder to meet your expectations. Thank you very much!*').

The intensification of SEEEG with EI was also marked by certain similarities and differences in Macedonian and English. Thus, it was interesting to note that, although not to exactly the same extent, but both Macedonian and English respondents in some of the situations tended to apply the same EI of SEEEG. Thus, for instance, in S10 (police) the EI used by both groups of respondents was the speech act of promising (that they would never repeat the same mistake). Similarly, in S9 (promotion), both groups of respondents intensified their SEEEG with the speech act of promising (that they would meet their superior's expectations).

Contrarily, in S7 (headache), which included thanking for a huge potential favor instigated by the interlocutor, the Macedonian respondents resorted to using compliments as EI, whereas the English respondents expressed a lack of obligation. Similar differences were spotted in S3 (purse) in which despite the fact that both groups of respondents used offers as EI of SEEEG, yet, the nature of their offers differed drastically. The offers of the Macedonian respondents referred

to buying the interlocutor a drink, whereas, the offers of the English respondents included money as a reward. All these differences could, undoubtedly, be attributed to the inevitable cultural differences which mark both the speech and behavior of these two completely distinct groups of respondents.

IV. CONCLUSION

To sum up, in those situations in which SEEEG were used to express gratitude for major favors, irrespective of whether the favors were potential or already realized, and irrespective of whether they were speaker/interlocutor-initiated, there was a very intensive usage of both II and EI, which resulted in creating manifestly longer and more complex expressions of gratitude.

When SEEEG were used as standardized, ritualized responses, i.e. in situations when the respondents were expected to express gratitude for minor favors, the intensification of SEEEG with II and EI was weaker, and, consequently, the length of SEEEG varied from rather short expressions of gratitude which included only the stems of SEEEG to expressions of a medium length, which apart from the stems also included an internal intensifier such as an adverb or a noun, for instance.

The explanation which can be provided for these findings is that both groups of the respondents naturally felt more obliged and more indebted to their interlocutor in the former case and that is why they tended to express a higher degree of politeness by prolonging and enhancing their expressions of gratitude with internal and external intensifier.

APPENDIX

The situations in the DCT questionnaire:

S1 (dinner)

You asked a member of your immediate family during supper to pass you the bowl with the salad because it was out of your reach and he/she was closer to it. He /she did that for you.

S2 (supermarket)

You are trying out a new supermarket in the area but couldn't find certain products in it. You ask one of the employees to help you. He/she directs you to the right shelf.

S3 (wallet)

As your are walking down the street unknown passer-by who was walking behind you informed you that your wallet had fallen out of your purse.

S4(time)

You are waiting for the bus at the bus stop. There is another person there waiting. You don't know each other but you need to find the exact time, so you ask him/her.

S5 (weekend house)

You and your family are going on holiday for two weeks. Your colleague from work has offered you to stay in his weekend house.

S6 (computer)

There was something wrong with the computer in your office. Since you didn't know how to fix it yourself, you asked one of your colleagues to help you out (even though you don't cooperate closely with this person since he works in another department for the same company and you don't see each other often). After an hour of hard work he manages to fix your computer.

S7 (headache)

You are the general manager of a big corporation.You have got a very important meeting scheduled for the next day with a foreign delegacy which is intrested to cooperate with you.You are preparing yourself for the meeting but you have a terrible headache. One of your employees who is also your close associate offers to finish the job instead of you even though it would take him 5 to 6 hours overtime work.

S8 (seminar paper)

You are writing a seminar paper but you have a major problem finding adequate literature. One of your professors (who has just started teaching you) accidently overhears your discussion about this problem with your fellow students and offers to lend you some very useful literature. You feel very grateful since he is the last person you would expect to help you.

S9 (promotion)

Six months ago you started working for a new company. Today you have been asked to go to the manager's office and the manager informed you that you are being promoted to a better position and given a raise.

S10 (police)

The police stops you for speeding. This is your first offence so the police officer decides not to fine you and you get away with just a warning.

REFERENCES

[1] K. Aijmer, *Conversational Routines in English: Convention and creativity*. London: Addison Wesley Longman, 1996.
[2] P. Brown, & S. Levinson, *Politeness. Some Universals in Language Usage. Cambridge*: Cambridge University Press (first published), 1978.
[3] S. Clankie, 'The Use of the Expressions of Gratitude in English by Japanese and American University Students". *Journal of Inquiry and Research*, 38. Osaka, Japan: Kansai Gaidai University, 1993.
[4] F. Coulmas, "Poison to your soul: Thanks and apologies contrastively viewed". *Conversational Routine*. The Hague: Mouton, 1981, pp. 69-91.
[5] M. Eisenstain, & J. W. Bodman, "I very appreciate: Expressions of gratitude by native and non- native speakers of American English". *Applied Linguistics*, 7 (2), 1986, pp.167-185.
[6] M. Eisenstain, & J. W. Bodman, "Expressing gratirude in American English. In G. Kasper & S. Blum Kulka (Eds.)", *Interlanguage Pragmatics*. NY: Oxford University Press, 1993, pp.64-81.
[7] R. K. Herbert, "Say 'Thank you' ... or Something", *American Speech* 61.1, 1986, pp. 76-88.
[8] E. Hinkel. "Pragmatics of interaction: Expressing Thanks in a Second Language", *Applied Language Learning*, Vol.5, NO.1, 1994, pp.73-91.
[9] R. Ide, "Sorry for your kindness: Japanese interactional ritual in public discourse", *Journal of Pragmatics* 29, 1998 pp.509-529.
[10] W. Jung, "|Speech Acts of ' Thank You' and responses to it in American English", *Paper presented at the Annual Meeting of the American Association for Applied Linguistics* (16th, Baltimore, MD, March 1994).
[11] J. Rubin, "The use of 'Thank you'". *Paper presented at the 1983 Sociolinguistics Colloquium, TESOL Convention*, Toronto, Canada, 1983.
[12] G. Schauer & S. Adolphs, "Expressions of gratitude in corpus and DCT data:
[13] Vocabulary, formulaic sequences, and pedagogy", *Science Direct*. Nottingham, UK: Elsevier Ltd., 2006, pp.119–134.
[14] D. Schiffrin, *Discourse Markers*. Cambridge: Cambridge University Press, 1987.
[15] R. J. Watts, *Politeness*. Cambridge: Cambridge University Press, 2003.

Dictionaries:

[16] *English Dictionary for Advanced Learners*. (Third Edition). Glasgow: Harper Collins Publishers, 2001.
[17] *Merriam-Webster Online Dictionary*(www.dictionary.com)
[18] *Oxford Advanced Learner's Dictionary*. (Fifth Edition). Oxford: Oxford University Press, 1995.
[19] *Golem anglisko makedonski recnik* (The second edition) Printed in Macedonia, 2001.
[20] *Golem makedonsko angliski recnik* (The thrid edition) Skopje: Cobiss, 2006.

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Remittances and Socio-Cultural Impact on Migrant Labourers: The Case Study of Amritsar

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Abstract- In this research paper an attempt has been made to study the impact of migration in relation to economic and socio-cultural aspects. In this attempt it was found that majority of the migrants were sending their earning in terms of kind and remittances to their families at the place of origin. These migrants found the improvement in their personal financial level and their families back at home. It is remarkable to note that although, the migrants belong to different religion, language and cultural background found it comfortable for the ultimate assimilation with the new societal set up. They found no discrimination and acceptance of the locals was appreciated.

Index Terms- Remittance, sending, Utilization, Socio-cultural impact, Frequency

I. INTRODUCTION

Although migration is emerging as an important phenomenon from economic, political and public health point of views (Bhagat 2008), yet the migration research finds low priority amongst Indian Demographers. This is partly because, since the early 1990s with a paradigm shift in the demographic research tilting to the issues of reproductive health, the interest in migration research in general and internal migration in particular has dwindled considerably among Indian demographers (Bhagat 2008). On the other hand, the quantum of data available in Indian censuses on migrants is grossly neglected by the Indian demographers who are busy with data collection exercises funded by external agencies (Bose 2003).

Thus, this paper is a small step towards micro level migration research that tries to study the remittances from the place of destination to origin in kind as well as in currency, describes as how it is managed and explains how these are typically used by the recipients, and in addition to that the paper also examines socio-cultural impact on migrant labor.

II. DATA AND METHODOLOGY

In order to fulfill the above objective, the study has been carried out by collecting the primary data from 500 male migrants from other States of the country in Amritsar city.

III. SAMPLING DESIGN

There are a total number of 65 wards in Municipal Corporation of Amritsar. After conducting the extensive field visit throughout the city and covering all the wards, a minimum of ten wards were selected where there was high concentration of selected inmigrants i.e., after 2001. Every effort was made to select those ten wards with maximum socio-economic and occupational heterogeneity of the migrants'. Then, in each of these wards, migrant pockets and clusters were identified. On an average 50 migrants were randomly picked up from each ward and interviewed.

IV. RESULTS AND DISCUSSION

The most direct impact of migration is remittances. Migration is a decision that impacts the welfare of the personal household, the home community at origin, and in the end the whole economy in various ways.

A. Remitting in kind

The Remittances in kind lead to cultural diffusion of the place of origin and destination. Table 1 show that clothes and domestic (food items and cosmetic) necessities were remitted in kind. The clothes include the fresh purchases as well the given by the locals. The clothes generally given by the locals include the Punjabi dresses for ladies and Western clothes worn by the gents.

Table 1: Percentage of distribution of Remittance in kind.

Items	**Percentage**
Clothes	54.6
Cosmetics	20.0
Food items	15.2
Others	10.2
Total	**100**

Thus, the clothing, the migrants move with to the original place carriages the social effects of the place of migration. As most of the migrants belong to the Hindi belt area, their traditional dress is sari for the women and dhoti for the males and this trend influence the dress culture at the place of origin over a span of period.

The food items generally include the cooking oil, confectionary and soft drinks. These are the items which are either not available in their villages or are of not good quality which they are getting at the place of destination. While in the cosmetics, the soap is the main item. As they consider it to be of superior quality than what they are getting at the place of origin. These products, the migrants either send through their friends /

relatives or carry along with them when they travel themself to the place of origin.

B. Size of remittance

Round 64% migrants were remitting up to rupees one thousand. A sizeable percentage remits one thousand to five thousand every month. Yet, although a small percentage of 11.4% were remitting more than rupees 5000 every month. Their remittances generally relates to their monthly earning at the place of migration.

Table: 2 Percentage of distribution of Size of Remittance per month.

Amount in Rs.	Percentage
Up to 1000	64.1
1000-5000	24.5
5000+	11.4

C. Frequency of sending the remittances

The migrants whose families were entirety dependent on their remittances were sending the money regularly i.e., on monthly basis (56%). Those at origin who do not need respondents money immediately, the remittances were quarterly (18%) or on need

Table 3: Percentage of distribution of frequency of sending the remittances.

Time period	Percentage
Monthly	56.9
Quarterly	18.2
Yearly	2.8
Need basis	21.6
Never	0.4

Basis (21%). Those not sending any remittance were not having any dependent at the place of origin.

D. Interval in sending the remittance after first arrival

About 62.2% of the respondents remit their wages within one or two months of arrival. It seems that the requirement of resources at homes was urgent. Most of the migrants in the study sample have to repay the loan taken for their living at the place of origin. Others (39%) send it later according to the requirements.

Table 4: Percentage of distribution of interval in sending the remittance.

Months	Percentage
1	35.5
2	27.0
3	18.2
4+	19.3

E. Method of sending remittances

Generally, the migrants send their earnings through bank or carry it home when they get the opportunity to visit their families.

Table 5: Percentage of distribution of method of sending remittances.

Method of sending	Percentage
Bank	60.6
Self	21.2
Friends	6.1
Others	12.1

The migrants who do not have their own accounts at the place of origin utilize the accounts of their friends or relatives for the transfer of money. About 18.2 percent were forced to rely on informal networks, for example, friends and relatives visiting home or else send money through the post office by money order, which is often expensive and less preferable.

Most of the migrants were not facing problem in sending the remittances. But few of them reported the problem of snatching or being cheated by the co-passengers while travelling to their place of origin. Few of the migrants revealed that they were given some sedative along with the food items and all of their belongings were taken away. One of the respondents who got cheated was made unconscious with some powdery material and the money was taken away while travelling to his place of origin and was thrown out of the train.

F. Recipients at origin

Major portion of the migrants were sending their earning to the parents (66.7%),

Table: 6 : Percentage of distribution of member receiving money at the place of origin

Person	Percentage
Parent	66.7
Wife	26.9
Brother	2.7
Relatives	1.8
Others	1.9

Since they are unmarried and the entire family back home is looked after by the parents. Even if they are married, their wives and children are residing with the parents 26.9 percent were sending to wives because they were separated from the main family or living independently.

G. Utilization of remittances

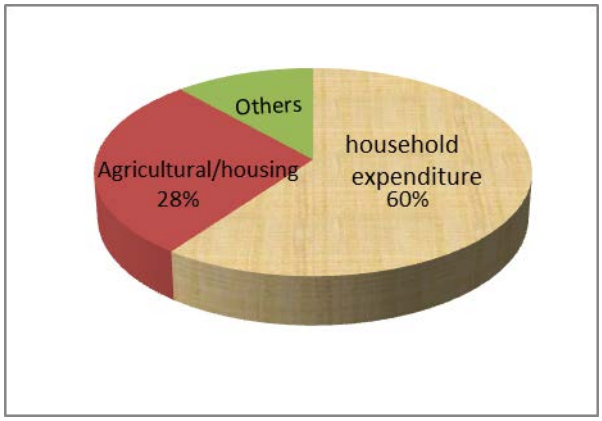

FIGURE 1: Percentage of distribution of use of remittances.

A large section of the migrants use their remittances on the maintenance and upbringing of their families back home (60%) for food, health, clothing, primary education, basic household amenities, paying off debts and so on. Further, a reasonable percentage i.e. (28.4%) were investing their money on activities such as agriculture and housing.

H. Use of remittance for Community Development

It is a healthy sign that these migrants with meager earnings still use it for the development of social and religious activities like the maintenance of school buildings (15%) and offering in the temples on the occasions of festivals (83.8%).

Table7: Percentage of distribution use of remittance for Community Development

Remittance for community development	Percentage
Religious Functions	83.8
Maintenance of Schools	15.0

I. Socio-Cultural impact of migration

Amritsar is a metropolitan city and majority of the people wear Western dress. The same trend could be seen among the migrants as majority of them prefer to wear Western Dresses (86.0%). This could be, that the locals of Amritsar of their level have also adopted Western dress. They have discarded their traditional dress after reaching at Amritsar.

Regarding the language, majority of them like to communicate in Hindi as they mention that there is great similarly in Punjabi and Hindi languages. Further, as the period of stay increases the migrants start making use of Punjabi words in their daily conservation. In fact, the respondents have observed that it's the locals who try to speak with them in Hindi.

Table 8: Percentage distribution of respondents by Socio-cultural impact at Amritsar

Variables	Percentage
Type of dress worn	
Local(destination)	12.5
Traditional (origin)	1.6
Western	86.0
Language use to communicate with locals	
Punjabi	3.8
Hindi	90.7
Both	5.5
Participation in the festivals	
Diwali	80.8
Holi	74.4
Lohri	56.2
Basakhi	55.4
Dushehra	77.9
Visiting Sikh shrine	32.0
Change in physical appearance	8.1
Marrying locals	14.2

The participation of migrants in the festivals was significantly high (80%). In case of celebration of common festivals, the migrants were participating in Diwali (80%), Holi (74%) and Dussahara (77%) but when it comes to the local festivals their participation is less, i.e. Lohari (56%) and Baisakhi (55%).

With regard to visiting the religious places, about 32% were visiting Sikh shrines. As Amritsar is having a world famous Sikh religious temple i.e. Golden Temple, That must have encouraged these migrants to visit the Sikh Shrine.

The eating habits of the migrants at Amritsar have undergone complete change at Amritsar. Higher proportions of the respondents have adopted the local food items (94.5%). In the area of place of origin, not many vegetables were used to be grown and there, these migrants use to eat other cereals like rice and bajra with some ingredients. But after reaching Amritsar they develop the habit of eating wheat, rice and more of vegetables along with pulses of their choice.

Most of the migrant lab ours have formed groups depending on their strength and divided the duties of preparing food as per their liking. Those who were staying with the families were preparing at home and the others who were living alone have arranged it according to the dishes of their choice from the market which are available at the reasonable rate.

When it comes to marriages, the migrants are very much orthodox as they prefer to have groom or bride from their native place (85.8%). Most of the unmarried young migrant would like to get partner from the areas of the origin and that too, to be arranged by their parents. It could also be arranged from the migrants family already settled at Amritsar. There is hardly any opportunity to get the partner at Amritsar from amongst the local population because of the social and cultural gap. They also follow the system of selection of the partners arranged by the elders during their childhood.

Further about 8% of the migrants have made changes in their physical appearances after migration. Most of migrants have grown beard (90%) and have started wearing turban. Some percentages of migrants at Amritsar have adopted the local physical appearance for easy acceptance for the business community and society. Most of them, when they go back to the place of origin they again change their appearance according to the place of origin.

V. CONCLUSION

From the analysis, it is clear that the migration is a well-planned strategy of the migrants to improve upon their economic and social status .Very often, all families resources are pooled to send one or more promising junior members of the family with the hope that as soon as the person gets a job in some metropolitan city, he will start sending money regularly back home as well as help others to migrate. Migration is thus always under the moral obligation to start sending the money as early as possible. It was found that migrants were sending remittances not only to the families but they were sending money to the village for developmental activities. Apart from the remittances, the focus of this paper is on effects of migration on (transnational) identity, cultural change and social structure .The analysis in this regard indicates that the migrants are getting assimilated to the socio-cultural conditions prevalent at destination.

ACKNOWLEDGEMENTS

I owe my deepest gratitude to Dr. Gopal Krishna Panda and to hundreds of my respondents who kept on sitting patiently through the long interviews.

REFERENCES

[1] Bhagat R.B (2008),"Assessing the Measurement of Internal Migration in India", Asian and Pacific Migration Journal, Vol.17, No.1, Pp91-102.

[2] Bose. A (2003),"Population Research Deteriorating Scholarship" Economic And Political Weekly, Vol 38, No.44 (November 1, 2003), Pp4637-4639.

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Modeling and Determining Urban Road Priority Rank for Maintenance Program Based on Multi-Criteria Decision Making in Makassar City, Indonesia

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Abstract- The gap between financing need and the fund allocated brings governments difficult to manage the road maintenance, thus a ranking procedure is required to optimize this limited fund. Determining the road maintenance priority is considered as a multi-criteria decision making problem. Recent priority procedure offered by the Department of Public Works and previous researches only consider technical aspects such as pavement condition and daily traffic. However, non-technical factor such as political intervention plays a significant role in determining priority. This paper suggests a comprehensive assessment framework that enables to take a number of technical and non-technical factors into consideration. Analytic Hierarchy Process (AHP) is used to evaluate these roads with respect to prescribed criterions. Five proposed road which funded by provincial government were subjected into criterions with diverse metrics that serve as multi-objective decision environment where AHP play an appropriate role and consistently lead toward the final decision.

Index Terms- priority, maintenance, multi-criteria decision-making, analytical hierarchy process

I. INTRODUCTION

Road management should be supported by adequate funding. In Indonesia, roadwork funding is allocated by government which falls into 3 categories: state funded roads, provincial funded roads, and municipal funded roads. However, recent situation shows that the allocated funds always do not meet with the financing needs. In other words, there is a lack of funding for effective road management. Empirical evidence shows that the government's ability to provide necessary fund is inadequate over the years. The budget for the management of state roads, provincially roads and municipally roads continues to decline (Tamin, 2002) whereas the price of construction materials is constantly increasing.

The gap between financing need and the fund allocated brings governments difficult to manage the road maintenance, thus a ranking procedure is required to optimize this limited fund. Determining the road maintenance priority is considered as a multi-criteria decision making problem. Recent priority procedure offered by the Public Works Department (2005) only considers technical aspects such as pavement condition and average daily traffic. In addition, several procedures have been suggested by Saputro (2011), Putri (2011), Moazami (2011), dan Munthe (2012) regarding these problems. However, these procedures did not take non-technical factors into consideration such as political influences. Since, a study by Alie (2006) reveals that the legislature politicians have strong intervention in determining the road maintenance program in Indonesia.

This paper suggests a comprehensive assessment framework that enables to take a number of major technical and non-technical aspects into consideration. The Analytic Hierarchy Process (AHP) (Saaty, 2001) is used to evaluate and rank these roads with respect to prescribed criterions. The AHP seems to be a flexible decision making tool for multiple-criterion problems. It enables decomposition of a problem into hierarchy and ensures that both quantitative and qualitative aspects of a problem are included in evaluation process.

II. METHODOLOGY

The assessment for determining road priority is a complex process. Many aspects should be taking into consideration. The proper solution to this complex and multi-criteria problem is to segregate the problem into a number of smaller sub-problems and solve them individually.

The Simple Multi-attribute Rating Technique (SMART) is one of the methods in dealing with the multi-objectives problems. Its main strength is its relative simplicity; however, the cost of its simplicity is that the method may not capture all the detail and complexities of the real problem (Goodwin and Wright, 2004). Decision tree is a valuable tool for people to obtain a deeper understanding of complex problems, but it deals with decision problems that consist of multi-stages. In addition, it involves continuous probability distribution that makes it difficult to use in practice. ELimination Et Choix Traduisant la REalité (ELimination and Choice Expressing REality) (ELECTRE) is another way of evaluating decision options which widely used and applied for many practical problems. However, since the method does not provided a way of obtaining weights and score, the numbers are accepted unchallenged as inputs to a complicated algorithm. Moreover, it compares alternatives but does not produce a single index of performance (Watson and Buede, 1987)

In our evaluating framework, we proposed to utilize analytic hierarchy process (AHP). It offers a number of strength over methods pointed out previously. Its widespread use has verified its popularity among decision-makers. The relative strengths of

AHP include: (a) formal structuring of problem; (b) simplicity of pair-wise comparisons; (c) redundancy allows consistency to be checked; and (d) having great diversity or variety. AHP offers an alternative approach when a decision-maker is dealing with a problem that involving multiple criteria. The method that was originally developed by Thomas Saaty (2001) has been commonly used in decision problems in areas such as project selection, economics and planning, material purchasing and handling, and transportation. The process consists of the following steps: (1) Set up the decision hierarchy, (2) Conduct pair-wise comparisons of criteria and alternatives, (3) Convert the comparisons into weightings and check the consistency of the comparisons, and (4) Use the weightings to gain scores for the different options and make a decision.

The study conducted in five road funded by provincial government as shown in table 1. The roads are located in Makassar city.

Table 1: Study Location

Code	Street Name	Length (m)
Link 1	Jend. Sudirman	1400
Link 2	Dr. Ratulangi	2200
Link 3	Dr. J. Leimena	1800
Link 4	Antang Raya	1500
Link 5	Tamangapa	4700

This decision hierarchy takes into account a number of tangible and intangible factors in the assessment. These factors and the hierarchy were identified by repetitively interviewing, discussing, and consulting with a number of professional and government staffs. They included officials from the Public Works Department, and Regional Planning Development Agency. Seven criterions with their sub-systems have been identified for the model as listed below:

A. Traffic characteristic
   A.1. Traffic volume (passenger car unit/hour)
   A.2. Traffic velocity (km/hour)
B. Land zone
   B.1. Residential zone ratio
   B.2. Commercial zone ratio
   B.3. Industrial zone ratio
C. Pavements condition
   C.1. Good
   C.2. Average
   C.3. Poor
D. Preferences
   D.1. Political intervention
   D.2. Fair funding

Traffic characteristic data is obtained through traffic survey based on the procedure in Indonesian Road Capacity Manual 1997. Land zone value is gained from observation to determining the percentage ratio of residential, commercial and industrial zone along the road. Pavement condition is obtained by visual survey based on the procedure in Manual of Road Maintenance Program 1990. Lastly, preference criterion is measured by questionnaire interview and fair-funding aspect is calculated by its fund allocated. For example, if maintenance budget for Link 1 is $X in this year therefore fair-funding value is 1/X. Pairwise comparison was carried out among these criterions whereas sub-criterions rating are measured using Likert scale.

AHP assists capture both objective and subjective evaluation measures, providing a useful mechanism for inspecting the consistency of the evaluations therefore reducing bias in decision making. When making complex decisions involving multiple objectives, the first step is to decompose the main goal into its constituent sub-goals or sometimes called objectives or criteria, progressing from the general to the specific. This structure contains a goal, criteria or objective and alternative level. Each set of criteria would then be further divided into an appropriate level of detail as illustrated in figure 1.

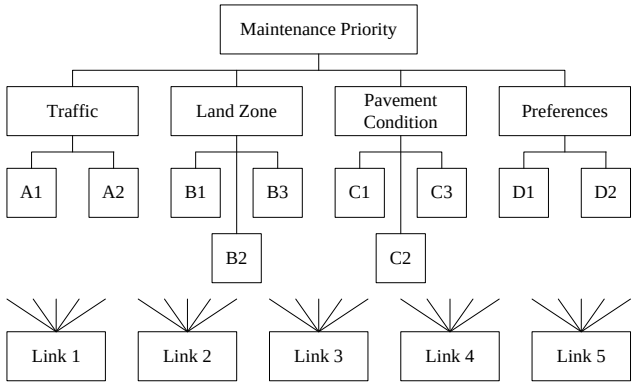

Figure 1: AHP hierarchy of goals, criterions, and alternatives

Generally, the main goal is placed on the top hierarchy while the decision alternatives are at the bottom. The relevant attributes of the decision problem such as the selection criteria and objectives lay between the top and bottom levels reside. Relative weights to each item in the corresponding level are assigned. Each criterion has a local and global priority. The sum of all the criteria beneath a given parent criterion in each layer of the model must equal one. The global priority shows alternatives relative importance within the overall model.

After the criteria factors are identified, scoring of each level with respect to its parent is conducted using a relative relational basis by comparing one option to another. Relative scores for each option are computed within each leaf of the hierarchy. Scores are then synthesized through the model, yielding a composite score for each option at every layer, as well as an overall score.

This relative scoring within each level will result in a matrix of scores, say a(i, j). The matrix holds the expert judgment of the pair-wise comparisons. Nevertheless, the judgment should be consistent. Therefore, inconsistency test is necessary to validate it. The inconsistency measure is useful for identifying possible errors in judgments data entry as well as actual inconsistencies in the judgments themselves. Inconsistency measures the logical inconsistency of the judgments. For instance, if we say that “A” is more important than “B” and “B” is more important than “C” and then say that “C’ is more important than “A”, we are not being consistent. A somewhat less inconsistent situation would occur if we would say that “A” is 4 times more important than “B”, “B” is 3 times more

important than "C", and that "C" is 7 times more important than "A". In broad-spectrum, the inconsistency ratio should be less than 0.1 be considered as reasonably consistent. Particularly, a matrix a(i, j) is said to be consistent if all its elements follow the transitivity and reciprocity rules below:

$$a_{i,j} = a_{i,k} \cdot a_{k,j} \tag{1}$$

$$a_{i,j} = \frac{1}{a_{j,i}} \tag{2}$$

where i, j and k are any alternatives of the matrix. For instance if "A" is considered 3 times more important than "B", then "B" should be 1/3 times more important than "A". The relational scale used in ranking is presented in Table 2.

Table 2: AHP importance scale

For any pair of objectives i, j:	
Score	Relative importance
1	Objectives i and j are of equal importance.
3	Objective i is weakly more important than j.
5	Objective i is strongly more important than j.
7	Objective i is very strongly more important than j.
9	Objective i is absolutely more important than j.
Note: 2, 4, 6, 8 are intermediate values.	

The pair-wise comparison matrices are able to be represented as:

$$A = \begin{bmatrix} a_{11} & \cdots & a_{1n} \\ \vdots & \vdots & \vdots \\ a_{n1} & \cdots & a_{nn} \end{bmatrix} = \begin{bmatrix} w_1 / w_1 & \cdots & w_1 / w_n \\ \vdots & \vdots & \vdots \\ w_n / w_1 & \cdots & w_n / w_n \end{bmatrix} \tag{3}$$

for a consistent matrix, it can be demonstrated that:

$$A = \begin{bmatrix} w_1 / w_1 & \cdots & w_1 / w_n \\ \vdots & \vdots & \vdots \\ w_n / w_1 & \cdots & w_n / w_n \end{bmatrix} \times \begin{bmatrix} w_1 \\ \vdots \\ w_n \end{bmatrix} = n \begin{bmatrix} w_1 \\ \vdots \\ w_n \end{bmatrix} \tag{4}$$

where A is the comparison matrix, w is the eigenvector and n is the dimension of the matrix. The equation above can be treated as an eigenvalue problem. For a slightly inconsistent matrix, the eigenvalue and the eigenvector are only slightly modified. Saaty (2001) demonstrated that for consistent reciprocal matrix, the largest eigenvalue is equal to the number of comparisons, or $\lambda_{max} = n$. Then he gave a measure of consistency, called Consistency Index as a deviation or a degree of consistency using the following formula:

$$CI = \frac{\lambda_{\max} - n}{n - 1} \tag{5}$$

The average random Consistency Index of a sample size of 500 matrices is shown in the table 3 (Saaty, 2001). Other researchers have conducted simulations with different numbers of matrices (Tummala, 1994; Alonso, 2006). Their indices are different but similar to Saaty's.

Table 3: Random index (RI) for the factors used in the decision making process

n	1	2	3	4	5	6	7	8	9	10	11	12
RI	0	0	0.58	0.9	1.12	1.24	1.32	1.41	1.45	1.49	1.51	1.58

A Consistency Ratio is a comparison between Consistency Index and Random Consistency Index, or in formula:

$$CR = \frac{CI}{RI} \tag{6}$$

If the value of Consistency Ratio is smaller or equal to 10%, the inconsistency is acceptable. Alternately, if the Consistency Ratio is greater than 10%, the judgment should be revised.

III. RESULTS AND DISSCUSSION

According to the above assessment framework, a weighting was assigned to each of the factors, and scores were given with respect to each of these factors. The weightings were obtained through a purpose-designed questionnaire completed by 32 experts. These data are listed in table 4.

Table 4: Data recapitulation

Sub Criteria	Weight	Link 1	Link 2	Link 3	Link 4	Link 5
Traffic volume (pcu/hour)	71.2%	1981	1748	1240	1048	1114
Traffic velocity (km/h)	28.8%	22.47	25.12	24.2	25.4	20.45
Residential	34.3%	2.3%	6.1%	65.2%	51.2%	35.1%
Commercial	36.5%	97.7%	93.9%	25.1%	29.4%	36.2%
Industrial	29.2%	0.0%	0.0%	9.7%	19.4%	28.7%
Good	9.2%	54.2%	69.4%	45.2%	65.1%	75.4%
Average	31.8%	44.1%	29.4%	41.4%	25.4%	14.2%
Poor	59.0%	1.7%	1.2%	13.4%	9.5%	10.4%
Political intervention	54.0%	5.00	5.00	2.00	2.00	2.00
Fair funding (1/$)	46.0%	0.09	0.13	0.20	0.41	0.17

A scale of verbal assessments is used in the questionnaire, namely: Extreme, Very strong, Strong, Moderate and Equal importance along with their corresponding scale of importance (Finan, 1999). Table 5 shows pairwise comparison between main criteria which obtained by expert judgment

Table 5: Pairwise comparison of main criteria

Criteria	A	B	C	D
A	1	4.8	0.48	1.04
B	0.21	1	0.52	0.32
C	2.10	1.94	1	0.99
D	0.96	3.12	1.01	1

Then if the columns of the above table are normalized and the resulting rows are averaged we acquire the corresponding weights of each criterion as demonstrated below:

$$\begin{bmatrix} 0.23 & 0.44 & 0.16 & 0.45 \\ 0.05 & 0.9 & 0.17 & 0.14 \\ 0.49 & 0.18 & 0.33 & 0.43 \\ 0.23 & 0.29 & 0.34 & 0.43 \end{bmatrix}$$

Therefore, the row averages are $(0.32\ 0.11\ 0.36\ 0.32)^T$ or normalized as $(0.28\ 0.09\ 0.32\ 0.29)^T$ which explains the priority weight of main criteria.

Consider $[Ax = \lambda_{max} x]$ where x is the eigenvector

$$\begin{bmatrix} 1 & 4.8 & 0.48 & 1.04 \\ 0.21 & 1 & 0.52 & 0.32 \\ 2.1 & 1.94 & 1 & 0.99 \\ 0.96 & 3.12 & 1.01 & 1 \end{bmatrix} \begin{bmatrix} 0.32 \\ 0.11 \\ 0.36 \\ 0.32 \end{bmatrix} = \begin{bmatrix} 1.35 \\ 0.46 \\ 1.56 \\ 1.33 \end{bmatrix} = \lambda_{max} \begin{bmatrix} 0.32 \\ 0.11 \\ 0.36 \\ 0.32 \end{bmatrix}$$

Hence, the largest eigenvalue is

$$\lambda_{max} = average\left(\frac{1.35}{0.32}, \frac{0.46}{0.11}, \frac{1.56}{0.36}, \frac{1.33}{0.32}\right) = 4.24$$

The consistency index with n = 4 as calculated using equation 5 is equal to 0.08. Whereas, the random index of a 4 criterion matrix = 0.9 as listed in Table 3; therefore consistency ratio is 0.089 ≈ 8.9%. The similar result is found using software package Expert Choice® as shown for this particular criterion in Figure 2. As stated above, a CI ratio that is less than 10% is acceptable and the judgments are considered to be consistent.

Figure 2. Priority weights of main criteria

For quantitative data, it is allowed to directly assign priorities without having to make paired comparisons. The values of the factors are normalized into dimensionless relative values with a range between 0 and 1. Synthesis which is the process of weighting and combining priorities throughout the model after judgments are made to yield the final result. Global priorities are obtained for nodes throughout the model by applying each node's local priority and its parent's global priority. The global priorities for each alternative are then summed to yield overall or synthesized priorities. The most preferred alternative is the one with the highest priority. Figure 3 presents the synthesis with respect to main goal. It shows that LINK 4 has the highest priority which expresses the most recommended road to be maintained, followed by LINK 1, LINK 3, LINK 2, and LINK 5 respectively. A complete hierarchy of goals and objectives with the corresponding aggregate weights is shown in Figure 4. It shows that multi-modal aspect factor contributes for the most weight in the hierarchy.

Figure 3: Synthesis with respect to main goal.

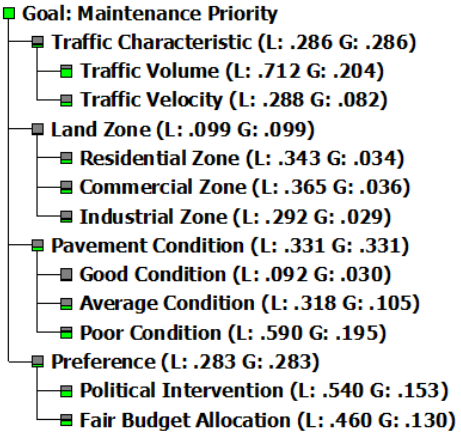

Figure 4: Importance of each factor with respect to the main goal and parent criterion

Lastly, sensitivity analysis is used to investigate the sensitivity of the alternatives to changes in the priorities of the objectives. What-if analysis can be performed with the sensitivity analyses graphs to determine how the overall result would change if the priorities of the objectives were changed. Figure 5 shows the current weights of each main criterion and alternatives with respect to the main goal. Noticeably, the results are in favor of the LINK 4. Now that the optimum option has been identified, how the model would respond to any changes in the weights of the listed criterions.

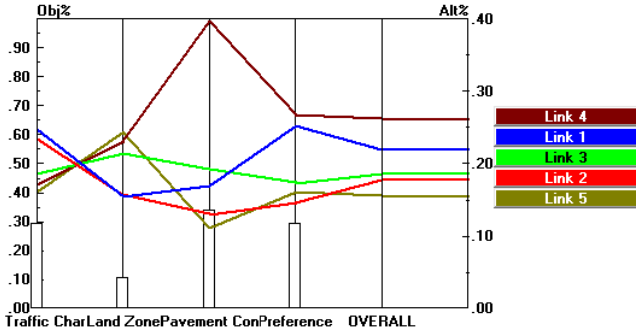

Figure 5: Sensitivity graph of the main factors and alternatives with respect to the main goal.

First, consider the land zone, by increasing the share of this criterion to an extreme of 50% of the main goal, leaving 50% for the others while keeping the proportionality between each, it has been noticed that the model is still in favor of LINK 4 with a score of 24.7% (Figure 6). The same conclusion can be drawn for the pavement condition and preferences criterions, where the LINK 4 stays as the optimum alternative with a score of 31.7% (Figure 7 and 8).

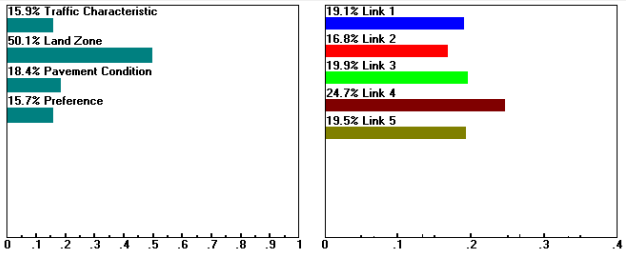

Figure 6: Sensitivity analysis of land zone, the new assigned weights (left) and the resulting scores of the alternatives (right).

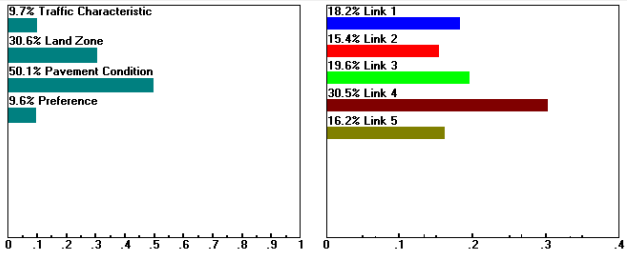

Figure 7: Sensitivity analysis of pavement condition, the new assigned weights (left) and the resulting scores of the alternatives (right).

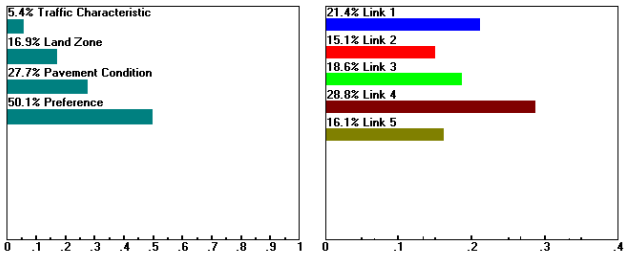

Figure 8: Sensitivity analysis of preference, the new assigned weights (left) and the resulting scores of the alternatives (right).

IV. CONCLUSION

It was observed that the developed analytic hierarchy process (AHP) model works sufficiently and yields adequate results as well as providing accurate decisions. This paper proposes a comprehensive framework, which takes a number of major technical and non-technical factors into consideration in determining urban road priority for maintenance program. Among the major criteria that guide decision maker in the evaluation, the main considerations are pavement condition traffic characteristic, and preference.

Application of this framework which is based on the AHP method and a survey among government officials and transportation experts in a study case with data in 2014 reveals that Dr. J. Leimena Street (LINK 4) has significant value; therefore, it is considered has the highest priority to be maintained.

REFERENCES

[1] Alie, Asmawi, 2006, Identification of Road Maintenance Financing Policy in Sungailiat City, Magister Thesis, Postgraduate Program, Diponegoro University

[2] Alonso, J. and T. Lamata (2006), Consistency in The Analytic Hierarchy Process: A new approach, International Journal of Uncertainty, Fuzziness and Knowledge-Based Systems 14(4): 445-459.

[3] Finan, J. S., and Hurley,W. J. (1999). Transitive Calibration of the AHP Verbal Scale. European Journal of Operational Research, 112: 367–372.

[4] Goodwin, P., and Wright, G. (2004), Decision Analysis for Management Judgment. 3rd Ed. Chichester: John Wiley & Sons Ltd.

[5] Moazami, D., R. Muniandy, H. Hamid, and Z M. Yusoff, 2011, The Use of Analytical Hierarchy Process in Priority Rating of Pavement Maintenance, Scientific Research and Essays Vol. 6(12), pp. 2447-2456.

[6] Munthe, S., 2011, Prioritizing Road Maintenance in Manokwari, Magister Thesis, Postgraduate Program, Institut Teknologi Sepuluh Nopember

[7] Public Works Department, 1990, Manual of Urban Road Maintenance Program, Directorate General of Highways, Jakarta.

[8] Public Works Department, 1997, Indonesian Road Capacity Manual, Directorate General of Highways, Jakarta.

[9] Public Works Department, 2005, Road Management Techniques, Centre for Research and Development of Transport Infrastructure, Jakarta.

[10] Putri, I. D., 2011, Determining Road Handling Priority in Bangli, Magister Thesis, Postgraduate Program, Udayana University

[11] Saaty, T. L. (2001), The Analytical Hierarchy Process: Planning, Priority Setting, Resource Allocation. London, England: McGraw-Hill International Book Co.

[12] Saputro, D.A., Ludfi D. dan Arief R., 2011, Evaluating Road Condition and its Maintenance Priority, Jurnal Rekayasa Sipil, Vol. 5, No. 2, ISSN 1978 – 5658

[13] Tamin, O.Z. (2002), Concept for development of state and provincial road network in East Nusa Tenggara, 7th Regional conference of road engineering; Indonesian Road Development Association, 18 – 19 Juli 2002, Denpasar, Bali. (in Indonesian)

[14] Tummala, V. and Y. Wan (1994), On The Mean Random Inconsistency Index of the Analytic Hierarchy Process (AHP), Computers & Industrial Engineering 27(1-4): 401-404.

[15] Watson, S. R., and Buede, D. M. (1987), Decision Synthesis: The Principles and Practice of Decision Analysis. Cambridge: Cambridge University Press.

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SOURCES OF VARIANCE IN PRE-WEAN GROWTH TRAITS OF MARINDUKE PIG (*Sus domesticus*)

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Abstract- The pre-wean growth is a complex trait that gauges the success or failure of the succeeding post-wean growth until a final product is produced. This study evaluates the variance components to identify the critical source of variance in pre-wean growth traits of Marinduke pig, the indigenous pig in the island province of Marinduque, Philippines. The pre-wean growth as measured on birth weight (BW_0), weaning weight at 49 day-old (BW_{49}), weight gain (BWG), and average daily gain (ADG) were evaluated from 62 piglets. The mean and variability *e.g.* standard deviation and coefficient of variation, correlation and regression, analysis of variance, and variance partitioning were instituted. Result shows that the pre-wean growth trait specifically the BW_0 was dependent on the maternal effect (37.74%) or the influence of the dam's phenotype on the phenotype of her progeny. The BW_{49} (42.20%), BWG (46.23%) and ADG (47.58%) were found due to the effect of litter size. A management protocol that shall provide better nutrition and welfare is required to sustain the physiological requirements thereby ensuring better and uniform pre-wean growth in Marinduke pig.

Index Terms - Growth traits, Marinduke pig, Philippines, Swine breeding, Variance components

I. INTRODUCTION

Three pig species, namely; *Sus philippensis*, *Sus ahoenobarbus*, and *Sus scrofa* are known to exist as protein foods of Filipinos in the Neolithic period [1, 2]. The *S. philippensis* (warty pig) and *S. ahoenobarbus* (Palawan bearded pig) are the endemic wild pigs in the Philippines. The *S. scrofa* is a domestic pig species grown in the country since early civilization. These three pig species are presumed to have shared evolutionary path producing the Philippine native pig. This is a scientific guess in the absence of factual and empirical information but provides interesting idea necessary for elucidating the nature of the current genetic property of the Philippine native pig. It is speculated that several evolutionary forces like inter-specific hybridization, fixation, isolation, and formation of sire-lines have contributed to the existing genotype of domestic pig [1, 2, 3, 4, 5, 6]. The recent qualitative study using microsatellite markers shows a low genetic diversity in the sampled 23 native pigs from three locations, namely; Ilocos, Tarlac, and Quezon in the Philippines [6]. Similarly, the Taoyuan pigs in Taiwan have low genetic diversity [5]. These reports show that the Philippine native pig and Taoyuan pig are both genetically pure and distinct genetic resources.

Several variants of native pig are known to exist in the Philippines [6]. The Marinduke pig is the classic example in the island province of Marinduque, Philippines (13°24'N 121°58'E). There are three variants of Marinduke pig with distinct visual phenotypes to include the pure black pig, black with white-feet pig, and multi-color pig that must be documented as part of the Philippines' commitment to conserve animal genetic resources (FAO Global Plan of Action for Animal Genetic Resources http://dad.fao.org/). The information about these pig variants is necessary in elucidating the complexity of domestication, magnitude of genetic improvement and required strategy for genetic conservation. Relatively, the population of Marinduke pig is declining based on the shipment of live piglets to other provinces having an average negative change of 27.85% from 2012 to 2014 (http://marinduquevet.ph/?page_id=438). The extraction rate for lechon processing (3,565±1,209 piglets being shipped monthly from 2012 to 2014) coupled with relatively low reproductive efficiency (8.3±1.9 piglets born; in this paper) and low growth rate (0.14kg/d; in this paper) of Marinduke pig are believed to aggravate the decline in pig population.

The Marinduke pig is popular and preferred in the processing of lechon (roast whole pig). The lechon has become part of the Filipino culture associated to festivities and thanks-giving [7]. Having this niche market, support system and innovation that shall improve their availability for the lechon are necessary. Their slow growth performance is one of concerns to be addressed. Growth as defined here refers to compositional change based on time-related accretion of body mass. The pre-wean growth is mostly associated with the nursing ability or maternal influences which are dependent on genetics and non-genetic functions [8]. Hence, this paper evaluates the pre-wean growth of Marinduke pig to identify its critical source of variation.

II. MATERIALS AND METHODS

Data Source

The pre-wean growth of Marinduke pig was evaluated on relative change in body weight from birth to weaning using the pooled data from two variants, namely: Marinduke black pig and Marinduke white-feet pig. The pre-wean growth traits, namely; birth weight (BW_0), weaning weight at 49 day-old (BW_{49}), weight gain (BWG), and average daily gain (ADG) were measured from 62 piglets (66 at birth) born on May 2014 (27 piglets) and November 2014 (39 piglets). The piglets were progeny of full-sib parents; 2 sires and 4 dams with two litters each dam. Relatively, the piglets belong to two sire families with two full-sib litters and four half-sib litters each sire family. The sires and dams were progeny of the unrelated foundation stock

maintained at the Livestock Farm of Marinduque State College (MSC), Philippines (13°20'52.2"N, 122°06'03.2"E). The Marinduke pigs are fed with composite of commercial feeds (BAI Reg. No. M-174, Lipa Agricultural Development Corp., Philippines) and forages e.g. *Trichanthera gigantea*, grasses, and legumes; and managed in consonance to Republic Act 8485 and Republic Act 10631 (The Animal Welfare Laws of the Republic of the Philippines) as certified by the MSC Ethics Review Committee.

The BW_0 of piglets was taken (Fuji Sun weighing scale, 0.05 kg graduation) and recorded at farrowing time specifically after removing the fetal membrane and treating the umbilical cord with iodine solution (Betadine®, Mundipharma Distribution GmbH, Philippines). After weighing; each piglet was assigned with identification code through notches in both ears. The right ear contains the litter number while the left ear contains the individual number within litter. The ear notch wounds were treated with iodine solution. The piglet was placed in the ventral area of the dam while in lay down position and trained to suckle colostrum. There was closed monitoring of the health condition of dam and piglets within 24 hr post-partum. Iron administration was performed within 48 hr of birth. All piglets in a litter were treated with the same procedure as described. The dam nursed her piglets until the weaning age.

Moreover, we practiced scattering of a handful of creep feed in the pig pen to train piglets eat solid food starting at 7th day old. The creep feeding was employed continuously until weaning to stimulate post-weaning feed consumption [9]. The weaning process commences from transferring the dam to the breeding herd and leaving the piglets in the pen. There were 62 piglets at weaning time. The BW_{49} of piglets was taken (Fuji GT weighing scale, 0.2 kg graduation) and recorded at weaning.

Data Format

The birth weight (BW_0) and weaning weight at 49 day old (BW_{49}) were encoded in a column format in Microsoft Office Excel ver. 2007. The weight gain (BWG) was computed as the difference of BW_{49} minus BW_0. The average daily gain (ADG) was a quotient of BWG in proportion to the weaning age (49 d). The data were expressed in kg except ADG, kg/d. The independent variables, namely; sire, dam, sex ratio, litter size, and sex of piglet were encoded correspondingly with the pre-wean growth traits data. There were two sires and four dams with corresponding identification code each. The sex ratio of piglets in a litter was composed of 1:1 (equal male to female ratio), >1:1 (more males than females), and <1:1 (less males than females). The litter size was categorized into ≤ 8 (5 to 8 piglets per litter; 6.8±1.3) and ≥ 9 (9 to 11 piglets per litter; 9.8±1.0). The sex of piglet refers to their biological sex of either male or female. The data file was linked to the Statistical Analysis System (SAS) software ver 6.12 (SAS Institute, Cary, USA) for statistical analyses.

Data Analysis

The mean and measures of variability such as standard deviation and coefficient of variation of pre-wean growth traits were calculated in PROC UNIVARIATE PLOT NORMAL. The skewness value as a measure of normality distribution was considered. The association among the pre-wean growth traits with litter size were determined in PROC CORR. The phenotypic variance of pre-wean growth traits was partitioned into variance components of sire, dam, sex ratio, litter size, and sex of piglet in PROC NESTED. The model was $\sigma^2_{Pijklmn} = \sigma^2_{si} + \sigma^2_{dj} + \sigma^2_{rk} + \sigma^2_{ll} + \sigma^2_{xm} + e_{ijklmn}$ where $\sigma^2_{Pijklmn}$ as the phenotypic variance, σ^2_{si} as variance between-sire, σ^2_{dj} as variance between-dam, σ^2_{rk} as variance between-sex ratio, σ^2_{ll} as variance between-litter size, σ^2_{xm} as variance between-sex of piglet, and e_{ijklmn} as the residual variance. The variance due to sire, dam, sex ratio, litter size, and sex of piglet were partitioned further to measure the magnitude of differences between-factors and with-in factor [10]. The model was $Y_{ij} = \mu + \alpha_i + e_{ij}$; where Y_{ij} is the j^{th} measurement on the i^{th} factor, μ is the overall mean, α_i is the between-factors effect, and e_{ij} is the residual (within-factor effect). The significance of the main effect and interaction effect of the independent variables were tested in PROC GLM.

III. RESULTS

Pre-wean Growth Performance

The pre-wean growth as measured on birth weight (BW_0), weaning weight (BW_{36} to BW_{56}), weight gain (BWG) and average daily gain (ADG) of native pigs varies considerably in different countries (Table 1). Relatively, the Marinduke pig was observed to have similar pre-wean growth performance with the native pigs in other countries (Table 2). The Marinduke pig had mean BW_0 of 0.84±0.15 kg and capable to grow into 7.74±1.52 kg achieving a BWG of 6.89±1.56 kg at the rate of 0.14±0.03 kg/d within the 49 d pre-wean period. However, its positively skewed data indicated that the majority of them had pre-wean growth performance below the mean while few was sufficiently heavy at weaning ($p>\alpha$). Relevant analysis shows that the amount of heterogeneity (coefficient of variation) in weight at birth and weaning was 17.49% and 19.65%, respectively. The heterogeneity had increase to 22.57% and 22.64% for the BWG and ADG, respectively indicating wide variability among the piglets of Marinduke pig.

Table 1. The pre-wean growth performance of different breeds of native pig.

Breed	BW0	BW36-56	BWG	ADG	Author
Hurrah (Nepal)	0.72	6.72	6.00	0.122	[11] Pokharel et. al., 2013
Nigerian hybrid	0.91	6.72	5.81	0.119	[12] Oluwole et al. 2014
Ghungroo (India)	0.96	7.07	6.11	0.109	[13] Banik et al., 2013
Nigerian	0.90	6.70	5.80	0.104	[14] Nwakpu, 2013
Kadon (Thailand)	0.58	6.10	5.52	0.092	[15] Vasupen et al., 2008
Niang Megha (India)	0.64	5.47	4.83	0.086	[13] Banik et al., 2013
Nigerian	1.34	4.48	3.14	0.056	[16] Ogah, 2010
Nigerian	0.93	4.03	3.10	0.055	[17] Ajayi & Akinokun, 2013
Nigerian	0.85	3.36	2.51	0.051	[18] Nwakpu & Ugwu, 2009
Mean	***0.87 (0.22)***	***5.63 (1.36)***	***4.76 (1.44)***	***0.088 (0.03)***	

BW0= birth weight, kg; BW36-56= weaning weight at 36 to 56 day old, kg; BWG= weight gain, kg; ADG= average daily gain, kg/d; some values were re-computed. Listed based on growth rate (ADG).

Table 2. The descriptive statistics of pre-wean growth traits of Marinduke pig.

Parameter	BW0	BW49	BWG	ADG
Observation	66	62	62	62
Mean, kg	0.842	7.737	6.892	0.141
Minimum, kg	0.693	6.217	5.336	0.109
Maximum, kg	0.990	9.257	8.448	0.172
Standard deviation	0.147	1.520	1.556	0.032
Coefficient of variation	17.491	19.649	22.575	22.636
Skewness	0.532	0.475	0.541	0.504
Pr < W	0.015	0.041	0.024	0.012

BW0= birth weight, BW49= weaning weight at 49 d/o, BWG= weight gain, ADG= average daily gain

Association Within Pre-wean Growth Traits

The heavy weight piglet at birth (>0.8kg) was found to belong into small litter size that ranges from 5 to 8 piglets per

litter (r = -0.2559). This negative correlation of BW_0 with litter size in this study did not affect the survivability of the piglets until weaning (r = -0.3155). On the other hand, the light weight piglets at birth (<0.8 kg) had relatively fast growth rate similar to the piglets that were heavier at birth (r = -0.2768), an indication of compensatory growth performance (Table 3).

Table 3. The phenotypic correlation of pre-wean growth traits with litter size in Marinduke pig.

Parameter	LS_B	LS_W	BW0	BW49	BWG	ADG
LS_B		0.0001	0.0381	0.6933	0.5711	0.5594
LS_W	0.9664**		0.0099	0.3985	0.2914	0.2880
BW0	-0.2559*	-0.3155**		0.1406	0.0265	0.0294
BW49	0.0511	0.1091	-0.1893		0.0001	0.0001
BWG	0.0733	0.1361	-0.2818*	0.9955**		0.0001
ADG	0.0756	0.1371	-0.2768*	0.9922**	0.9963**	

LS_B = litter size at birth, LS_W = litter size at weaning, BW0= birth weight, BW49= weaning weight at 49 d/o, BWG= weight gain, ADG= average daily gain; the values below the diagonal line were the correlation coefficient (with asterisk was significant at α of 1%** or 5%*) while values above were the p-values.

Sources of Variance in Pre-Wean Growth Traits

The variation in pre-wean growth traits was primarily associated to the dam and litter size effects (Table 4). The dam effect contributed 37.74% to differences in BW_0 and 24.59% in BW_{49}. The litter size effect was relatively low at BW_0 (22.27%) but high at BW_{49} (42.20%). Further analysis shows that the variation in weight was associated largely on individual differences or "residual effect" under a particular independent factor. The between-factor effect also called the "treatment effect" measures the extent of variation in pre-wean growth traits that is associated on level of independent factors e.g. sex ratio and litter size. The presence of significant interaction effect indicates the potential influence of other factors to the variation in pre-wean growth traits.

Table 4. Variance component, functions of variance component, and significance value in pre-wean growth traits of Marinduke pig.

	BW0		BW49		BWG		ADG	
Variance Source	Variance	Percent	Variance	Percent	Variance	Percent	Variance	Percent
Sire	-0.0048	0	-0.4994	0	-0.5601	0	-0.0002	0
Dam	0.0134	37.74	0.7195	24.59	0.8358	26.89	0.0004	31.11
Sex ratio	-0.0090	0	0.1930	6.60	0.1580	5.08	-0.0000	0
Litter size	0.0079	22.27	1.2348	42.20	1.4371	46.23	0.0006	47.58
Sex of piglet	0.0041	11.67	0.2438	8.33	0.1866	6.00	0.0001	5.71
Residual	0.0100	28.32	0.5349	18.28	0.4910	15.79	0.0002	15.59
Total	0.0354	100	2.9259	100	3.1084	100	0.0013	100
Functions of variance components								
t_{HS}	-0.1356		-0.1707		-0.1802		-0.1538	
t_{FS}	0.2429		0.0752		0.0887		0.1538	
c^2	0.3785		0.2459		0.2689		0.3077	
p-value								
Sire	.		.		.		.	
Dam	*0.0080***		*0.0001***		*0.0001***		*0.0001***	
Sex ratio	*0.5202*		*0.4558*		*0.4824*		*0.6339*	
Litter size	*0.0017***		*0.0001***		*0.0001***		*0.0001***	
Sex of piglet	*0.4430*		*0.8305*		*0.7171*		*0.7377*	
Interaction effect	*0.9057*		*0.0241**		*0.0117**		*0.0080***	
CV	*14.2293*		*11.6375*		*12.2039*		*12.2583*	
R^2	*49.0897*		*73.5477*		*77.9612*		*77.8851*	
Intercept	*0.8583*		*7.4000*		*6.5300*		*0.1320*	
SEE	*0.0489*		*0.4027*		*0.3761*		*0.0077*	

BW0 = birth weight, BW49 = weaning weight at 49 d/o, BWG = weight gain, ADG = average daily gain; t_{HS} = half-sib correlation, t_{FS} = full- sib correlation, c^2= combination of maternal and common environmental effects and dominance effect; CV = coefficient of variation, R^2 = coefficient of determination, SEE= standard error of estimate; **= significant at α of 1%, *= significant at α of 5%

IV. DISCUSSION

The birth weight (BW_0) is a complex trait and the most important determinant for the succeeding post-natal growth. Studies involving large data set (40,000 piglets) were unanimous in disclosing its complex nature and functions in different pig breeds [19, 20, 21,22, 23]. The inverse relationship of BW_0 with litter size is of paramount importance. Reduction in BW_0 from 43 g per piglet to 56 g per piglet in crossbreds (landrace x large white) and 95 g per piglet in purebred large white selected for increase litter size were observed [19, 24]. Relevant evaluation shows a negative association (r = -0.30 and -0.15/-0.20, respectively) with litter size in hyperprolific Czech large white and F_1 of Nigerian pigs and large white or landrace [23, 25]. This study in Marinduke pig adheres on the negative association (r = -0.2559) of BW_0 with litter size indicating that these traits was independent on data set ($p<0.05$, Table 3). The main effect of litter size shows that the heavier piglets at birth (0.91±0.02 kg > population mean of 0.84±0.15 kg) belong to the litter size of 6.8±1.3 piglets, which was below the population mean of 8.3±1.9 piglets ($p<0.05$, Table 4).

The measures of variability, namely; range, variance, standard deviation and coefficient of variation were positively correlated between BW_0 and litter size [23]. It shows that a variation in BW_0 (CV from 15% to 24%) was associated to prolificacy but with increased proportion (3% to 15%) of small piglets (<1.0 kg) in landrace and large white [24]. Thus, several management options (e.g. cross-fostering, split suckling, etc) were reviewed to mitigate the negative effects of large litter size and overcome the potential risk to welfare of pigs and economic performance [26]. Relatively, it is presumed that any or combination of the management options well do considering the non-additive nature of gene regulating the expression of CV_{BW0}. Its low heritability (<0.05) confirms the non-additive effect indicating low influence to the succeeding generations [23]. The repeatability estimate of BW_0 was moderate (0.33 in large white to 0.42 in crosssbred landrace x large white) while CV_{BW0} was low, <0.15 [24]. Observation in this study similarly shows that the repeatability estimate due to litter size effect was 0.43 indicating that a substantial variation between piglets within-litter do exists. This finding reiterates the necessity to select for a dam possessing genetics capable of producing uniformly-sized piglet (≈1.0kg).

The influence of litter size and BW_0 with BW_{49} was not established in this study. However, there was 2% increased in CV of weaning weight (Table 2). This finding disagrees with report that shows negative correlation (-0.348) between litter size and weaning weight and positive correlation (0.168) between birth weight and weaning weight in Yorkshire and F_1 of Yorkshire x Landrace [19, 21].

V. CONCLUSION

The maternal effect was identified as the critical source of variance in BW_0 (37.74%). The variation in BW_{49} (42.20%), BWG (46.23%) and ADG (47.58%) was due to the litter size effect. However, the existence of interaction effect indicated an influence of other factors in the variation of pre-wean growth. Thus, a management protocol that shall provide better nutrition and welfare is required to sustain the physiological requirements for ensuring better and uniform pre-wean growth in Marinduke pig.

VI. ACKNOWLEDGMENT

This paper is an output for the PCAARRD (Philippine Council for Agriculture, Aquatic and Natural Resources Research and Development) Multi-Agency Research and Development Program on Conservation, Improvement and Profitable Utilization of the Philippine Native Pig being funded by the PCAARRD, Philippines Department of Science and Technology. The author wishes to thank the PCAARRD, Partner-Institutions and the Project Staff for all support and assistance.

VII. REFERENCES

[1] P. J. Piper, F. Z. Campos and H. C. Hung, "A study of the animal bone recovered from pits 9 and 10 at the site of Nagsabaran in Northern Luzon, Philippines," Hukay, 2009a, 14:47-90, Retrieved from http://www.journals.upd.edu.ph/index.php/asp/article/view/4119.

[2] P. J. Piper, H. C. Hung, F. Z. Campos, P. Bellwood and R. Santiago, "A 4000 year-old introduction of domestic pigs into the Philippine archipelago: implications for understanding routes of human migration through island Southeast Asia and Wallacea," Antiquity, 2009b, 83:689-695, Retrieved from http://www.thefreelibrary.com/A+4000+year-old+introduction+of+....

[3] A. Evin, L. G. Flink, A. Bălăşescu, D. Popovici, R. Andreescu, D. Bailey, P. Mirea, C. Lazăr, A. Boroneanţ, C. Bonsall, U. S. Vidarsdottir, S. Brehard, A. Tresset, T. Cucchi, G. Larson and K. Dobney, "Unravelling the complexity of domestication: a case study using morphometrics and ancient DNA analyses of archaeological pigs from Romania," Philosophical Transactions of Royal Society B, 2015, 370:20130616, Retrieved from http://dx.doi.org/10.1098/rstb.2013.0616.

[4] H. Hongo, N. Ishiguro, T. Watanobe, N. Shigehara, T. Anezaki, V. T. Long, D. V. Binh, N. T. Tien and N. H. Nam, "Variation in mitochondrial DNA of Vietnamese pigs: Relationships with Asian domestic pigs and Ryukyu wild boars," Zoological Science, 2002, 19(11):1329-1335, Retrieved from http://dx.doi.org/10.2108/zsj.19.1329.

[5] K. Y. Li, K-T Li, C-C Cheng, C-H Chen, C-Y Hung and Y-T Ju, "A genetic analysis of Taoyuan pig and its phylogenetic relationship to Eurasian pig breeds," Asian-Australasian Journal of Animal Science, 2015, 28(4):457-466, Retrieved from http://dx.doi.org/10.5713/ajas.14.0595.

[6] J. D. Oh, R. G. C. Cacho, J. Y. Choi, J. H. Seo, K. D. Song, R. S. A. Vega, R. C. Santiago, J. E. R. Octura, S. W. Kim, C. W. Kim, S. H. Kim, H. S. Kong, H. K. Lee and B. W. Cho, "Genetic analysis of Philippine native pigs (*Sus scrofa* L.) using microsatellite loci," Philippine Journal of Science, 2014, 143(1):87-93, Retrieved from www.researchgate.net/profile/Josh_Elisha_Octura/publication/268210142_Genetic_Analysis_of_Philippine_Native_Pigs_(Sus_scrofa_L.)_Using_Microsatellite_Loci/links/546448090cf2cb7e9da9a7b9.pdf.

[7] M. L. A. Valdez, "Parada ng lechon in Balayan, Batangas, Philippines to honor St. John the Baptist: an ethnographic study," Asia Pacific Journal of Multidisciplinary Research, 2014, 2(3):96-102, Retrieved from http://www.ejournals.ph/index.php?journal=APJMR&page=article&op=viewArticle&path[]=8699.

[8] L. Canario, M. C. Père, T. Tribout, F. Thomas, C. David, J. Gogué, P. Herpin, J. P. Bidanel and J. Le Dividich, "Estimation of genetic trends from 1977 to 1998 of body composition and physiological state of Large white pigs at birth," Animal, 2007, 1(10):1409-1413, doi: 10.1017/S1751731107000766

[9] R. A. Cabrera, J. L. Usry, C. Arrellano, E. T. Nogueira, M. Kutschenko, A. J. Moeser and J. Odle, "Effects of creep feeding and supplemental glutamine or glutamine plus glutamate (Aminogut) on pre- and post-weaning growth performance and intestinal health of piglets," Journal of Animal Science and Biotechnology, 2013, 4:29. doi: 10.1186/2049-1891-4-29.

[10] N. D. Cameron, "Selection indices and prediction of genetic merit in animal breeding," CAB International, Wallingford Oxon OX10 8DE, UK, 1997, 203pp.

[11] B. B. Pokharel, N. Bhattarai, M. Sapkota and P. Kafle, "Effect of non-genetic factors on litter traits of Hurrah pigs in Nawalparasi, Nepal," International Journal of Agriculture and Forestry, 2013, 3(4):141-144. doi: 10.5923/j.ijaf.20130304.03.

[12] O. O. Oluwole, A. K. Tiamiyu, T. O. Olorungbounmi, M. O. Oladele-Bukola and N. A. Akintoye, "Pre-weaning growth traits in Nigerian indigenous pig crossbreds," Agricultural Sciences, 2014, 5:891-896. http://dx.doi.org/10.4236/as.2014.510096.

[13] S. Banik, S. Naskar, P. K. Pankaj, R. Pourouchottamane, K. Barman, N. R. Sahoo and M. K. Tamuli, "Construction of growth band for early selection of indigenous pigs in India," Applied Biological Research, 2013, 15(1):73-77, Retrieved from http://www.researchgate.net/publication/236108048_Construction_of_growth_band_for_early_selection_of_indigenous_pigs_in_India.

[14] P. E. Nwakpu, "Preweaning litter growth and weaning characteristics among inbred and cross bred native by exotic piglet genotypes," Agriculture and Biology Journal of North America, 2013, 4(4):393-397, http://dx.doi.org/10.5251/abjna.2013.4.4.393.397.

[15] K. Vasupen, C. Yuangklang, S. Wongsuthavas and P. Panyakaew, "Growth performance, carcass and meat characteristics of female and male Kadon pigs," Journal of Biological Sciences, 2008, 8(3):671-674. doi: 10.3923/jbs.2008.671.674.

[16] D. M. Ogah, "Canonical correlation analysis for estimation of economic traits at weaning in indigenous pigs," Analele IBNA, 2010, 26:111-115, Retrieved from www.ibna.ro/pdf/anale/Anale_26_2010%20pdf/Anale%20IBNA%2026_16_Ogah.pdf.

[17] B. A. Ajayi and J. O. Akinokun, "Evaluation of some litter traits and heritability estimates of Nigerian indigenous pigs," International Journal of Applied Agricultural and Apicultural Research, 2013, 9(1&2):113-119, Retrieved from http://www.ajol.info/index.php/ijaaar/article/view/96936.

[18] P. E. Nwakpu and S. O. C. Ugwu, "Heterosis for litter traits in native by exotic inbred pig crosses," Journal of Tropical Agriculture, Food, Environment and Extension, 2009, 8(1):31-37, Retrieved from www.agrosciencejournal.com/public/agro8-5.pdf.

[19] A. D. Beaulieu, J. L. Aalhus, N. H. Williams and J. F. Patience, "Impact of piglet birth weight, birth order, and litter size on subsequent growth performance, carcass quality, muscle composition, and eating quality of pork," Journal of Animal Science, 2010, 88:2767-2778. doi:10.2527/jas.2009-2222.

[20] J. Bérard, M. Kreuzer, and G. Bee, "Effect of litter size and birth weight on growth, carcass and pork quality, and their relationship to post-mortem proteolysis," Journal of Animal Science, 2008, 86:2357-2368. doi: 10.2527/jas.2008-0893.

[21] B. N. Milligan, D. Fraser and D. L. Kramer, "Within-litter birth weight variation in the domestic pig and its relation to pre-weaning survival, weight gain, and variation in weaning weight," Livestock Production Science, 2002, 76:181-191,doi:10.1016/S0301-6226(02)00012-X.

[22] C. Rehfeldt, A. Tuchscherer, M. Hartung and G. Kuhn, "A second look at the influence of birth weight on carcass and meat quality in pigs," Meat Science, 2008, 78:170-175, doi: 10.1016/j.meatsci.2007.05.029.

[23] J. Wolf, E. Žáková and E. Groeneveld, "Within-litter variation of birth weight in hyperprolific Czech large white sows and its relation to litter size traits, stillborn piglets and losses until weaning," Livestock Science, 2008, 115:195-205, doi: 10.1016/j.livsci.2007.07.009.

[24] H. Quesnel, L. Brossard, A. Valancogne and N. Quiniou, "Influence of some sow characteristics on within-litter variation of piglet birth weight," Animal, 2008, 2(12):1842-1849, doi: 10.1017/S175173110800308X.

[25] P. E. Nwakpu and P. N. Onu, "Correlations between some weaning traits in four strains of F_1 piglet genotypes," Journal of Animal and Veterinary Advances, 2007, 6(10): 1238-1241.

[26] E. M. Baxter, K. M. D. Rutherford, R. B. D'Eath, G. Arnott, S. P. Turner, P. Sandøe, V. A. Moustsen, F. Thorup, S. A. Edwards and A. B. Lawrence, "The welfare implications of large litter size in the domestic pig II: Management factors," Animal Welfare, 2013, 22:219-238, doi: 10.7120/09627286.22.2.219.

[27] R. R. Kraeling and S. K. Webel, "Current strategies for reproductive management of gilts and sows in North America," Journal of Animal Science and Biotechnology, 2015, 6(3). doi: 10.1186/2049-1891-6-3.

Paleoenvironmental Studies of Ahoko Shale, south eastern Bida basin, Nigeria: Insight from Palynomorph Assemblage and Trace Metal Proxies

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Abstract- Ahoko lies within the Lokoja Sub-basin of the Bida Basin in the North Central part of Nigeria. Local stratigraphy of the sediments and the field relationship show that the lithologic succession consists of dark grey shales at the base, followed by light grey shales and siltstones that are intercalated at intervals by grey to brownish, highly indurated ironstone concretion. The sediments when subjected to geochemical analysis showed ratio of Th/Cr, Cr/Th, Th/Co and Cr/Ni which suggests felsic source rocks. Geochemical results further revealed lower Mo/Al, V/Al, U/Al, Cr/Al, Ba/Al, Sr/Al, Ni/Al and Co/Al ratios which indicate the potentially 'extreme' bottom-water oxic conditions during deposition. The approximate order of enrichment relative to average shale being in the order: Zr > U > Pb> Mo > Y > Co > Cr > V> Zn > Ba > Cu > Rb >Ni > Sr and Zr > Y > U > Zn > Co > Mo > Sr > Pb > Cr >Ba > V > Cu > Ni > Rb for profile A and B respectively. Estimated Ce/Ce* ratio and Log (Ce/Ce*) show positive anomaly in studied samples which suggests well oxygenated bottom-water conditions during deposition. Trace element ratios such as U/Th, V/Cr, Ni/Co, Cu/Zn, V/Sc ratios and V/(Ni+V) indicate oxic environment of deposition. These results in conjunction with the recovery of *Echitriporites trianguliformis*, *Monocolpites marginatus*, *Retimocolpites* obaensis, *Psilatricolporites crassus*, *Longapertites marginatus*, *Proxapertites cursus*, *Acrostichum aureum*, *Cyatridites minor*, *Zlivisporites blanensis* and charred graminae in the sediments suggest fluviodeltaic source and moderately distal oxic environment of deposition.

Index Terms- Ahoko shale, Bida basin, Trace metal, rare earth metals, paleoenvironmental conditions.

I. INTRODUCTION

The Bida basin, which is located in west central Nigeria, is perpendicular to the main axis of the Benue Trough. Due to its large areal extent and facies variation, the basin is often geographically divided into northern and southern Bida basins or what some authors prefer to refer to as Bida and Lokoja Sub-basins (1; 2; 3). Most previous geologic accounts indicate a rift related origin for the basin (4; 5; 6) that was associated with the Benue Trough system and the drifting apart of African and Brazilian plates; whilst Braide (2) advanced a wrench fault tectonics for its evolution and, thus, suggested a pull- apart origin.

Stratigraphic framework in this basin has been along the geographic subdivision of the basin into Bida and Lokoja Sub-basins. Adeleye and Dessauvagie (7) and Adeleye (8) established four stratigraphic horizons in the northern Bida Sub-basin whereas three are three formations that are their lateral equivalents in the southern Lokoja Sub-basin.

Trace elements characteristically show substantial enrichment in laminated, organic- rich facies, mostly those deposited under euxinic conditions and, equally, little if any enrichment in bioturbated, organic-poor facies (9; 10; 11). The geochemical pattern of trace elements in modern organic rich fine grained sedimentary rocks (i.e. shales) and anoxic basins has often been reported in literature (12; 10; 13; 11). Redox-sensitive trace element (TE) concentrations or ratios are among the mostly broadly used indicators of redox conditions in modern and ancient sedimentary deposits (e.g., 10; 14; 15; 16; 18; 19; 20; 11).

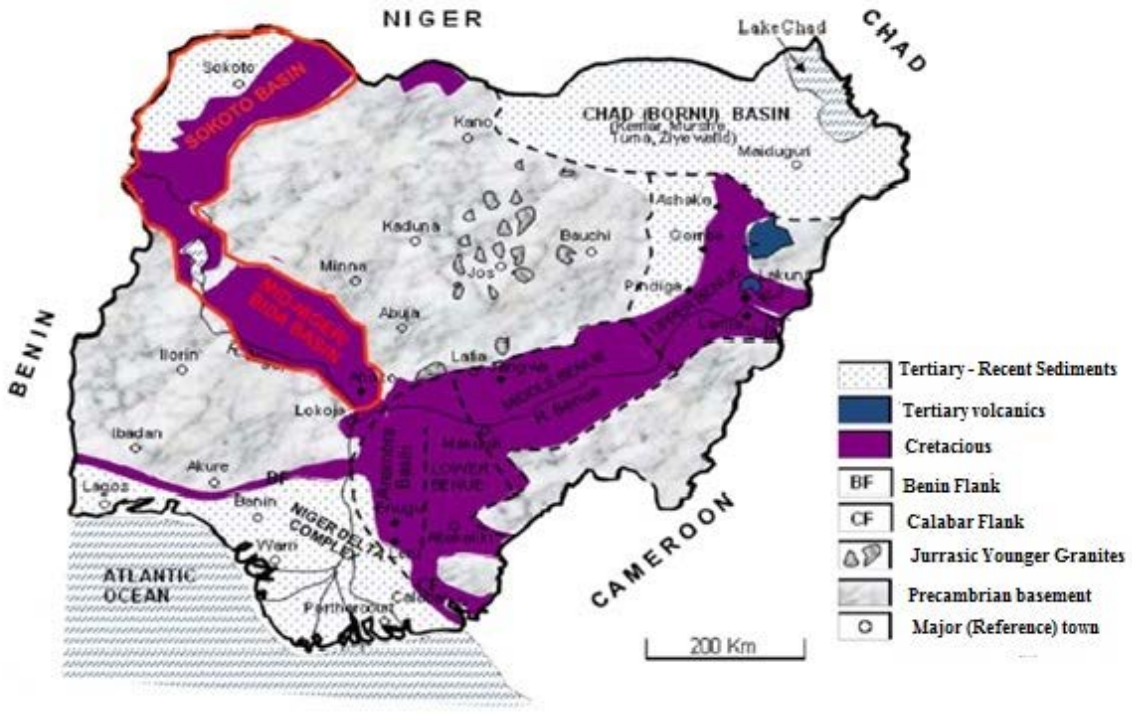
Enrichments of redox-sensitive elements can reconstruct the depositional environment of ancient organic carbon-rich sediments and sedimentary rocks and accordingly be used to reveal the likely palaeoceanographic conditions leading to their formation (21, 22; 23; 24). The degree of enrichment/depletion is typically based on the element/Al ratio in a sample, and calculated relative to the respective element/Al ratio of a common standard material, e.g. average marine shale (25). Although such comparisons have to be handled with care, as the composition of any common standard material is not necessarily representative for a certain erosional source area (26), they are uncomplicated for elements with very high degrees of enrichment/depletion and/or low concentrations in the standard material. High enrichments of redox-sensitive elements in organic carbon rich sediments have been related to anoxic bottom waters. Under reducing conditions these metals may be precipitated as sulfides, co-precipitated with iron sulfides or bound to organic matter (21; 27; 28; 12; 29; 23; 10; 24; 30).

It is indisputable that the reliability of the predictions of the paleoenvironments of deposition, source and reservoir rocks and mineral prospect of this basin will depend on adequate and detail reconstruction of the provenance and the depositional history of the sediments (31). This can be best achieved through an integrated study of the freshly exposed and thick clastic road-cut outcrop sequences along Lokoja - Abuja road. The aims of this paper are to determine the provenance, redox conditions of bottom water condition during deposition, and element enrichments of the Maastrichtian shale sequence around Ahoko, along Lokoja - Abuja

highway. The objectives of this paper is to combine palynomorph assemblage and trace metal proxies (i.e. Ni/Co, V/Sc, V/Cr, Cu/Zn, U/Th and V/(Ni+V)) to reconstruct paleogeography and paleoceanographic conditions during deposition.

II. GEOLOGICAL SETTING OF MIDDLE NIGER (BIDA) BASIN

The Middle Niger (Bida) Basin is a linear intracratonic sedimentary basin situated in central Nigeria. It trends NW – SE and roughly perpendicular to the Benue Trough. It is separated from the basal continental bed of the Sokoto Basin by a narrow outcrop of the crystalline basement rocks in the west and it is adjacent to the Anambra Basin in the east (Fig.1). The basin occupies a gently downwarped trough (32). The epeirogenesis responsible for the basin genesis appears closely connected with the Santonian tectonic crustal movements which mainly affected the Benue Basin and SE Nigeria. The underlain basement complex perhaps has a high relief (1) and the thick sedimentary successions is approximately 2000 metres as shown by gravity survey (33), comprised of unfolded post-tectonic molasse facies and thin marine strata. Borehole logs, Landsat images interpretation, and Geophysical data across the basin suggest that it is bounded by a NW-SE trending system of linear faults (34). Gravity survey studies also corroborate central positive anomalies flanked by negative anomalies (35; 6). This trend agreed with rift structures as observed in the adjacent Benue Trough/Basin. A detailed study of the facies indicates rapid basin-wide changes from various alluvial fan facies through flood-basin and deltaic facies to lacustrine facies (3). Consequently, a simple sag and rift origin earlier suggested may not account for the basin's evolution (32). Braide (2) paleogeographic reconstruction suggests lacustrine environments were widespread and elongate.



Lacustrine environments occurred at the basin's axis and close to the margins. This suggests that the depocenter must have migrated during the basin's depositional history and subsided rapidly to accommodate the 3.5 km thick sedimentary fill (32).

The sedimentary sequences are Late Cretaceous (Campanian – Maastrichtian) in age and were named the Nupe Sandstone by Russ (37). Adeleye (38) upgraded Nupe Sandstone to Nupe Group and subdivided it into four formations: Bida Sandstone (oldest), Sakpe Ironstone, Enagi Siltstone and Batati Ironstone (youngest). A lateral facies variation occurs in the southern part of the basin. Around Lokoja, the basal sequence is usually referred to as the Lokoja Sandstone. Nonetheless, the sandstone is only partly equivalent to the (Bida) Sandstone (39) and is overlain by Patti Formation and Agbaja Ironstones respectively (32). The Bida area and Lokoja area are usually considered separately as the stratigraphy are slightly different. The Lokoja Formation consists of pebbly clayey grit and sandstone, coarse-grained cross bedded sandstone, and few thin oolitic iron stones. A basal conglomerate of well-rounded quartz pebbles in a matrix of white clay is rarely exposed. Its thickness depends on the relief of the underlying Basement Complex floor and varies between 100 and 300 metres (40). The Patti Formation is a sequence of fine to medium-grained, grey and white sandstones, carbonaceous siltstone, claystone, shale and oolitic ironstone. Thin coal seams may be present and white gritty clays are common. The maximum exposed thickness is 70 m (1), while the oolitic ironstones range from 7-16 m thick. The strata yielded a few non-diagnostic plant remains (38). A Maastrichtian (and possibly Senonian) age was thus assigned to it based mainly on correlation with other formations e.g Enugu Shale. Dessauvagie (39) showed that Patti Formation yielded fossil plants (from the carbonaceous beds) and dates the formation as Campanian - Maastrichtian.

III. MATERIALS AND METHOD OF STUDY

The location of study lies between longitude 06^0 54 E and latitude 078^0 22 N (Fig. 2). Samples for this study were taken from two profiles at the exposed road-cut at Ahoko along Lokoja- Abuja road. Eleven samples representing the Lokoja and the Patti formations were studied on the basis of bed to bed measurements and systemic sampling of relevant intervals.

3.1 XRF AND LA-ICPMS ANALYSES

The pulverized shale samples were analysed with XRF and LA-ICPMS technique. The elemental data for this work have been acquired using X- ray fluorescence (XRF) and Laser Ablation inductively coupled plasma spectrometry (LA-ICPMS) analyses.
The analytical procedures are as follows;

Pulverised shale samples were analysed for major element using Axios instrument (PANalytical) with a 2.4 kWatt Rh X-ray Tube. Further, the same set of samples were analysed for trace element using LA-ICPMS instrumental analysis. LA-ICP-MS is a powerful and sensitive analytical technique for multi-elemental analysis. The laser was used to vaporize the surface of the solid sample, while the vapour, and any particles, were then transported by the carrier gas flow to the ICP-MS. The detailed procedures for sample preparation for both analytical techniques are reported below.

3.2.1. Fusion bead method for Major element analysis

- Weigh 1.0000 g ± 0.0009 g of milled sample
- Place in oven at 110°C for 1 hour to determine H_2O+
- Place in oven at 1000°C for 1 hour to determine LOI
- Add 10.0000 g ± 0.0009 g Claisse flux and fuse in M4 Claisse fluxer for 23 minutes.
- 0.2 g of $NaCO_3$ was added to the mix and the sample+flux+$NaCO_3$ was pre-oxidized at 700°C before fusion.
- Flux type: Ultrapure Fused Anhydrous Li-Tetraborate-Li-Metaborate flux (66.67 % $Li_2B_4O_7$ + 32.83 % $LiBO_2$) and a releasing agent Li-Iodide (0.5 % LiI).

3.2.2. Pressed pellet method for Trace element analysis

- Weigh 8g ± 0.05 g of milled powder
- Mix thoroughly with 3 drops of Mowiol wax binder
- Press pellet with pill press to 15 ton pressure
- Dry in oven at 100°C for half an hour before analysing.

These analytical methods yielded data for eleven major elements, reported as oxide percent by weight [SiO_2,TiO_2, Al_2O_3, Fe_2O_3, MgO, MnO, CaO, Na_2O, K_2O, Cr_2O_3 and P_2O_5] and 21 trace elements [Ni, Cu, Zn, Ga, Rb, Sr, Y, Zr, Nb, Co, V, Pb, Th, U, Ti, Cr, Ba, La, Ce, Nd and P] reported as mg/kg (ppm).

IV. RESULTS AND DISCUSSION

4.1 LITHOLOGICAL DESCRIPTION

At Felele along Okene-Lokoja road, the Lokoja Formation is composed of a fining upward sequence of conglomerates, sandstones and claystones (Figs. 3&4). The basal clast-supported conglomerates (0.4 m thick) consist of angular to sub-rounded quartz pebbles, feldspars and rock fragments. A slightly stratified, ferruginized and pebbly sandstone unit (0.6m thick), separates the basal conglomerates from the overlying matrix-supported conglomeratic facies that grades into another weakly stratified pebbly sandstones and medium to coarse grained sandstones in the middle. The sequence is finally capped by massive sandy claystone and the argillaceous units of the Patti Formation are well exposed on both sides of the road due to a road-cut (Fig. 2). The approximately 30 m thick sequence consists predominantly of shales and siltstones which are rhythmically interbedded with concretional to massive ironstones, the ironstones are sometimes bioturbated. The basal part of the section consists of dark to dark-grey shales strata with an average bed thickness of 0.5 m. The shales are carbonaceous and fissile with several joints that are in-filled with ferruginized siltstones. The silty shale unit overburden rocks. At the outcrop section at Ahoko, along Lokoja - Abuja expressway (Fig.2) within the interval 5.5-8.0 m at the upper section contains abundant woody fragments

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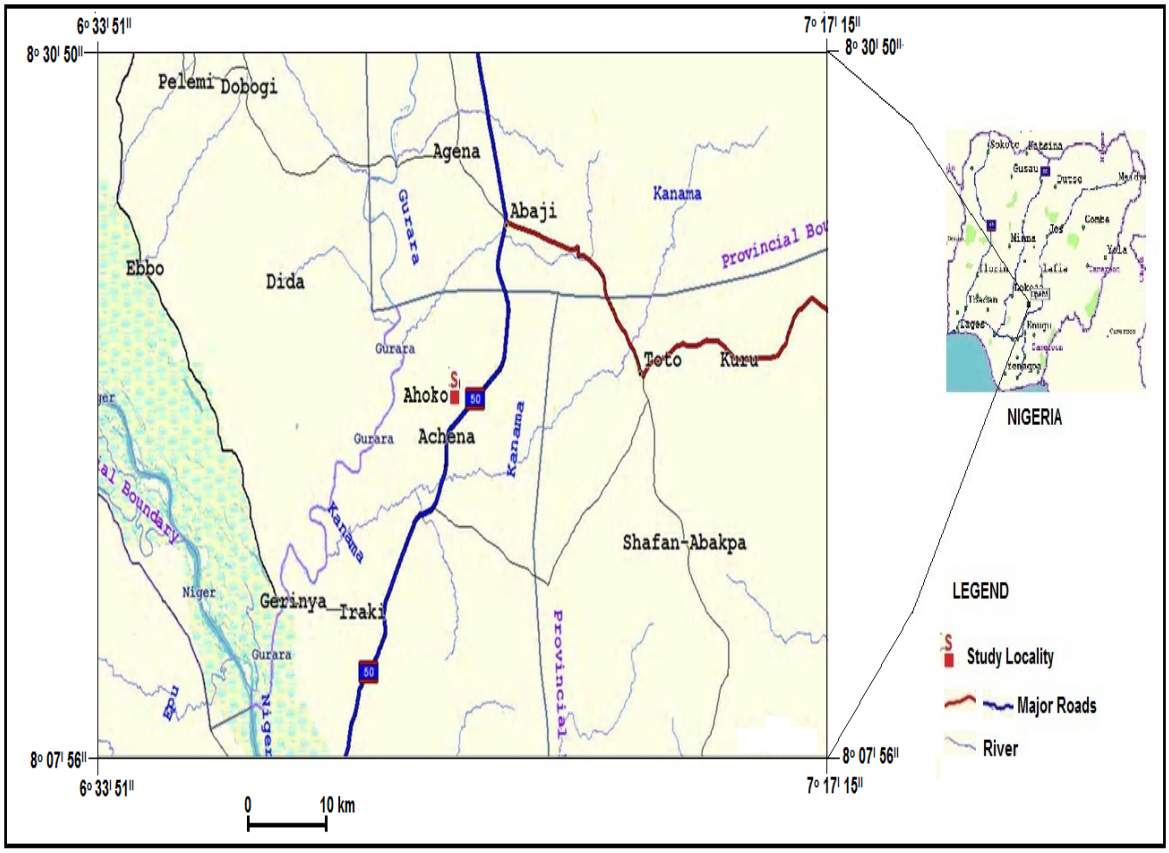

Fig. 2: Location map of exposed Ahoko shale along Lokoja-Abuja Road.

and plant remains. Silty shales and siltstones become more pronounced towards the upper part of the section where they are interbedded with ironstones. The ironstones have an average thickness of 0.2 m and are mainly concretional, although some of the beds are massive and contain vertical and horizontal burrows (40).

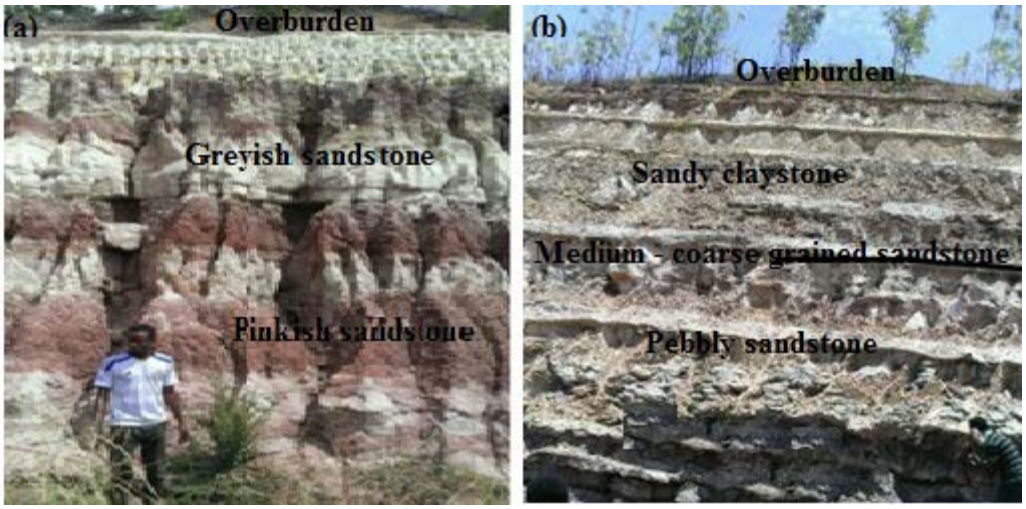

Fig. 3: (a) Lokoja Formation at Felele Junction and (b) Patti Formation at Ahoko, Lokoja-Abuja Road.

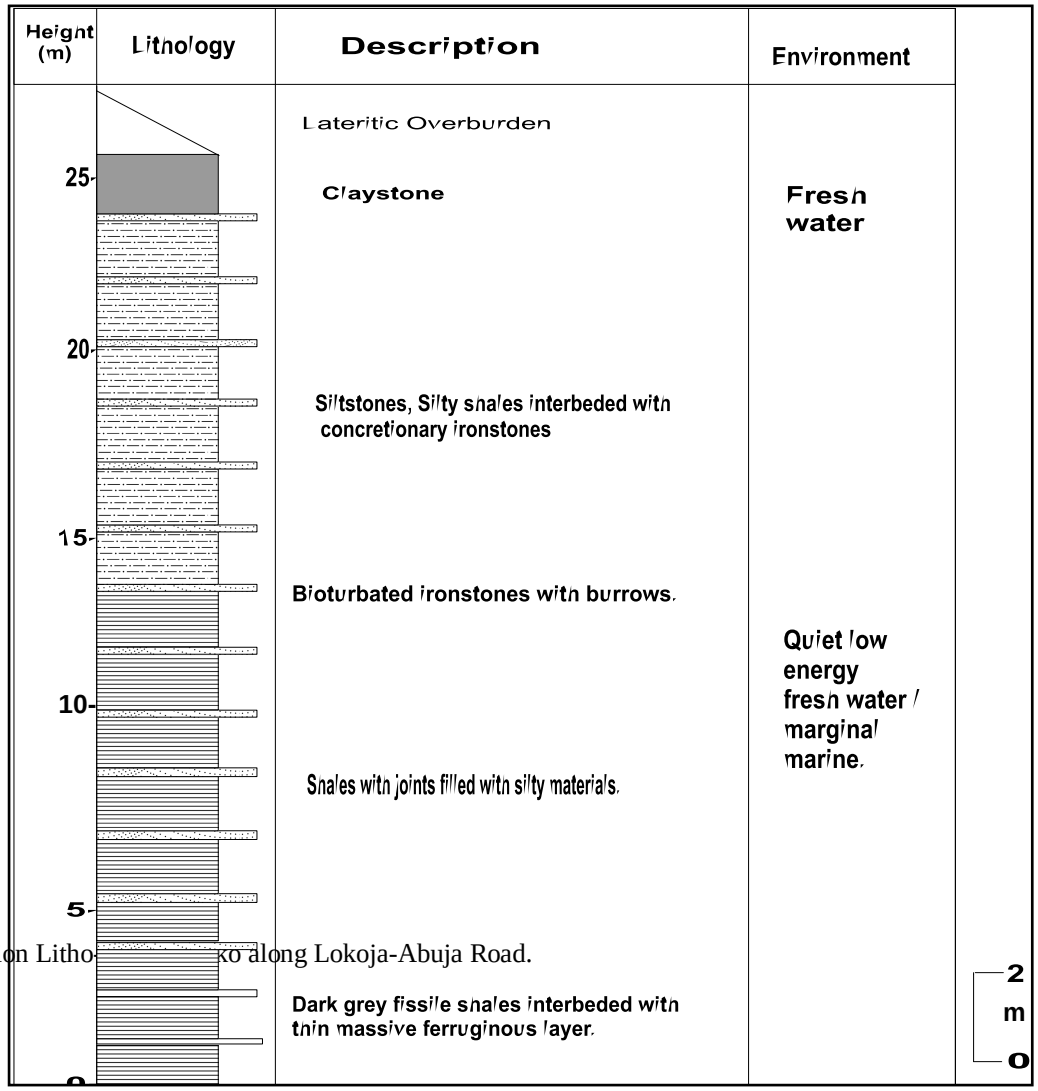

Fig. 4: Patti Formation Litho- ko along Lokoja-Abuja Road.

4.2 PALYNOMORPH ASSEMBLAGE

According to a work done by the first author (31), the biostratigraphical assemblage consists of well preserved palynomorphs dominated by angiospermous pollen and pteridophytic spores. Some of these are *Echitriporites trianguliformis*, *Monocolpites marginatus*, *Retimocolpites obaensis*, *Psilatricolporites crassus*, *Longapertites marginatus*, *Proxapertites cursus*, *Acrostichum aureum*, *Cyatridites minor* and *Zlivisporites blanensis*. Some charred graminae were also recovered in the sediments. The presence of pteridophytic spores (*Acrostichum aureum*, *Cyatridites minor*, *Zlivisporites blanensis*) have been attributed to vegetation growing on wetland (41; 42) whilst the recovery of charred graminae in addition suggest a marginal dysoxic-anoxic source to mud-dominated oxic shelf environment of deposition (43).

4.3. TRACE ELEMENT/AL RATIOS AND ENRICHMENTS

The enrichment factor (EF) is equal to (Element/Al) / (Element/Al) shale, where the ratio in the numerator is that for the shale in question, and the ratio in the denominator is that for a''typical'' shale (using data from 9 & 44). This approach has been used by various authors to evaluate trace-element enrichments in modern and ancient sediments (e.g., 10; 45; 46). Generally, comparisons of V/Al ratios in the Ahoko shale samples with average shale (Wedepohl, 1971) show clear enrichments in the samples code-named profile A (Ahk_{3PA}) and profile B(Ahk_{1PB} and Ahk_{2PB}) (Tables 1&2). Mo/Al ratios in the studied samples compared with average shale show obvious enrichments in samples from both profiles with exception of sample code-named Ahk_{2PA} from profile A. Lower Mo/Al and V/Al ratios in studied samples from both profiles indicates the potentially 'extreme' bottom-water oxic conditions during deposition. The Ni/Al ratio in the studied shales compared to average shale does not show noticeable enrichments in profile A and B. Whereas, Co/Al show clear enrichment in the samples code-named profile A(Ahk_{1PA}, Ahk_{2PA}, Ahk_{3PA} and Ahk_{5PA}) (Tables 1&2). Lower Ni/Al and Co/Al ratios in the samples suggest higher oxygen regime during deposition.

U/Al ratio compared with average shale show clear enrichment in all studied samples from both profiles A and B. Conversely, Cr/Al ratio compared with average shale show evidence of enrichment in shale samples with the exception of sample code-named profile A (Ahk_{5PA} and Ahk_{6PA}) and profile B (Ahk_{3PB}). Lower U/Al and Cr/Al ratios suggest oxic bottom water condition during deposition. Ba/Al and Sr/Al ratios in the Ahoko shale compared with average shale do not show evidence of enrichments but clear enrichment was observed in profile B. Furthermore, lower Ba/Al and Sr/Al ratios suggest well oxygenated bottom water condition during deposition.

The Cu/Al ratio compared with average shale in Ahoko shales show clear enrichment in code-named sample profile A (Ahk_{6PA} and Ahk_{2PA}). Zn/Al ratio in studied shales compared with average shale show evidence of enrichment in sample code-named profile A (Ahk_{3PA}) and B (Ahk_{2PB}). Lower Cu/Al ratio is obtained from both profiles A and B. Conversely, higher Zn/Al ratio is observed in the samples code-named profile A (Ahk_{3PA}) and profile B (Ahk_{2PB}). The Pb/Al ratio in the studied shale samples compared with average shale show clear enrichments with the exception of samples code-named profile A (Ahk_{6PA}). In addition, lower Pb/Al ratio is observed in the Ahoko shales obtained from both profiles. Rb/Al ratio in the samples compared with averaged shale does not show evidence of enrichments. Higher Rb/Al ratio is recorded in the samples collected from profile B code-named Ahk_{1PB}, Ahk_{3PB}, Ahk_{4PB} and Ahk_{5PB}. On the other hand, lower Rb/Al ratio is observed in the samples obtained from profile A. The Y/Al and Zr/Al ratios in the samples compared with averaged shale showed clear enrichments in both profiles A and B with the exception of enrichment factor of Y in the sample code-named profile B (Ahk_{1PB}).

The studied shales exhibit different degrees of trace-element enrichment, with the approximate order of enrichment relative to average shale being in the order: Zr > U > Pb> Mo > Y > Co > Cr > V> Zn > Ba > Cu > Rb >Ni > Sr in the profile A. On the other hand, the approximate order of enrichment of Zr > Y > U > Zn > Co > Mo > Sr > Pb > Cr >Ba > V > Cu > Ni > Rb is obtained in the shale samples from profile B.

4.4. RARE EARTH ELEMENT GEOCHEMISTRY

Standards that are commonly used (Table 4) include the World Shale Average (WSA), as calculated by (24) from published analyses (47 and 48); the North American Shale Composite (NASC), analyzed by (49); the Upper Continental Crust (UCC), with several slightly different values reported by numerous individuals (e.g., 50; 51; 52), but with quite similar interelement concentrations; Post Archean Australian Shale (PAAS), advanced by (53); and lastly an average of chondrites (54).

Table 1: Trace element/Al ratios and enrichments in the profile A compared to World Average Shale (WSA) (9)

Element	WSA	Ahk_{1PA}	$Ahk_{2\ PA}$	Ahk_{3PA}	Ahk_{4PA}	Ahk_{5PA}	Ahk_{6PA}
Ni (ppm)	68	26.03	19.85	46.35	19.28	28.86	20.51
$(Ni/Al)*10^4$	7.7	2.69	1.94	4.01	2.40	2.58	1.89
EF		0.35	0.25	0.52	0.31	0.33	0.70
Co (ppm)	19	75.12	8.12	49.47	9.21	34.68	21.39
$(Co/Al)*10^4$	2.1	7.75	0.79	4.28	1.15	3.10	1.97
EF		3.69	0.38	2.04	0.55	1.48	0.25
Cu (ppm)	45	14.83	16.16	18.23	19.21	31.71	24.43
$(Cu/Al)*10^4$	5.1	1.53	1.58	1.58	2.40	2.83	2.25
EF		0.30	0.31	0.31	0.47	0.56	1.47
Zn (ppm)	95	76.44	51.93	263.24	46.37	80.88	38.12
$(Zn/Al)*10^4$	11	7.89	5.07	22.75	5.78	7.23	3.51
EF		0.72	0.46	2.07	0.53	0.66	0.44
V (ppm)	130	95.52	147.93	215.55	95.46	122.20	94.50
$(V/Al)*10^4$	15	9.86	14.43	18.63	11.90	10.92	8.70
EF		0.66	0.96	1.24	0.79	0.73	0.88
Cr (ppm)	90	105.17	117.99	133.82	86.57	107.37	98.56
$(Cr/Al)*10^4$	10.2	10.86	11.51	11.57	10.79	9.59	9.08
EF		1.06	1.13	1.13	1.06	0.94	0.84
Ba (ppm)	580	408.90	486.44	473.47	415.19	401.99	398.67
$(Ba/Al)*10^4$	66	42.21	47.46	40.92	51.76	35.91	36.72
EF		0.64	0.72	0.62	0.78	0.54	0.87
Rb (ppm)	140	43.70	51.24	50.48	52.89	43.03	47.83
$(Rb/Al)*10^4$	16	4.51	5.00	4.36	6.59	3.84	4.41
EF		0.28	0.31	0.27	0.41	0.24	0.98
Sr (ppm)	300	59.36	73.26	132.15	61.17	66.79	65.22
$(Sr/Al)*10^4$	34	6.13	7.15	11.42	7.63	5.97	6.01
EF		0.18	0.21	0.34	0.22	0.18	0.98
Zr (ppm)	160	1413.48	1049.23	1007.92	1308.83	1299.68	1784.71
$(Zr/Al)*10^4$	18	145.93	102.36	87.11	163.18	116.10	164.40
EF		8.11	5.69	4.84	9.07	6.45	1.13
Pb (ppm)	22	44.17	55.43	51.91	53.46	49.54	45.28
$(Pb/Al)*10^4$	2.5	4.56	5.41	4.49	6.67	4.43	4.17
EF		1.82	2.16	1.79	2.67	1.77	0.91
U (ppm)	3.7	11.95	9.84	19.08	12.02	18.01	17.18
$(U/Al)*10^4$	0.42	1.23	0.96	1.65	1.50	1.61	1.58
EF		2.94	2.28	3.93	3.57	3.83	1.28
Mo (ppm)	1	2.55	0.99	2.10	1.25	2.21	1.65
$(Mo/Al)*10^4$	0.1	0.263	0.097	0.181	0.155	0.197	0.152
EF		2.63	0.97	1.81	1.55	1.97	0.58
Y (ppm)	41	77.55	64.09	81.12	70.61	77.95	88.32
$(Y/Al)*10^4$	4.6	8.01	6.25	7.01	8.80	6.96	8.14
EF		1.74	1.36	1.52	1.91	1.51	1.02

Table 2: Trace element ratios and enrichments in the profile B compared to World Average Shale (WSA) (9)

Element	WSA	Ahk_{1PB}	Ahk_{2PB}	Ahk_{3PB}	Ahk_{4PB}	Ahk_{5PB}
Ni (ppm)	68	59.28	17.83	17.15	11.36	28.38
$(Ni/Al)*10^4$	7.7	5.30	7.20	2.15	1.36	3.05
EF		0.69	0.93	0.28	0.18	0.40
Co (ppm)	19	23.07	22.47	33.55	3.73	83.08
$(Co/Al)*10^4$	2.1	2.06	9.07	4.21	0.45	8.92
EF		0.98	4.32	2.00	0.21	4.25
Cu (ppm)	45	38.81	14.69	16.34	5.77	26.49
$(Cu/Al)*10^4$	5.1	3.47	5.93	2.05	0.69	2.84
EF		0.68	1.16	0.40	0.14	0.56
Zn (ppm)	95	111.05	298.93	32.01	30.71	34.21
$(Zn/Al)*10^4$	11	9.93	120.67	4.02	3.68	3.67
EF		0.90	10.97	0.37	0.33	0.33
V (ppm)	130	183.43	50.51	74.42	93.33	90.55
$(V/Al)*10^4$	15	16.40	20.39	9.34	11.18	9.72
EF		1.09	1.36	0.62	0.75	0.65
Cr (ppm)	90	138.58	25.48	79.12	96.86	95.42
$(Cr/Al)*10^4$	10.2	12.39	10.28	9.92	11.60	10.24
EF		1.21	1.01	0.97	1.14	1.00
Ba (ppm)	580	378.97	420.72	429.12	409.99	393.77
$(Ba/Al)*10^4$	66	33.88	169.84	53.83	49.12	42.27
EF		0.51	2.57	0.82	0.74	0.64
Rb (ppm)	140	59.99	8.54	50.69	51.18	44.33
$(Rb/Al)*10^4$	16	5.36	3.45	6.36	6.13	4.76
EF		0.34	0.22	0.40	0.38	0.30
Sr (ppm)	300	79.76	851.63	57.67	63.08	75.66
$(Sr/Al)*10^4$	34	7.13	343.80	7.23	7.56	8.12
EF		0.21	10.11	0.21	0.22	0.24
Zr (ppm)	160	703.95	88.65	1831.38	1454.35	1622.73
$(Zr/Al)*10^4$	18	62.92	35.79	229.74	174.23	174.19
EF		3.50	1.99	12.76	9.68	9.68
Pb (ppm)	22	46.65	9.88	43.80	25.67	46.94
$(Pb/Al)*10^4$	2.5	4.17	3.99	5.49	3.08	5.04
EF		1.67	1.59	2.20	1.23	2.02
U (ppm)	3.7	11.72	5.21	11.51	12.75	10.58
$(U/Al)*10^4$	0.42	1.05	2.10	1.44	1.53	1.14
EF		2.49	5.00	3.44	3.64	2.70
Mo (ppm)	1	1.45	0.77	2.58	1.01	2.63
$(Mo/Al)*10^4$	0.1	0.130	0.310	0.324	0.121	0.282
EF		1.30	3.10	3.24	1.21	2.82
Y (ppm)	41	48.46	274.65	87.38	73.25	83.33
$(Y/Al)*10^4$	4.6	4.33	110.87	10.96	8.77	8.94
EF		0.94	24.10	2.38	1.91	1.94

The concentrations of the REE in these standards represent two compositional extremes of siliciclastic-source-rocks the one felsic (WSA, UCC, PAAS, NASC) and the second ultramafic (chondrites) (55). The Ce anomaly may possibly be quantified by comparing the measured concentration (Ce) with an expected concentration (Ce*) obtained by interpolating between the values of the neighboring elements. Ce anomalies in shales of the anoxic facieses attributed to eustatic sea level changes (56). Similar to Mn, Ce^{4+} is less soluble under oxic conditions, whereas under anoxic conditions it will be mobilized, leading to depletion in Ce in anoxic sediments relative to those deposited under oxic conditions. A negative Ce anomaly would result.

Table 3: Ce anomaly for Ahoko shale samples (Two quantification approaches are given).

Profile A							
	Equations	Ahk_{1PA}	$Ahk_{2\ PA}$	Ahk_{3PA}	Ahk_{4PA}	Ahk_{5PA}	Ahk_{6PA}
Taylor and McLennan (1985)	Ce* = SQRT(La*Pr)	35.45	30.63	78.27	30.89	49.10	42.70
	Ce/Ce*	4.13	4.04	4.63	4.12	4.26	4.24
Wilde et al. (1996)	Ce* = (La + Pr)/2	85.46	78.71	170.12	73.43	121.93	104.44
	Log (Ce/Ce*)	0.23	0.20	0.33	0.24	0.23	0.24
Profile B							
	Equations	Ahk_{1PB}	Ahk_{2PB}	Ahk_{3PB}	Ahk_{4PB}	Ahk_{5PB}	
Taylor and McLennan (1985)	Ce* = SQRT(La*Pr)	40.09	48.48	34.62	30.71	27.76	
	Ce/Ce*	4.57	3.97	4.08	4.06	3.93	
Wilde et al. (1996)	Ce* = (La + Pr)/2	93.42	137.12	84.04	73.92	69.35	
	Log (Ce/Ce*)	0.29	0.15	0.23	0.23	0.20	

Table 3 shows two different values given for the Ce anomaly, which are based on different calculations. Taylor and McLennan (57) recommended use of the geometric mean Ce*=√(La*Pr). The ratio Ce/Ce*is then a measure of the anomaly, with values greater than unity being termed positive. Wilde et al. (56) support use of the arithmethic mean Ce*=(La+Pr)/2 and calculated the logarithm of the ratio Ce/Ce*. Both calculations lead to essentially the same values for Ce*, with the most positive anomaly in Ahoko shale samples. Therefore, the Ahoko shales were deposited under oxic conditions.

4.5. PROVENANCE AND PALEO-ENVIRONMENTAL CONDITIONS

Armstrong-Altrin et al. (58) reveals low concentration levels of Cr indicates a felsic provenance, and elevated contents of Cr and Ni are primarily found in sediments derived from ultramafic rocks. Chromium and nickel concentrations are lower in the studied Ahoko shale samples compared with average shale (Tables 5, 6 &7). Consequently, the low Cr/Ni ratios in both profile A (i.e. 2.89-5.95) and profile B (i.e. 1.43 – 8.53) indicate that felsic components were the main components among the basement complex source rocks. A few number of authors showed that ratios such as La/Sc, Th/Sc, Th/Co, and Th/Cr are significantly different in felsic and basic rocks and may allow constraints on the average provenance composition (59; 60; 61). The ratios of Th/Cr (profile A =~0.23 – 0.40 and profile B = ~0.16-0.39), Cr/Th (profile A = ~2.47 - 4.32 profile B = ~2.58 - 6.45), Th/Co (profile A = ~0.32- 3.58 and profile B = ~0.18 – 8.34) and Cr/Ni (profile A = ~2.89 – 5.95 and profile B = ~1.43 – 8.53) suggests that the Ahoko shale sequence were derived from felsic source rocks (62; 63; 64; 59; 65).

Trace element ratios such as Ni/Co, V/Cr, Cu/Zn and U/Th have been used to evaluate paleoredox conditions (66; 14). The ratio of uranium to thorium may be used as a redox indicator with U/Th ratio being higher in organic rich mudstones (14). U/Th ratios below 1.25 suggest oxic conditions of deposition, whereas values above 1.25 indicate suboxic and anoxic conditions (14; 69). The studied shale samples show low U/Th ratio (profile A = ~0.34 – 0.51 and profile B = ~0.29 – 1.32) (Tables 5, 6 &7), which indicate that Ahoko shale sequence were deposited in an oxic environment.

Some authors have used V/Cr ratio as an index of paleooxygenation (70; 71; 65). The incorporation of Cr in the detrital fraction of sediments and its possible substitution for Al in the clay structure (73). Vanadium may be bound to organic matter by the incorporation of V^{4+} into porphyrins, and is generally found in sediments deposited in reducing environments (73). The V/Cr ratios above 2 indicate anoxic conditions, whereas values below 2 suggest more oxidizing conditions (14). Therefore, the V/Cr ratios of Ahoko shale sequence vary between (i.e. profile A = 0.91 and 1.61 and profile B = 0.94 and 1.98) (Tables 5, 6 &7) which indicates that they were deposited in an oxic bottom water condition. Several authors have used the Ni/Co ratios as a redox indicator (74; 70; 65). The Ni/Co ratios below 5 indicate oxic environments, whereas ratios above 5 suggest suboxic and anoxic environments (14). The Ni/Co ratios vary between (i.e. profile A = ~0.35-2.45 and profile B = ~0.34 – 3.05) (Tables 5, 6 & 7) suggesting that Ahoko shale were deposited in a well oxygenated environment. The Cu/Zn ratio is also used as a redox parameter (66).

High Cu/Zn ratios indicate reducing depositional conditions, while low Cu/Zn ratios suggest oxidizing conditions (66). Consequently, the low Cu/Zn ratios (profile A = ~0.07 – 0.64 and profile B = ~0.05 – 0.77) in the studied Ahoko shale (Tables 5, 6 & 7) indicate that they were deposited under oxic conditions. The V/(Ni+V) ratios below 0.46 indicate oxic environments, but ratios above 0.54 to 0.82 suggest suboxic and anoxic environments (23). The V/(Ni + V) ratios in the studied shale sequence vary between (profile A = ~0.74 and 0.89 and profile B = ~0.74 – 0.89) which indicate suboxic to anoxic environment of deposition. The V/Sc ratios below 9.1 indicate oxic environment of deposition (75). Therefore, the V/Sc ratios in the studied shale samples indicate oxic environment of deposition. Conversely, shale sample code-named Ahk_1 shows V/Sc ratio above 9.1 (Tables 5, 6 & 7).

V. CONCLUSIONS

The lithologic succession consists of dark grey shales at the base, followed by light grey shales and siltstones that are intercalated at intervals by grey to brownish, highly indurated ironstone concretion. Geochemical analysis showed ratios of Th/Cr, Cr/Th, Th/Co and Cr/Ni suggests that the studied samples were derived from felsic source rocks.

Geochemical results further revealed lower Mo/Al, V/Al, U/Al, Cr/Al, Ba/Al, Sr/Al, Ni/Al and Co/Al ratios which indicate the potentially ‘extreme’ bottom-water oxic conditions during deposition. The estimated order of enrichment relative to world average shale (WSA) being in the order: Zr > U > Pb> Mo > Y > Co > Cr > V> Zn > Ba > Cu > Rb >Ni > Sr and Zr > Y > U > Zn > Co > Mo > Sr > Pb > Cr >Ba > V > Cu > Ni > Rb for profile A and B respectively. Ratio of Ce/Ce* and Log (Ce/Ce*) values showed positive anomaly which indicates well oxygenated bottom-water conditions during deposition.

Redox sensitive element ratios such as U/Th, V/Cr, Ni/Co, Cu/Zn, V/Sc ratios and V/(Ni+V) suggests oxic environment of deposition. The identified palynomorph assemblage such as *Echitriporites trianguliformis*, *Monocolpites marginatus*, *Retimocolpites* obaensis, *Psilatricolporites crassus*, *Longapertites marginatus*, *Proxapertites cursus*, *Acrostichum aureum*, *Cyatridites minor*, *Zlivisporites blanensis* and charred graminae in the sediments suggest fluviodeltaic source and moderately distal oxic environment of deposition.

Table 4: Rare earth elemental composition of studied samples and rock standards-World Shale Average (WSA), North American Shale Composite (NASC), Upper Continental Crust (UCC), Post Archean Australian Shale (PAAS), and Average chondrites.

Ahoko shale profile A											
Element	WSA	UCC	PAAS	NASC	Aver. Chondrites	Ahk_{1PA}	$Ahk_{2\ PA}$	Ahk_{3PA}	Ahk_{4PA}	Ahk_{5PA}	Ahk_{6PA}
La	41	30	38.2	31.1	0.32	77.33	72.22	149.65	66.23	111.08	94.83
Ce	83	64	79.6	66.7	0.9	146.27	123.84	362.74	127.33	209.08	181.08
Pr	10.1	7.1	8.83	7.7	0.13	16.26	13.00	40.94	14.41	21.70	19.23
Nd	38	26	33.9	27.4	0.57	59.35	44.32	152.66	52.99	78.86	69.90
Sm	75	4.5	5.55	5.59	0.21	11.26	8.29	26.27	10.46	14.73	13.77
Eu	1.61	0.88	1.08	1.18	0.074	1.98	1.51	4.76	1.61	2.59	2.09
Gd	6.35	3.8	4.66	4.9	0.31	10.76	7.97	19.07	9.61	13.30	12.64
Tb	1.23	0.64	0.774	0.85	0.051	1.76	1.46	2.90	1.68	2.09	2.16
Dy	5.5	3.5	4.68	4.17	0.3	12.64	10.09	16.43	11.44	14.15	14.36
Ho	1.34	0.8	0.991	1.02	0.074	2.70	2.38	3.25	2.63	2.96	3.29
Er	3.75	2.3	2.85	2.84	0.21	8.45	7.16	8.88	7.94	8.94	10.04
Tm	0.63	0.33	0.405	0.84	0.032	1.28	1.15	1.27	1.16	1.30	1.52
Tb	3.53	2.2	2.82	3.06	0.18	1.76	1.46	2.90	1.68	2.09	2.16
Lu	0.61	0.32	0.433	0.46	0.032	1.36	1.26	1.23	1.27	1.44	1.59
Ahoko shale profile B											
Element	WSA	UCC	PAAS	NASC	Aver. Chondrites	Ahk_{1PB}	Ahk_{2PB}	Ahk_{3PB}	Ahk_{4PB}	Ahk_{5PB}	
La	41	30	38.2	31.1	0.32	83.83	127.94	76.17	66.87	63.26	
Ce	83	64	79.6	66.7	0.9	183.06	192.53	141.30	124.56	109.06	
Pr	10.1	7.1	8.83	7.7	0.13	19.17	18.37	15.74	14.11	12.19	
Nd	38	26	33.9	27.4	0.57	70.22	78.57	58.16	52.11	44.83	
Sm	75	4.5	5.55	5.59	0.21	12.60	15.91	11.14	9.84	8.53	
Eu	1.61	0.88	1.08	1.18	0.074	2.39	4.33	1.58	1.75	1.29	
Gd	6.35	3.8	4.66	4.9	0.31	10.08	25.21	10.65	10.06	8.96	
Tb	1.23	0.64	0.774	0.85	0.051	1.51	3.82	1.94	1.67	1.70	
Dy	5.5	3.5	4.68	4.17	0.3	9.29	26.63	13.47	12.28	12.77	
Ho	1.34	0.8	0.991	1.02	0.074	1.90	6.42	3.08	2.68	2.95	
Er	3.75	2.3	2.85	2.84	0.21	5.55	18.73	9.76	8.08	9.16	
Tm	0.63	0.33	0.405	0.84	0.032	0.80	2.45	1.49	1.21	1.43	
Tb	3.53	2.2	2.82	3.06	0.18	1.51	3.82	1.94	1.67	1.70	
Lu	0.61	0.32	0.433	0.46	0.032	0.91	2.08	1.62	1.37	1.55	

WSA (24; 9, 44; 76; 77; 78); UCC (50; 52; 51); PAAS (53); NASC (49); Average Chondrites (54).

Table 5: Trace elements (as mg/kg) and redox-sensitive elements in the studied samples from profile A and World Shale Average (WSA)

Element	WSA	Ahk_1	Ahk_{1PA}	$Ahk_{2\ PA}$	Ahk_{3PA}	Ahk_{4PA}	Ahk_{5PA}	Ahk_{6PA}	WSA	Ahk_{1PA}	$Ahk_{2\ PA}$	Ahk_{3PA}	Ahk_{4PA}	Ahk_{5PA}	Ahk_{6PA}
As	10	*nd*	*nd*	*nd*	*nd*	*nd*	*nd*	Mn	850	142	138	232	143.39	155	142
Ni	68	26.03	19.85	46.35	19.28	28.86	20.51	Sc	*nd*	19.14	24.69	35.07	19.14	29.03	23.56
Cu	45	14.83	16.16	18.23	19.21	31.71	24.43	Cs	*nd*	2.47	2.81	3.10	2.56	2.74	2.60
Zn	95	76.44	51.93	263.24	46.37	80.88	38.12	U	3.7	11.95	9.84	19.08	12.02	18.01	17.18
Pb	22	44.17	55.43	51.91	53.46	49.54	45.28	Mo	1	2.55	0.99	2.10	1.25	2.21	1.65
Rb	140	43.70	51.24	50.48	52.89	43.03	47.83	V	130	95.52	147.93	215.55	95.46	122.20	94.50
Sr	300	59.36	73.26	132.15	61.17	66.79	65.22	Cr	90	105.17	117.99	133.82	86.57	107.37	98.56
Y	41	77.55	64.09	81.12	70.61	77.95	88.32	Co	19	75.12	8.12	49.47	9.21	34.68	21.39
Zr	160	1413.48	1049.23	1007.92	1308.83	1299.68	1784.71	Ba	580	408.90	486.44	473.47	415.19	401.99	398.67
Nb	*nd*	67.07	68.17	53.26	58.86	52.85	60.68	Th	*nd*	24.36	29.09	37.91	23.37	40.63	39.84
La	41	77.33	72.22	149.65	66.23	111.08	94.83	Hf	*nd*	41.77	29.70	27.79	39.23	37.45	54.70
Ni/Co	3.58	0.35	2.45	0.94	2.09	0.83	0.96	Ta	*nd*	5.62	5.30	4.01	5.01	4.37	5.17
V/Cr	1.50	0.91	1.25	1.61	1.10	1.14	0.96	Cr/Th	28	4.32	4.06	3.53	3.71	2.64	2.47
U/Th	*nd*	0.49	0.34	0.50	0.51	0.44	0.43	Th/Co	0.006	0.32	3.58	0.77	2.54	1.17	1.86
Cr/Ni	1.32	4.04	5.95	2.89	4.49	3.72	4.81	Th/Cr	0.036	0.23	0.25	0.28	0.27	0.38	0.40
V/Sc	*nd*	4.99	5.99	6.15	4.99	4.21	4.01	Cu/Zn	0.053	0.19	0.31	0.07	0.41	0.39	0.64
La/Sc	*nd*	4.04	2.93	4.27	3.46	3.83	4.02	Th/Sc	*nd*	1.27	1.18	1.08	1.22	1.40	1.69
V/Ni	1.91	3.67	7.45	4.65	4.95	4.23	4.61	V/(Ni+V)	0.66	0.79	0.88	0.82	0.83	0.81	0.82

Table 6: Trace elements (as mg/kg) and redox-sensitive elements in the studied samples from profile B and World Shale Average (WSA)

Element	WSA	Ahk_{1PB}	Ahk_{2PB}	Ahk_{3PB}	Ahk_{4PB}	Ahk_{5PB}	Element	WSA	Ahk_{1PB}	Ahk_{2PB}	Ahk_{3PB}	Ahk_{4PB}	Ahk_{5PB}
As	10	*nd*	*nd*	*nd*	*nd*	*nd*	Mn	850	137.907	7977.35	140.45	154.90	145.33
Ni	68	59.28	17.83	17.15	11.36	28.38	Sc	*nd*	20.08	16.27	20.06	21.50	22.05
Cu	45	38.81	14.69	16.34	5.77	26.49	Cs	*nd*	3.72	0.65	2.16	2.16	2.13
Zn	95	111.05	298.93	32.01	30.71	34.21	U	3.7	11.72	5.21	11.51	12.75	10.58
Pb	22	46.65	9.88	43.80	25.67	46.94	Mo	1	1.45	0.77	2.58	1.01	2.63
Rb	140	59.99	8.54	50.69	51.18	44.33	V	130	183.43	50.51	74.42	93.33	90.55
Sr	300	79.76	851.63	57.67	63.08	75.66	Cr	90	138.58	25.48	79.12	96.86	95.42
Y	41	48.46	274.65	87.38	73.25	83.33	Co	19	23.07	22.47	33.55	3.73	83.08
Zr	160	703.95	88.65	1831.38	1454.35	1622.73	Ba	580	378.97	420.72	429.12	409.99	393.77
Nb	*nd*	49.41	6.11	56.28	61.79	72.47	Th	*nd*	28.82	3.95	28.07	31.07	37.03
La	41	83.83	127.94	76.17	66.87	63.26	Hf	*nd*	19.95	2.09	56.11	41.31	50.13
Ni/Co	3.58	2.57	0.79	0.51	3.05	0.34	Ta	*nd*	5.37	0.88	4.96	5.05	6.23
V/Cr	1.50	1.32	1.98	0.94	0.96	0.95	Cr/Th	28	4.81	6.45	2.82	3.12	2.58
U/Th	*nd*	0.41	1.32	0.41	0.41	0.29	Th/Co	0.006	1.25	0.18	0.84	8.34	0.45
Cr/Ni	1.32	2.34	1.43	4.61	8.53	3.36	Th/Cr	0.036	0.21	0.16	0.35	0.32	0.39
V/Sc	*nd*	9.14	3.11	3.71	4.34	4.11	Cu/Zn	0.053	0.35	0.05	0.51	0.19	0.77
La/Sc	*nd*	4.18	7.87	3.80	3.11	2.87	Th/Sc	*nd*	1.44	0.24	1.40	1.45	1.68
V/Ni	1.91	3.09	2.83	4.34	8.22	3.19	V/(Ni+V)	0.66	0.76	0.74	0.81	0.89	0.76

Table 7: Some trace element ratios to evaluate paleoredox conditions

Element ratios	Oxic	Dysoxic	Suboxic to Anoxic	Euxinic
Ni/Co[1]	< 5	5 to 7	> 7	
V/Cr[1]	< 2	2 to 4.25	> 4.25	
U/Th[1]	< 0.75	0.75 - 1.25	> 1.25	
V/(Ni+V)[2]	< 0.46	0.46 - 0.60	0.54 - 0.82	> 0.84
V/Sc[3]	< 9.1			

[1](14); [2](23); [3](76).

ACKNOWLEDGMENTS

The authors sincerely acknowledge the technical assistance of the final year students who participated in the fieldwork (Sedimentary/Petroleum geology option 2012/2013 session). The authors would also like to acknowledge Ms. Riana Rossouw, LA-ICP-MS laboratory in the University of Stellenbosch for multi-element analysis and Mr. A. B. Eluwole for his contribution in the production of location map of the study area.

REFERENCES

[1] H. A. Jones, The oolitic ironstone of Agbaja Plateau, Kabba Province. Record of the Geological survey of Nigeria, 1955, pp.20 – 43.

[2] S. P. Braide, Geological development, origin and energy mineral resource potential of the Lokoja Formation in the southern Bida Basin. Journal of Mining and Geology, 28, 1992a, 33-44.

[3] S. P. Braide, Syntectonic fluvial sedimentation in the central Bida Basin. Journal of Mining and Geology, 28, 1992b, 55-648.

[4] L. C. King, Outline and disruption of Gondwanaland , Geol. M., V. 87, 1950, p 353-359.

[5] C. A. Kogbe, Geological interpretation of Landsat imageries of part of central Nigeria, Journal of Mining and Geology, 18, 1981, 66-69.

[6] S. B. Ojo, and D. E. Ajakaiye, Preliminary interpretation of gravity measurements in the Mid-Niger Basin area, Nigeria. In: Kogbe, C.A. (Ed.), Geology of Nigeria. 2nd edition, Elizabethan Publishers, Lagos, 1989, pp. 347–358.

[7] D. R. Adeleye, and T. F. J. Dessauvagie, Stratigraphy of the Niger Embayment near Bida, Nigeria. In Dessauvagie, T. J. F. and Whiteman, A. J. (Eds.). African Geology, Ibadan University Press, 1972, 181-186.

[8] Adeleye, D. R., 1974. Sedimentology of the fluvial Bida Sandstone (Cretaceous), Nigeria, Sedimentary Geology, 12: 124p.

[9] K. H. Wedepohl, Environmental influences on the chemical composition of shales and clays. In: Ahrens, L.H., Press, F., Runcorn, S.K., Urey, H.C. (Eds.), Physics and Chemistry of the Earth, vol. 8, pp. 1971, 305–333.Pergamon, Oxford

[10] S.E. Calvert, and T. F. Pedersen, Geochemistry of recent oxic and anoxic marine sediments: implications for the geological record. Marine Geology, 113 (1–2), 1993, 67–88.

[11] T. J. Algeo, J. B. Maynard, Trace-element behavior and redox facies in core shales of Upper Pennsylvanian Kansas-type cyclothems. Chemical Geology, 206, 2004, p. 289 – 318.

[12] H. J. Brumsack, Geochemistry of recent TOC-rich sediments from the Gulf of California and the Black Sea. Geologische Rundschau, 7, 1989, 851–882.

[13] B. Warning, H. J. Brumsack, Trace metal signatures of eastern Mediterranean sapropels. Palaeogeography, Palaeoclimatology, Palaeoecology, 158, 2000, 293–309.

[14] B. Jones, and D. A. C. Manning, Comparison of geological indices used for the interpretation of palaeoredox conditions in ancient mudstones. Chemical Geology, 111, 1994, 111-129.

[15] J. Crusius, S. Calvert, T. Pedersen, D. Sage, Rhenium and molybdenum enrichments in sediments as indicators of oxic, suboxic and sulfidic conditions of deposition. Earth Planet. Sci. Lett. 145, 1996, 65–78.

[16] W.E. Dean, J.V. Gardner, D. Z. Piper, Inorganic geochemical indicators of glacial – interglacial changes in productivity and anoxia of the California continental margin. Geochim. Cosmochim. Acta, 61, 1997, 4507– 4518.

[17] W.E. Dean, D.Z. Piper, L.C. Peterson, Molybdenum accumulation in Cariaco basin sediment over the past 24 k.y.: a record of water-column anoxia and climate. Geology, 27, 1999, 507– 510.

[18] K.M. Yarincik, R.W. Murray, T.W. Lyons, L.C. Peterson, G.H. Haug, Oxygenation history of bottom waters in the Cariaco Basin, Venezuela, over the past 578,000 years: results from redox-sensitive metals (Mo, V, Mn, and Fe). Paleoceanography, 15, 2000, 593– 604.

[19] J. L. Morford, A. D. Russell, S. Emerson, Trace metal evidence for changes in the redox environment associated with the transition from terrigenous clay to diatomaceous sediment, Saanlich Inlet, BC. Marine Geology, 174, 2001, 355– 369.

[20] Pailler, D., Bard, E., Rostek, F., Zheng, Y., Mortlock, R., van Geen, A. 2002. Burial of redox-sensitive metals and organic matter in the equatorial Indian Ocean linked to precession. Geochim. Cosmochim. Acta, 66: 849– 865.

[21] H. J. Brumsack, Geochemistry of Cretaceous black shales from the Atlantic Ocean (DSDP Legs 11, 14, 36, and 41). Chemical Geology, 31, 1980, 1–25.

[22] H. J. Brumsack, The inorganic geochemistry of Cretaceous black shales (DSDP Leg 41) in comparison to modern upwelling sediments from the Gulf of California: In Summerhayes, C.P., Shackleton, N.J. (Eds.), North Atlantic Palaeoceanography. Spec. Publ.-Geol. Soc. Lond., vol. 21, 1986., 447– 462.

[23] J. R. Hatch, and J. S. Leventhal, Relationship between inferred redox potential of the depositional environment and geochemistry of the Upper Pennsylvanian (Missourian) Stark Shale Member of the Dennis Limestone, Wabaunsee County, Kansas, U.S.A. Chemical Geology, 99, 1992, 65–82.

[24] D. Z. Piper, "Rare-Earth Elements in the SediCycle: A Summary," Chemical Geology, Vol. 14, 1974, pp. 285-304. http://dx.doi.org/10.1016/0009-2541(74)90066-7.

[25] Turekian, K.K., Wedepohl, K.H. 1961. Distribution of the elements in some major units of the Earth´s crust. Geol. Soc. Am. Bull., 72: 175-192.

[26] C. Van der Weijden, Pitfalls of normalization of marine geochemical data using a common divisor. Mar. Geol., 184, 2002, 167-187.

[27] L. Jacobs, S. Emerson, S. S. Huested, Trace metal geochemistry in the Cariaco Trench. Deep-Sea Research, 34 (5–6), 1987, 965–981.

[28] L. Jacobs, S. Emerson, J. Skei, Partitioning and transport of metals across the O2/H2S interface in a permanently anoxic basin: Framvaren Fjord, Norway. Geochimica et Cosmochimica Acta, 49 (6), 1985, 1433–1444.

[29] G.N. Breit, R. B. Wanty, Vanadium accumulation in carbonaceous rocks. A review of geochemical controls during deposition and diagenesis. Chemical Geology, 91 (1–2), 1991, 83–97.

[30] I. A. Nijenhuis, H. J. Brumsack, G.J. de Lange, The trace element budget of the eastern Mediterranean during Pliocene sapropel formation. In: Robertson, A.H.F., Emeis, K.-C., Richter, C., Camerlenghi, A. (Eds.), Proceedings of the Ocean Drilling Program. Ocean Drilling Program, College Station, TX. Scientific Results, vol. 160, 1998, 199–206.

[31] O. F. Adebayo, Palynology and palaeoenvironment of the Patti Formation, Southern Bida Basin, Nigeria, Global Journal of Geological Sciences, 4 (1), 2006, 79 – 84.

[32] J. Osokpor, J. Okiti, Sedimentological and Paleodepositional Studies of Outcropping Sediments in Parts of Southern Middle Niger Basin. International Journal of Science and Technology, Vol. 2, 2013, 840-846.

[33] S. B. Ojo, D.E. Ajakaiye, Preliminary interpretation of gravity measurements in the Middle Niger Basin area, Nigeria. In C.A. Kogbe (editor) Geology of Nigeria, 1976, pp. 295 – 307.

[34] C. A. Kogbe, D. E. Ajakaiye, G. Matheis, Confirmation of rift structure along the middle- Niger Valley, Nigeria. Journal of African Earth Sciences, 1, 1983, 127-131.

[35] S. B. Ojo, Middle Niger Basin revisited: magnetic constraints on gravity interpretations. Abstract, 20th Conference of the Nigeria Mining and Geosciences Society, Nsukka, 1984, pp. 52–53.

[36] N.G. Obaje, G. Wehner, G. Scheeder, M. B. Abubakar, A. Jauro, Hydrocarbon Prospectivity of Nigeria's Inland Basins: From the Viewpoint of Organic Geochemistry and Organic Petrology. AAPG Bulletin, 88, 2004, 325-353.

[37] W. Russ, The Minna-Birnin Gwari belt. Reports of the Geological Survey of Nigeria, 1930, p. 10-14.

[38] Adeleye, D. R., 1972. Sedimentology of the fluvial Bida Sandstones (Cretaceous) Nigeria. Sedimentary Geology, 12, 1974, 1-24.

[39] T. F. G. Dessauvagie, Explanatory note to the geological map of Nigeria, scale 1: 1,000,000. Jour. Min. and Geol. (Nig. Min. Geol. And Met. Soc.), 9 (1 2), 1975, 3-28.

[40] S. O. Akande, O. J. Ojo, and K. O. Ladipo, Upper Cretaceous Sequences in the Southern Bida Basin, Nigeria: A Field Guidebook. NAPE Geological Field Guide, No. 1. Mosuro Publishers, Ibadan, 2005, 60p.

[41] G. Playford, Palynology of Lower Cretaceous (Swan River) strata of Saskatchewan and Manitoba. Palaeontology, 14 (4), 1971, 533-565.

[42] E. Schrank, M.S. Mahmoud, Palynology (pollen, spores and dinoflagellates) and cretaceous stratigraphy of the Dakhla Oasis, central Egypt. Journal of African Earth Sciences, 26, 1998, 167-193.

[43] M.A.Carvalho, J.G. Mendonça-Filho, & T.R. Menezes, "Palaeoenvironmental Reconstruction Based on Palynofacies Analysis of the Aptian-Albian Succession of the Sergipe Basin, Northeastern Brazil". Marine Micropaleontology, 59, 2006, 56-81.

[44] K. H. Wedepohl, The composition of the upper earth's crust and the natural cycles of selected metals. Metals in natural raw materials. In: Merian, E. (Ed.), Metals and Their Compounds in the Environment. Natural Resources, VCH,Weinheim, 1991, pp. 3–17.

[45] M. Arnaboldi, and P. A. Meyers, Geochemical evidence for paleoclimatic variations during deposition of two Late Pliocene sapropels from the Vrica section, Calabria. Palaeogeography, Palaeoclimatology, Palaeoecology, 190, 2003, 257- 271.

[46] S. M. Rimmer, Geochemical paleoredox indicators in Devonian–Mississippian black shales, Central Appalachian Basin (USA). Chemical Geology, 206, 2004, 373– 391.

[47] M. A. Haskin, and L. Haskin, "Rare Earth Elements in European Shales, a Redetermination. Science, No. 3, 748, 1964, 507-509.

[48] W. E. Wedepohl, "The Composition of the Continental Crust," Geochimica et Cosmochimica Acta, Vol 59 (7), 1995, 1217-1232. http://dx.doi.org/10.1016/0016-7037(95)00038-2.

[49] P. L. Gromet, F. P. Dymektev, L. A. Haskin, R. O. Korotev, "The North American Shale Composite: Its composition, Major and Minor Element Characteristics," Geochimica et Cosmochimica Acta, Vol. 48, No. 12, pp. 1984, 2469-2482. http://dx.doi.org/10.1016/0016-7037(84)90298-9.

[50] K. H. Wedepohl, Handbook of Geochemistry, I-IV," Springer-Verlag, Berlin, 1969-1978.

[51] S. M. McLennan, "Rare Earth Elements in Sedimentary Rocks: Influence of Provenance and Sedimentary Proc-esses," Reviews in Mineralogy and Geochemistry, Vol. 21, No. 1, 1989, pp. 169-200.

[52] R. L. Rudnick, and S. Gao, "Composition of the Conti-nental Crust," In: H. D. Holland and K. K. Turekian, Eds. Treatise on Geochemistry, Elsevier, New York, 2003, pp. 1-64. http://dx.doi.org/10.1016/B0-08-043751-6/03016-4.

[53] S. M. McLennan, "Relationships between the Trace Element Composition of Sedimentary Rocks and Upper Continental Crust," Geochemistry Geophysics Geosystems, Vol. 2, No. 4, 2001, pp. 1-24. http://dx.doi.org/10.1029/2000GC000109.

[54] R. A. Schmidt, R. H. Smith, J. E. Lasch, A. W. Mosen, D. A. Olehy, J. Vasilevshis, "Abundances of Fourteen Rare-Earth Elements, Scandium, and Yttrium in Meteoritic and Terrigenous Matter," Geochimica et Cosmochi- mica Acta, Vol. 27 (6), 1963, 577-622. http://dx.doi.org/10.1016/0016-7037(63)90014-0.

[55] D. Z. Piper, and M. Bau, Normalized Rare Earth Elements in Water, Sediments, and Wine: Identifying Sources and Environmental Redox Conditions. American Journal of Analytical Chemistry, 4, 2013, 69-83. http://dx.doi.org/10.4236/ajac.2013.410A1009.

[56] P. Wilde, M. S. Quinby-Hunt, B. D. Erdtmann, The whole-rock cerium anomaly: a potential indicator of eustatic sea-level changes in shales of the anoxic facies. Sedimentary Geology, 101(1-2), 1996, 43-53.

[57] S. R. Taylor, and S. M. McLennan, The Continental Crust: Its Composition and Evolution. Blackwell Scientific, Oxford, 1985.

[58] J. S. Armstrong-Altrin, Y. I. Lee, S. P. Verma, S. Ramasamy, Geochemistry of sandstones from the upper Miocene Kudankulam Formation, southern India: Implications for provenance, weathering, and tectonic setting. Journal of Sedimentary Research, 74(2), 2004, p.285-297.

[59] D. J. Wronkiewicz, K. C. Condie, Geochemistry and mineralogy of sediments from the Ventersdorp and Transvaal Supergroups, South Africa: Cratonic evolution during the early Proterozoic. Geochimica et Cosmochimica Acta, 54(2), 1990, 343-354.

[60] R. Cox, D. R. Lowe, R. L. Cullers, The influence of sediment recycling and basement composition on evolution of mudrock chemistry in the southwestern United States. Geochimica et Cosmochimica Acta, 59(14), 1995, 2919-2940.

[61] R. L. Cullers, The controls on the major and trace element evolution of shales, siltstones and sandstones of Ordovician to Tertiary age in the Wet Mountain region, Colorado, U.S.A. Chemical Geology, 123(1-4), 1995, 107-131.

[62] R. L. Cullers, The controls on the major and trace element variation of shales, siltstones and sandstones of Pennsylvanian – Permian age from uplifted continental blocks in Colorado to platform sediment in Kansas, USA: Geochimica et Cosmochimica Acta, 58(22), 1994, 4955-4972.

[63] R. L. Cullers, The geochemistry of shales, siltstones and sandstones of Pennsylvanian-Permian age, Colorado, U.S.A. implications for provenance and metamorphic studies. Lithos, 51, 2000, 305-327.

[64] R. L. Cullers, V. N. Podkovyrov, Geochemistry of the Mesoproterozoic Lakhanda shales in southeastern Yakutia, Russia: Implications for mineralogical and provenance control, and recycling: Precambrian Research, v. 104, 2000, 77–93.

[65] R. Nagarajan, J. Madhavaraju, R. Nagendral, J. S. Armstrong-Altrin, J. Moutte, Geochemistry of Neoproterozoic shales of the Rabanpalli Formation, Bhima Basin, Northern Karnataka, southern India: implications for provenance and paleoredox conditions. Revista Mexicana de Ciencias Geológicas, v. 24, núm. 2, 2007, 150-160.

[66] R. O. Hallberg, A geochemical method for investigation of palaeoredox conditions in sediments: Ambio. Special Report, 4, 1976, 139-147.

[67] B. N. Nath, M. Bau, B. R. Rao, C. M. Rao, Trace and rare earth elemental variation in Arabian Sea sediments through a transect across the oxygen minimum zone. Geochimica et Cosmochimica Acta, 61(12, 1997, 2375-2388.

[68] H. Dill, Metallogenesis of early Paleozoic graptolite shales from the Graefenthal Horst (northern Bavaria-Federal Republic of Germany). Economic Geology, 81, 1986, 889-903.

[69] H. G. Dill, M. Teshner, H. Wehner, Petrography, inorganic and organic geochemistry of Lower Permian Carboniferous fan sequences (Brandschiefer Series) FRG: constraints to their palaeogeography and assessment of their source rock potential. Chemical Geology, 67(3-4), 1988, 307-325.

[70] K. Bjorlykke, Geochemical and mineralogical influence of Ordovician island arcs on epicontinental clastic sedimentation: a study of Lower Palaeozoic sedimentation in the Oslo region, Norway. Sedimentology, 21(2), 1974, 251-272.

[71] T. J. Shaw, J. M. Geiskes, R. A. Jahnke, Early diagénesis in differing depositional environments: the response of transition metals in pore water: Geochimica et Cosmochimica Acta, 54(5), 1990, 1233-1246.

[72] H. Dypvik, Geochemical compositions and depositional conditions of Upper Jurassic and Lower Cretaceous Yorkshire clays, England. Geological Magazine, 121(5), 1984, 489-504.

[73] H. Kimura, and Y. Watanabe, Oceanic anoxia at the Precambrian-Cambrian boundary. Geology, 21, 2001, 995-998.

[74] H. J. Brumsack, The trace metal content of recent organic carbon-rich sediments: implications for Cretaceous black shale formation. Palaeogeography, Palaeoceanography, Palaeoecology, 232 (2–4), 2006, 344–361.

[75] A. Hetzel, M. E. Böttcher, U. G. Wortmann, H. Brumsack, Paleo-redox conditions during OAE 2 reflected in Demerara Rise sediment geochemistry (ODP Leg 207). Palaeogeography,Palaeoclimatology, Palaeoecology, 273, 2009, 302–328.

[76] S. A. Akinyemi, O. F. Adebayo, O. A. Ojo, O. A. Fadipe, W. M. Gitari, "Mineralogy and Geochemical Appraisal of Paleo-Redox Indicators in Maastrichtian Outcrop Shales of Mamu Formation, Anambra Basin, Nigeria", Journal of Natural Sciences Research,(10), 2013, 48-64.

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Cost Based Penetration Pricing Strategy for Beverages Industry

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Abstract- Food and beverage industries in the fast moving consumer goods sector is growing rapidly in Indonesia. Effective marketing strategies are required particularly for a new company in face of intense competition from rivals. Freshbrew Mels Beverages is a newcomer in the glass packaged tea beverage industry. The aim of this study is to identify current marketing at Freshbrew Mels Beverages, analyze internal and external factors affecting the company's marketing, and develop alternative marketing strategies. This research involved comprehensive interviews of company management and an evaluation of a competitor company. By using CAP-CSP (Company Allignment Profile Competitive Setting Profile) analysis and industry competition analysis, the research showed Freshbrew Mels Beverages' current marketing activities were inadequate in an industrial environment with competition of medium intensity. The subsequent formulation of alternative marketing strategies for Freshbrew Mels Beverages was based on a marketing mix (4P) developed using SWOT analysis and QSPM analysis, with the latter used to determine priority of the alternative strategies. This study provided Freshbrew Mels Beverages with seven alternative marketing strategies with the following priorities: 1) penetration pricing strategy; 2) product differentiation strategy; 3) event promotion strategy; 4) direct selling strategy; 5) product design strategy; 6) strategic distribution coverage; 7) non - store retailing strategy.

Index Terms- New Company, Marketing Mix, Strategy, Tea Beverages, and Penetration Pricing

I. Introduction

The food and beverage industries in the fast moving consumer goods sector is growing rapidly in Indonesia. Beverages particularly instant tea drinks are notable because more and more people are consuming it on a daily basis, especially those with a high level of activity and mobility. AC Nielsen study showed 48% of total spending in Indonesia is for fast moving consumer goods, especially food and beverages (Industry Review - Bank 2015). Overall, non-alcoholic beverage consumption in Indonesia is still dominated by mineral water (84.1%). However, instant tea beverages is now at 8.9% followed by carbonated beverages (3.5%) and other soft drinks (3.5%) (Industry Review - Bank Mandiri 2013). This trend is driving more companies to enter the instant tea beverages industry. Based on statement from Head of Marketing ABC President Indonesia, Dwi Hatmadji, instant tea product growth can reach 30% to 40% per year (Yuswiyanto 2013). Triyono Prijosoesilo as Head of Indonesian Soft Drink Association says that each year instant mineral water grow constantly but instant tea increase by 10% (Issetiabudi 2015). In 2010, RTD tea growth volume is 1554 million litre, it's bigger than RTD carbonates in which the growth volume is 634.8 million litre (Poeradisastra 2011).

In a dynamic market environment with a wide availability of substitute products, consumers are provided with many alternatives for their purchase decision. Certainly consumer hope that the product they consume will satisfy their need. Consumers will easily switch to other products if a particular item a company manufactures is not able to satisfy their needs. Consumer expectations are thoughts or beliefs of consumers about what they will receive. Consumer expectations may not be met due to misinterpret signals campaign carried out by the company (Pattiapon 2011). If a product can meet consumer expectations or even exceed customer expectations and provide quality assurance on every occasion, consumers will be confident with his choice and consumers will have confidence in the product brand (Rizan, Saidani, and Sari 2012). This research was conducted at a new company called Freshbrew Mels Beverages. The company produces tea beverages in cup size packaging. At the time this research was conducted, Freshbrew's tea beverage was only marketed in Central Java and Lampung with the brand "Mary Teh".

Based on researcher observation, Freshbrew Mels Beverages is a small company consist of 4 employees and the rest is freelance workers. Researcher cannot get quantitative data for finance and sales but researcher have qualitative data from field observation and in depth interview with Director, General Manager, Administration Division Head, and Production Division Head. From January to May 2014 there is an increase in product shipment. Based on interview with General Manager of Freshbrew Mels Beverages, Mustain said "Mary Teh" distributed straight to distributor without marketing approach in advance. In aftermath, distributor start to reduce their demand because they still have stock that hasn't been sell. And so from June to December 2014 there is a declining in product shipment. The product that hasn't been sell until close to expire date must be taken from distributor. Freshbrew Mels Beverages need marketing strategy to help them sell "Mary Teh".

In formulating an effective marketing strategy, a company should be able to map its strengths and weaknesses and identify opportunities and threats that exist in the market. In addition, the company should also be able to recognize the intensity of competition faced by the industry so that market development objectives can be achieved effectively. A successful marketing

strategy can determine the right marketing efforts, identify segments or target marketing, and create business advantage (Srivastava and Sakunke 2011).

The aim of this study is to identify current marketing at Freshbrew Mels Beverages, analyze internal and external factors affecting Freshbrew Mels Beverages' marketing, and develop effective alternative marketing strategies.

II. THEORETICAL FRAMEWORK

A. Marketing Mix Strategy

One of the marketing strategies that can support the marketing of products to create customer satisfaction and increase sales is the use of marketing mix that includes product, price, promotion and place. Marketing mix is a blend of product, promotion, place, and price strategy designed to produce a mutually satisfactory exchanges with the intended market (Lamb, Hair, and McDaniel 2001). The use of marketing mix can yield in higher competitive advantage and yield better performance as perceived by consumer. Without a competitive advantage, the company will wither away (Ibidunni 2011).

According to Sofjan (2002), product is everything that are offered to the public to be bought or consumed in order to meet the needs and provide satisfaction to the customer. In marketing mix, product is the most important element to reach the intended target market. Price is the amount of money that consumers pay for product or replace proprietary products that can affect the level of sales and profitability. In determining the price is to consider factors that influence it, namely, the price of raw materials, production costs and the price of similar products sold by competitors. Promotion is a company's activities to communicate and introduce the product to the market. Activities that can be done in promotion is advertising in all forms of nonpersonal presentation and promotion of ideas, sales promotion with short-term incentives to encourage the desire to try or buy products and services, promotion event like a variety of programs designed to promote and protect the image of the resulting product, direct selling that perform direct marketing communications to get a response from the customer and a particular candidate. Place is company's activities to make the products affordable and available to consumers. The product does not make much sense for the customer if they are not available at the desired time and place.

In a study conducted by Danibrata (2009) and Suprapto (2014), in the early stages of entering the market, the company should be able to socialize its products to the public to raise the character of the products. Being able to socialize its product value, company can strengthen their bond with consumer. Shared value between company and consumer can increase company performance (Kucukkancabas, Akyol, and Ataman 2007). Study by Hu (2012) suggested that by focusing on marketing strategy can increase sales or enhance consumer re-purchasing rate.

B. Cost Based Penetration Pricing Strategy

Blythe and Megicks (2010) says that pricing strategy was meant to set prices according to the characteristic of the target segment. For new product, the pricing strategy will be based on a penetration price policy looking to establish long-term growth and return through building the brand.

Penetration price strategy is designed to maximize sales, gain widespread market acceptance, and capture a large market share quickly by setting a relatively low initial price. Company cost in producing product are an important factor in setting prices. Based on production cost company can set temporary price reduction to stimulate sales or store traffic (Ferrell and Hartline 2014).

Research conducted by Harminingtyas (2013) and Hendri (2009) stated marketing activities such as promotions and price variations can influence consumer purchasing decisions. Varying prices can give different effect on consumers. Whereas flat pricing was considered to be fairer, company should vary their prices to meet consumer perception (Bujisic, Bilgihan, and Hutchinson 2013).

C. Company Alignment Profile (CAP) – Competitive Setting Profile (CSP)

According to Rangkuti (2002), the process of formulating a marketing strategy begins with identifying marketing problems the company facing. Results of comparing the average value between CAP and CSP provide three possibilities:

A: CAP> CSP, ie a positive gap where companies have gone too far in anticipation of action to deal with the existing situation

B: CAP = CSP, the company is at the same point on industrial environmental conditions and is ready to face the existing conditions.

C: CAP <CSP, which is a negative gap which the company must take measures to anticipate the situations. In study conducted by Prantommy (2011), before formulate marketing strategy, researcher identify current marketing condition with Company Alignment Profile and Competitive Setting to determine.

D. Industry Competition Analysis

Industry competition analysis is conducted to determine the intensity of the industry competition. There are five factors that determine the intensity. The factors are the threat of a potential new players, the threat of substitute products, buyer power, supplier power, and competition between the existing companies. The values of intensity obtained are categorized into 3 groups: 1.00 to 2.32 value indicates the intensity of competition is low, the value of 2.33 to 3.67 indicates the intensity of competition is moderate, and a value above 3.67 indicates high competition intensity (Porter 1998). Research by Nurcahyono, Segoro, and Bakara (2013) says that by profiling the industry competition intensity can help determine the target for the strategy.

E. SWOT and QSPM Analysis

Strength, Weakness, Opportunity, and Threat analysis (SWOT) is used to determine a company's internal factors as it relates to the company's strengths and weaknesses that are considered important and external factors that become opportunities and threats. This analysis based in maximizing strengths and opportunities, and simultaneously minimizing weaknesses and threats to formulate strategy (Rangkuti 2001).

David (2009) states, Quantitative Strategic Planning Matrix (QSPM) is a tool that allows strategists to evaluate alternative strategy objectively, based on key internal and external success factors that have been identified previously. The result of internal and external analysis and alternative strategies derived from the SWOT matrix are used as an input for QSPM. Using QSPM, a

"best strategy'' will be obtained from various alternative strategies that are recommended.

Mukminatin and Harisudin (2012) conduct a research to formulate marketing strategy by using SWOT analysis and QSPM analysis. SWOT analysis is used to formulate alternative marketing strategy and QSPM is to determine the priorities of marketing strategy. Another research done by Fahmi, Baihaqi, and Kadir (2013) by using SWOT analysis to formulate marketing strategy in beverage company.

F. Framework of The Research

This study focused on the marketing of tea beverage in cup size packaging produced by Freshbrew Mels Beverages with the brand "Mary Teh". The research begins with identifying the current marketing. Identification of marketing done descriptively by describing Freshbrew Mels Beverages marketing based on segmentation, targeting, and positioning. After that, Company Alignment Profile (CAP) and Competitive Setting Profile (CSP) analysis used to see the gap between company current marketing and its business environment.

The next stage is to determine the competitive intensity in the industry of bottled tea beverages. Industry competition analysis obtained through interviews with the management of Freshbrew Mels Beverages and company's competitor. After that is to conduct a situation analysis (SWOT) by analyzing the internal factors (strengths and weaknesses) and external factors (opportunities and threats). Identification of internal factors obtained through interviews with the management of Freshbrew Mels Beverages which has an important role and has expertise in the field. Identification of external strategic factors is the company's industry environment through interviews with the management of Freshbrew Mels Beverages and company's competitor. Formulation of alternative marketing strategy is done by applying the elements of the marketing mix 4P (Price, Product, Place, and Promotion). QSPM matrix used to assign alternative strategy priority by assigning values relative attractiveness of some alternative strategies based on predetermined weight. The last stage is to do the preparation of managerial implications for management. Based on these descriptions, the conceptual framework of this research can be seen in Figure 1.

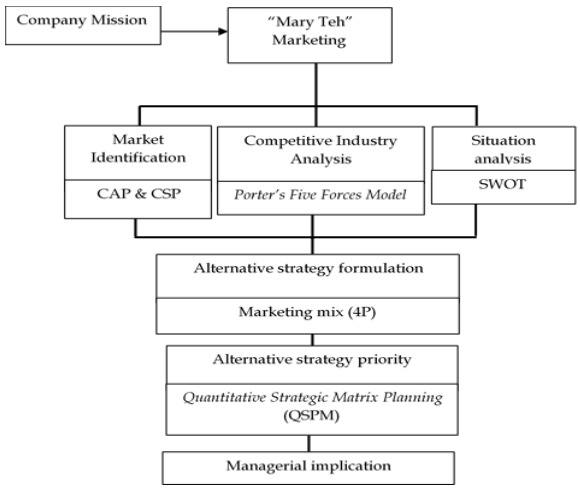

Figure 1. Framework of Research

III. RESEARCH METHOD

The method used in this research was a descriptive method with a case study approach. The use of case studies was intended to provide more details about the object of research and the conditions that exist in the company.

This research was done at one of beverage company at Bogor from Desember 2014 – February 2015. The selection of this company as a research target was based on the consideration that the company was a newcomer in the instant tea beverage industry with no marketing strategy and could still be developed amid overall growth in the Indonesian beverage industry.

Data used in this study comprised primary data and secondary data. The primary data was obtained through direct observation in the company, interviews and questionnaires distributed to the management of Freshbrew Mels Beverages (1 Director, 1 General Manager, 1 Chief of Administration Division 1, and 1 Head of Production Division) and one competitor. Secondary data was obtained through the study of literature. The selection of respondents was done using purposive sampling technique based on the consideration that the respondent has the expertise and competence in the field studied.

In this study, there are three steps researcher conduct. First is the identification of segmentation, targeting, and positioning. Yusuf and Williams (2007) describes segmentation as categorizing each customer group based on different needs and wants. Targeting is the act of evaluating and selecting one or more segments to which the product to be sold (Tjiptono, Chandra, and Adriana 2008). Wijayanti (2012) describes positioning as activities to make a particular product the center of consumers' attention.

Analysis of CAP-CSP (Company Allignment Profile-Competitive Setting Profile) and industry competition analysis is used to identify a company's marketing gaps with its industrial environment and determine the intensity of the industry competition. Alternative strategy formulated by identified internal and external factors then use SWOT analysis to formulate marketing strategies that met the condition. Once these strategies are done, QSPM analysis is used to determine the priorities from the alternative marketing strategies.

IV. RESULT AND DISCUSSION

A. Freshbrew Mels Beverages Marketing Identification

Freshbrew Mels Beverages with its product "Mary Teh" has broad consumer segmentation. Evaluating its demographics, "Mary Teh" segmentation is not limited by age, as the product is consumed by consumers across all ages. In a psychographic analysis, "Mary Teh" can form part of a tea drinking lifestyle in Indonesian society. This lifestyle is a main driver for Freshbrew Mels Beverages to market its product. In addition, Freshrew Mels Beverages is marketing "Mary Teh" as a ready to drink product to cater to a practical, fast paced lifestyle.

Freshbrew Mels Beverages' target customers are all consumers who like to drink tea and requires the product to be ready to drink. Factors to be considered in marketing "Mary Teh" to these targest constumers are the price, packaging, and availability of goods.

To differentiate "Mary Teh" with competitors' products, Freshbrew Mels Beverages has produced "Mary Teh" as a

fragrant tea in cup size packaging. The company also uses natural ingredients with minimum preservatives. This is reflected, for example, with "Mary Teh" storage period which is shorter when compared to competitors' products.

Based on CAP and CSP analysis, CAP value is 2.33 which is lower than CSP value of 3.25. This negative gap implies marketing done by Freshbrew Mels Beverages is obsolete because of changes occurring in the business environment for tea beverages with glass packaging, where the number of competitors continue to multiply and technologies used in the production become more advanced. Freshbrew Mels Beverages must take action to overcome these challenges.

B. Industry Competition Analysis

An industrial competition analysis shows that tea beverages with glass packaging can be categorized as an industry with medium intensity competition with a score of 3.15. The Factor that has the highest impact on competition in the packaged tea beverage industry is the purchaser with a score of 3.29. the factor that has the lowest influence is competition among its peers with a score of 3.05. A summary of the industry competition analysis is provided in Table 1.

Table 1. Industry Competition Intensity

No	Variable	Total score	Competition Intensity	Rank
1	Threat of new entrants	3.11	Moderate	4
2	Threat of substitute products	3.17	Moderate	2
3	Bargaining power of suppliers	3.14	Moderate	3
4	Bargaining power of buyers	3.29	Moderate	1
5	Competition among existing companies	3.05	Moderate	5
	Competition Intensity	3.15	Moderate	

The high impact of the purchaser is driven by the fact there are many purchasers of cup size tea packaging. The more purchasers there are, the greater impact they have on the intensity of industry competition.

C. Alternative Strategies Formulation

In identifying a company's strengths and weaknesses, internal factors forming the company's strengths and weaknesses based on the 4P (price, promotion, product and place) need to be considered in facing opportunities and threats in the business environment. Meanwhile, identifying the external environment was conducted to determine the opportunities and threats faced by Freshbrew Mels Beverages. External factors potentially impacting the company's marketing performance are the competitor, the consumer, government, and the broader social and cultural environment. Strengths that played important roles in the company's marketing strategy are (in order of importance): 1) product quality (0.41); 2) affordable price (0.37); 3) secured stock of raw materials (0.22). Weaknesses in the company's market strategy (in order of importance): 1) no staffing specifically assigned for marketing (0.31); 2) product promotion lacked intensity 0.26; 3) unattractive design of product packaging 0.24; 4) Reliance on third parties to deliver products (0.19). In addition to internal factors (strengths and weaknesses), weighting was also done for external factors (opportunities and threats).

In formulating alternative marketing strategies that Freshbrew Mels Beverages could implement, these factors will be combined in a SWOT matrix by combining the opportunities and threats that are likely to be faced with the strengths and weaknesses of the company (Figure 2). The company current conditions, which is still in an early growth phase, will not allow it to directly face more established competitors like "Teh Gelas" (Orang Tua Group) and Mountea (Garuda Food).

INTERNAL FACTORS / EXTERNAL FACTORS	**Strengths** 1. Product Quality 2. Affordable price 3. Secured stock of raw materials	**Weakness** 1. No staffing specifically assigned for marketing 2. Product promotion lacked intensity 3. Unattractive design of product packaging 4. Reliance on third parties to deliver products
Opportunities 1. Lifestyle of Indonesian society that liked to drink tea 2. Government support in the market and product development 3. Consumers are open to various variants of tea 4. Consumers prefer products that are practical (fast) 5. Wide segmentation	**SO Strategy** - Product differentiation strategy (S1, S3, O1, O2, O3, O4)	**WO Strategy** - Product design strategy (W3, O4) -Non-Store Retailing Strategy (W1, W2, O2, O3) - Distribution coverage strategy (W4, O1, O2)
Threats 1. Number of competitors 2. Competitor more vigorous in promotion 3. The difficulty of bureaucratic licensing for beverage product from government 4. The lack of consumer awareness of information related to product content 5. Consumers tend to pay attention to the low price compared to the quality of the product	**ST Strategy** - Penetration Pricing Strategy (S2, T2, T4, T5)	**WT Strategy** - Direct selling Strategy (W2, T4) - Event promotion Strategy (W1, T1)

Figure 2. SWOT Matrix

Formulation of alternatives strategy for Freshbrew Mels Beverages based on aspects of the marketing mix ie price, product, promotion and place. In Kottler and Keller (2011) price is flexible, where a price to be stable within a certain time but in a short time the price may also be increased or decreased. The price determination may based on cost, value, or competition. Product is the most important element in the marketing mix because it can affect marketing strategy and determine the required promotional activities.

Promotion is a communication made by a company that aims to inform the public of the presence of a product. Company can use a variety of promotional tools namely advertisements through television, newspapers, radio, and the Internet; sales promotion through performances, demonstrations, or exhibits; direct selling by building positive interaction between companies and consumers; and event promotion to build the image using the key person of influence in the community.

Place/distribution is an activity of the company so that products can be obtained easily and readily available to consumers. Distribution strategy can be done by placing the

product on many retailers intensively or distribute products in a particular market area by selecting a few distributors only. Besides, distribution strategy can also be carried out exclusively by providing the distribution rights to one or two distributors only.

D. Strategy Priorities

In conducting the determination of strategy priorities, filling out the questionnaire conducted by the management of Freshbrew Mels Beverages then processed using the QSPM analysis. Of the seven alternative strategies, its priorities will be determined by the level of interest (Attractiveness Score) against any internal and external factors. Each grade level of interest would be multiplied by each strategic weight of each factor to get the total value of attractiveness. Alternative strategies with the total value of the highest attractiveness is an alternative that will be given priority in implementation. Table 2 shows the QSPM analysis result.

Table 2. QSPM Analysis

Alternative Strategies	TAS Score	Strategy priority
Product differentiation strategy	9.47	2
Penetration pricing strategy	10.54	1
Product design strategy	7.91	5
Non – store retailing strategy	5.81	7
Distribution coverage strategy	7.66	6
Direct selling strategy	8.20	4
Event promotion strategy	8.32	3

This study shows alternative marketing strategies for Freshbrew Mels Beverages based on SWOT and QSPM analysis. Recent study shows that Komaryatin (2008) formulated marketing strategy by using SAP and ETOP analysis with SWOT analysis. The objective of this study is to discuss marketing strategy that can be implemented for small company. The results of these analysis shows that for small company, price and promotion is the best strategy for growing and expand. Similar to this study is using SWOT analysis to formulate strategies.

In cup size tea beverage industry, price competition occurs very tight. Each beverage manufacturers compete to offer attractive prices for consumers. Among the beverages, they have very thin price differences. Hendri (2009) examined that marketing communication based on non-promotion activity have greater impact in consumer buying decision. Price and product can give more influence in consumer buying decision. With a penetration pricing strategy, Freshbrew Mels Beverages can overcome the competition in terms of price. The company can offer cheaper price compared to the price of other products within a specified period. Reduction in product price can be a stimulus for consumers to buy "Mary Teh". Start with cheaper prices, consumers will be interested to try "Mary Teh" and feel the flavor of "Mary Teh". Purchasing "Mary Teh" by consumers, followed by tasting the flavor provided by "Mary Teh" will begin to grow consumer confidence of the product. Study by Chang and Horng (2010) shows giving low price can succesfully penetrate market to break through existing market trend. In industry that have dominant design, variety on the production side is not substantial so it's more associated realtively to low prices (Corrocher and Guerzoni 2009).

Second priority is product differentiation strategy. Implementation of this strategy can be carried out by the company by making a variety of products that have improvised characteristic and more value in the eyes of consumers. Examples of product differentiation that can be done by the company is to highlight the value of spices or fruits that characterizes Indonesia. By combining new flavors into the tea, the company will provide a new experience for consumers. Determination of new flavors certainly cannot be marketed as such. To realize it, the company can collaborate with universities which have departments related to food and beverages in determining the composition and nutritional value in the right amount for the content of the product.

The third priority for Freshbrew Mels Beverages is event promotion. This strategy emphasizes the promotion of products to embed more value for "Mary Teh" in the minds of consumers. As the new product in the tea beverage industry, "Mary Teh" has not been widely known and still sound unfamiliar to consumers. By implementing a strategy of promotion events, companies can take advantage of opportunities for cooperation provided by the government to promote their products. This cooperation opportunities can be participated in the event which is done by the government while promoting "Mary Teh". In the event promotion activities, key individuals appointed by the company can instill values and benefits contained in the "Mary Teh" into the minds of consumers. Hopefully it can influence the perception of consumers and help raise the brand value of "Mary Teh".

The fourth strategy prioritized for Freshbrew Mels Beverages is direct selling. One of the drawbacks that are owned by the company is less intense in the promotion. To overcome these weaknesses the company can sell directly to consumers. By doing direct selling, consumers will feel more needed and considered by the producers and will build up a new image for the company. It would also strengthen the relations that occur between the brand and the consumer. Consumers will be more confident of the quality offered by "Mary Teh".

The fifth priority is product design strategy. Updating the package would lead to better appeal for consumers eye. In terms of size, "Mary Teh" can offer a greater quantity to attract customers. Besides changes in packaging design will lead his own appeal for "Mary Teh" easily recognized by consumers. Uniqueness contained in packaging will create curiosity for consumers so that consumers will try to buy the product.

Distribution coverage strategy and non - store retailing strategy are two strategies that have the least priority for Freshbrew Mels Beverages. Distribution coverage strategy rely on how effective distribution range of products can be distributed to reach a wider market. In this strategy the company must establish cooperation with retails or stores that are in the area of marketing objectives. Food and beverage product is a product that has a very fast turnover rate, therefor the company's ability to choose distribution channel should be good and thorough. Retails and stores as the market destination should have good credibility in the eyes of consumers and whether it can maintain the confidence of consumers and of producers.

The last strategy is non - store retailing strategy. Developments in technology and the Internet provide access to communications and information to promote "Mary Teh". Companies can utilize social media to promote their products. In addition, the company can open an online shop in the market network for "Mary Teh". The rise of internet users will be easier for company to introduce "Mary Teh".

V. CONCLUSION

Freshbrew Mels Beverages with "Mary Teh" has a broad market segmentation, targeting all people who like to drink tea and requires a quick tea beverages. As a newcomer, Freshbrew Mels Beverages position as a manufacturer of cup size tea beverages with the composition of products using 100% original tea leaves and 100% pure sugar by promoting quality and food safety.

CSP and CAP analysis shows that the marketing activities undertaken by Freshbrew Mels Beverages already lags behind the changes that occur in the business environment. Company must immediately take action to adapt to its business environment. Industry competition analysis showed that cup size tea beverage industry, has moderate competition intensity with a score of 3.15.

With the situation company face there are several strategies that can be implement based on SWOT matrix. The strategies are product differentiation strategy, penetration pricing strategy, product design strategy, non-store retailing strategy, distribution coverage strategy, direct selling strategy, and event promotion strategy. According to the priorities, as a new company with limited resources the best strategy can be implement is penetration pricing strategy. Company can give promotional price based on cost of production (cost base pricing) in certain period. The new price that company give can help affect consumer decision for buying the product.

REFERENCES

[1] Blythe, J, Megicks, P. *Marketing Planning Strategy, Environment, And Context*, Pearson Education Limited. 2010.
[2] Bujisic, M, Bilgihan, A, and Hutchinson, J. "The Effect of The Type-Pricing Strategy On Perceived Price Fairness And Behavioral Outcomes In Beverage Establishments". *Journal of Revenue and Pricing Management*. 2013. Vol. 13 No. 1. pp. 35 – 60.
[3] Chang, HC, Horng, DJ. "The High-Quality Kow Price Strategy In Penetrating Emerging Market: A Case of Nokia's Business Strategy In China". *The Journal Of International Management Studies*. 2010. Vol. 5 No. 2. pp: 37 – 43.
[4] Corrocher, N, Guerzoni, M. "Product Variety And Price Strategy In The Ski Manufacturing Industry". *Journal Of Evolutionary Economics*. 2009. Vol. 19 No. 4. pp: 471 – 486.
[5] Danibrata, A. "Segmentation Strategy, Targeting, Positioning For Extra Joss Products". *Media Bisnis*. 2009. Vol. 1 No. 1. pp. 9 – 14.
[6] David, FR. *Strategic Management: Concepts, 12th Edition Book 1*. Penerbit Salemba Empat. 2009.
[7] Fahmi, M, Baihaqi, A, Kadir, IA. " Marketing Strategy Analysis of Arabica coffee Bergendaal Koffie In Bener Meriah". *Agrisep*. 2013. Vol. 14 No. 1. pp. 28 – 35.
[8] Ferrell, OC, Hartline, MD. *Marketing Strategy Text And Cases Sixth Edition*. Cengage Learning. 2014.
[9] Harminingtyas, R. "Analysis of the use of the tagline on any advertising efforts for carbonated soft drink brands of Coca-Cola and its influence on consumer purchasing decisions in Semarang". *Fokus Ekonomi*. 2013. Vol. 8 No. 2. pp. 162 – 178.
[10] Hendri, M. "Marketing Communications Influence Purchase Decision Against Jasmine Tea Box Ultra Sense By Teens In Bandung". The 3rd National Conference on Management Research, Universitas Widyatama. 2009.
[11] Hu, YJ. "The Moderating Effect Of Brand Equity And The Mediating Effect Of Marketing Mix Strategy On The Relationship Between Service Quality And Customer Loyalty: The Case Of Retail Chain Stores In Taiwan". *The International Journal Of Organizational Innovation*. 2012. Vol. 5 No. 1. pp: 155 – 162.
[12] Ibidunni, OS. "Marketing Mix as Tools For Achieving Competitive Advantage In Nigerian Market Place: Multi-National And Indigenous Companies In Perspective". *Journal of Marketing Development and Competitiveness*. 2011. Vol. 5 No. 7. pp. 81 – 94.
[13] Issetiabudi, DE. "Soft Drinks Type Fluttering This Year" <http://industri.bisnis.com/read/20150426/257/427041/ini-dia-jenis-minuman-ringan-yang-berkibar-tahun-ini>. 2015.
[14] Komaryatin, N. "Marketing Strategy With SWOT Approach". *Jurnal Dinamika Ekonomi & Bisnis*. 2008. Vol. 4 No. 1. pp. 85 – 100.
[15] Kottler, P, Keller, KL. Marketing Management 14e Global Edition, Pearson Education. 2011.
[16] Kucukkancabas, S, Akyol, A, Ataman, BM. "Examination of The Effects of The Relationship Marketing Orientation On The Company Performance". *Quality and Quantity*. 2009. Vol. 43 No. 3. pp. 441 – 450.
[17] Lamb, CW, Hair, JF, McDaniel, C. Marketing Ed. 1, Salemba Empat. 2001.
[18] Mandiri Bank. Industry Update: Office of Chief Economist Vol.4 February. PT Bank Mandiri (Persero). 2015.
[19] Mandiri Bank. Industry Update: Office of Chief Economist Vol.9 May. PT Bank Mandiri (Persero). 2013.
[20] Mukminatin, Harisudin. "Marketing Strategy For Durian Sanggaran In District Matesih Karanganyar With Competitive Profile Matrix Method". *Jurnal Sosial Ekonomi Pertanian*. 2012. Vol. 1 No. 1. pp. 15 – 32.
[21] Nurcahyono, Segoro, W, Bakara, MYV. "Marketing Strategy At Kuband VSAT Internet Service With Analytical Approach Five Porters And Fuzzy SWOT". *Jurnal Telekomunikasi dan Komputer*. 2013. Vol. 4 No. 2. pp. 173 – 192.
[22] Pattiapon, ML 2011. "The Design Of Product Marketing Strategy Of Honda Motorcycles Using SWOT Method And QFD". *Jurnal Perancangan Strategi Pemasaran Produk ARIKA*.2011. Vol. 5 No. 1. pp. 61-70.
[23] Poeradisastra, F. Prospects and Development of Soft Drinks Industry in Indonesia. <http://foodreview.co.id/>. 2011.
[24] Porter, ME. *Competitive Strategy: Techniques For Analyzing Industries and Competitors*. Free Press. 1998.
[25] Prantommy. "Marketing Strategy Analysis of Energy Saving Lamps On Channel Professional Segment PT Philips Indonesia". [Thesis]. 2011. Institut Pertanian Bogor, Bogor.
[26] Rangkuti, F. *Creating Effective Marketing Plan*. PT. Gramedia Pustaka Utama. 2002.
[27] Rangkuti, F. *SWOT Analysis Techniques Dissecting the Business Case*. PT. Gramedia Pustaka Utama. 2001.
[28] Rizan, M, Saidani, B, Sari, Y. "The Influence Of Brand Image And Brand Trust On Brand Loyalty For Botol Sosro". *Jurnal Riset Manajemen Sains Indonesia*. 2012. Vol. 3 No. 1. pp. 1 – 17.
[29] Sofjan, A. *Marketing Management*. PT. Raja Grafindo Persada. 2002.
[30] Srivastava, RK, Sakunke, ST. "Impact of future trends on marketing strategy". *Far East Journal of Marketing and Management*. 2011. Vol. 1 No. 1. pp. 10 – 14.
[31] Suprapto, DA. "Milk Marketing Strategy For Indomilk Biokids Brand Growth In Jakarta". [Thesis]. 2014. Institut Pertanian Bogor, Bogor.
[32] Tjiptono, F, Chandra, G, Adriana, D. *Strategic Marketing*. ANDI OFFSET. 2008.
[33] Wijayanti, T. Marketing Plan, Should? Managing Marketing Plan (Theory and Applications). PT Elex Media Komputindo. 2012.

[34] Yusuf, EZ, Williams, L. *Marketing Management Indonesia Case Studies*. Lembaga Manajemen PPM. 2007.

[35] Yuswiyanto, A. Consumption Growth For Instant Tea. <http://agro.kemenperin.go.id/1736-Pertumbuhan-Konsumsi-Teh-Kemasan-Semakin-Membesar>. 2013.

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Spectral Analysis of Aeromagnetic Anomalies from Parts of Mmaku and its Adjoining Areas in Southeastern, Nigeria

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Abstract- To estimate the depth to various magnetic sources within the study area, an aeromagnetic map with sheet number 301 published on a scale of 1:100000 was processed, analyzed and interpreted using spectral depth analytical technique with the aid of Arc GIS, Ms Excel and Origin Pro Software's. In this study, two layered source model, D1 and D2 were observed and proposed and also prospective areas were delineated using Surfer 10. The topographic map generated using Surfer 10 shows the undulating nature of the basement surface. Depths to the deeper magnetic sources, D1 vary from 3.472 km to 6.972 km but with an average depth value of 5.010 km while the depth to shallower magnetic sources, D2 vary from 1.177 km to 1.834 km but with an average depth of 1.047 km. D1 and D2 represents magnetic basement bodies and intrusions respectively. The estimated average depth to basement of 5.010 km suggest relative sedimentary thickness for hydrocarbon accumulation and the non uniform basement suggest lineaments resulting to possible conduits and traps for economic fluids. Hence, the possibility of the study area to add to the economic reserve of the country cannot be ruled out when seismic sections are run over the area.

Index Terms- Basement map, Economic deposition, Fast Fourier Transform (FFT), Geosoft file format, Spectral window.

I. INTRODUCTION

A classic use of the aeromagnetic method has been the estimation of the thickness to sediments (or depth to basement) within sedimentary basins and volcanic areas. The Benue Trough has been extensively studied by a lot of researchers with various aims including determination and reconstruction of the depositional, tectonic and evolutionary history, mapping of the geological and stratigraphic setting as well as the evaluation of the mineral potential of the basin. As such many geological tools and geophysical methods including, Seismic, Landsat, gravity, aeromagnetic, geochemistry etc as well as geological mapping have been employed in the various studies. On the origin, the Benue trough has been regarded as an intra-continental rift basin that resulted as a failed arm of the triple-junction during the separation of the South American plate from African (Burke *et. al.*, 1972, Olade, 1975). This aulacogen model explanation presumes the Benue Basin as being restricted to Nigeria only.

The main factors responsible for sedimentation within the study area during the Cretaceous are the progressive sea level rise from Albian Maastrichtian leading to worldwide transgression, regression and local tectonics (Petters, 1978). Spectral depth analytical technique which describes the frequency content of a signal based on a finite set of data (Igwesi and Umego, 2013) has proven to be apt for the determination of the depth to basement. Its advantage is that the spectral domain expressions of the anomalies are generally simple as compared to the expressions of the anomalies in the space domain (Igwesi and Umego, 2013). The method averages over an area so that, if noise is a factor, the results will give a more accurate result than other methods that are commonly used (Ofoha, 2015). Finally, features with given direction in space domain are transformed into a feature with only one direction in the spectral domain (Igwesi and Umego, 2013).

With the vision of ascertaining the basement morphology and hydrocarbon bearing potential of the study which could probably add to the economy of the nation thus reducing the dependence on the ever depleting Niger Delta basin, the present study was undertaken.

1.1 LOCATION AND GEOLOGY OF THE STUDY AREA

The study area with Latitude 6^0 00'-6^0 30'N and Longitude $7^0$00' 7^0 30'E and sheet number 301 is located in Enugu state and parts of Anambra state, south-east Nigeria. Fig.1 shows the study area with inserts maps of Enugu and Nigeria. Geologically, study area lies between the Lower Benue Trough and Anambra basin. The Benue Trough generally has been subdivided into three: the Upper Benue Trough at the NE Nigeria, the Middle Benue Trough and the Lower Benue Trough. The Lower Benue Trough has somewhat developed different tectonic history resulting in the formation of the Anambra Basin to the west and Abakaliki Anticlinorium to the east. According to Murat, 1972 reconstruction model, the Anambra Basin remained a stable platform supplying sediments to the Abakaliki depression during a period of spasmodic phase of platform subsidence (Ojoh, 1990) in the Turonian. Following the flextural inversion of the Abakaliki area during the Santonian uplift and folding, then the Anambra Basin was initiated.

Four Cretaceous depositional cycles where recognized by Murat, 1972 in the Lower Benue and each of these was associated with the transgression and regression of the sea. The opening of the Atlantic Ocean in the Middle Albian to Upper Albian gave rise to the transgression of the first sedimentary cycle. The Asu River group which consist predominantly sandstone and shale was deposited at this time. Between the Upper Cenomanian and Middle Turonian, the second

sedimentary deposition of the Ezeaku Shale occurred. The third sedimentary circle occurred from Upper Turonian to the Lower Santonian leading to deposition of the Awgu Shale and Agbani Sandstone. The fourth and final depositional phase took place during the Campanian-Maastrichtian transgression. It was at this time that the Nkporo Shale, Owelli Sandstones, Afikpo Sandstone, Enugu Shale as well as the coal measures including the Mamu Formation, Ajali Sandstone and Nsukka Formation were deposited

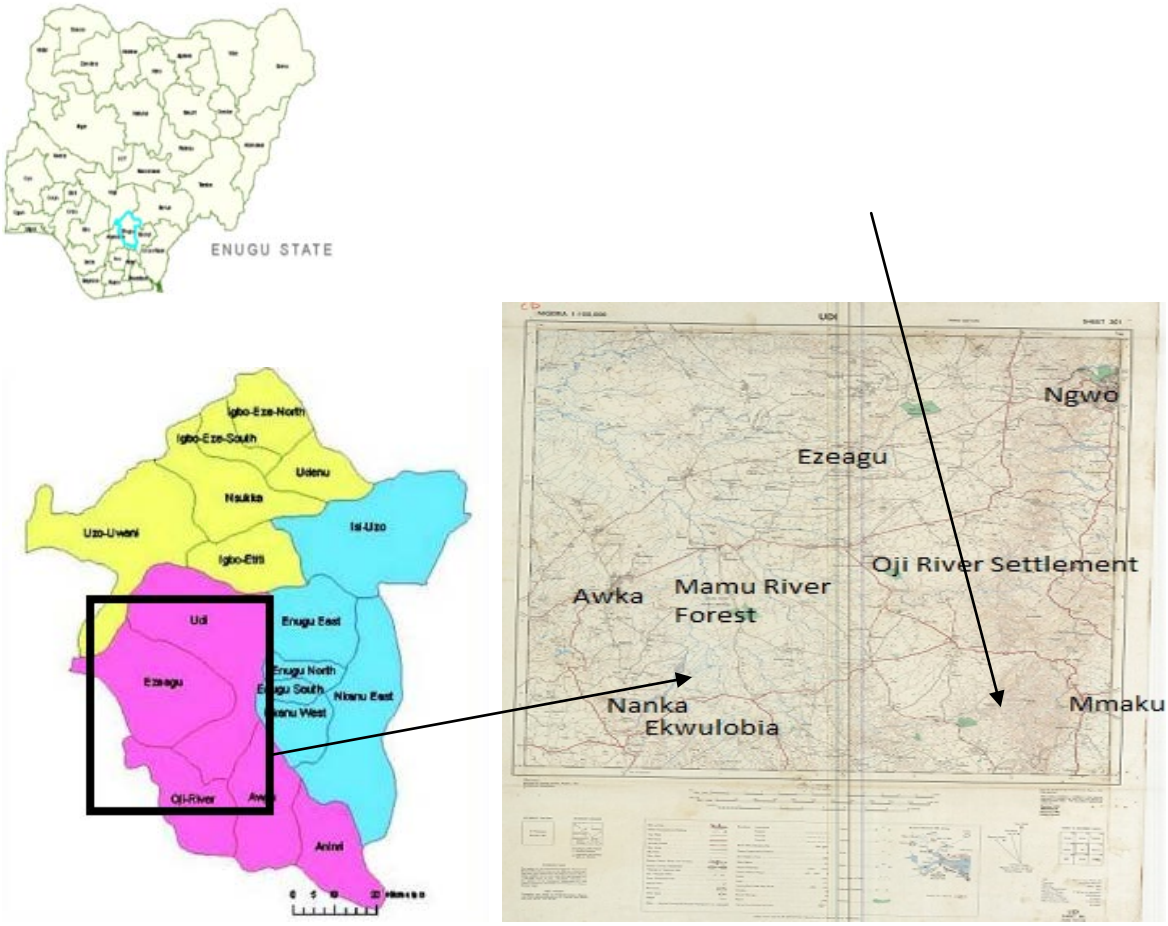

Fig 1: Location and Topographic Map of the study area (Courtesy: NGSA Office, Enugu)

II. MATERIALS AND METHODS

The aeromagnetic map (Fig 2) published on a scale of 1:100000 were acquired in a flight line direction, NE-SW by Fugro Air Servicers in 2009 on behalf of the Nigeria geological agency (NGSA). The high resolution data was acquired at a ground clearance and flight line spacing of about 100 m and 500 m respectively while the tie line spacing occur at 20 km. As part of the processing and pre-processing stages, diurnal variations were removed and the corrections for international geomagnetic reference field (IGRF) model, for the year 2010, applied by the NGSA using Oasis Montaj software. This was transmitted as IGFR corrected total magnetic intensity (TMI) data and was saved in Geosoft dataset as Geosoft grid file format. For onward processing and interpretation, the data in Geosoft file format was opened and converted to a format usable by the sulfer 10 and Origin Pro 8 software's using the Arc GIS software. The Sulfer 10 was, thereafter used to generate the topographic map as D_1 was imported into Surfer 10 worksheet environment while the Origin Pro was used in determining the sedimentary thickness by partitioning or dividing the residual map into sixteen (16) equal spectral windows or grids using the filtering tool of the MS Excel sheet. This thereby makes easy the depth parameter to be determined by means of Fast Fourier Transform (FFT) which was performed on each window. Consequently, the radial average energy (power) spectrum was plotted in MS Excel using Excel chart wizard as Log of Energy (FFT magnitude) versus radial frequency in Rad/km. A straight line is then visually fit to the energy spectrum, both in the higher and lower frequency of the figure. The negative of slope of this line is equal to twice the depth to the center of mass of the bodies producing the magnetic anomaly. After the depth has been calculated over one window a new calculation is made over a new window. This continues over the spectral grid until all windows have had their radial spectra calculated and the depths picked. By calculating the depth value for each window or grid in a stepwise fashion, the average value of the whole cells thus gives the thickness to sediment. The

Depth values due to low frequency magnetic sources are then imported into surfer 10 for depth to magnetic basement map to be generated (Fig 3).

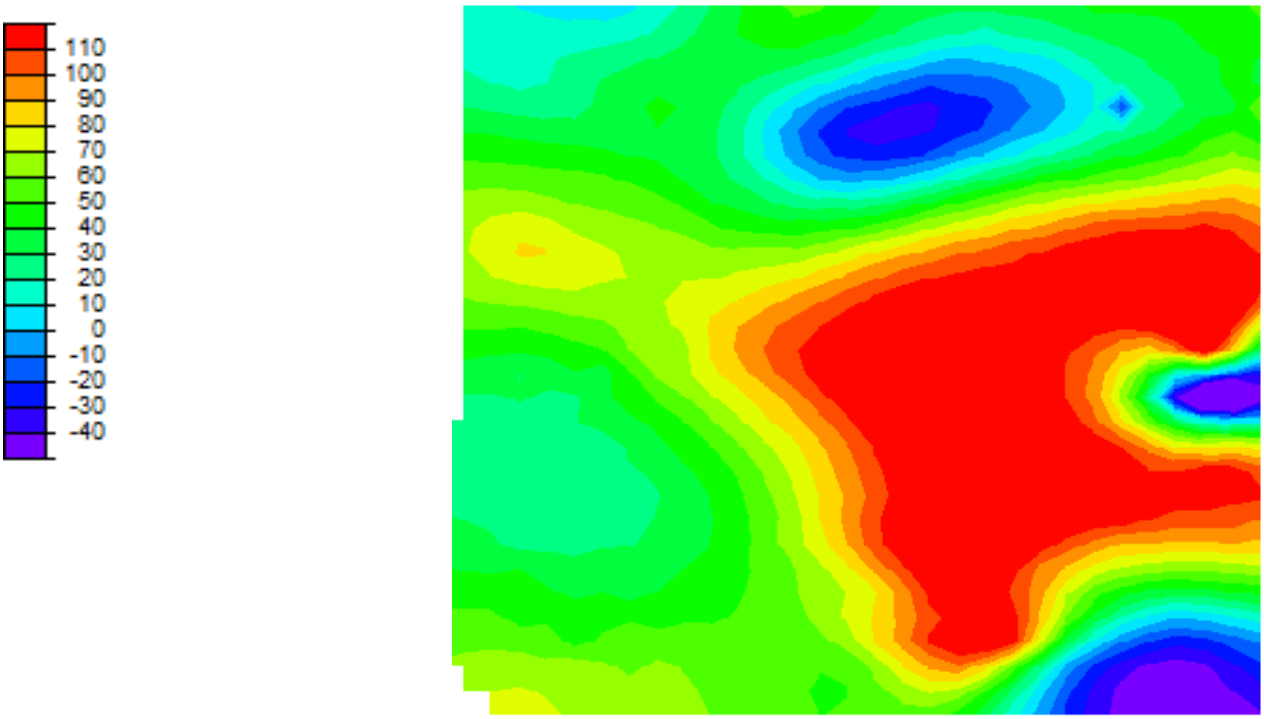

Fig. 2: Raster Map of the Aeromagnetic Data (Udi Sheet 301)

III. RESULTS AND DISCUSSION

Table 1 summarizes the depth to various magnetic bodies. The table shows the maximum and minimum slopes, M_1 and M_2, and two magnetic source models,

TABLE 1: Established Depth to Basement (Sediment thickness) through the study area using spectral analysis.

CELL PLOTS	**SLOPE**		**DEPTH (m)**	
	M_1	**M_2**	**D_1**	**D_2**
Cell 1	-7187	-3385	-3594.	-1692
Cell 2	-6944		-3472	
Cell 3	-10000.0	-3461	-5000	-1731
Cell 4	-12500.0	-2857	-6250	-1429
Cell 5	-9259	-2500.0	-4630	-1250

Cell 6	-10344	-3125.0	-5173	-1563
Cell 7	-11000		-5500	
Cell 8	-10344	-3125.0	-5172	-1563
Cell 9	-11857		-5929	
Cell 10	-7105	-3125.0	-3553	-1563
Cell 11	-12500	-3162	-6250	-1581
Cell 12	-13944	-3667	-6972	-1834
Cell 13	-8333	-2353	-4167	-1177
Cell 14	-10000		-5000	
Cell 15	-9000	-2750	-4500	-1375
Cell 16	-10000		-5000	

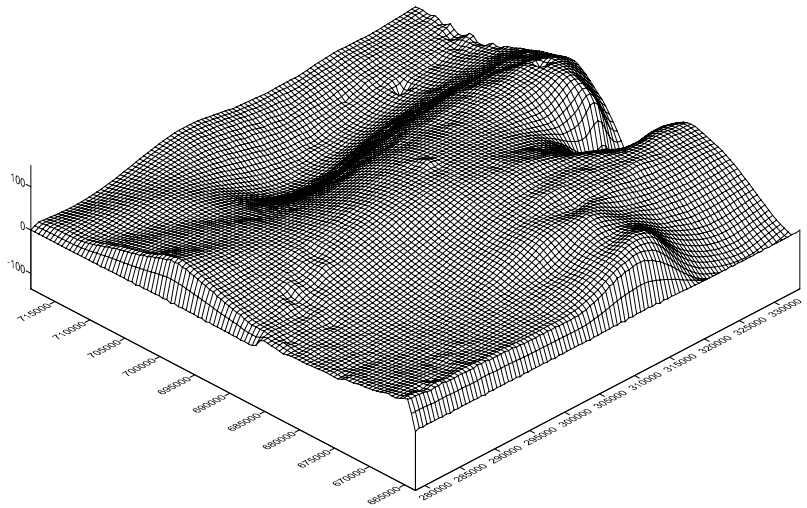

FIG 3: 3D depth to basement map

D_1 and D_2 was observed and then proposed across the study area. D_1 was then used to generate the 3D depth to basement map depicting the undulating nature of the magnetic basement. The slope is a negative slope; hence the corresponding depth values are all negative values. D_1 and D_2 consequently represent the deep and shallow seated magnetic sources respectively. The deeper magnetic sources regarded as the low frequency component is represented by the steep gradient of the spectral energy curve while the shallow magnetic bodies seen as the high frequency component is represented by the less steep gradient of the energy curve. The deeper magnetic sources are attributable to magnetic bodies on the basement surface and the shallow sources probably regarded as magnetic intrusions. These deeper sources lie at depth that varies between 3.472 km and 6.972 km but with an average or true depth value of 5.010 km. Conversely, the shallower magnetic bodies lie between 1.177 km and 1.834 km but with an average depth of 1.047 km. Maximum sedimentary thickness of 6.972 km found in block 12 is located in the eastern portion of the map whereas the minimum sediment of 1.177 km found in block 13 is located in the north western portion of study area. The depth to shallow sources for window two, seven, nine and fourteen were not computed nevertheless, due to the absolute noise effect within the region as evidenced by the non linearity of the energy curve. The established true sedimentary thickness is

in disparity with the results obtained by most previous researchers that had worked within the area of study. Igwesi and Umego (2013), obtained basement depth for deeper magnetic sources to vary between 1.16 km and 6.13 km but with an average depth of 3.03 km while the depth for the shallower source bodies was evaluated to vary from 0.06 km to 0.37 km but with average of 0.22 km. Igwesi and Umego (2013) also reported that Owuemesi (1997) and Madufor (1984), opined the sedimentary thickness to range from 0.9 km to 5.6 km ,1.95 km to 5.09 km respectively while Kogbe (1989) determined the average sedimentary thickness to be 3.03 km. Similarly, Ofoegbo and Onuoha (1991) showed that the basement depth vary from 1.2 km to 2.5 km These differences in true sedimentary thickness value is owed to rapid progressive sea level rise leading to high transgressive and less regressive patterns with tectonic activities as at when the data was obtained within the study area. The basement map nevertheless presents successive patterns of structural (basement) highs and lows which are, perhaps, attractive site for economic deposition.

IV. CONCLUSION

The results of the quantitative analysis shows that the study area holds a promise for hydrocarbon accumulation and exploration provided other conditions are met. The 3D basement topographic map presents irregular nature of the basement which are possibly associated with faults and fractures that aids the migration and entrapment of hydrocarbon and other mineralized deposits.

REFERENCES

[1] Burke, K., Dessauvagie, T.F.J. and Whiteman A.J. Geological History of the Benue Valley and Adjacent areas. African Geology, University of Ibadan Press Nigeria, 1972, 187-205.

[2] David, I. I and Umego, M.N. Interpretation of aeromagnetic anomalies over some parts of lower Benue trough using spectral analysis technique. International journal of scientific and technology research, Vol 2, issue 8, 2013, 2277-8616.

[3] Kogbe, A.C. "Geology of Nigeria," Rock view (Nigeria) Limited. 2nd Revised edition, Jos. Nigeria, 1989, Pp 328.

[4] Madufor, P.N. The Geology of the area south of Abakaliki (with particular reference to Petroleum Potentialities), unpublished M.Sc. Thesis, University of Nigeria, Nsukka, 1984.

[5] Murat, R.C. Stratigraphy and paleogeography of the Cretaceous and lower Tertiary in southern Nigeria, (2nd Edn). African Geology. University of Ibadan Press, 1972, 251-266.

[6] Ofoegbu, C.O. and Onuoha, K.M. Analysis of magnetic data over the Abakaliki Anticlinorium of the Lower Benue Trough Nigeria. Marine and Petroleum Geology, 8, 1991, 174-183.

[7] Ofoha, C.C. (2015): Structural interpretation of aeromagnetic data over parts of offshore Niger Delta, Nigeria. Msc thesis, University of Port Harcourt, Choba, Nigeria, (Unpubl), 2015

[8] Ojoh, k. Cretaceous geodynamic evolution of the equatorial domain South Atlantic; stratigraphy, basin analysis and paelogeography. Bulletin, Centre Research, exploration and production ELF, Aquitaine, 14, 1990, 419-442.

[9] Olade, M.A. Evolution of Nigerian Benue trough (aulocogen): A tectonic model. Geol. Mag. Vol. 112, 1975, 575-583.

[10] Onwuemesi A.G. One-dimensional spectral analysis of aeromagnetic anomalies and curie depth isotherm in the Anambra Basin of Nigeria, Journal of Geodynamics. 23 (2), 1997, 95-107.

[11] Petters S.W. Stratigraphic evolution of the Benue Trough and its Implications for the upper cretaceous paleogeography of West Africa, J. Geol. 86, 1978, 311-322.

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Determinant Affecting Performance of Supply Chain Systems in the Petroleum Industries in Kenya

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Abstract- The purpose of this paper was to analyze the effect of crude oil price as a determinant on performance of supply chain systems in the petroleum industries in Kenya. Supply chain is a dynamic process and involves the constant flow of information, materials, and funds across multiple functional areas both within and between chain members. Members in the chain need to cooperate with their business partners in order to meet customer's needs and to maximize their profit by reducing cost of crude oil. However, it is a very difficult task in managing the multiple collaborations in a supply chain because there are so many firms involved in the supply chain operations with its own resources processes also requires real-time operation and decision making across different tasks, functional areas, and organizational boundaries in order to deal with problems and uncertainties. The strategic move of focus for mass customization, quick response, and high-quality service cannot be achieved without more complex cooperation and dynamic structure of supply chains.

Index Terms- Cost of crude oil price, and Performance of supply chain

I. INTRODUCTION

This study explored how crude oil can be a determinant affecting performance of supply chain systems in the petroleum industries in Kenya. Empirical studies show that most successful oil companies do not only embrace customer satisfaction but they also do proper forecasting to mitigate shortages. The petroleum industry works as a global supply chain involving exploration, material handling, domestic and international transportation, use of technology, and so on. The industry offers a strong model for implementing supply chain management (SCM) techniques (Hou et al,, 2014). Supply chain management involves providing maximum satisfaction to end users (consumers), in other words, delivering the right product to the right person at the right time while still maximizing profits. Today, there are many opportunities for the coordination of activities across the supply chain even in the ever complex oil and gas sector. This is largely due to the development of information systems and communication technologies within the sector (W B ,2012b).

The oil and gas industry is one of the largest and most complex industries in the world today that touches on peoples' everyday lives with services ranging from transportation, electricity, heating, lubricants and a host of chemical and petrochemical products. Globally, a whopping 30 billion barrels of oil is consumed per year. The United States Energy Information Administration (EIA) in its 2011 International Energy Outlook projects that the world's energy consumption will increases by 53% by the 2035 (Gruenspecht, 2011). In Europe and Asia, oil accounts for 32% of energy consumption, whilst in the Middle East, 53%. For South and Central America the figure is 44% whereas in North America it is 40%.

1.1.2 Oil Pricing

The prices of internationally traded fuels and food surged until mid-2008, fell sharply, and then began rising again, reversing much of the price fall by 2011. By one measure, the prices on the world market have nearly doubled since 2005. The fiscal breakeven price of oil needed to balance the budget in major oil exporters has risen sharply in recent years, making the prospect of prolonged periods of low prices unlikely in the future. Equally important, the marginal cost of oil production in 2011 was US$92 a barrel for the 50 largest listed oil companies and could rise further if it continues to follow the long-term trend (Wall Street Journal, 2012). Similarly, long-term growth in global demand for food and continuing U.S. ethanol demand for maize and European Union (EU) biodiesel demand for vegetable oils are expected to keep prices of maize, oilseeds, and many other crops at historically high levels (Chadha & Gagandeep, 2013).

Many governments in developing countries control petroleum product prices. In the face of mounting subsidies, a number of governments seriously explored options for pricing reform in the period leading up to mid-2008. The budgetary pressure to press on with reform subsided briefly following the price collapse in late 2008, but those governments that had done little were caught by rising prices again soon thereafter (Billy Gray et al,2013). To the extent that price increases on the world market have been transmitted to the domestic market, soaring prices have led to calls on governments across the world to take action, ranging from providing greater safety nets to the poor and increasing the minimum wage to releasing oil from strategic reserves, reducing taxes, and granting outright price subsidies (Bowersor et al, 2010).

Given the high share of household expenditure on food in some low-income countries, the food share can be as high as half or more, and even in middle-income countries it is typically 20 to 30 percent (WB ,2012b) rising food prices have made fuel price reform, politically difficult under any circumstances, all the more challenging. Conversely, rising fuel prices have compounded the

political difficulties of reducing food price subsidies, as households face rapidly increasing expenditures on other basic goods. As a result, some countries have seen people taking to the streets to protest both high food and energy prices (Ministry of Energy and Petroleum (2013, November).

Price transmission to the domestic market has differed markedly from country to country. In the case of petroleum products, aside from price differences due to transportation costs and differences in fuel quality, international crude oil and petroleum product prices are broadly uniform across all regions, so that differences in government pricing policies account for much of the differences in end user prices. The price differences are significant: a recent price survey showed that the retail prices of four petroleum products in 65 developing countries in January, 2012 varied by two orders of magnitude, with the lowest prices found predictably mostly in major net oil exporting countries (Kojima, 2012). Chadha & Gagandeep, (2013), as in the years immediately following rising oil prices in 2004, which saw suspension of pricing policies linked to world price movements, some governments responded to high oil prices in 2011 and 2012 by freezing prices. Many interlinked developments have affected costs, availability, and prices paid for petroleum products in recent years.

Recent high oil prices have exacerbated the poor financial states of the national oil companies in some countries with price subsidies, leading to the inability to procure petroleum products on time, acute fuel shortages, and high black market prices; Fuel price subsidies in the face of high world prices have increased incentives for diversion to black markets and smuggling to neighboring countries. Delai & Takahashi (2013) observed that smuggling and black marketing can push up domestic prices markedly above the official prices; Power shortages in a number of countries have increased demand for diesel for emergency power generation, causing diesel fuel shortages in some markets and higher diesel prices. A growing cause of power shortage is declining rainfall, leading to falling hydropower generation in East Africa and elsewhere; Piracy in the Gulf of Aden and the Indian Ocean has increased insurance costs, led to shipping delays, and at times caused fuel shortages in East Africa; The challenges to the authorities mounted by citizens across the Middle East and North Africa since 2010 have stalled and sometimes reversed petroleum price reforms in several countries against the backdrop of declining perceived state legitimacy (Bowersox et al,2010).

Oil forms a major source of energy in Kenya and world at large for it contributes about 40% of world energy consumption. Kenya's petroleum market has 73 major players and hundreds of independents. The oil sector has become highly competitive and is being characterized by price wars and low sales margins. Industry data shows that petroleum dealers are currently selling retail price between Sh115.55 per litre to Sh115.80 per litre for super, Kerosene 87.12 to Sh 89.15 per litre for every litre of diesel 108.50 to 109.20 respectively (Muhammad, 2013). Kenyan Oil sector was liberalized in October 1994. It is regulated by Ministry of Energy through the Energy Act of 2006 and enforcement is done by Energy Regulatory Commission (ERC). Part IV of the Act (Petroleum and Natural Gas) deals with the issuance of business licenses for importation, storage, refining, exportation, sale and resale, transportation of petroleum and natural gas (Anderson, 2013).

1.1.3 Price Competition

Where prices are not controlled or only price ceilings are set, the government can promote price competition by making information available. The price information needs to be broken down by company, and preferably by filling station. In addition, it is important to promulgate and enforce a rule that requires prices to be posted on display boards at readable heights that are clearly visible to drivers (Muhammad, 2013).

Taylor, (2014) observe that some governments post detailed information about fuel prices to help consumers. Some list current prices only, others post recent but not current prices, and a handful lists both current and historical prices. Among the most detailed and timely is the online price database in Chile mandated by a resolution issued in January 2012 which is also available on iPhone, BlackBerry, and Android. The database gives viewers the choice of displaying data in order of increasing or decreasing price and the address of each filling station, prices, and the date and time of the last price change (Luthra et al, 2013). The government of Guatemala highlights on its Web site the filling stations with the lowest and highest prices in the Guatemala City Metropolitan Area with their addresses and street maps every week.

1.2 Statement of the Problem

The available literatures touches only on monetary values, showing that supply chain systems has no creativity and innovatability to exploit the benefit of crude oil price from all companies towards improving performance of up to 80 percent depending on the extent of adherence to supply chain requirements needs to have clear performance strategy (Zhu et al, 2013). These problems of often oil shortages resulted to this study to disclose challenges affecting performance of supply chain systems in the petroleum industries in Kenya. (Fugate et al, 2010 & Luthra et al, 2013) observed that the studies available have largely remained far below the expected standards which was intended to meet this expectation of the oil companies. It's noteworthy that procurement efficiency and effectiveness cannot be achieved unless they are pursuant in tandem with the goals of supply chain performance. For instance supply chain goals revolve around embracing the five rights i.e. right quality, right quantity, right source, right time and right price respectively so as to maintain stock level inventory often, with longer term strategy goal revolving around the ultimate customer satisfaction, controlling of shortages, competency in skills and timely delivery of oil products to retailers (Meyer, 2010).

1.3 Specific Objectives

Generally, the research objective is establishing the extent to which cost of crude oil affects performance of supply chain systems in the petroleum industries in Kenya.

Also, to determine the moderating effect of legal and regulatory environment in the oil companies on the, relationship between, cost of crude oil and performance of supply chain systems in the oil industries in Kenya.

1.4 Crude Oil Price

The real (inflation-adjusted) price of crude oil is a key variable in the macroeconomic projections generated by central banks, private sector forecasters, and international organizations (IMF). The recent cutback in Libyan oil production, widespread political unrest in the Middle East, and ongoing concerns about the state of the global recovery from the financial crisis have sharpened awareness of the uncertainty about the future path of the real price of crude oil. It seems surprising that, to date, no studies have systematically investigated how best to forecast the real price of oil in real time. One reason is perhaps that there has been no readily available real-time database for the relevant economic variables (Caniato et al, 2012).

First, even preliminary data often become available only with a lag. For example, it may take months for the first estimate of this month's global oil production to be released. Second, the initial data releases are continuously revised. It takes successive data revisions until we know, to the best of our ability, the true level of oil production in the current month. Little is known about the nature of these revisions in oil market data or about how data revisions and delays in data availability affect the out-of-sample accuracy of oil price forecasts. In recent research with (Baumeister and Kilian, 2013) observed the need to address this problem. They construct a comprehensive monthly real-time data set consisting of vintages for January, 1991 through December, 2010, each covering data extending back to January, 1973. Back casting and now casting methods are used to fill gaps in the real-time data sets (Azevedo et al, 2011).

This database allows the construction of real-time forecasts of the real price of oil from a variety of models. Perhaps surprisingly, it can be shown that suitably constructed model-based real-time forecasts of the real price of oil are more accurate than the no-change forecast at horizons up to one year. This result holds both for the US refiners' acquisition cost for crude oil imports, which may be viewed as a proxy for the price of oil in global markets, and for the West Texas Intermediate price that receives most attention in the media. (The price of Brent crude oil is not available for a long enough time span to allow a similar analysis). These results are based on a forecast evaluation window covering January, 1992 through June, 2010. This window includes recent periods of turmoil in oil markets and provides a challenging test of the forecasting ability of alternative forecasting models. The evaluation criteria are the recursive mean-squared prediction error of the forecasts and their directional accuracy (Chan et al, 2012).

Petroleum price, like prices of many commodities, coincides with law of value, but it has its own singularity, for petroleum is a kind of special commodity. Intense fluctuation of petroleum price is one of the most spectacular phenomena during the process of international trade, for there is no price rising and falling rapidly in a short term. Petroleum price's historic trace is like rolling alp and coulee rising and falling, but this kind of rising and falling presents periodical changes, because there is certain intrinsic link between petroleum price and major influencing factors (production capacity of OPEC, operating rate, world average Gross Domestic Product (GDP), price of coal, price of natural gas, demand of petroleum, expenditure coefficient, balance between supply and demand of OPEC, productivity of non-OPEC, balance between supply and demand of non-OPEC Ministry of Energy and Petroleum (2013, November).

The first problem is that the interpretation of crude oil as an intermediate input in the value added production function is questionable if we think of oil as an imported commodity. Under standard assumptions, imported oil enters the production function of domestic gross output, but it does not enter the production function of domestic value added (Chan et al, 2013). Since gross output is separable in value added and imported energy, holding capital and labor fixed, oil price shocks do not move value added. Hence, oil price shocks by definition cannot be interpreted as productivity shocks for real GDP (Dao et al, 2011). Rather they affect the domestic economy by changing domestic capital and labor inputs. The second problem is that, to the extent that oil prices affect domestic output, under standard assumptions their impact should be bounded by the cost share of oil in domestic production, which is known to be very small. For example, for the United States, the ratio of imported and domestically produced crude oil in GDP has been fluctuating between 1 and 5 percent (Giovanni & Vinzi, 2012). Thus, if oil price shocks are viewed as cost shocks for the oil-importing economy, their effect by construction cannot be very large. In their study by Delai & Takahashi (2013) have demonstrated that standard production based general equilibrium models of the transmission of oil price shocks are not capable of explaining large fluctuations in real GDP (Sople, 2012).

Some countries have embraced price control, including all five West African countries. They use different variations of an import parity structure with international spot reference prices, market marine freight rates, and the dollar-local currency exchange rates as the three key short-term adjustment parameters.

A system of price control consists of two basic elements: The price buildup structure, starting with import-parity landed costs and adding storage, transportation, margins, and other costs; The adjustment mechanism comprising short-term adjustment parameters, and the frequency of and the trigger for adjusting prices With the exception of Malawi, the countries with price control adjust prices monthly. Malawi has a price stabilization fund and has no pre-set automatic adjustment frequency. The stabilization fund ran up a large deficit in 2008. Only in Botswana, Senegal, and South Africa is the price adjustment automatic, based on pre-established administrative procedures (Silva, 2013).

In Burkina Faso, Côte d'Ivoire, Mali, and Niger, in spite of having pre-established procedures, ad-hoc interventions occur in each adjustment. Pan-territorial pricing by definition means that true costs are not reflected in market prices, and reduces incentives to minimize costs because offering lower prices by improving supply efficiency is not an option. In Mali, for example, prices are maintained uniform through tax differentiation. Fuels obtained in the lowest-cost manner are taxed most heavily, and conversely highest-cost fuels are taxed the least. This means that cost savings cannot be passed onto consumers, and a firm cannot lower prices in the hope of expanding its market share. Astilla and Longo (2013) observed that in West Africa, for the most part, the prices are maintained uniform throughout each country. The only minor exception is Burkina Faso which adjusts ex-depot prices at Ouagadougou

(Bingo depot) and Bobo-Dioulasso, and has two sets of prices depending on the location. The countries with sector liberalization have regional price variations established by the market. One exception is Madagascar where the logistics operator Société Logistique Pétrolière SA, a private firm that owns and controls all terminals and depots provides a common "postage stamp" ex-depot price from all the depots in the country. Such a setup is unlikely to lead to a strong drive to increase efficiency and reduce cost (Bulk Oil Storage and Transporation, 2013).

A recent review of developing country governments' response to the oil price volatility of the past two years showed that, against the severe price rises of 2007 and 2008, few governments were able to withstand the pressure to use or increase fiscal measures to lower prices (Salavasidis, 2012). As a result, some countries that moved to automatic price adjustment mechanisms years ago suspended price adjustment and bore financial losses. In West Africa, four of the five study countries engaged in price smoothing during the run-up in international prices from 2007 through mid-2008. Only Senegal maintained a consistent automatic adjustment process (Devold, 2013). The adjustment timing and process steps to be taken every four weeks are defined in the 1998 sector restructuring legislation and have been rigorously followed. The other four countries, Burkina Faso, Côte d'Ivoire, Mali, and Niger, suspended automatic price adjustment based on a clearly defined import parity structure. Price stabilization was achieved through large fuel tax reductions (resulting in a loss of government revenue) or making the state supply company bear the financial losses. An added positive element in Senegal's pricing regime is the provision built into the legislation for a regular review of longer-term adjustment parameters such as distributor and retail margins (Sople, 2012).
According to Ghana Exploration and Production Forum (2013), the other four countries still rely on an ad-hoc approach to such adjustments three principal price components: Landed cost including cost, insurance, and freight, which covers the FOB price at the port from which the petroleum product is imported, marine freight and all freight/cargo-related costs, evaporation and other losses en route, and port fees to land the product in the pertinent receiving port, or, in countries with price control, hypothetical import-parity price corresponding to the landed cost used to calculate retail prices; Government take (referred to as tax hereafter), which includes all taxes, duties, and government fees that are incurred in the supply chain that go to the treasury or to earmarked funds; Oil industry component, which covers all gross margins for storage, inland bulk transport, local delivery, wholesale, and retail distribution (Sople, 2012). The difference between the retail selling price and the sum of the landed cost and government take represents the gross margin component available to the downstream petroleum industry. In markets where prices are liberalized, this number is derived by difference and is the least accurate of the three components

Transportation of oil

Nowadays, the most beneficial and environmentally friendly way to transport oil is through pipelines, which moves at very high speed under high pressure, reaching up to three meters per second. The pipeline can be ground and underground and lay according to the terrain relief. The structure of pipes for pipeline includes highly plastic steel, reinforced plastic, which ensures its high reliability, resistance to damage, temperature and corrosion. Ground and underground pipelines has its pros and cons. First of all, ground pipeline is beneficial because in the case of an emergency, the damage is easier to find and fix than if it was located on ground. Underground pipeline has its advantages. For example, it much better protected against environmental influences than the ground method (Chandan, 2014).

Main threats in the Gas and Oil supply chains

These years, the oil and gas industry see environmental accountability as a top priority, underlined by the intersection between public concern and industry efforts. Many companies are facing different challenges with every aspect of the industry. At the moment, companies struggle with governmental policies and political situations. Specifically: regulatory and legislative changes and increased cost of compliance, fickle oil and gas prices, general national or global economic concerns and overall industry competition. Additionally, some reliable source such as oilprice.com (The No. 1 source for oil and energy news) claimed that environmental issues, climate change concerns and human capital deficit are even more important risk factors than any others (Dacker,2013)..

II. Legal and Regulatory Environment

The government policies was in the Kenyan market to moderated against the challenges affecting performance of supply chain systems in the petroleum industries in Kenya, to disclose the alternative hypotheses whether there are existing relationship among the independent variable; cost of crude oil and legal and regulatory with the oil companies. Lin & Sheu (2012) observes that over the years, the oil and gas industry has continued to face growing challenges, from stricter government regulation, political risks, competition, emergent new comers and political hostilities, which has affected price hike and shortages. Due to the scramble for resources, many oil companies have been driven to explore and produce in some of the most hostile and harsh environments, which in turn tend to be extremely costly (Liu et al, 2012).

Also, there have been concerns in the industry about the growing scarcity of natural resources, which underlies fears of not being able to meet production levels and goals. However, in reality, the resources are not the cause of supply restrictions with vast potential still available due to continuous discoveries of oil reservoirs around the world (Liu et al.,2012). The main challenge facing the oil and gas industry is not the availability of oil and gas resources, but putting these reserves into production and delivering the final products to consumers at the minimum cost possible. Thus, a solid supply chain management competency program will enhance this goal, Tax analysis and revenue forecasting are of critical importance for a government in ensuring adequacy and stability in tax and expenditures policies (Lun ,2011).The broad function of tax policy units are: (a) Monitoring of Revenue Collection. (b) Evaluation of the Economic, Structural and Revenue Aspects of the Tax Policy. Tax policies have to be weighed against the following criteria: economic efficiency; economic growth; revenue adequacy; revenue stability; simplicity; and low administrative and

compliance costs. (c) Tax Expenditure Analysis. (d) Evaluation of the Impact of Non-Tax Economic Policies. (e) Forecasting of Future Tax Revenues. The several steps involved in the preparation of revenue forecasts are: evaluation of tax elasticity, evaluation of changes in economic conditions, and evaluation of the effect of inflation and price changes (Liu,et al, 2012).

Olugu & Wong (2012) observes that the policies, laws and institutions that presently govern the mineral sector in Kenya need significant reform if the sector is to grow sustainably and contribute to economic development and poverty reduction in the counties. The highest priority must be given to finalizing the Geology, Mining and Mineral Bill (2013), which has remained in draft form for some years. Kenyans need a shared vision of how the development of mining will take place at the counties, building on experiences gained from Titanium mining in Kwale (Olugu & Wong,2012). The Bill must define the role and mandate of the state and its public mining institutions, and make very clear what public institutions at the county level will exercise; what the regulatory roles are and the relationships between them; how, if at all, decentralization might apply to governance of the mineral sector; specify the environmental obligations of operators consistent with internationally recognized safeguard standards; define arrangements governing provision for community development and benefits sharing, including the roles to be played by different stakeholders; and address the rights of vulnerable groups that might be impacted adversely by mineral sector development and measures for their protection (Schrettle et al,2013).

Oil and natural gas development faces political and environmental issues. Political issues stem from the overlapping and disputed claims of economic sovereignty. Environmental issues pertain to the preservation of animal and plant species unique to the areas where oil, gas or other minerals have been discovered, particularly Turkana and Kwale. The environmental impact of oil exploitation is a dominant driver for most technology development in the industry today. Although much of this effort is focused on waste treatment and disposal, a significant amount of waste prevention will be crucial. Development of technologies to displace less material during mining will result in reduced environmental impact (Zhu et al, 2013).

Botswana in East and Southern Africa can be said to have reasonable to good systems. It is too early to draw conclusions about Kenya or Malawi where new regulators have very recently been established. The tables also show the results from Doing Business 2010, which tracks regulatory reforms aimed at improving the ease of doing business British Petroleum (2013). Doing Business ranks economies based on 10 indicators of business regulation that record the time and cost to meet government requirements in starting and operating a business, trading across borders, paying taxes, and closing a business; the rankings do not reflect such areas as macroeconomic policy, security, labor skills of the population, or the strength of the financial system or financial market regulations and (Fugate et al, 2010). While Burkina Faso, Côte d'Ivoire, Mali, and Niger need to update and strengthen their legal and regulatory frameworks. With the exception of Botswana and South Africa, the study countries suffer from weak enforcement and policing, even in those countries where a strong legal and institutional framework has been established. Inadequate regulations and weak enforcement allow too many oil marketing companies to operate in Kenya, Tanzania, and Uganda. This overwhelms limited enforcement capacity, making commercial malpractice an attractive way of making profits (Lin, 2013).

The remedy, in a liberalized market, is not to limit these companies by number but to ensure that the licensing criteria for operators are stringent and that compliance with rules to obtain and retain a license is enforced (Castilla, and Longo, 2013). One approach is to establish a separate body for inspection and enforcement, as in other developing regions such as South America, where strong, specialized, independent inspection institutions have been developed. These institutions have encouraged the formation of a cadre of private, certified inspectors, to which the enforcement institutions outsource work, minimizing their requirements for permanent staff. Senegal has already identified the need to update the legal texts developed as part of the 1998 reform, particularly in the areas of product specifications, open access, security stocks, and regulatory institution building. Lin (2013), Senegal plans to convert the Comité National des Hydrocarbures into a regulatory body, the Regulatory Body for Downstream Hydrocarbon Sub-Sector Activities.

An assessment of the cost-effectiveness of Kenya's Open Tender System managed by the ministry of energy, given that the volume of imports can easily justify more than one tender a month, may be useful. The Open Tender System for crude oil is linked to the requirement that all oil marketing companies process crude oil at KPRL. Consideration may be given to applying modest duty protection, for example on the order of 5 percent, to the refinery as a temporary measure and liberalize product imports, allowing competition between domestic refining and imports (Silva, 2013).

III. RESEARCH METHODOLOGY

The main objective of this study was to investigate cost of crude oil as a determinant of Oil Company's performamne.t hinder sustainability of small and medium family enterprises after the exit of the founders in Kenya. There were both quantitative and qualitative variables. Social scientists routinely collect data that is both qualitative and quantitative and carefully examine the patterns that emerge in an attempt to interpret, understand and explain social life (Kothari, 2011).

3.1 Research Design

The design enabled the study to combine both qualitative and quantitative research approaches. Qualitative approaches enables collection of data form of words rather than numbers. It provides verbal descriptions rather than numerical (Kothari, 2011).Qualitative methods can be used to gain more in depth information that may be difficult to convey quantitatively. Quantitative approach strives for precision by focusing on items that can be counted into predetermined categories and subjected to statistical analysis (Taylor,2013).The use of these two approaches reinforces each other (Zhu et al,2013). The research used this approach because the data collected used the main questionnaire was quantitative and was analyzed using statistics. Qualitative on the other hand involve interpretation of phenomena without depending on numerical measurement or

statistical methods (Styles et al, 2012). The study explored the actual position of fuel shortages and supply chain systems on the challenges affecting performance in Kenya on poor forecasting from the industry. In trying to investigate the effect of the independent variables on the dependent variable, the study did not manipulate, cost of crude oil and performance of supply chain systems; the independent and dependent variables. They had already occurred. The challenge thus, was in how to control variance, when one has no control over the variables Johnson & Christensen (2012). The study did not control variance by direct manipulation or by random assignment. The concern here was in the performance due to fuel shortages, the dependent variable, which was influenced by one independent variable. These were some of the reasons why the study adopted this research design.

3.2 Sampling Frame

There are 73 registered oil companies in Kenya and this formed the sampling frame. The list of oil companies was obtained from Energy Regulatory Commission of Kenya (ERC) or registrar of companies in Kenya. The study employed a censuring sampling frame due to the fact that the targeted populations of entire stakeholders about 73 companies who are involved in day to daily in the oil industry management and other users were drawn from various stakeholders specified in the targeted population. (Meyer, 2010) states that this method was suitable because/ since it randomly select the required representative in the course of the study. This method of sampling frame enabled the researcher to draw a reasonable adequate sample size, where all the members of the population of interest had an equal chance of being addressed in the sampling frame (Zhu,et al,2013).

3.3 Instruments

The main research instrument that was used in this study was the set of questionnaires .In developing the questionnaire items, both closed-ended and open-ended formats of the item were used. This format was used in all categories of the questionnaires. However, in the fixed choice item, it involved 'putting words' in the respondents' mouth, especially when providing acceptable answers, there was temptation to avoid serious thinking on the part of the respondent. The respondent ended up choosing the easiest alternative and provided fewer opportunities for self-expression. It is because of these reasons that it was necessary to combine this format of items with open–ended response items to attract qualitative responses which gave the study in-depth feelings and perceptions of the respondents. The interviewer used survey questions to deeply probe the relationship between the variables under study. Mohan (2012), note that, survey questions address each research question satisfactorily and meet each objective.

The questionnaire was divided into six parts as follows: Part 1: General information of respondents; This section sought to find out the general information of the respondents such as Age, marital status, level of education, work experience, type of business, number of employees, etc. It also served the purpose of the preliminary study. Part II: Cost of Crude Oil; This section had items on the cost of crude oil and its effects on the supply chain performance of the petroleum industries towards proper forecasting to mitigate fuel shortages. Part III: Dependent Variable; Performance; This section sought to find out whether the respondents had poor performance in their companies which resulted to often fuel shortages and how it influenced crucial fuel decisions and the effect of the same on the performance of fuel companies.

Qualitative data: Data frequency distribution and cross tabulation was used in describing and explaining the situation as it is in the enterprises. Data was coded and analyzed simultaneously as collected. Through content coding, a list of key ideas and themes for each variable was generated and this guided the nature of integration needed for both qualitative and quantitative data collected. Views and ideas that were frequently expressed were noted. This formed the basis for crosschecking and comparing the two sets of data and drawing of conclusions. Data was then operationalized through scoring for crosschecking with the quantitative data (Delai,and Takahashi, 2013).Quantitative data: Data was analyzed using descriptive statistics; measures of central tendency, measures of dispersion and measures of symmetry and inferential statistics. Scatter plots were used to show if the relationships wear linear. SPSS software version 20 was used as a statistical tool for analysis.

Linear regression analysis showed the correlation and strength of the relationship between variables both independent and dependent and the effect of the intervening variables on each relationship. Multiple regression analysis was thereafter conducted to test the overall effect on the study model. Analysis of Variance (ANOVA) was also to test the goodness of fit of the regression models and finally to test the hypothesis of the multiple regression models.

Data Presentation: The information was presented using a combination of statistical techniques and graphical techniques. Statistical techniques include: frequency distribution for grouped and ungrouped data, measures of central tendency; mean, median and mode to present characteristics that determine performance of supply chain systems; measures of dispersion these include range, variance, deviation ,coefficient of variability and percentiles. Graphical representations: This is presenting grouped data diagrammatically, the most common from being histograms, and polygon. At a glance once is able to make conclusions about the study (Yang et al, 2013).

3.4 Gender of the Respondents

The survey results indicated in table 3.1 shows that 60 (84.51%)of the respondents were men while the remaining 11 (15%) were women. The above results may be attributed to the strong male domineering culture in Kenya where until recently women were relegated to domestic chores. This culture is dying off and a large population of women population is now strongly competing with their male counterparts in most jobs (Luthra et al, 2013). The cultural, customary and religious beliefs governing performance and forecasting may also have contributed to the same (The Holy Quran, Chapter 4 vv12-14; Hindu Succession Act, 1956, The Holy Bible: NIV; Gen 25: 5, 31-33, Matt. 6: 1-4, James 2: 24.

Table 3.1 Gender of the respondents

	Frequency	Valid Percent
Male	60	85
Female	11	15
Total	**71**	**100**

Market Price at which you set your Crude Oil Price

Table 3.2 indicates, an average of three respondents who respondent to the written questionnaire, they indicated the minimum and maximum market price set by crude oil as ksh.10.00 and ksh.45.00 respectively, with mean of ksh.31.67 and standard deviation of 18.930.

Table 3.2 Market Price Percentage

Descriptive Statistics					
	N	**Minimum**	**Maximum**	**Mean**	**Std. Deviation**
what % of market price at which you set your Crude Oil Price	3	10	45	31.67	18.930
Valid N (list wise)	3				

Hypothesis 3

H_o: Cost of crude oil does not significantly affect performance of supply chain systems in the petroleum industries in Kenya.

Table 3.3 Correlations on Cost of Crude Oil

		Performance	**Cost**
Performance	Pearson Correlation	1	.643**
	Sig. (2-tailed)		.000
	N	58	58
Cost	Pearson Correlation	.643**	1
	Sig. (2-tailed)	.000	
	N	58	58

**. Correlation is significant at the 0.01 level (2-tailed).

Regression

Table 4. Regression Model Summary on Cost of Crude Oil

Model	**R**	**R Square**	**Adjusted Square**	**RStd. Error of the Estimate**
1	.643[a]	.414	.403	.68080

a. Predictors: (Constant), ICT

ANOVA[a]

Model		**Sum of Squares**	**df**	**Mean Square**	**F**	**Sig.**
1	Regression	18.316	1	18.316	39.518	.000[b]
	Residual	25.955	56	.463		
	Total	44.271	57			

a. Dependent Variable: performance

b. Predictors: (Constant), ICT

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Std. Error	Beta		
1	(Constant)	-.168	.083		-2.027	.004
	Cost	.534	.085	.643	6.286	.000

a. Dependent Variable: performance = -0.168 + 0.534 xCost

The linear regression analysis shows a relationship, R = 0.643 and R2 = .414 which means that 41.1% of the corresponding change in cost of crude oil after the f the founder can be explained by a unit change in performance . A further test on the beta coefficient of the resulting model, the constant α = -0.168 is not significantly different from 0, and since the p value p = 0.004 is greater than p= 0.05, the constant is not significant. However, the coefficient β = 0.534 is significantly different from 0,model analysis of regression is shown the table 4.49 above. Regression indicates the strength of the relationship between the independent variables and the dependent variable (performance). The R square value in this case is 0.414 which clearly suggests that there is a strong relationship between the independent variables and the dependent variable. This indicates that the independent variables share a variation of 41.4 % of performance. This implies that if all the oil companies can enhance cost of crude oil, skills, ICT and tendering systems challenges affecting performance of supply chain systems in the petroleum industries in Kenya will minimize fuel shortages.

3.Testing Hypothesis: This explains α that if were held constant then performance will be -0.168 (low) and therefore the gradient (β) and the performance would be very low. The Anova test in Table 3.3 shows that the significance of the F-statistic is less than zero. This implies that the null hypothesis $\beta 1=0$ is rejected and the alternative hypothesis $\beta 1 \neq 0$ is taken to hold implying that the model $Y= \beta 0 + \beta 1X1 + e$, is significantly fit.

The model performance = $\alpha + \beta$ (cost) holds for as suggested by the test above. This confirms that there is a positive linear relationship between cost and on performance of supply chain systems in the oil industries. The model performance = β (cost) holds as suggested by the test above. This confirms that there is a positive linear relationship between cost of crude oil and performance of supply chain systems

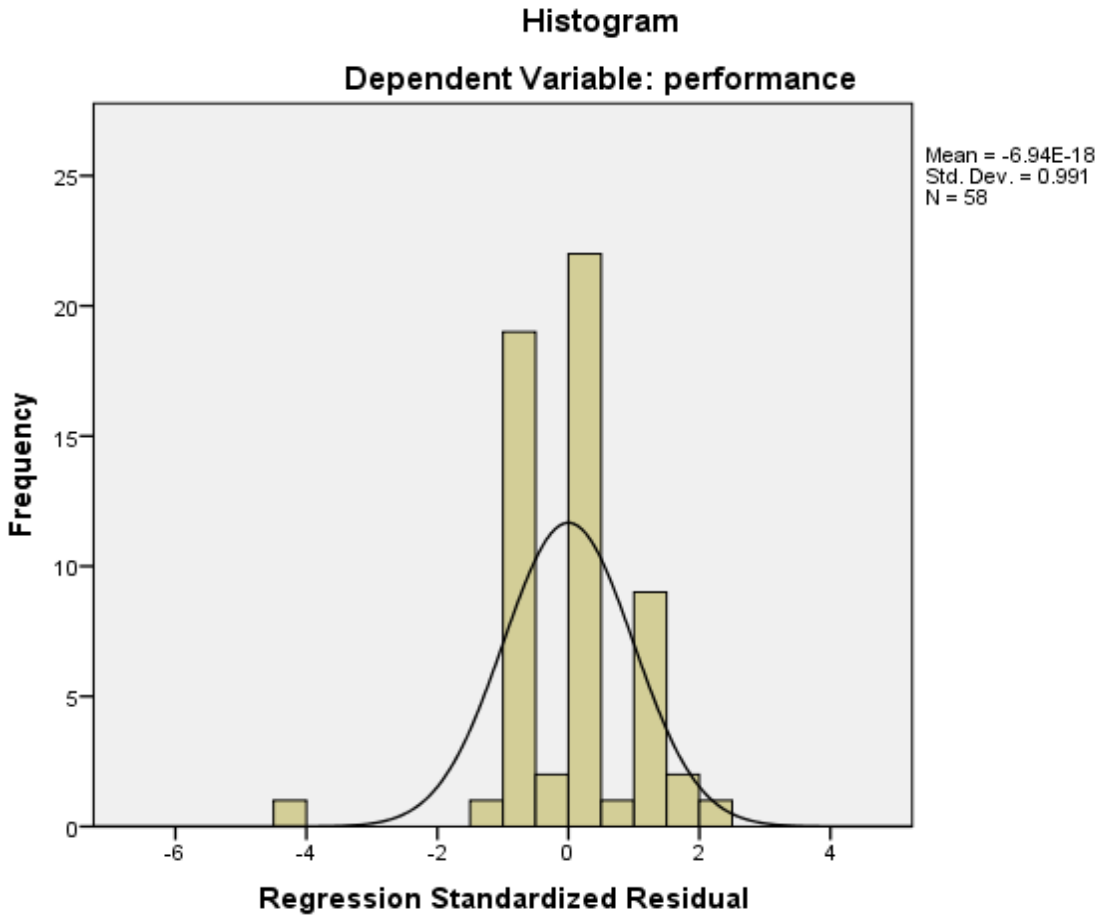

Figure3.1 Histogram Dependent Variable on Cost of Crude Oil

The histogram in figure 3.1 indicates, that there is normality. The residual describes the error in the fit of the model to the *ith* observation y_i and are used to provide information about the adequacy of the fitted model .Analysis of the residual is frequently helpful in checking the assumption that errors are normally distributed with constant variance, and in determining whether additional terms in the model would be useful. From figure 3.1 indicates the dispersion of the distribution of a histograms showing the mean, median, and mode give us some measure of the central tendency in a list of numerical data, and the upper and lower figures for the range tells us the high and low scores and the same was observed (Meyer (2010). But in order to understand a set of statistical data more clearly we obviously require a sense of the way in which the measured values are spread out from the central tendency. For example, are the values almost all clustered around the middle, or are there some very low and very high vales. The range and various "averages" tell us something, but they do not describe accurately the distribution of the values.

This objective was assessed using correlation and regression analysis on the local and international registered oil companies' basis and general analysis for all the oil companies. At the local level the correlation result indicate that crude oil price is positively and significantly related with level of skills information communication and technology, except at the locally registered oil companies where information communication and technology are not significantly related. The R square value in this case is 0.197 which clearly suggests that there is a strong relationship between the independent variables and the dependent variable. This indicates that the independent variables share a variation of 19.7 % of performance. Comparing with medium unpredictable price

Table 3.3 indicates, high unpredictable price compared with medium unpredictable has a significant regression coefficient of (-0.234) with a t-value of -3.557 (p-value =0.001). Low unpredictable price compared with medium unpredictable has a significant regression coefficient of (-0.192) with a t-value of -3.132 (p-value =0.003). Regression analysis result at the local levels indicate that crude oil price contributed to supply chain performance at local registered oil companies (-0.234) with a t-value of -3.557 (p-value =0.001 and also international registered oil companies' ((-0.192) with a t-value of -3.132 (p-value =0.003 but not for the rest of the industry. Further, crude oil price was a stronger predictor of supply chain performance at local registered oil companies. In establishing the influence/performance of crude oil price in the supply chain, a comparison of the local and international registered oil companies revealed different findings. The explanation could be found in the practices which varied per each group. For instance, most of the locally registered oil companies were not ready realize their staff to go for further studies to enhance their understanding in the crude oil pricing. However, in the general analysis, it was established that the effect of crude oil price on performance was not significant (-0.234) with a t-value of -3.557 (p-value =0.001). significant level in the presence of level of skills, ICT and tendering systems, crude oil price does not affect supply chain performance in the petroleum industry.

In finding based on the general analysis were unexpected because there are many studies indicate that pricing is a predictor of performance of supply chain and they were the hypothesized relationship. The explanation could be because the registered oil companies' are supportive of the crude oil price, as they adjust their prices either up/down wards depending on the crude oil price adjustment. The ultimate customers are the sufferer in this case. This is evident in the findings on descriptive analysis where majority agreed that they were satisfied with the crude oil price for their current job in their respective companies. The interview confirmed that the staffs were supported in their crude oil price terms of supply chain performance. This argument is supported by (Anderson, 2013), who established that while crude oil price may have an impact on staff performance mobility, crude oil price that is wholly paid by an entity is likely to prelude to staff search. In contrast, when supply chain performance for crude oil price the negative relationship to staff mobility is observed as supply chain are more likely to perform. This is in the petroleum industry where the crude oil cost is factored in the retail price to cover the investment cost plus the accrued interest. The relationship between tendering and crude oil price which is in this study is positive and significant provides another explanation is. One cannot acquire crude oil without following the process of tendering systems unless they want to avoid competitive bidding. Therefore, indirectly in away, crude oil price is covered through tendering which has been found to be a predictor of supply chain performance in this study. The hypothesized relationship was not supported, however the unfavourable aspects related to crude oil price that came outing the interview and written responses are a pointer that there are crude oil price aspects that need to be addressed since they cause of non-performance in the supply chain.

IV. SUMMARY

The study established that cost of crude oil affects performance of supply chain systems in the petroleum industries. The null hypothesis was tested through F-test and results indicated that there is a relationship between cost of crude oil and performance of supply chain systems. Pricing is important for any product as it can affect its demand in the market. Many of the world's best business organization would endeavor to sale more at higher price to sustain their trade. That the theory of any affirm when in business. They price products at a reasonable rate to enable them to compete with other sister companies. From the crude oil perspective, pricing products need proper forecasting as customers are always sensitive to any adjustment of price. The study sought to establish the extent to which cost of crude oil affects performance of supply chain systems in the petroleum industries in Kenya.

From the qualitative analysis the respondents were satisfied with crude oil price. This argument is supported by (Anderson, 2013), who established that while crude oil price changes affect supply chain performance throughout transit within the chain, hence crude oil price that is wholly paid by an entity is likely to prelude to customers complaints. In contrast, when supply chain performance for crude oil price the negative relationship to staff mobility is observed as supply chain are more likely to perform.

In the oil companies' regression analysis, crude oil price was found to be a predictor of performance to deliver and shortages in the oil industry. In general multiple regression analysis, the

relationship between supply chain systems and crude oil price was significant. This means that, in the absence of appropriate conducive environment, crude oil can affect performance of the supply chain and they are challenges of performance. The findings, therefore shows that the study which sought to establish determinant effect of cost of crude oil on performance of supply chain systems in the petroleum industries. Further, although crude oil price was a significant predictor in the general analysis for all petroleum companies and hence a challenge to supply chain systems, interview and written response gave a high in depth information on aspects to crude oil that were favourable for the registered oil companies' management performance.

REFERENCES

[1] Anderson, C. (2013), What is a Quality Management System? Bizmanualz.Retrieved July 03, 2014 from http://www.bizmanualz.com/blog/qualitymanagement-system-qms.html

[2] Allcott, H., and N. Wozny (2010), "Gasoline Prices, Fuel Economy, and the Energy Paradox",mimeo, MIT.

[3] 207.Association of Oil Marketing Companies (2013). Retrieved from http://aomcs.org.

[4] Azevedo, S.G., Carvalho, H., & Machado, V.C.(2011). The influence of green practices on Supply chain performance: A case study approach.Transportation Research Part E: Logistics and Transportation Review, 47(6), 850-871.

[5] Baumeister, C., Kilian, L., and X. Zhou (2013), "Are Product Spreads Useful for Forecasting? An Empirical Evaluation of the Verleger Hypothesis," mimeo, University of Michigan.

[6] Bowersox, D., Closs, D., and Cooper, M. (2010), Supply Chain Logistics Management (International Edition), McGraw-Hill, New York.

[7] Caniato, F., Caridi, M., Crippa, L., & Moretto, A.(2012). Environmental sustainability in fashion supply chains: An exploratory case based research .International Journal of Production Economics, 135(2), 659-670.

[8] Chan, R.Y.K., He, H., Chan, H.K., & Wang, W.Y.C.(2012). Environmental orientation and corporate performance: The mediation mechanism of green supply chain management and moderating effect of competitive intensity. Industrial Marketing management, 41 (4), 621-630.

[9] Chandan Kumar, Manish Bafna, Ashish Nayyar, VedParkash, Nitin Goyal, "Experimental Investigation of the Performance of VCR Diesel Engine Fuelled by NM-Diesel blend",International Journal of Emerging Technology and Advanced Engineering,Volume 4, Issue 8, August 2014

[10] Dacker L. (2013, May). removal-of-petroleum-subsidies.html. The Daily Graphic .Retrieved from http://graphic.com.gh/General-News/npa-calls-for-industry.

[11] Defee, E. and Fugate, J. (2010) .Changing perspective of capabilities in the dynamic supply chain era, The International Journal of Logistics Management, Vol.21, No.2, pp 180-206.

[12] Delai, I., & Takahashi, S. (2013). Corporate sustainability in emerging markets: insights from the practices reported by the Brazilian retailers. Journalof Cleaner Production, 47 pp 211- 221.

[13] Fugate, B., Mentzer, T. and Stank, T. (2010), "Logistics performance: efficiency, effectiveness and differentiation", Journal of Business Logistics, Vol. 31 No. 1, pp.43-62.

[14] Giovanni, P.D., & Vinzi , V.E. (2012). Covariance versus component-based estimations performance in green supply chain management. International Journal of Production Economics, 135(2), 907-916.

[15] Johnson, B. & Christensen, L. (2012), Educational Research: Quantitative, Qualitative and Mixed Approach (4th ed.). California: SAGE Publications Ltd.

[16] Kimani, C. W. (2013). Supply Chain Management Challenges in Kenya Petroleum Industry: Case of National Oil Corporation of Kenya, International Journal of Social Sciences and Entrepreneurship , 1 (3), 231-246.

[17] Kojima, Masami 2009. "The Role of Liquefied Petroleum Gas in Reducing Energy Poverty " Extractive Industries and Development Series #25. Washington DC: World Bank. http://siteresources.worldbank.org/INTOGMC/Resources/LPGReportWeb-Masami 1.pdf.

[18] Kojima, Masami 2012. "Oil price risks and/ pump price adjustments." World Bank Policy Research Working Paper No. 6227. _http://go.worldbank.org/SIM8QA2VI0_Korkmaz, Selcuk. "Package 'royston'" (PDF). Cran.r-project.org. Retrieved 26 February 2014.

[19] Kothari,C.R (2011). Research Methodology. Methods and Techniques. New Delhi: New Age International Publishers. (2nd Edition).

[20] Lin, R.J. (2013). Using fuzzy DEMATEL to evaluate the green supply chain management practices. Journal of Cleaner Production, 40, 32-39.

[21] Lin, R.J., & Sheu, C. (2012). Why Do Firms Adopt/Implement Green Practices? An Institutiona Int. J Sup. Chain. Mgt Vol. 3, No. 4, December 2014 62 Theory Perspective. Procedia - Social and behavioral Sciences, 57, 533-540.

[22] Liu, S., Kasturiratne, D., & Moizer, J. (2012). A huband-spoke model for multi-dimensional Integration of green marketing and sustainable supply chain management. Industrial Marketing Management,41(4), 581-588.

[23] Lun, Y.H.V., (2011). Green management practices and firm performance: A case of container terminal operations. Resources, Conservation and Recycling,55(6), 559-566.

[24] Luthra, S., Garg, D. and Haleem, A. (2013) Identifying and ranking of strategies to implement green supply chain management in Indian manufacturing industry using Analytical Hierarchy Process. Journal of Industrial Engineering and Management, Vol. 6 No. 4, pp. 930-962.

[25] M. Zhang and B. Huo, "The impact of dependence and trust on supply chain. International Journal of Physical Distribution & Logistics Management, vol. 43, pp. 544-563, 2013.

[26] Maheshwarkar, M. and Sohani, N. (2013) Combined AHP-TOPSIS Based Approach for the Evaluation of Knowledge Sharing Capabilities of Supply Chain Partners. Management Science and Engineering Vol. 7, No. 3, 2013, pp. 27-32.

[27] Meyer,D.K.(2010). Research Methodology. Presentation of data collection Analysis. Auckland, New Zealand:Viking.

[28] Mirhedayatian, S.M., Azadi, M., & Saen, R.F.(2013). A novel network data envelopment analysis model for evaluating green supply chain management. International Journal of roductionEconomics.

[29] Mojtaba Saei Moghaddam and Abdolsamad Zarringhalam Moghaddam, "Performance and exhaust emission characteristics of a CI engine fueled with diesel-nitrogenated additives", chemical engineering research and design, 2014.pp 23-35.

[30] Moore, G.A., (2005), "Strategy and your Stronger Hand", Harvard Business Review.

[31] Mugenda,O.M. and Mugenda, A,G. (2003).Research Methodology: Quantitative s and Qualitative Approaches, Nairobi, Kenya-Acts Press.

[32] Muhammad Jiyad Shaikh "IT Revolutionizing the Supply chain Transformation: A Case Stud of Unilever Pakistan Ltd." The International Journal of Supply Chain Management Vol.2 No. 1, 2013 N. Nordin, "Malaysia: Investment performance January-June 2013" ed:

[33] Nasarullah. M and Raja Gopal. K, "Effect of Ethanol and Tetra Nitro Methane on Performance and Emission Characteristics of CI Engine Fuelled With Methyl Ester of Jatropha",International Journal of Emerging Engineering Research and Technology Volume 2, Issue 3, June 2014, PP 31-39.

[34] Olugu, E.U., & Wong, K.Y. (2012). An expert fuzzy rule-based system for closed-loop supply chain performance assessment in the automotive industry. Expert Systems with Applications, 39(1), 375-384.

[35] Petro China Annual Report. 2013. Available: http://www.petrochina.com.cn/ptr/ndbg/201404/0450f7c3638145e 08676036317ab4e97/files/40615da8916144309bc9f4960ba35739.pdf Accessed: 15.03.2015.

[36] S.Saad, Z. M. Udin, and N. Hasnan, "Dynamic supply chain management in oil and gas industry.," in 3rd Asia-Pacific Business Research Conference, Kuala Lumpur, Malaysia, 2013.

[37] Sakhuja, S., & Jain, V. (2012). Service Supply Chain: An Integrated Conceptual Framework.CIE42 Proceedings. 216 207.

[38] Sharma, A., Iyer, G.R., Mehrotra, A., & Krishnan, R. (2010). Sustainability and business-to- business marketing: A framework and implications. Industrial Marketing Management, 39(2),330-341.

[39] Sharma, R.; Bhandari, R. (11 Sep 2013). "Skewness, kurtosis and Newton's inequality". Arxiv.arXiv:1309.2896.

[40] Shatina S., Zulkifli M., U., Norlena H., "Dynamic Supply Chain capabilities: A case Study in Oil and Gas Industry" The International Journal of Supply Chain Management Vol.3 No.2,2014. Shopping the Cloud: Performance. Benchmarks,"http://gevaperry.typepad. com/main /2010/08 /shopping -the-cloud- performance-benchmarks.html, 11-08-2010.

[41] Schrettle, S., Hinz, A., Rathje, M.S., Friedli, T.(2013). Turning sustainability into action: Explaining firms' sustainability efforts and their impact on firm performance International Journal of Production Economics.

[42] Sople, V.V. (2012). Supply Chain Management: Text and Cases. New Delhi: Dorling Kindersle (India) Pvt. Ltd, Licensees of Pearson education in South Asia.

[43] Styles, D., Schoenberger, H., & Galvez-Martos, J.L.(2012). Environmental improvement of product supply chains: A review of European retailers' performance. Resources,Conservation and Recycling, 65, 57-78.

[44] Taylor, E. (n.d.).Differences in Supply Chain Designs for a Manufacturing Industry vs. a Service Industry Demand Media. Retrieved June 26, 2014 from http://smallbusiness. chron.com/differences-upply chain-designs-manufacturing in industry- vs- service-industry- 14610.htm MHI,"Material Handling Student Design Competition." CICHME 01 October 2013 http://www.mhi.org/cicmhe / competition, 06-30-2014.

[45] Testa, F., & Iraldo, F. (2010). Shadows and lights of GSCM (Green Supply Chain management) :determinants and effects of these practices based on a multi-national study. Journal of Cleaner Production, 18(10–11), 953-962.The Federation of America Societies for Experimental Biology, "Individual Development Plan for Postdoctoral Fellows, "http://www.faseb.org/,07-10-2014.

[46] Trochim, William M. K. (2006). "Descriptive statistics". Research Methods Knowledge Base. Retrieved 14 March 2011.

[47] Tseng, M.L., & Chiu, A.S.F. (2013). Evaluating firm's green supply chain management in linguistic preferences. Journal of Cleaner Production, 40, 22-31.

[48] United States. U.S. Energy Information Administration (U.S.EIA). OPEC Countries. Washington: Frequently Asked Questions, 2012.

[49] World Bank (2012b). "Food Price Watch August 2012. http://siteresources.worldbank.org/_ XTPOVERTY/ Resources/336991-311966520397.

[50] Y. Hou, Y. Xiong, X. Wang, and X. Liang, "The effects of a trust mechanism on a dynamic supply chain network," Expert Systems with Applications, vol. 41, pp. 3060-3068, 5// 2014

[51] Yang, C.S., Lu, C.S., Haider, J.J., & Marlow, P.B. (2013). The effect of green supply chain management on green performance and firm competitiveness in the context of container shipping in Taiwan. Transportation Research Part E: Logistics and Transportation Review, 55, 55-73.

[52] Zhu, Q., Sarkis, J., & Lai, K.H. (2013). Institutional based antecedents and performance outcomes of internal and external green supply chain management practices. Journal of Purchasing and Supply Management, 19(2), 106-117.

[53] Zhu, Q., Sarkis, J., & Lai, H.K. (2012). Green supply chain management innovation diffusion and its relationship to organizational improvement: An ecological modernization perspective. Journal of Engineering and Technology Management, 29(1), 168-18 e. Journal of Engineering and Technology Management, 29(1), 168-18.

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Management Information Systems for Supporting Educational Organizations: A Case Study through One Private University in Malaysia

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Abstract- Management Information System (MIS) is becoming one of the most important assets for an organization competing in the 21st century global economy. The MIS in a university includes important institutional activities such as relational database, applications for managing admissions, registration, financial aid, managing human resources, and for budgeting the fiscal controls. The university's ability to customize its MIS is critical to institutional competitiveness. The selected organization for this paper is a private university that offers online distance education for matured students at both undergraduate and postgraduate levels. The author obtained information about the MIS functions by analyzing written documents and a brief interview with the senior systems engineer and two students. The discussion of the paper includes: (a) the profile and structure of the organization, (b) management of the information system, (c) the IT structure and its effectiveness, (d) the information system required and its effective deployment.

Index Terms- Management Information System, MIS, Information Technology, IT, Institution of Higher Learning

I. INTRODUCTION

Education contributes to the advancement of society by providing individuals with the skills and knowledge to improve their capacity for productivity. Research studies support education as the key factor for sustainable growth of a nation [1], [2], [3]. However, maximizing student learning in an educational setting remains the main challenge for most institutions of higher learning [4], [5]. Management and monitoring of the learning system require frequent gathering of information and data for effective educational decision making [6].

PJU is the organization selected to identify and analyze how its management information system is developed to attain the goal of increased access, efficiency and effectiveness of quality education provided to adult learners through a blended pedagogy. The framework of the MIS in PJU is to collect, store, integrate, process and organize data for the task of decision making in the areas of resource allocation, budget planning, and policy analysis. A description of PJU as a distance education institution is discussed as follows: (a) a discussion of the organization, and (b) findings related to the management information system (MIS) of the organization.

Profile of Organization

The PJU is a local private university established in August 2001 by a consortium of local public universities. PJU was subsequently registered in May 2001 and launched in August 2002 as the premier university that provides education for the adult working population. The main aim of the university is to: (a) provide life-long learning to learners of all age groups focusing on matured students, (b) facilitate learning through a blended pedagogy of on-line learning and face-to-face interactions, (c) provide educational opportunities for learners who wish to enhance their knowledge and skills for career advancement or personal satisfaction, and (d) enable learners to set their own learning goals and learn at their own pace in their chosen environment.

Currently PJU has 5 faculties namely the Faculty of Applied Social Science, Faculty of Education and Languages, Faculty of Information Technology and Multimedia Communication, Faculty of Nursing and Allied Health Sciences and the PJU Business School. The university is also supported by 7 support centers namely the Center for Instructional Design and Technology, Center for Student Management, Learner Service Center, Institute for Teaching and Learning Advancement, Institute for Professional Development, Institute of Quality, Research and Innovation, Digital Library, and the International College. A total of 57,138 students have graduated from PJU from 2002-2015. This university has won the national Industry Excellence Award in 2014 and the international Award of Excellence for Institutional Achievement in Distance Education in 2010 from the Commonwealth of Learning.

Structure of the Organization

PJU was initially set up by a consortium of 11 public universities in 2001. The university is governed by a Board of Directors responsible for policy decisions and budget allocation. The management of PJU is the responsibility of the President, an Emeritus

Professor in Economics, who oversees the effective and efficient functioning of all departments. Next in line is the Senior Vice President (SVP), a Professor in Engineering, who oversees all faculties, the e-learning center, and all learning centers outside the main campus in Kuala Lumpur. The SVP works with the Vice President of Campus Development, a Professor in Engineering who is responsible for developing the infrastructure of PJU such as opening new learning centers and maintaining security.
In addition, the SVP is also supported by the Vice President of Corporate Planning and Financial Services who is responsible for budgetary matters, staffing and educational program planning. The position of the Senior General Manager for Learner Experience is equivalent to the registrar of most universities and the Senior General Manager for Group Business Development and Technology takes care of the technological needs of the university. The detailed structure of PJU is provided in Figure 1 below:

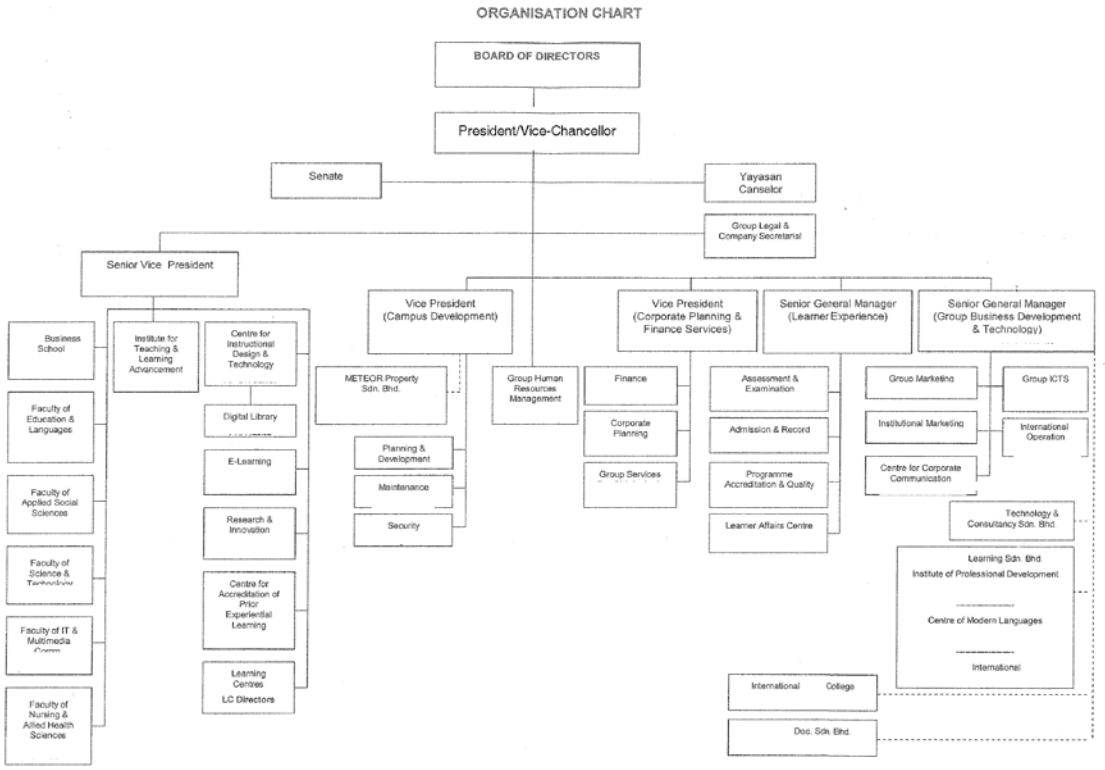

Figure 1: Structure of PJU

II. EDUCATION, MANAGEMENT, BUSINESS PROCESSES, PRODUCTS AND SERVICES

PJU as an institution of higher education is devoted to providing excellent and quality education to both local and international students. The university strives to provide educational programs that serve the needs of a diverse population of students. Both the undergraduate and postgraduate programs are approved by the Malaysian Qualifying Agency (MQA) and offered at the main campus and the 62 learning centers spread around the country.
Table 1 illustrates the progress of PJU from 2001 to 2015. The details indicate the tremendous progress achieved by the university in the last 15 years. The student population has increased along with the introduction of new faculties and learning centers. The popularity of PJU is attributed to the following factors: (a) weekend tutorials for students who are employed full-time, (b) experienced and knowledgeable teaching staff, (c) a flexible blended learning mode which combines on-line learning with classroom face-to-face interaction, and (d) its reasonable course fees which is payable on an installment basis.

Table 1: Student Enrollment (2001-2015)

Statistics	August 2001	January 2015
Cumulative Intake	753	143,727 Undergraduates: 133,747 Postgraduates: 9,980
Programs	4	52

Modules	29	1,463 (Tutorial and Lecture Modules)
Learning Centers	2	33 (Local Centers) 10 (International Centers)
Staff	87	579
Tutors (Part Time)		11,352 (Active in Data Base) 2,566 (Active per Semester)

PJU offers courses at the diploma, bachelors, master and doctoral levels in various fields and specialization. Diploma courses are offered for 1 year, bachelors from 3 to 4 years, masters for 2 years and the doctorate from 4 to 8 years. Table 2 illustrates the programs available at PJU.

Table 2: List of Courses at PJU

Level	Courses
Diploma	Management
	Human Resource Management
	Information Technology
	Early Childhood Education
	Islamic Studies with Education
	Advanced Diploma in Teaching Methodology
Bachelor	Management
	Business Administration
	Human Resource Management
	Accounting
	Marketing
	Information Technology
	Information Technology and Network Computing
	Information Technology and Management
	Computer Science
	Education (Educational Administration)
	Education (TESL)
	English Studies
	Early Childhood Education
	Technology Management Tourism Management

	Manufacturing Management
	Occupational Health and Safety Management
	Islamic Studies (Islamic Management)
	Psychology
	Communication
	Political Science
	Nursing
	Science in Project and Family Management
	Malay Studies
Post Graduate Diploma	Post Graduate Diploma in Teaching
Masters	Management
	Business Administration
	Human Resource Management
	Information Technology
	Education
	Instructional Design and Technology
	Project Management
	Nursing
	Islamic Studies
	English Studies
	Occupational Safety and Health Risk Management
	Counseling
Doctorate	Business Administration
	Education
	Nursing
Doctor of Philosophy	Business Administration
	Information Technology
	Education
	Science Engineering

The courses listed in Table 2 are all offered on a part-time basis on weekends. Tutorials in classroom are provided on Saturdays and Sundays for 5 meetings per semester. Tutorials are not compulsory but students located in nearby learning centers are encouraged to attend. Students who are unable to travel can fulfill the requirements of the courses through a fully on-line learning mode. Courses are either assignment-based or exam-based depending on the course structure and requirements.

The staff members in PJU are either academics or administrators. However, many academics are also administrators responsible for the coordination of specific programs. The number of staff members has also increased as new programs are introduced into the university. Table 3 illustrates the full time staff population of PJU as of January 2015. The table does not include 3,300 part-time tutors who support the university by teaching courses and marking examination scripts.

Table 3: List of Staff Members in PJU

Level	Number
Top Management	8
Academic	120
Administration	451
Total	579

Both local and international students are enrolled in PJU. The highest international student population is located in the university's learning center in Maldives and the smallest number in Zambia. The most demanded courses among international students are for teacher training and business management. Table 4 illustrates the student enrollment in international learning centers as per January 2015.

Table 4: International Student Enrollment

Country	Student Population
Maldives	3,088
Vietnam	1,323
Yemen	1,299
Ghana	1,184
Bahrain	854
Sri Lanka	299
Somalia	268
Zambia	36

The highest number of students enrolled in PJU is at the bachelor's degree level. Most of the students are currently employed and require a tertiary education for career enhancement and promotional prospects. A unique aspect of PJU is that its own staff is also enrolled as students in various programs for free. Table 5 illustrates the student enrollment in local learning centers according to programs as per January 2015.

Table 5: Local Student Enrollment

Level	Student Population
Diploma	2,781
Bachelor	34,375

Masters	3,7770
PhD	344
Total	49,652

III. MANAGEMENT INFORMATION SYSTEM IN PJU

Information systems are essential for every organization to access its information. Management Information System (MIS) has been developed as a system which provides information support for decision making in the organization. MIS is a system based on the database of the organization evolved for the purpose of providing information to the people in the organization [7]. The selection of PJU as a premier organization for tertiary education is based on its unique experiences in providing non-traditional on-line programs to promote educational opportunities for adult learners. The purpose of this section is to study and analyze the management information system (MIS) associated with PJU as an institution of higher learning based on the following aspects: (a) identifying PJU's IT infrastructure and information systems and the business processes performed, (b) appraising the effectiveness of PJU's information system and how it improves business performance, (c) other information systems required by PJU to improve its current situation, and (d) complementary assets that support the successful deployment of PJU's information systems.

Methodology

In order to study, analyze, and report the findings concerning the MIS of PJU, a semi-structure interview was used in addition to data and information collected from readings about the organization. Participant A is the Senior Systems Engineer who provided the details and functions of the MIS, Participant B is an undergraduate student in Business Management and Participant C is a Masters student in Education, both of whom responded to questions related to the effectiveness of the information technology services at the university. The 2 student participants for this semi-structured interview were purposefully selected from non-traditional students completing their on-line degree program at PJU. As on-line degree seekers, they were fully aware of the technological requirements and commitment needed to complete the degree successfully. The 2 students were considered non-traditional as they were employed full-time, and they selected the on-line degree programs due to their work and family commitments. Participant B is male and participant C is female. The interview was to assess the participants' general education experiences in the on-line program.

IT Infrastructure and Information Systems

The MIS in PJU is a set of formalized and integrated operational processes and procedures by which information such as graduate and post graduate programs, learning facilities, student evaluation, policy changes and staff recruitment are regularly shared, integrated, analyzed and disseminated for educational decision making at each level of the organization's hierarchy. The university's MIS attempts to perpetuate an institutional culture that advocates the use of data and information for organizational sustainability. The 3 key successes of the MIS is dependent on: (a) timely and reliable production of data and information, (b) data integration and data sharing among the various departments, and (c) the effective use of data and information for educational policy decisions.

The timely and reliable production of data and information must meet the needs of the producers, users and clients. In addition, both must also meet the needs of the educational planning and services, budgetary requirements, policy research and international collaboration. Collaborative effort at all administrative and managerial levels is required for timeliness of meeting the needs and disposing obsolete data to increase trust in the organization. Data and information produced must be reliable and reflects the current status of the organization and future trends for meaningful change. The database application in the MIS is carefully designed to ensure the users' confidence and trust in the data. According to participant A, challenges do exist with the university's MIS:

We constantly upgrade our system to save money and time but at times minor problems appear like disruptive hacking, e-mail spam….. but to me that's just nuisance activities. I am more concern with vulnerable information that can be fabricated.

Data integration and sharing in all departments is the most important component of the MIS. Data from different departments such as human resources, faculties, the learning centers, IT support services and research development can be linked, integrated or merged for the purpose of educational planning or analysis. Large data can be collected to describe the elements of each department for example the payroll, supply of modules and textbooks, examination evaluation and student enrollment. A coordinated MIS facilitates answering important questions for educational planning and policy for example how the resource allocation facilitates student learning, what programs are demanded by international students, and what educational project increase student achievement. The impact of multilevel data which is integrated and organized lies in its value for educational policy research and management [3].

The effective use of data and information contributes to effective making of policy decisions [8], [9]. The university's users of data and information are the stakeholders who as policy makers and policy analysts create an institutional culture of constantly improving the organization's productivity and business benefits. The MIS on its own does not bring about organizational change unless the organization itself has a culture of using data and information for organizational change there [10], [2], [6]. MIS helps to manage data in a more effective and consistent manner for a useful policy-oriented analysis, planning and monitoring of PJU.

Effectiveness of the Information Systems

In the early stages of its development, PJU faced challenges related to the implementation of the MIS. Among the "teething" problems were: (a) low motivation among staff to use computer data applications, (b) lack of data integration and quantitative analysis skills, (c) lack of system and program monitoring and evaluation, (c) lack of policy research and analysis, (d) lack of optimal way to allocate resources, and (e) decisions made that lack data evidence. Fortunately as PJU continues to expand its local and international borders, the IT challenges were identified and resolved. Today the MIS uses Google as its IT support and reliable and timely data are now available through computer technology and office network connectivity for policy decisions.

Timely and reliable data are especially critical for the students as part users of the MIS. Participant B relates his experience when he was first admitted to PJU:

I was overwhelmed by the tasks at hand. I felt isolated without a learning community. But in a way, I was lucky. The MyVLE has forum discussions so I can communicate with friends even though I don't see them. The learning materials are also available for revision before exams. I like the flexibility of learning at my own rate.

PJU today, has a culture of communication and information sharing which are steps in the direction of information thinking. This gradual paradigm shift in realizing the importance of data and information is brought about by training PJU staff to see the interrelationships of their interactions within the university. This paradigm shift increases the staff understanding of the value of communication and the free flow of information between departments as parts of the organization rather than seeing the department as an isolated unit of the organization. The MIS of PJU is now a shared vision attributed to the effort of the Vice Chancellor who is a strong leader and manager who is able to identify individual visions of the staff and embrace them as a shared vision of the organization.

It is essential for the staff to be able to communicate information to students with the flexible access to the information on the MIS. Participant C spoke about her relationship with the staff:

I find my tutors helpful. They reply to all my e-mails rather quickly. My supervisor is in constant communication with me. I feel so lonely when doing my research but the frequent communication with my supervisor helps a lot. I am able to do good work…plus access to the digital library was great.

IV. INFORMATION SYSTEMS REQUIRED

The MIS is the campus core management system. The purpose of the MIS is to inform the stakeholders about the state of the organizational efficiency, the performance of the organization, the shortcomings and the future needs. MIS provides the raw statistical data but the stakeholders need to interpret the data into meaningful and comprehensible information on which to base their policy decisions. Participant A agrees that the present MIS needs improvement:

The present system must be upgraded…both hardware and computer applications. Need to enhance access to any device, faster speed and target user experience….like the apps. Example a higher bandwidth for e-mail…

An enhanced MIS required will be an effective system that has the capacity to create a strong demand for using MIS data and information specifically for budgeting, planning, monitoring, evaluating as well as for policy research, analysis and formulation (Moore, 2014). The MIS must accomplish the following functions in a timely and reliable manner: (a) define, collect, and process educational data and statistics, (b) systematically store and retrieve relevant data when required, (c) produce report and statistics for all education information users, and (d) respond and support activities for analysis, budgeting, enrolment, and monitoring educational effectiveness. As commented by participant A:

We are in the business of providing education. So our system must be able to provide data and information on demand without using too much time. We are rapidly expanding so our system must expand in accordance to our needs….otherwise we are no longer competitive with the other private universities out there.

V. SUCCESSFUL DEPLOYMENT OF INFORMATION SYSTEMS

According to participant A, the successful deployment of the MIS is due to three factors of accountability, budget and staffing. Accountability was established by creating an MIS structure that clearly defined the responsibilities and policies of each department such as the level of data to be collected, shared and disseminated at specific managerial level. Accountability is important when there is a demand for PJU's products and services. Internal accountability is established by work-related procedures and policies and external accountability by marketing the information and departmental collaboration. Participant A emphasized the fact that:

We have so much data to handle but our MIS is efficient but we also need efficient staff to be responsible. MIS is just technology, we need to trust our staff to decide what data they can use, share and transfer to other people.

The MIS of PJU is funded by the consortium of public universities at the initial stage of its development. Currently, the university is self-supportive and able to sustain the MIS as part of its annual budget. The budget also includes on-going training for its staff and maintenance services. The MIS is now secured in its role in the management of the education system of the university.

The university's MIS is successful largely due to the qualified and willing staff members. Participant A highlighted the following:

Our university makes sure that the staff members we select stay with us. If we train them, then they leave, it is a waste for us. You know it is not easy to get qualified staff.

Qualified and skilled staff is employed to manage the MIS and most of them extend their services beyond 5 years due to the appeal of the employment benefits for technical staff at PJU. The attractive salary package is able to decrease the possibility of staff turn-over for a higher salary elsewhere. Many IT positions in PJU are considered "cutting-edge" and their roles and responsibilities put them on a career path with future prospects for promotion. Staff attrition in the past especially after training has been an immediate concern with PJU especially when considering its long term organizational needs. Staff motivation is now enhanced by incentive programs such as overtime work, professional training, study benefits and subsidized overseas trips.

The MIS of PJU need to be secure in terms of confidentiality, integrity, and availability of the information. As the number of student increases, in both undergraduate and graduate programs, maintainability of the university's MIS becomes critical for its business continuity. Participant A indicated the solution as follows:

Information security is our magical solution so we have a security audit of the system. We develop, define and prioritize the risks faced by our MIS. Our security management system is developed to assess the vulnerability of our system and securing our information becomes our top priority.
and understand all the provided review comments thoroughly. Now make the required amendments in your paper. If you are not confident about any review comment, then don't forget to get clarity about that comment. And in some cases there could be chances where your paper receives number of critical remarks. In that cases don't get disheartened and try to improvise the maximum.

VI. CONCLUSION

The development of MIS in any institution of higher learning is important for a modern management of the education systems. Computer applications, technology and the data base assist in data and information gathering, use and dissemination [11], [12]. However, the creation of an efficient and effective MIS requires a clear vision of what products to use and which departments to be involved [13]. The development of MIS is not limited to creating a data and information system but more importantly, the development of a new management culture of information sharing [1], [14], [15]. As seen from the case study of PJU, policy decisions are related to business profits for the organization. Policy decisions reflect on the success of the business enterprise and its capacity to expand its operations. As a parting comment, the organization's investment in MIS must be coupled with a clear sense of a business strategy [16].

REFERENCES

[1] Boling, E. C., Hough, M., Krinsky, H., Saleem, H., & Steven, M., "Cutting the Distance in Distance Education: Perspectives on What Promotes Positive, Online Learning Experiences", The Internet and Higher Education, vol. 15, no. 2, 2012, pp. 118-126.

[2] Katane, I., Kristovska, I., & Katans, E., "Evaluation of Distance Education Environmental Advantages", Engineering for Rural Development, no. 20, 2015, pp. 720-728.

[3] Thompson, N.L., Miller, N.C., & Franz, D.P., "Comparing Online and Face-to-face Learning Experiences for Nontraditional Students: A Case Study of Three Online Teacher Education Candidates", The Quarterly Review of Distance Education, vol. 14, no. 4, 2013, pp. 233-251.

[4] Moore, R. L., "Importance of Developing Community in Distance Education Courses", TechTrends, vol. 58, no. 2, 2014, pp. 20-24.

[5] Sagitova, G. K., "Management information system for higher educational institutions during Kazakhstan transition to knowledge economy", World Applied Sciences Journal, no. 18, 2012, pp. 55-60.

[6] Kim, J. M., Park, K. N., & Kim, Y., "Diversity and Satisfaction: Analysis of Learners' Satisfaction According to the Online Learning Interaction", International Journal of Applied Enginering Research, vol. 9, no. 2, 2014, pp. 9157-9166.

[7] Sukru, A., & Ghaffarzadeh, M., "Decision Making Based on Management Information System and Decision Support System", European Researcher, vol. 93, no. 4, 2015, pp. 260-269.

[8] Gorr, W., & Hossler, D., "Why All the Fuss About Information Systems? Or Information Systems as Golden Anchors in Higher Education", New Directions for Higher Education, no. 136, 2006, pp. 7-20.

[9] Itradat, A., Sultan, S., Al-Junaidi, M, Qaffaf, R., Mashal, F., & Daas, F., "Developing an ISO27001 Information Security Management System for an Educational Institute: Hashemite University as a Case Study", Jordan Journal of Mechanical and Industrial Engineering, vol. 8, no. 2, 2014, pp. 102-118.

[10] Chiero, R., & Beare, P., "An Evaluation of Online Versus Campus-based teacher Preparation Programs", Journal of Online Learing and Teaching, vol. 6, no. 4, 2010, pp. 780-790.

[11] Chen, B., "Barriers to Adoption of Technology-mediated Distance Education in Higher Education Institutions", vol. 10, no. 4, 2009, pp. 333-338.

[12] Chen, B., Voorhees, D., & Rein, D.W., "Improving Professional Development for Teaching Online", Journal of Computer Information Systems, vol. 2, no. 1, 2006, pp. 303-308.

[13] Bol, L., & Garner, J.K., "Challenges in Supporting Self-regulation in Distance Education Environment", Journal of Computing in Higher Education, vol. 23, no. 2-3, 2011, pp. 104-123.

[14] Borden, V.M.H., Calderon, A., Fourie, N.,Lepori, B, & Bonaccorsi, A., "Challenges in Developing Data Collection Systems in a Rapidly Evolving Higher Education Environment", New Directions for Institutional Research, no. 157, 2013, pp. 39-57.

[15] Taft, S. H., Perkowski, T., & Martin, L. S., "A Framework for Evaluating Class Size in Online Education", The Quarterly Review of Distance Education, vol. 12. no. 3, 2013, pp. 181-187.

[16] Perez-Mendez, J.A., & Machado-Cabezaas, A., "Relationship between Management Information Systems and Corporate Performance", Spanish Accounting Review, vol. 18, no. 1, 2015, pp. 32-43.

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Profile of Disability in Children with Leprosy

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Abstract- Inspite of taking complete Multidrug treatment some patients with leprosy are left with disability and deformities. They remain reminders of disease leading to social discrimination , economical constraints and loss of confidence among patients . Recent increase in number of cases of leprosy with disability at our tertiary care centre especially in children encouraged us to undertake a descriptive study for the last 5 years. Records were analysed to describe the clinical pattern of disability in children with leprosy pertaining to the period 2010 to 2014.

Objective : To find out prevalence of disability in children (below 15 years of age) with leprosy registered at Department of skin during the period 2010 to 2014.

Results :- Amongst 664 new cases of leprosy registered between the period 2010 to 2014 , total 86 were found to be children between 0-15 years of age (13.1%). The number of newly detected children with leprosy increased from 7 cases (8%) in the year 2010 to 29 cases (34%) in the year 2014. Majority of patients belonged to 10-15 years of age group (59%), with a male preponderance. PB cases were significantly more (71 %) than cases of MB (29%). Borderline tuberculoid leprosy was the commonest type seen (77%). Grade 1 and grade 2 deformity were observed in 8% and 6% of cases respectively.

Conclusion : . Significant rise in number of children with leprosy was noted in our Hospital during last 2 to 3 years. Early case detection ,and thorough neurological examination is needed to decrease the chance of developing disability

Index Terms- Children **,** Disability, Deformity, Leprosy, Tertiary Care Centre.

I. INTRODUCTION

India accounts for 55% of new leprosy cases detected globally. Global figures for 2011-12 show 21,349 new child cases with 76.5% of these residing in south East Asia region [1]. The prevalence of childhood leprosy in highly endemic zones of world varies from 0.012 in Argentina to 41.6 in Micronesia [2]. In India the proportion of new childhood cases reduced from 13,387(9.6%) in 2012-2013 [3] to 12043 (9.4%) in the year 2013-2014 [4].Ten states in India have child proportion of over 10% while in Daman & Diu it was 30 % . Occurrence of childhood leprosy in urban clinics and tertiary care hospitals varied from 5.1 – 11.4%[5] .The figure dropped to 7 - 9% in studies done at tertiary centres between 1995 to 2003[3] . At National level percentage of new childhood cases from year 2005 to 2012 remained unchanged (9.4% to 10.4%) . Contrary to the expectation number of childhood leprosy in Maharashtra were higher (13.04%) during the year 2011-2012 with prevalence of 1.07 and 12.7% during year 2012-2013 [6] **.** Leprosy is one of the foremost causes of disability and crippling deformities. Deformities may occur due to disease process (like loss of eye brows, facial deformities) or due to loss of motor functions (Clawing of hand, foot drop, lagopthalmos) or those resulting from injuries (like ulcers , resorption of fingers , fracture of bones and corneal ulcers). Prevalence rate of disability in leprosy patients varies between 16 to 56%. Timely diagnosis of Grade I disability is of great importance for disability elimination. In 2009 WHO launched enhanced Global strategy for further reducing the disease burden due to leprosy for 2011-2015 (reduction of new case of Leprosy with Grade 2 disability per lakh by 35% at the end of 2015) . Disability prevention can be achieved by active collaboration between health care professionals , patients and their family .Only then the goal of prevention of disability in leprosy patients can be realized .In the light of seriousness of the problem, this study has been undertaken at this tertiary care centre during the period between 2010-2014 with objective of studying proportion of disability among childhood leprosy patients and epidemiological factors associated with it.

MATERIAL AND METHODS :

The present study was a observational non analytical study of new patients who were diagnosed as having leprosy during the period from 2010 to 2014 and who had not taken any anti-leprotic treatment in the past. Before data collection permission was obtained from administrative authority of this tertiary care centre. Cases of leprosy up to 15 years of age who presented in the in the department of Dermatology during the period 2010-2014 were included in this study. Demographic data were noted from records. Clinical presentation including number of patches, presence of sensations, nerve involvement, presence of reaction and deformities were noted. Cases were classified as Multibacillary (MB), Paucibacillary (PB). The data recorded was coded and analyzed. Mean and standard deviation was used for quantitative data. Data regarding type of disability , socio-demographic variables like age , sex , education was recorded. For disability classification WHO 3 point scale in 1998 was followed for hands and feet.

WHO disability grading 1998

Hands and feet

Grade 0 : No anaesthesia , no visible deformity or damage.

Grade 1 : Anaesthesia present but no visible deformity or damage .

Grade 2 : Visible deformity or damage present.

RESULTS:

During the period from 2010 to 2014 it was noticed that total 664 new cases of leprosy were diagnosed as having leprosy . Out of these 162 cases (24 %) were found to be having disability. 106 (65.43 %) were males and 56 (34.56 %) were females. 86 patients were found to be children below 15 years of age (13.1%). Mean age of presentation was 11.11 with SD 3.09. Out of 86 cases seen in last 5 years , 7 cases (8%) were seen in year 2010, 13 cases(15%) were seen in year 2011, 14 cases (16%) were seen in year 2012, 23 cases (27%) were seen in year 2013, 29 cases (34%) were seen in year 2014. ***(Table 1)*** The majority of patients belonged to 10-15 age group (59%), with a male preponderance M: F = (1.5:1) . 60 out of 80 cases had less than 5 patches and ten out of 60 cases had single lesion. 24 cases had more than 5 patches. (Table 2). Borderline tuberculoid leprosy (77%) was the commonest type followed by tuberculoid leprosy 7%, Borderline Borderline (6%), indeterminate leprosy (3.5%), 2.3% pure neuritis and Borderline Lepromatous 5%, Nerve thickening single or multiple was seen in 17 cases (20%).(Table 3)

Out of total 86 cases of childhood leprosy, 61 cases (71%) were of PB type whereas 25 cases (29%) were MB. Mean age of presentation for PB cases was 10.60 with SD 3.08. Mean age for MB cases was 12.36 with SD 3.04. Seven cases (8%) showed grade 1 deformity and five cases (6%) showed grade 2 deformity. ***(Table 2)*** Eleven patients had deformity of upper extremity and only one patient showed deformity of lower extremity. It was noticed that out of 25 MB cases deformity was seen in 32 %, whereas out of 61 PB cases the deformity was seen in 6.5 % of cases. ***(Table 3)*** This difference was found to be statistically significant . None of the children had deformity on the face. Lagopthalmous and severe visual impairment was not seen in any of our cases . Type I Lepra reaction was observed in 6 cases. 95% children had BCG scar .18 cases (21%) gave a definite history of contact out of which (12 cases) 70% were intrafamilial.

Table 1 : Year wise Leprosy cases by age group, gender and clinical classification.

Variable	Year wise distribution					Total
	2010	2011	2012	2013	2014	
Total Cases of leprosy	74	89	113	192	196	664
Age group (childhood cases) in years						
0-5 years	1	1	0	1	2	5
6-10 years	2	2	7	10	9	30
11-15 years	4	10	7	12	18	51
Total	7	13	14	23	29	86
Gender (childhood cases)						
Male	4	5	8	13	18	48
Female	3	8	6	10	11	38
Total	7	13	14	23	29	86

Table 2 : Leprosy cases by age group, Type of Leprosy and deformity according to WHO classification

Variable	Age groups			
	0-5	6-10	11-15	Total
Type				
PB	5	23	33	61
MB	0	7	18	25
Deformity				
Grade 0	5	25	44	74
Grade 1	0	4	3	7
Grade 2	0	1	4	5

Table 3 : Presence of Deformity according to Type of Leprosy

Deformity	PB	%	MB	%
Deformity not seen	57	93.5	17	68
Deformity seen	04	6.5	08	32
Total	61	71	25	29

Yates corrected Chi square = 7.55 , d f = 1, $p<0.05$

DISCUSSION:

The disease profile in children with disabilities can be evaluated either with community surveys, school surveys or hospital based case studies. Various studies have been done in different age groups ranging from 0 to 18 years of age. Present study is a descriptive non - analytical study of childhood cases belonging to age group 0-15 years in a tertiary care centre in Maharashtra. Childhood leprosy accounts for 13.1% of all leprosy patients attending our centre in last 5 years, which is more as compared to other studies. Various studies have demonstrated the prevalence of 7 to 10 % . As per National leprosy eradication programme (NLEP), it was 9.7% in 2012[3] and 9.49% in 2013 [4]. It is less than 16.34% as reported by Rohini G [8]. Male preponderance in our study is in concurrence with observations made by others [7, 8]. Corroborating with other studies maximum number of cases were noted in 10-15 age group [8], youngest being 4 year of age. Surprisingly children as young as 6 months of age have been reported to be having leprosy . In our study 21% children were having history of contact either intrafamilial or in neighbours . 12% of cases were

found to be having single skin lesion which is similar to reports by Burman D. [9] but less than reported in other studies [16 ,19].

Majority of cases belonged to Borderline Tuberculoid (77%) leprosy which concurs with findings by Jain et al. (66.3%), Mahim J. (86.3%), and Rao (68%) [10, 11]. Cases of Tuberculoid leprosy (7%), Borderline Borderline (6%), Indeterminate leprosy (3.5%), pure neuritis (2.3%) and Borderline Lepromatous 5%, were also detected. Although few studies have reported occurance of Lepromatous leprosy and Histoid leprosy , none of our patients had these types. PB cases (71%) were seen to be more common than MB cases (29 %). Similar predominance of PB cases were observed by Sardana K. (63%) and Elisia B (70.7%) . Surprisingly higher numbers of MB cases were reported by Mahim Jain (91.6%) and Singhal (51.7%) [12] . Higher number of PB cases in our studies is encouraging. It indicates enhanced awareness and concern among parents for their children leading to early consultation.

Nerve involvement was noted in 20% of cases. This is less than reports by other authors (27.4% to 80%) which could be due to lesser number of MB cases with nerve thickening. Only 6% of cases showed Grade 2 deformity, claw hand being the only deformity observed. This is similar to findings by others authors. At presentation none of the patients had lepra reactions. However, 6 cases (7%) developed Type 1 Lepra Reaction during Multidrug treatment. BCG scar was noted in 91% of children. The transmission of leprosy in children inspite of receiving BCG vaccination questions the efficacy of BCG in protecting against leprosy. As suggested by C Ruth it might have protective effect for 5-10 years after which it wanes [4].Whether the second dose sustains the effect for longer duration is uncertain.

33-56% of newly registered leprosy patients already have clinically detectable nerve function impairment) . In the present study it was found that 14 % of patients having leprosy suffered with disability .These rates are lower than rates reported by others Singhi et al 2004 (35 %) (13) and Farooq R 2008 (55%) (14) .This indicates the decrease in disability rates as compared to last decade . Grade 1 and Grade 2 deformities were noticed in 8 % and 6 % patients respectively. The higher prevalence of Grade 2 disability was also reported in studies by other authors . This was slightly more than as reported by Mahajan (4.6 %) (15) and less than as reported by Sarkar (9.4%) (16). This was in accordance with other authors . Disability rate was significantly higher in males (65.4 %) than females (34.56.%) . Ulnar nerve was commonly involved (71%) followed by lateral poplitial nerve and great auricular nerve . Cases with MB leprosy were seen to have higher prevalence of disability (9.3 %)compared to PB patients (5 %) . Our study clearly indicates that chances of acquiring disability in leprosy patients increased in MB cases .

II. **CONCLUSION** Contrary to the conventional concepts childhood leprosy is more frequent in Indian children. Illiteracy, ignorance about the consequences of the disease, reluctance to seek advice in early stages by the parents contributes towards non decline of childhood cases and increase in deformities. Poor housing conditions, inadequate nourishment and overcrowding in homes facilitate transmission of leprosy. MB cases may act as source for many other new children in school, households and neighbors. This has led to increase in undiagnosed, hidden cases in the community contributing to active transmission of the disease especially in children who owing to less immunity are more susceptible than adults. Prevention of disability/ deformity can be done easily by basic level health workers . Early case detection , contact tracing , timely treatment and thorough examination for signs of possible nerve function impairments is need of the hour. Keeping close watch on development of nerve involvement , periodic examinations for nerve function impairment and reactions in leprosy during and after MDT is essential . Special emphasis on physiotherapy is needed

References

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1) Reddy BN, Bansal RD. An epidemiological study of leprosy disability in a leprosy andemic rural population of Pondicherry (South India) clinic in Gwalior. India .J Lepr 56 (1984) 191-194 .
2) World Health Organization. Global Leprosy: Update on 2012 situation.Weekly epidemiological record 2013;88:360-380. Available from :http://www.WHO.int/wer.
3) NLEP Progress report for year 2011-12. Central Leprosy Division . New Delhi: Directorate General Of Health Services Nirman Bhavan 2012. Available from :http://www.nlep.nic.in/Revised%20progress%report%203 1st 0%20March%202011-12pdf.
4) NLEP Progress report for year 2013-14. Central Leprosy Division . New Delhi: Directorate General Of Health Services Nirman Bhavan 2014. Available from :http://www.nlep.nic.in / pdf /. Progress report 31st march 2013-14.
5) Mahajan S, Sardana k (2006) . A study of Leprosy in children , from a tertiary Pediatric hospital in India. Lepr Rev . 77:160-2.
6) Palit A , Inamdar A (2014). Childhood leprosy in India over past two decades. Lepr Rev . 85: 93-99.
7) Mahim jain, Chitra N , Ramaya C.C (Jan-April 2014) . Clinical , bacteriological, and histopathological characteristics of children with leprosy : A retrospective analytical study in Dermatological department of tertiary care centre. Indian Journal of Paediatric Dermatolology . 15: 16-19.
8) Prasad PV (1998) . Childhood Leprosy in rural hospital . Indian J of Paeds . 65:751-4
9) Burman KD , Rijal A et al (2003) . Childhood leprosy in Eastern Nepal : A hospital based study. Indian J Lepr . 75 (1) : 47-52.
10) Jain PK et al :A study of high disability rate among LAPs in Gwalior district .Indian Journal of Community Health . Vol 23 , No. 2, July 2011-2011
11) Rao PS, Karat A.B , Karat S. Prevalence of deformities and disabilities among leprosy patients in an endemic area . Indian J Leprosy 1970. (38) : 1-11.
12) Singhal A , Sonthalia S (2011) . Childhood leprosy in a tertiary care hospital in Delhi, India :A reappraisal in post elimination era . Lepr Rev . 82: 259-269.

13) Singhi MK, Ghiya BC , Gupta D, Kachhawa D. Disability rates in leprosy. Indian J Dermatol Venerol Leprol 2004; 70 :314-6.
14) Farrokh R, Ghaderi E, Moradi G. A study of disability status of live leprosy patients in Kurdistan Province of Iran .Pak J Med Sci . 23 (6) 857-61.
15) Mahajan PM , Jogaikar DG , Mehta JM . a study of pure neuritic leprosy – clinical
Experience. Indian J Lepr 1996 ; 68 : 137-41
16) Sarkar J , Dasgupta A , Duta D. Disability among new leprosy patients , an issue of Concern . Indian J Dermatol Venerol Leprol 2012. 78 (3) 328-334 .

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Endodontic Surgical Treatment - A Literature Review

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Abstract- The aim of the current literature review shows the reasons for endodontic-surgery treatment and its techniques (methods) for its realization. When conservative treatment is not possible because of post with crowns, bridges and consideration of the possibility of weakening of the remaining dental hard tissues, there are reasons for undertaking apical surgery. This can be defined as endodontic-surgery procedures that include apical resection, curettage and retrograde filling. The aim is sealing the root canal in order to eliminate microleakage of periapical tissues. In relation to this literature discusses issues related to the sealing of the root canal and updating of various cements for root canal filling. The access to the apical portion may be provided by a low-speed handpiece with fissure burs or high-energy lasers, supported by microsurgical mirror and microscope. Different ultrasonic tips are an alternative for retrograde root canal preparation. Materials that might be used are: MTA, Biodentin, IRM, EBA, I Root SP, MTA Fillapex, ProRoot Endo Sealer, EndoSequence Bioceramic Root Repair Material. Conclusion: in appropriately selected clinical cases, endodontic-surgical approach gives good and reliable results and should be preferred over the decision for extraction of the tooth and its subsequent replacement by implant therapy.

Index Terms- cements, endodontic surgery treatment, materials, retrograde filling

I. INTRODUCTION

Conceptions for endodontic treatment indicate that root canal therapy conducts on eliminating the reasons leading to periapical lesion. The main method of choice is the orthograde treatment of the infected endodontic system. The result of that treatment shows that in 83% to 97% of following cases there is recovery (1, 2), when the main principles of endodontic treatment are being observed.

The orthograde endodontic treatment includes medical and mechanical treatment and finishes with obturation of the endodontic system. The mechanical treatment starts by using stainless steel files 0.02 taper with an apical-coronal technique (Step Back). This technique does not lead to appropriate shape that is suitable for cold lateral or warm vertical condensation for 3D filling, whereas the use of stainless steel files with large diameter in curved root canals leads to transportation of the natural root canal. Therefore this mechanical treatment, irrigation and filling of the root canal system are insufficient (1, 3, 4, 6, 7, 8, 10, 12). Using crown - down technique the enlargement in the coronal part allows better contact of the irritants with dental tubules. This allows better obturation of the lateral canals with sealer and gutta-percha.

These considerations manage the use of rotary Ni-Ti instruments. Prepared in that way, root canals have less straightening, less transportation of the natural root canal and less perforations (10, 11, 13, 14, 15, 16). Also treated canals are more centered (12) and the natural curvature of the root canal has been saved. Curvatures generate stress in instruments because of the moment of torsion and the cyclic fatigue. In order to prevent and reduce these effects rotary Ni-Ti instruments are used in combination with coronal-apical technique for enlargement. In that way first it is prepared the coronal part of the root canal and then the conditions for treating the apical part are better and the extrusion of debris is less (7-9). However in root canals with high expressed curvatures there is a risk of instrument fracture (6).

II. INDICATIONS

Indications for conduction of apical resection are following:

- Periodontitis chronica apicalis with diameter of the lesion around 5 mm;
- Radicular cysts;
- Good looking radiographically endodontic treatment but with pain;
- Second unsuccessful endodontic treatment;
- Transportation of the apical foramen, perforation in the apical part, ledges and other iatrogenic mistakes and persistent symptoms and pathology;
- Availability of periapical pathology and volume post restorations and bridges in the esthetic zone;
- Calcified root canals with or without symptoms and radiographic pathology;
- Fractured instruments in the apical third of the root canal;
- Unsuccessful conventional endodontic treatment;
- Overfilling and presence of persistent pain;
- Difficult curvature, unavailable in the orthograde treatment;
- Incompact and insufficient length of the root filling;
- Internal resorbtion;
- Need for biopsy of the periapical lesion (17).

In addition, the surgical treatment provides fast mitigation when the drainage is needed and cannot be achieved or it is not sufficient through the root canal (57).

III. CONTRAINDICATIONS

Contraindications for apical surgery are engagement of more than one third of the root surface of the tooth that can break the static of the tooth. Exceptions to the last rule could be allowed in

the frontal zone in order to save esthetics and the ratio root: crown should be at least 1:1 after the resection. Teeth suffering from periodontal disease are not appropriate for endodontic surgical treatment. Anatomical contraindications are: proximity of the periapical pathology to anatomical cavities. Insufficient oral hygienic procedures can compromise the long-term success of treatment (17).

The reasons of failure of the orthograde endodontic treatment could be seen in cases in which the root canal is not instrumented in sufficient volume or complex anatomical variations could be found; reaction antigen-antibody as a result of extrusion of irritants or material (3). Although an important role in the healing process has health status of the patient, the majority of failures are due to the inability to fully removal of the causes that led to the apical pathology. Nowadays conventional endodontic techniques are insufficiently adequate in the case of hard-processing curved canals, lateral canals, fracture of endodontic instruments in the apical part, presence of bulky post restorations, and its removal is risky, availability of various types of resorptive processes of the root system, perforations in apical portion and resistant to conventional medication microbial strains (18, 50, 54, 55, 56). Solving such problems determines the need for the application of more invasive approach to eliminate periapical pathology.

The aim of the current literature review shows the reasons for endodontic-surgery treatment and its techniques (methods) for its realization, announced in the contemporary literature as alternative for saving the tooth instead of extraction and its further replacement with implant therapy.

After depletion of all conventional alternatives and assessment the advantages and disadvantages of implant therapy, the endodontic surgery might be alternative instead of tooth extraction. The success of periapical surgery has been dictated because of the elimination of the infected tissues and hermetic apical filling. In cases in which conservative treatment is not possible because of posts with crowns or bridges and consideration of the possibility of a further weakening of the remaining dental hard tissues of the tooth, there are reasons for undertaking apical surgery (5). This can be defined as endodontic-surgery procedures that include apical resection, apical curettage and obturation.

The aim in periapical surgery is sealing the root canal in order to eliminate microleakage of periapical tissues and a problem after resection of the root tip. In relation to this literature discusses issues related to the sealing of the root canal and updating of various cements for root canal filling and with the method of apex resection of the pathological tooth.

The access to the apical portion may be provided by a low-speed handpiece under water cooling. High-speed handpieces should be avoided because of the risk of emphysema (58). Thesis et al (59) recommend the apical resection to be made with the fissure bur below 90 degrees and the phase is not greater than 10 degrees. At an angle to 10 degrees provides a complete removal of the apical delta and lateral apical tubules. Curetted apical tissues are sent for histopathological analysis. The apex angle of the root tip is most commonly 45 degrees relative to the longitudinal axis of the tooth. It was found that microleakage is influenced by the angle of the cut and the depth of the apical cavity. In the application of the cut angle of 0^0, 30^0 and 45^0 the fewest microleakage was found in section of 0 degrees and at most 45 degrees. This is explained by the area of exposed dentin - the slope of the cut with its growth increases the surface area of exposed dentin and microleakage increases. Regarding the depth of the prepared apical cavity was found that cavity with the depth of 1 mm provides a transmittance of zero for the horizontal section; 2,1 mm and 2,5 mm depth of the apical cavity provide zero leakage under sections respectively 30 and 45 degrees. This demonstrates on one hand the influence of the relationship of the apical cavity depth and slope of the cut and on the other hand microleakage of the retrograde filling on apical infiltration (60). Kim and coworkers found that in 3 mm resection is reached reduction of apical ramifications 98%, in 2 mm resection reduction is about 78%, and in 1 mm - 52%. The study shows that if not removed the apical ramification there is a risk of reinfection and failure (17). Apical cavity depth of 3 mm provides a safe and adequate apical seal (61). Resection of the root tip could be accomplished by fissures and handpiece burs in the clinical setting.

Modern tools imply the use of high-energy lasers group ErCr: YSGG (Erbium Chromium: Yttrium, Scandium, Gallium, Garnet) laser through which could be carried out resection of the root tip to be prepared an apical cavity, as well as used as a hemostatic agent and the disinfection in the apical region (62, 63, 64, 65). The realization of root tip resection with fissure burs causes vibrations and dental cracks that cause unpleasant sensations in the patient, producing contaminating layer and debris, which is a carrier of infection and lead to tissue heating in the area of resection. Hibst and al. stated that the use of the Er:YAG laser for the purpose of resected root apex does not cause thermal damage and carbonization (charring) of the surrounding tissues, and minimal or no discomfort to the patient (66, 67). Takashi Shimizu et al. (68) used Er:YAG laser with the following characteristics: wavelength - 2940 nm, maximum frequency - 20 Hz, pulse power: 80-700 μs. They remove 3 mm of the root apex as in this manner in 98% of the root canals apical branching are eliminated. In conclusion, it may be argued that the use of Er:YAG laser for root tip resection takes less clinical time, no smear layer, which does not require the use of EDTA, which demineralises healthy dentin smear layer below. According to the literature Er:YAG laser sterilizes and inactivates endotoxins (69, 70). Therefore the use of the Er:YAG laser for the purpose of apical resection is clinically effective (68).

Modern endodontic surgery treatment is supported by microsurgical mirror and increases under the microscope, which improves visual control of operative field and assesses the apex for cracks, perforations available channel obturation, prepared apical cavity and subsequent retrograde filling (58).

IV. ULTRASONIC TIPS FOR APICAL CAVITY PREPARATION

The ultrasonic tips are an alternative for retrograde root canal preparation. Using them it is possible to follow the natural course of the root canal. However, the authors describe microcracks in root walls after resection (46, 47). It is studied that these cracks do not affect the sealing of the sealer. The authors compare several types of ultrasonic tips for ultrasound

filling. There were used stainless steel tips, as well as with diamond and zirconium coating. The criteria by which they are compared is the presence of microcracks, the degree of exposure of dentinal tubules and time for which the access cavity was made. The authors make the conclusion that the use of US tips with a diamond coating takes less time for preparing endodontic cavity than with the other groups (48). The study of cavities made with three retro-tips showed no significant difference in the number of microcracks and the exposure of dental tubules. Working with a higher power does not increase microcracks. According to Peters (49) stainless steel ultrasonic tips lead to a smaller number of microcracks.

The preparation of the retrograde cavity by ultrasound is more accurate as compared to low speed handpieces. Diamond-coated tips have more efficient cutting ability and therefore can reach excessive cutting of hard tooth tissues. That is why the work with them should be more careful.

V. MATERIAL REQUIREMENTS FOR RETROGRADE FILLING.

Requirements to the ideal material include: biocompatibility, stability, radiopacity, hardness, ability to harden in a liquid medium, to have antibacterial properties, to be easy manipulated, to have osteoinductive or osteoconductive qualities, to have good adhesion to the canal walls and good apical sealing (20, 21, 22). The ideal filling material used to seal the apical part, prevents the penetration of irritants in the periapical area and the percolation fluid from the periapical tissue in the root canal (20). Filling of root-canal system in view of the upcoming endodontic surgery should be done with hard, non resorbable material. In the past, it was used zinc phosphate cement, in modern endodontics - gutta-percha and sealer termoplastified gutta-percha and epoxy-resin sealer. After flap reflection for access and resection of the root apex, retrograde filling should be done by reliable means. These are: mineral trioxide aggregate (MTA), Biodentin, IRM (Intermediate Restorative Material), ethoxy-benzoyl acid (EBA), I Root SP, MTA Fillapex, ProRoot Endo Sealer, EndoSequence Bioceramic Root Repair Material (ES-BCRR, Brasseler USA) (25, 26).

MTA is composed of a hydrophilic powder mainly composed of calcium oxide. The high level of the apical seal of MTA, compared to that of other materials has been confirmed by several studies (27-31). The main advantages of the material are: biocompatibility, osteoinduction and regenerative potential (32), MTA did not induce cytotoxicity or inflammatory response of the body (25). Some of its disadvantages are: difficult manipulative and slow hardening (33) which may be the reason for the penetration (34) and also surface disintegration (35) and loss of marginal adaptation (36). Some authors have reported that the success in retrograde filling with MTA is higher in comparison with dental amalgam (37) while others come to the conclusion that both materials used in the retrograde filling have similar clinical outcomes (38). Such clinical results were obtained in comparison between MTA and IRM (39, 40).

Biodentin - consists of powder and liquid. The composition of the powder includes: tricalcium silicate (main component), dicalcium silicate, calcium carbonate, iron oxide, zirconium oxide. The liquid is composed of calcium chloride and water-soluble polymer (51). Biodentine is indicated in deep carious lesions, pulp covering perforations in the furcation and roots, internal and external resorption, retrograde filling in the apical surgery. Manipulation time is from 6 to 10-12 minutes. The manufacturer claims that it has excellent sealing properties and is available in capsules. Compared to MTA it has a faster curing, which reduces the risk of bacterial contamination (51). In vitro studies of the same authors showed that the least penetration (0,13 mm) has Biodentin when compared to that in MTA (0,73 mm) and glass ionomer cements (1,49 mm), which puts it in the group of reliable modern means of sealing the root canal.

EndoSequence BioCeramic Root Repair Material (ES-BCRR, Brasseler USA) is used as material for root canal filling and sealing. Main ingredients are calcium silicate, calcium phosphate, zinc oxide. At the market it is available in two forms: powder and paste. Important properties are: biocompatibility and bioactivity, hydrophilic, high pH, which suggests its antibacterial properties and it is easy to apply. Microleakage is greater as compared to MTA (44). In other studies marginal adaptation of the cement is similar to the MTA. In retrograde filling it is recommended to use the one that is in the form of powder due to its higher degree of adjustment in comparison to the other form (45).

ProRoot Endo Sealer (Dentsply, Tulsa Dental Specialties) is calcium silicate sealer, which may be used as root canal filling material with the technique of cold condensation and warm vertical condensation. It consists of powder and liquid. The powder contains: tricalcium silicate, dicalcium silicate and calcium sulfate (for slowing the hardening process), bismuth oxide (radiopaque) and tricalcium aluminate. The composition of the liquid is viscous water-soluble polymer. According to Weller in terms of apical sealing ProRoot Endo Sealer is equivalent to popular epoxy sealer. Compared to the zinc-oxide-eugenol cements, it seals better and demonstrates ex vivo bioactivity when it is in contact with the phosphate ions (41, 42).

MTA Fill apex (Angelus, Brazil) is a relatively new cement-based MTA. It is available in the form of two pastes or double syringe. The manufacturer reported its ability to seal the lateral canals, inability to recolor tooth, as well its ability to prevent recontamination of the root-canal system, release calcium ions, which provide rapid tissue regeneration. The material has improved handling properties compared to MTA. These properties are determined by its composition: Paste 1: silicate resin, bismuth trioxide, silicon dioxide; Paste 2: titanium dioxide, MTA (40%) and an activator. The sealer has improved setting time - 130 minutes with a variation of 10 minutes and manipulation time - 30 minutes according to the manufacturer (43).

I Root SP (Innovative BioCeramix Inc, Canada) - according to the manufacturer this cement represents a prepared white, insoluble, radiopaque paste. The material is insoluble calcium silicate cement that does not contain aluminum. The hardening is carried out by moisture in the dentinal tubules (23). Composition: zinc oxide, calcium silicate, calcium phosphate, calcium hydroxide and fillers. It has strength similar to that of AH Plus sealer (24).

Clinical studies have shown that in the use of **IRM** the success rate was 74%, and in dental amalgam - 57% (18), which is proven by the reduction of the toxicity and improved apical

sealing of the root canal. According to Chong, Ford and others. slightly higher rate of healing of periapical lesions (84% after 12 months and 92% after 24 months) was observed in the MTA compared with IRM (76% after 12 months and 87% after 24 months) (19). The manufacturer determines the setting time - 4 hours while in very dry root canals it can last more than 10 hours. To solidify I Root SP the necessary moisture is taken from the dentinal tubules in the root canal walls. Canal itself should be well dry with paper points before placing in the sealer (52, 53).

VI. CONCLUSION

The data in literature suggests that in appropriately selected clinical cases, endodontic-surgical approach gives good and reliable results and should be preferred over the decision to extraction of the tooth and its subsequent replacement by implant therapy.

REFERENCES

[1] Y. Ng, Mann V, S. Rahbarab, J. Lewsey, K. Gulabivala. Outcome of primary root canal treatment: systematic review of the literature – part 1. Effects of study characteristics on probability of success. Int Endod J 2007, 40, 921–939.

[2] S. Lieblich. Advanced topics in Dentoalveolar Surgery. Oral and Maxillofacial Surgery Clinics of North America.W.B. Saunders Company. 2002 May; Column 14 Number 2.

[3] M. Torabinejad, R. Corr, R. Handysides, S. Shabahang. Outcomes of nonsurgical retreatment and endodontic surgery: a systematic review. J Endod 2009, 35, 930–937.

[4] D. Arens, M. Tarabinejad, N. Chivian, R. Rubinstein. Practical lessions in endodontic surgery. Quintessence Publishing Co Inc 1998.

[5] P. Carrotte. Surgical endodontics. Br Dent J 2005, 198, 71–79.

[6] B. Musikant. The Evolution of Endodontic Progress: Making Excellence a Reflection of Simplicity, 2005, Dentistry Today.

[7] J. Leeb. Canal orifice enlargement as related to biomechanical preparation. J Endod 1983, 9, 463–470.

[8] L. F. Morgan, S. Montgomery. An evaluation of the crowndown pressureless technique. J Endod 1984, 10, 491–498.

[9] A. Stabholz, I. Rotstein, M. Torabinejad. Effect of preflaring on tactile detection of the apical constriction. J Endod 1995, 21, 92–94.

[10] J. Versumer, M. Hulsmann, F. Schafers. A comparative study of root canal preparation using ProFile .04 and lightspeed rotary Ni-Ti instruments. Int Endod J 2002, 35, 37–46.

[11] K. Knowles, J. Ibarrola, R. Christiansen. Assessing apical deformation and transportation following the use of Lightspeed root-canal instruments. Int Endod J 1996, 29, 113–117.

[12] H. Park. A comparison of Greater Taper files, ProFiles, and stainless steel files to shape curved root canals. Oral Surg Oral Med Oral Pathol Oral Radiol Endod 2001, 91, 715–718.

[13] H. Walia, W. Brantley, H. Gerstein. An initial investigation of the bending and torsional properties of Nitinol root canal files. J Endod 1988, 14, 346–351.

[14] http://www.edsdental.com/productpdfs/sidersprofile.pdf Accessed December 2014

[15] http://www.edsdental.com/inst/safesiders/sidersinst.pdf Accessed December 2014.

[16] http://pantera.sdm.buffalo.edu/PER811/Chapter%2019%20Ruddle-Castelucci.pdf - How To Use ProTaper Endodontic Files.

[17] E. Radeva, Ts. Uzunov. Endodontsko-hirurgichno lechenie - tradicionni i syvremenni tehnici. Dentalna medicina 2013, 95, 2, 186. (in Bulgarian)

[18] S. Dorn, H. Gartner. Retrograde filling materials: a retrospective success-failure study of amalgam, EBA and IRM. J. of endodontics 1990, 16, 391-393.

[19] B. Chong, T. Ford, M. Hudson. A progressive clinical study of Mineral Trioxide Aggregate and IRM when used as root-end filling materials in endodontics surgery. J. of International Endodontics, 36, 520-526, 2003

[20] J. L. Gutmann, J. W. Harrison. Surgical Endodontics. 1st ed. Boston: Blackwell Scientific Publications; 1991.

[21] B. Johnson, M. I. Fayad, D. E. Witherspoon. Periradicular surgery. In: Hargreaves KM, Cohen S, editors. Cohen's Pathways of the pulp. 10th ed. St. Louis: Mosby, 2011, 720-776.

[22] B. S. Chong, T. R. P. Ford. Root-end filling materials: rationale and tissue response. Endodontic Topics. 2005,11, 114–130.

[23] http://veriodent.com/pb/wp_a0eb3a9d/wp_a0eb3a9d.html

[24] B. Sagsen,, Y. Ustün,S. Demirbuga, K. Pal. Push-out bond strength of two new calcium silicate-based endodontic sealers to root canal dentine. International Endodontic Journal. 2011, 44, 1088-1091.

[25] S. A. Fernandez-Yanez, M. I. Leco-Berrocal, J. M. Martinez-Gonzalez. Metaanalysis of filler materials in periapical surgery. Med Oral Patol Oral Cir Bucal 2008, 13, 180–185.

[26] R. A. Rubinstein. Reflections on designing and conducting long-term surgical studies. J Endod 2002; 28, 384–385.

[27] M. Torabinejad, C. U. Hong, S. J. Lee, M. Monsef, T. R. Pitt Ford. Investigation of mineral trioxide aggregate for root end filling in dogs. J Endod 1995, 21, 603–608.

[28] J. D. Yatsushiro, Baumgartner JC, Tinkle JS. Longitudinal study of the microleakage of two rootend filling materials using a fluid conductive system. J Endod 1998, 24, 716–719.

[29] M. Torabinejad, A. F. Rastegar, J. D. Kettering, T. R. Pitt Ford. Bacterial leakage of mineral trioxide aggregate as a root-end filling material. J Endod 1995, 21, 109-112.

[30] E. J. Fischer, D. E. Arens, C. H. Miller. Bacterial leakage of mineral trioxide aggregate as compared with zincfree amalgam, intermediate restorative material, and Super-EBA as a root-end filling material. J Endod 1998, 24, 176–179.

[31] T. T. Nakata, K. S. Bae, J. C. Baumgartner. Perforation repair comparing mineral trioxide aggregate and amalgam using an anaerobic bacterial leakage model. J Endod 1998, 24, 184–186.

[32] B. Emre. Biocompatibility of retrograde root filling materials: A review. Aust Endod J 2008, 34, 30–35.

[33] E. S. Lee. A new mineral trioxide aggregate root-end filling technique. Journal of Endodontics 2000, 26, 764–765.

[34] E. S. Reeh, E. C. Combe . New core and sealer materials for root canal obturation and retrofilling. Journal of Endodontics 28, 2003, 520–523.

[35] J. D. Yatsushiro, J. C. Baumgartner, J. S. Tinkle . Longitudinal study of microleakage of two root-end filling materials using a fluid conductive system. Journal of Endodontics 24, 1998, 716–719.

[36] C. I Peters, O. A. Peters. Occlusal loading of EBA and MTA root-end fillings in a computer-controlled masticator: a scanning electron microscopic study. International Endodontic Journal 2002, 35, 22–9.

[37] W. X. Hou. Effect of mineral trioxide aggregate in retrograde filling. J Med Forum 2008, 29, 19–20.

[38] Y. Gao, C. J. Yu, L. Y. Su. A retrospective clinical study of amalgam and mineral trioxide aggregate as rootend filling materials. Beijing J Stomatol 2009, 17, 149–151.

[39] B. S. Chong, T. R. Pitt Ford, M. B. Hudson. A prospective clinical study of mineral trioxide aggregate and IRM when used as root-end filling materials in endodontic surgery. Int Endod J 2003, 36, 520–526.

[40] J. A. Lindeboom, J. W. Frenken, F. H. Kroon. A comparative prospective randomized clinical study of MTA and IRM as root-end filling materials in single-rooted teeth in endodontic surgery. Oral Surg Oral Med Oral Pathol Oral Radiol Endod 2005, 100, 495–500.

[41] R. Weller, K. Tay, L. Garret, S. Mai, C. Primus, J. Gutmann, D. Pashley, F. Tay. Microscopic appearance and apical seal of root canals filled with gutta-percha and ProRoot Endo Sealer after immersion in a phosphate-containing fluid. International Endodontic Journal, 2008, 41, 977–986.

[42] http://www.angelusdental.com/img/arquivos/mta_fillapex_technical_profile_download.pdf

[43] C. Hirschberg, L. Patel, D. Kadouri. Comparison of sealing ability of MTA and

[44] EndoSequence Bioceramic Root Repair Material: A bacterial leakage study. Quintessence International 44, 2013, 5, 157-162.

[45] N. Shokouhinejad, M. Nekootar, K. Ashortehyazdi, Z. Shohreh, M. Khoshkhounejad. Marginal Adaptation of New Bioceramic Materials and Mineral Trioxide Aggregate: A Scanning Electron Microscopy Study. Iranian Endodontic Journal, 9, 2014, 2, 144-148.

[46] H. R. Abedi, B. L. Van Mierlo, P. Wilder-Smith, M. Trabinejad. Effects of root-end cavity prepration on the root apex. Oral Surgery, Oral Medicine, Oral Pathology, Oral Radiology and Endodontics, 1995, 80, 207-213.

[47] M. Waplington, P. J. Lumley, A. D. Wamsley, Incidence of root face alteration after ultrasonic retrograde cavity prepration. Oral Surgery, Oral Medicine, Oral Pathology, Oral Radiology and Endodontics, 1997, 83, 387-392.

[48] H. Ishikawa, H. Sawada, N. Kobayashi, C. Suda. Evaluation of root-end cavity preparation using ultrasonic retrotips. International Endodontic Journal, 2003, 36, 9, 586-590.

[49] C.I. Peters, O.A. Peters, F. Barbakow. An in vitro study comparing root-end cavities prepared by diamond-coated and stainless steel ultrasonic retrotips. International Endodontic Journal, 2001, 34, 2, 142-147.

[50] J. Ingle. PDQ Endodontics, 2005, 167-215.

[51] Sh. Kokate, A. Pawar. An in vitro comparative stereomicroscopic evaluation of marginal seal between MTA, glass inomer cement & biodentine as root end filling materials using 1% methylene blue as tracer.

[52] http://www.accessdata.fda.gov/cdrh_docs/pdf13/K130312.pdf.

[53] http://www.ibioceramix.com/.

[54] T. Arx, M. Pennarocha, S. Jensen. Prognostic factors in apical surgery with root-end filling: A meta-analysis. JOE, 36, 2010, 6, 957-963.

[55] P. Bernabe. et al. Root reconstructed with MTA ad GTR in apical surgery: A five year follow-up. Branz Dent J 24, 2013, 4-10.

[56] P. Bernabe. et al. Sealing ability of MTA used as root end filling material: effects of the sonic and ultrasonic condensation. Branz Dent J 24, 2013, 107-110.

[57] S. Yancheva. Periapikalna hirurgia - endodontsci aspecti. Chast pyrva. Falshivi i realni pokazaniq za periapikalna hirurgia. Podgotovka na korenovia kanal. Zybolekarski pregled, 84, 2002, 1, 41-44.

[58] I. Pop. Oral Surgery: part 2. Endodontic surgery. British dental journal, 215, 6, 279 - 286.

[59] I. Tsesis, Rosen E, Schwartz-Arad D, Fuss Z. Retrospective evaluation of surgical endodontic treatment: traditional versus modern technique. J Endodontic 2006; 32, 412 - 416.

[60] S. Yancheva. Periapikalna hirurgia - endodontsci aspecti. Chast vtora - anterogradno zapylvane na korenoviq kanal - preparacii i nyakoi materiali za retrogradno zapylvane. Zybolekarski pregled, 84, 2002, 1, 45-49.

[61] L. Post, F. Lima, C. Xavier, F. Demarco, M. Gerhardt-Oliveira. Sealing ability of MTA and amalgam in different root-end preparations and resection bevel angles: An in vitro study evaluation using marginal dye leakage. Brazil Dent J, 2010, 21, 416-419.

[62] J. A. Wallace. Effect of Waterlase laser retrograde root-end cavity preparation on the integrity of root apices of extracted teeth as demonstrated by light microscopy. Aust Endod J, 2006, 32: 35–39.

[63] X. Wang, C. Zhang, K. Matsumoto. In vivo study of the healing processes that occur in the jaws of rabbits following perforation by an Er,Cr:YSGG laser. Lasers Med Sci 2005, 20, 21–27.

[64] U. Schoop, W. Kluger, A. Moritz, N. Nedjelik, A. Georgopoulos, W. Sperr. Bactericidal effect of different laser systems in the deep layers of dentin. Lasers Surg Med 2004, 35, 111–116.

[65] Y. Kimura, D. G. Yu, J. Kinoshita. Effects of erbium, chromium:YSGG laser irradiation on root surface: morphological and atomic analytical studies. J Clin Laser Med Surg 2001, 19, 69–72.

[66] R. Hibst, U. Keller. Experimental studies of the application of the Er:YAG laser on dental hard substances: I. Measurement of the ablation rate, Lasers Surg. Med. 9, 1989, 338-344.

[67] R. Hibst, U. Keller. Experimental studies of the application of the Er:YAG laser on dental hard substances: II. Light microscope and SEM investigations, Lasers Surg. Med. 9, 1989, 345-351.

[68] T. Shimizu, K. Koba, J. Kinoshita, K. Matsumoto. Morphological Study on Apicoectomy by High-Powered Er:YAG Laser. J Oral Laser Applications 2008; 8, 245-255.

[69] Q. Q. Ang, C. F. Zhang, X. Z. Yin. Evaluation of the bactericidal effect of Er,Cr:YSGG and Nd:YAG lasers in experimentally infected canals. J Endod 2007, 33, 830-832.

[70] M. S. Vezzani, R. Pietro, Y. T. Silva-Soua, A. Brugnera-Jr, M. D. Sousa-Neto. Disinfection of root canals using Er:YAG laser at different frequencies. Photomed Laser Surg 2006, 24, 499-502.

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Designing of an optical fiber sensors of statistical mode via image processing of speckle pattern changes

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Abstract- To investigate the possibilities of employing speckle patterns alterations, to be noticed in an emerging light spot from step index multimode optical fiber, due to outer perturbation for sensing purposes; first order moment statistical feature is used to design the optical fiber sensors of statistical mode. The experiments of optical fiber sensor of statistical mode are performed for different applied weights and the related images were captured by using a CCD camera. First moment statistical feature is taken out from these images after suitable image processing. A definite weight was applied on a fiber optic in which beams of a He-Ne laser were propagating then variations in speckle patterns were noticed. To achieve the application of effective weight on the fiber optic, a part of load application which has some ridges positioned between two parallel flat plates was employed. The achieved results illustrated that when fiber optic was positioned so that corrugation of bending was made by the application part of load (by means of ridges)and when loads were applied on the optical fiber, the difference in first order moment increased as weight was applied. The effect of area size of contact between fiber optic and ridges was set by employing some different preparations for the application part of load. With these results and by using statistical mode feature it was assured that speckles observation in a light spot emerging from a fiber optic can be used for realization of fiber optic sensor having statistical mode for sensing the application of load applied on the fiber optic. For enhancement of load application effects, appropriate arrangements were used with ridges having convenient dimensions which are alternately organized against the fiber optic.

Index Terms- Optical fiber, Image processing, Laser, sensor of Statistical mode, Speckles, application of load, Statistical feature.

I. INTRODUCTION

Optical fiber sensors have begun to have great role in the technology of sensing in the last ten years because of the cost reductions and the improvements in the technology of the optical fiber. A great number of researches have been done about optical fiber sensors. In many applications optical fiber sensors are still limited in use, in spite of their advantages over the mechanical and the electrical conventional sensors. Problems of standardization and mass production lack cause these limitations. There are four groups of optical fiber sensors according to the principle of modulation named as (wavelength, polarization, phase and intensity). Wavelength, polarization, phase modulated optical fiber sensors have higher sensitivity, but they need complicated hardware, techniques for signal processing and they are costly. While intensity modulated optical fiber sensors are economical and simple to build [1].Sensors of spatial intensity modulation that depend on analyzing patterns of light intensity emerge from the sensors, which are called modal sensors as well. Sensors of statistical mode depend on distributions of different output intensity resulting from inter-modal interference among all modes that are guided in the optical fiber. Sensors of modal power distribution concentrate on the transformation of modes having higher order into modes having lower order, which are tested as a radial distribution change of the signal that is transmitted [2]. Some limitations that affect the sensors sensitivity and variations of the optical output power are the main problems of the intensity modulated sensors. When light is emerging from a multimode optical fiber and form on a screen then a pattern of a uniform circle will be observed. A pattern with an intensity of a smooth distribution happens if an incoherent optical source is used, but the pattern will be granular with speckles of variable intensities when the source is coherent. Modes of different propagation will form a speckle pattern when they interfere randomly. Speckles distribution changes quietly over time, while the total pattern intensity doesn't change. This pattern will change while applying a disturbance like a force on the fiber [3]. Since the pattern emerging from the optical fiber depends on the outer perturbation, so it's used in sensing applications and for getting cheap and sensitive sensors named optical fiber sensors of statistical mode. Measurements of displacement, vibration, temperature and force have been registered when sensors of statistical mode were used. For analyzing of speckle image various parameters of statistics were used [4]. The speckle pattern observation as a data of image looks to be more favored for providing much information [5]. In the field of this research, for designing of sensors with statistical mode, first moment statistical parameter was used and then the difference was taken between the first moments of two main cases; the first without using weight and the second one with applying weights of 500g till the total weight became 6 kg.

II. THEORETICAL BACKGROUND

2.1 Principle of statistical mode optical fiber sensors

In multimode optical fibers, modes propagate in several paths and then interference happens, forming speckle pattern at the rear end of the optical fiber. Generally, at the end of optical fiber, the total intensity of (N) guided modes is formulated as …

$$I(x,y) \approx \left| \sum_{m=1}^{N} \vec{E}_m(\vec{r}) exp[i(\vec{k}_m \cdot \vec{r} - \omega t) + i\Phi_m] \right|^2 \quad \ldots\ldots \quad (1)$$

Where: km, the propagation constant, ϕm, the phase of the mth optical fiber mode, ω, the light angular frequency. When applying an outer disturbance to the optical fiber, the fiber refractive index and the optical path length will be changed and the guided mode phase will be modified, so the total intensity will be …

$$I(x,y) \approx \left| \sum_{m=1}^{N} \vec{E}_m(\vec{r}) exp[i(\vec{k}_m \cdot \vec{r} - \omega t) + i\Phi_m + i\Delta\Phi_m] \right|^2 \quad \ldots. \quad (2)$$

Where: Δϕm: the change in phase of the mth optical fiber mode that is caused by the outer disturbance. This shows a changing in speckles or distribution of intensity with disturbance [6].The lengths of the optical path of each guided mode will be differently changed and the pattern of the intensity will also change when the optical fiber is subjected to disturbance. Detecting of this change is by the analysis of the resulting patterns by using statistical parameters for the analysis of the image.

2.2 Algorithm of Statistical analysis

Image correlation and image difference parameters are used for the analysis of speckle image, and based on these parameters; many various algorithms are recorded in a report. [4]. First order moment is also another technique for image analysis which is preferred to the correlation and it's the better alternative for statistical mode sensors design in sensor applications where characteristics like (high linearity or/and precision)are important [7].

2.2.1The Moment parameter

When I(x, y) is the emerging pattern of the intensities, the mean values in x and y directions is given by:

$$\mu_x = \frac{\sum_{x,y} xI(x,y)}{\sum_{x,y} I(x,y)} \ldots\ldots.. (3) \text{ and } \mu_y = \frac{\sum_{x,y} yI(x,y)}{\sum_{x,y} I(x,y)} \ldots\ldots.. (4)$$

The radial moment of pth order is :

$$\mu_p = E\{r^p\} = \frac{\sum_{x,y}[(x-\mu_x)^2 + (y-\mu_y)^2]^{p/2} I(x,y)}{\sum_{x,y} I(x,y)} \ldots\ldots. (5)$$

By using equation (9), the first moment will be: $\mu_1 = \frac{\sum_{x,y}[(x-\mu_x)^2 + (y-\mu_y)^2]^{1/2} I(x,y)}{\sum_{x,y} I(x,y)}$ …… (6)

III. EXPERIMENTAL SETUP AND RESULTS

The experimental system set-up used in the study was shown in Fig 1.

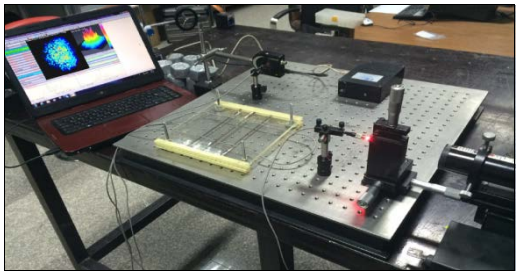

Figure (1): Actual setup photo

A multimode step-index optical fiber having total length of 10m with a 62.5μm diameter of core was used. As an optical source, a Helium Neon laser operating at 632.8 nm wavelength including a cylindrical head with output Power of 5mwwas employed. The light of laser was guided into the optical fiber, and emerges from the other side then projected onto a CCD camera (Gentec-EO). The observed output light spot image, which includes an output light intensity patterns(speckle patterns) was recorded onto a Laptop, then processed and analyzed by Matlab program. In addition, a laser power meter (Gentec-EO) was located in front of the emerging light from the optical fiber for recording the output power after applying of each weight .For the aim of applying load on the optical fiber, a section of load application was used. It consists of two acrylic plates (upper and lower plate) having the same dimensions. The fiber optic was traveled two times inside this section, this mean that the fiber optic was sandwiched between the two plates. The two plates are provided with three extended parts (Ridges); these ridges are elevated towards the fiber and placed alternately as illustrated in Fig 2.

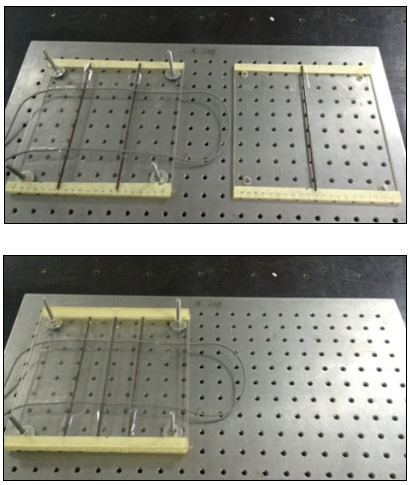

Figure (2): A section of load application before and after fiber sandwiching

Each one of these extended parts had a cylindrical shape with 3mm diameter. With this configuration the optical fiber sandwiched between the two plates will compressed alternately with these elevated parts, resulting in bending having corrugated form, as shown in Fig 3.

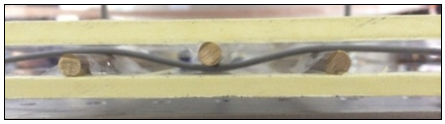

Figure (3): A photo shows an optical fiber bending by ridges

The above configuration was employed to apply weights on the optical fiber then several changes in speckle pattern observed in the emerged light spot. To achieve application of load, 12 weights each one weighing500g were placed on the top plate of load application section one by one until 6 kg of load was attained. When one weight was applied on the optical fiber, the observed speckle pattern at the emerged light spot was recorded. Same procedure of the measurement was repeated when the second weight was applied. After finishing of all the procedure, the noticed data of the pattern image were analyzed as will be mentioned later and the whole speckle pattern radius appears to reduce in general upon raising the weights that are placed over the fiber optic. Fig.4 illustrates the patterns before and after load application.

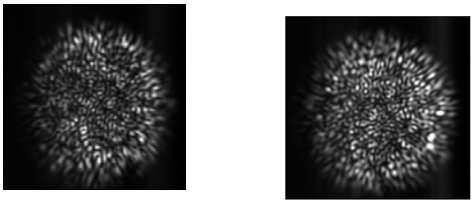

Figure (4): The patterns before (left) and after (right) load application

For the reason of extra study influences of load applying on alteration in the experimental speckle pattern, extra experiments were carried out with some dissimilar preparations of load applying section. They had principally the same arrangement excepting for the number of extended elevated segments (ridges) offered between the plates when applying weight. Specially having three situations, one of them had the full amount of three ridges offered between the opposed plates (one onto the lower plate and the other two ridges onto the upper plate). Other system had four ridges (two ridges for each plate) or the five ridges (three onto the lower plate and the other two ridges onto the upper plate). Intervals between ridges were equal. The ridges were steel rods of a 3mm, 5mm and 7mm in diameter. The results that obtained from suitable processing to the images given in figures 5, 6 and 7, they illustrate the difference in first moment statistical feature against applied weights for each situation respectively.

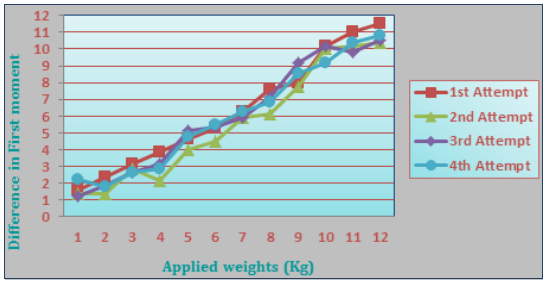

Figure (5): Difference in first moment against the applied weight with three ridges of 3mm diameter

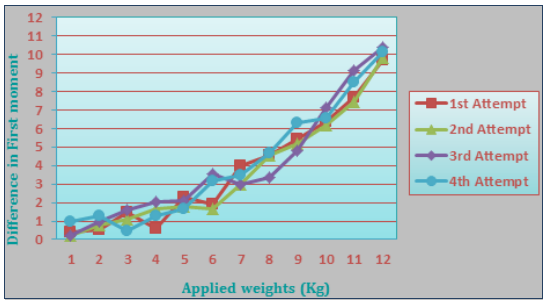

Figure (6): Difference in first moment against the applied weight with four ridges of 3mm diameter

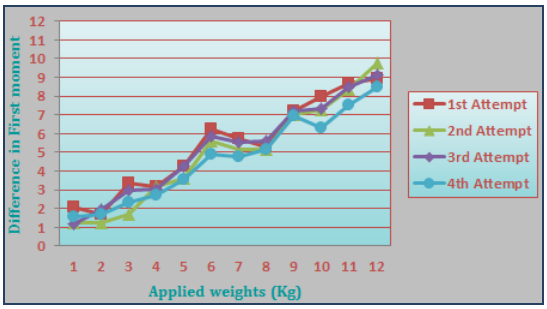

Figure (7): Difference in first moment against the applied weight with five ridges of 3mm diameter

From these figures it may be noticed that the difference in first moment is positively correlated with the applied weight and there is constant outcome for both increasing weights. So, this feature used in the sensors of statistical mode planning. The measuring procedures were repeated four times for each arrangement and the respective calculated data were shown. The results show that the difference in first moment was expected to increase with increased number of weights means larger load onto the optical fiber, with moderately excellent reproducibility of the achieved data. Moreover, a bigger slope was familiar with the lesser ridges number. Difference in first moment decreased a lot in the case with five ridges when compared to the case with three ridges as in Figure 8.

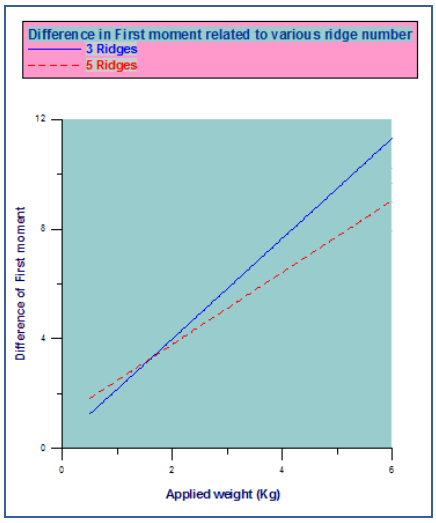

Figure (8): Comparison between differences of first moment vs. applied weight with 3 and 5ridges of 3mm diameter

Such disposition is clarified by taking into account the fact that with lesser number of ridges, the applied weight per ridge increases, resulting in much fiber bending which will induce in turn more significant effects on the speckle pattern observed in the output light spot. When the applied load on the fiber will be distributed with the bigger quantity of ridges; the resultant will be not so much of bending of the optic fiber and less important effects on the noticed speckle pattern. The same result could be predicted to be observed with different contact area sizes between the ridges and the fiber through which load was applied. So, additional application of load arrangements were arranged in which the ridges were offered as the similar bar but having different diameter of 5 mm and 7 mm rather than 3 mm. Number of ridges was found to be three in each case. Figures 9 and 10 illustrate difference in first moment in agreement with rise of the applied weight for the particular arrangements with the ridges of the different diameter. The procedures of measuring were four times recurred for each case.

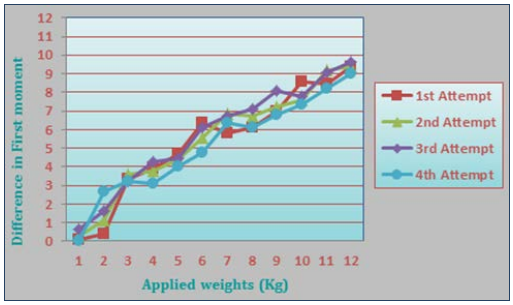

Figure (9): Difference in first moment against the applied weight with three ridges of 5mm diameter

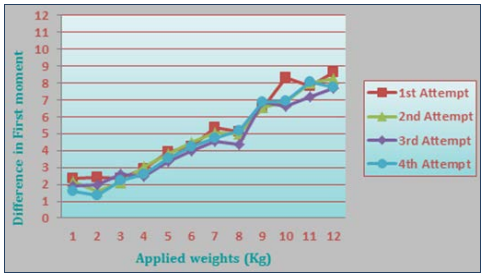

Figure (10): Difference in first moment against the applied weight with three ridges of 7mm diameter

Difference in first moment decreased a lot in the case with 7mm ridges when compared to the case with 3mm ridges as in Figure 11.

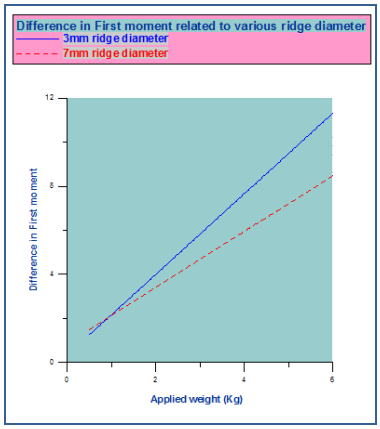

Figure (11): Comparison between differences of first moment vs. applied weight with three ridges of 3mm and 7mm diameter

The outcome of Fig.11 shows that with 7 mm diameter ridge, there is more decrease in the difference of first moment than those with 3 mm diameter ridges. Furthermore a bigger diameter of a rod to be used as a ridge in the section of load submission means an increased contact area size between the ridge and the fiber. So, the results given in Fig.11 do not oppose the results given in Fig.8 with the different quantity of ridges. Figure.12 explains more experimental data about the characteristics of transform of the speckle pattern according to the load applied onto the fiber optic. Specially, when using the weight application arrangement using 5 ridges each with 3mm in diameter, weight was applied on the fiber optic by putting weights one by one like in previous measurements.

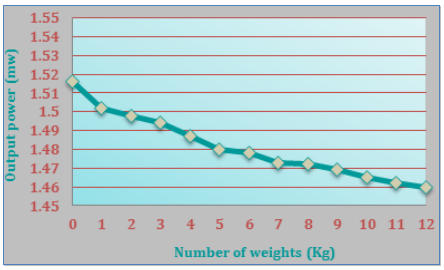

Figure (12): Changing in the output light intensity

In this situation, beside the image data gaining and analysis, the output level of power from the laser power meter was recorded at every level of weight. The results show that the level of output power from the laser power meter or the intensity of light emerging from the fiber optic, reduced according to the increasing level of weight applied onto the fiber optic in a manner related to the increasing in difference of first order. So, increasing in the difference of first order is deemed to be correlated to the reduction in intensities of laser beams that propagating in the fiber which are thought to be induced through fiber deformation because of load application. So, from the above results, it was established that watching speckle patterns in a light spot emerging from a fiber optic may be employed to realize sensing of application of load on the fiber optic by using suitable arrangements with suitable ridges that are alternately disposed adjacent to the fiber optic to increase load application effects.

IV. CONCLUSION

The first order statistical feature was used in this work for designing of optical fiber sensors with statistical mode a definite weight was applied on a multimode fiber optic in which beams of He-Ne laser were propagating and the resulting speckle patterns alterations in a light spot emerging from a fiber optic were noticed. However, as an outcome if weight was applied on a fiber optic by means of load application part that produce optical fiber bending with corrugating form when a definite number of extended elevated segments(ridges) were employed, it was concluded that the difference of first order moment increased as load applied on the fiber optic. The increase tendencies of the differences in first order moment were more influenced by load application part arrangements, like ridges number and their diameters. This shows that the size of contact area between the optical fiber and ridges by which weight was applied on the optical fiber will contain definite influence on these phenomena.

REFERENCES

[1] M.A. El-Sherif, Smart structures and intelligent systems for health monitoring and diagnostics, Appl. Bion. Biomech. 2 (2005) 161–170.

[2] X. Xu, William B. Spillman Jr., R.O. Claus, K. Chen, I.S. Jacobs, C.P. Bean, Spatially distributed fiber sensor with dual processed outputs, Proc. SPIE 58 (2005).

[3] W.B. Spillman Jr., B.R. Kline, L.B. Maurice, P.L. Fuhr, Statistical-mode sensor for fibre optic vibration sensing uses, Appl. Opt. 28 (15) (1989) 3166–3175.

[4] Hasan S. Efendioglu, et al, "New statistical features for the design of fiber optic statistical mode sensors" Optical Fiber Technology 19 (2013) 279–284.

[5] Makoto Hasegawa, Yuta Shimizu and Takuya Nakamaru, Changes in speckle patterns induced by load application onto an optical fiber and its detection through image processing, Proc. of SPIE Vol. 9285 (2014).

[6] J.H. Lim, G.H. Kim, G. Lim, J.Y. Cho, K.S. Lee, Car window antitrapping optical fiber system based on a fiber speckle pattern, Opt. Eng. 43 (5) (2004) 1148–1151.

[7] H.S. Efendioglu, T. Yildirim, O. Toker, K. Fidanboylu, Design of intelligent fiber optic statistical mode sensors using novel features and artificial neural networks, in: Int. Symp. Innov.Intell. Syst. Appl., INISTA 2012, July 2012, Trabzon, Turkey, pp. 1–4

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Optimizing Software Testing with Cryptic Six Sigma Analyses

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Abstract- Software testing is skill of investigating the purpose and rightness in software behavior caused by variations in component values or the environment. Quality improvement and customer satisfaction becomes an increasingly difficult challenge when there are fewer resources available. This paper proposes an innovative technique of DMAIC methodology using six sigma software testing. The paper supports that Six Sigma is not going to supersede other initiatives, but instead offer a tactics to determine the best approach for the process of testing software. In this paper a discussion has been made to use DMAIC methodology and principals while carrying out six sigma projects.

Index Terms- DMAIC, Software Testing, Six Sigma

I. INTRODUCTION

The term "Six Sigma" alludes to the power of extremely adequate to processes to produce output within specification .Particularly Six Sigma quality controls processes; produce at defects levels below 3.4 defects per one million opportunities called DPMO. Six Sigma caliber as simply an exhaustive diligence of basic and advanced statistical tools throughout an organization and with this view number of consultants and organizations repackaged statistical components of their TQM programs and assign a new name Six Sigma."

One of the unquestioning goals of Six Sigma is to improve all processes to that level of quality or better. Lately others have used the 'TRIZ' methodology for problem solving and product design as part of the six sigma approach. Six Sigma considers as a strategically business concern weapon initiatory rather than a quality program; considered as a philosophy, performance measurement, improvement framework, set of improvement tools and structured approach for business improvement.

Although it is perceived as an advanced form of Total Quality Management but there are some drawbacks that is to be highlight, those are like for the analysis, a sophisticated measurement program is needed; for accuracy purpose it demands a sound mathematical statistics. In spite of lot of care and attention impact of early stages glimpse can never remove. It requires Elicitation and should be attentive towards Customer Voice and for fulfilling process needs functional Size must be measured.

The approach proposed in this paper focuses o the drawbacks and try to solve the complexities of typical six sigma methodology. The paper concentrates on prioritizing specific improvements projects that would be more intended in communication with customers and market place. The suggested approach in this paper by and large a process or product such type of system that convinces the inputs to outputs; it can figure out as IFO i.e. Input, $_{\text{Transfer}}$ function and Output.

Typically proposed approach has chosen an engineering problem 'Black Box' which transfer functions, calculates the problem by observing the behavior of system. Orthogonal experiment, data collection, variance analysis, and other linear regression methods enable functions. Proposed approach draws a mode i.e. utilized for black box transfer function. Black box is chosen as it is quite easy to estimate the tolerance design in white box; but in black box variance analyses is required.

a. DMAIC methodology

Six Sigma is an obligating way to discover improvements for deporting world class processes with a defect rate of less than 3.4 ppm (parts per million). Usually Six Sigma is known as five step methodology-DMAIC. i.e. *Define, Measure, Analyze, Improve and Control.*

Define phase defines the actual problem. It focuses business cases, problems and scope and for understanding the real problem empathizes on customer requisites to identify ill in processes. It maps the process for easily recognizing the links between each step. Further fix the problem too, gather data , pick problems and fix them.

Measure phase measures the problem in quantifiable terms i.e. capabilities of a given process-means what is possible, which endeavors to estimate the process capability that a customer needs can meet.

It measures how many opportunities for defects a certain process or procedure acquaints. throughout measure process defines" critical to quality' or CTQ.

Analyze phase works in quantifiable manner too. It identifies dissimilar engenders for the failure of delivering the customer needs. It finds out that how well or poor the process functions on the basis that what the current competition and what is possible presently. Analyzing means popping out the errors are being committed and how to fix.

Improve phase works in very creative way where the problem and cause are already awarded. It identifies numerically the problematic factors and implements the necessary changes for improvement.

It approaches the problem, make specific changes and make them better by thinking creatively on the development of solution.

Control phase works on avoiding fall back of improvement actions as within their new operating limits, or locked securely and monitor to remain that same order.

The DMAIC methodology is consists of what, where, when, whom and why technology.Today's market catch world is to produce high quality products at lower costs with greater responsiveness. To contend in a world market a company needs to move toward a six sigma level of execution.

b. Fundamental dependencies

1. Six-Sigma accepts a leadership capability and team structure as patrons, champions, process owners, green belts, black belts.
2. Six-Sigma accepts an agreed and well- understood top level down business process model.
3. Six-Sigma accepts that the business includes IT, understand the purpose and mandate of the method and how it will integrate to other methods such as development life cycle, organization design methods change management methods.
4. Six-Sigma accepts a sealed knowledge and culture within the business including an awareness of the business strategy, intellect the process and confidence with changes to process and systems.

II. RELATED WORK

Relatively several articles are available that defines the distinctive views and proposals to improve software testing. Reference [4] gives an overview of six sigma, its historical perspective, definition, and its changed phases with changing environment and period and finally its procedure. In [9] the involvement of six sigma has been explained and introduced the power of six sigma by showing DMAIC methodology; it gives a deep motivation towards the direction of business strategies in improvement. Reference [7] describes the present challenges in adopting six sigma in business projects; while in [1] some significant practical solution has been suggested to overcome the problem when it is used in a pharmaceutical sales and marketing field. Reference [2] shows how monte carlo simulation can be applied to predict and improve the quality of a system before even one prototype has been built.It helps to develop the new products rapidly. The analytical methods and optimization process has been applied efficiently. In reference [6] a comparison has been made with other quality initiatives.

III. PROPOSED APPROACH FOR OPTIMIZATION PROCESS

Based on the work [14],[2],[9],[15] an innovative process has been carried out that convinces the inputs to outputs.The unique feature of the model contains several functions in which test process changes its behavior like input,transfer and output.

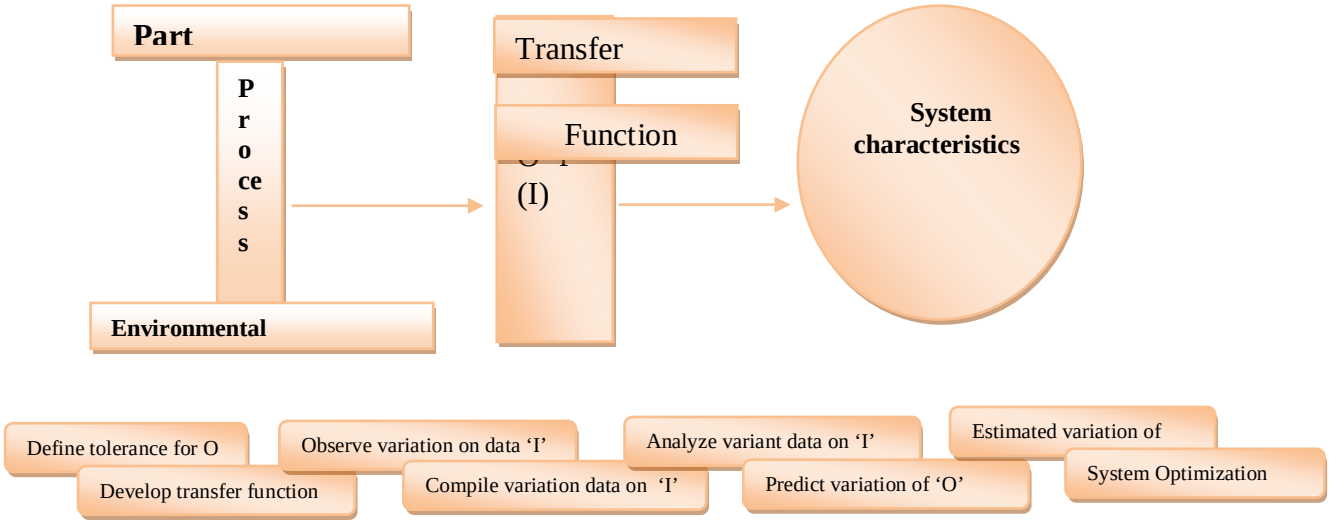


Figure1: Proposed Architecture of optimization process

Steps that has been followed in proposed methodology are as follows

Step1: Creating input phase

1.1 Observing variation on data
1.2 Compiling variation on data
1.3 Analyze variant data

Step2: Building Transfer phase

2.1 Defining tolerance for outputs
2.2 Developing transfer functions
2.3 Predict variation of outputs
2.4 Estimating variation of outputs

Step3: Generating Output

3.1 Generating the output for system optimization

The overall optimization process of proposed method is mentioned in figure [1] and explained in the following figure [1] contains the following steps.

Step1: Input Phase

Input process is consists of different type of characteristics; Part characteristics and environmental characteristics. Input is denoted as 'I' that determines which input is conducted well nigh to variation of output? And what type of input can provide right periodical variations towards output?

Part characteristics are the included features in the input process whereas *environmental characteristics* concerned with external conditions or surroundings.

Concerned features are

Observing variations on data observes the instances of change; the rate or magnitude of change or an activity that varies from a norm or standard either from changes in part characteristics or in environmental characteristics.

Compiling variations on data this phase also compiles the variations found on data after variation due to changes in characteristics.

Analyses the variant data *:* It considers in detail and subject to an analysis in order to discover essential features or meaning before transfer to the F basis.

Step2.Transformation phase

This phase is denoted as 'F'. The basic function of F basis is to transfer the functions performed on I basis.After variation, adoption is very necessary, whether the function is platform independent and can be develop newly if business process is re-styling.

Defining tolerance for outputs

'F' basis determines and defines the tolerance level for output. It fixes the range of tolerance that has been varied on 'I ' basis.

Developing transfer functions

It develops the transfer function; and while developing Predict variation of outputs and Estimating variation of outputs.

Step3. Output Phase

The final and most important phase is output denoted as 'O' that generates the outputs with the verification and validation process that whether the estimated result matches the customer requirements? And whether the reflections of input are accurate for the tolerance of output?

Although the result of the magnitude of difference between sigma levels can obtained and accepted simply.these differences helps to encourage efforts. These differences can be of various types can be depicted graphically are as follows.

Magnitude of difference between sigma levels

Sigma Level	Area	Spelling	Time	Distance
1	Floor space of the covered stadium	170 misspelled words per page in a book	31 ¾ years per century	From here up to 500 feets
2	Floor space of a large workshop	25 misspelled words per page in a book	4 ½ years per century	1 ½ times around the world
3	Floor space of a small head-quarter of armed forces	1.5 misspelled words per page in a book	3 ½ months per century	Coast-to-coast trip
4	Floor space of a distinctive Bank	1 misspelled words per 30 pages	2 ½ days per century	45 minutes of freeway depositing and withdrawing
5	Volume of a book on table	2 misspelled words in a set of guide	5 pages per hour	1 trip to the local station
6	Size of a stone	1 misspelled words in encyclopedias	6 seconds per century	5 steps in direction of garden
7	Size of a statue	2 misspelled words in all books	10 seconds per century	1 km towards the direction of market
8	Size of the holes in cooking stove	1 misspelled word in most of the books and magazines	2-3 eye blink per century	inches

Table 1: Sigma Level differences

Advantages to go through with Six- Sigma in testing environment

1. Management stock (buy in)
2. Consecrate team both drivers and as well as adopters.
3. Training and cultivating.
4. Acculturation edifice: preprocess culture is very efficient to make the life better.
5. Continuous and affirm determination and effort for improvement over adoption as transforming,people,thoughts and actions.
6. An apparent difference between hardware and software, because software is not hardware,software defects are designed in, not the result of manufacturing variation.
7. Merging six sigma with strategic planning
8. Re-Style the business process framework.

3.1. Limitations and Disputes to go through with Six- Sigma in testing environment

As an improvement in testing process, Six-Sigma is adopted by very few organizations and they have their experience either beneficial or speculative. Although, yet organizations are not fully successful to implement Six-Sigma precisely. Organization hesitates to take risk of adoption of Six-Sigma in their conventional process method.

The complexities of Six-Sigma are:

1.Some prominent authorities view that it is very expensive and using it is a mistake.

2.it is just to empower all strength and energy and fizzled.

3.Use of Six-Sigma does not ensure any verified or exact assistance in time of need.

4.Six-Sigma does not carry on with individual consequences.

Conduct the disputes of Six-Sigma:

a. First with the positive approach organization should make up the mind that it is impossible to implement any process improvement method successfully and organization should need to look at the bigger picture rather than assume the method itself is the solution, should appraise critically whether the right framework is in place to make the method work.Problem analyzing and find out the solution with the framework. :

The question arises and must satisfy that

- Whether all individuals are familiar and happy with changes or not.
- Whether the testing process model is comprehensive.
- Whether the people are committed to the team roles and duties.
- Whether the strategy of organization is elaborate and systematic from peoples perspective.
- Whether the testing process or model is really able to implement in broader testing environments and methods.

b. Valid measurement of method should be placed, tests carefully and check is it really adding value and providing approx. accurate result.

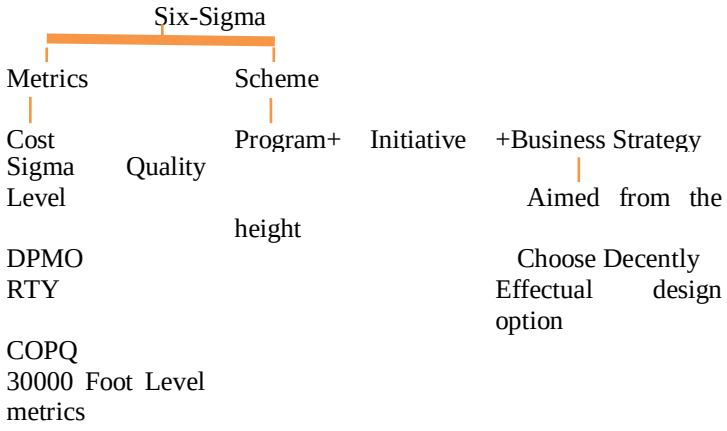


Figure2: Six-Sigma Metrics

IV. TESTING OPTIMIZATION PROCESS CASE STUDY WITH ILLUSTRATION

The decision table shown below is an illustrated part of a Printer Troubleshooter designed to detect when the HP L1023 dangles too jammed. When this falls out, user changes conditions as well as state, resets the printer settings before it starts doing objectionable behavior.

Printer troubleshooter

		Rules							
Conditions	Printer does not print	Y	Y	Y	Y	N	N	N	N
	A red light is flashing	Y	Y	N	N	Y	Y	N	N
	Printer is unrecognised	Y	N	Y	N	Y	N	Y	N
Actions	Check the power cable			X					
	Check the printer-computer cable	X		X					
	Ensure printer software is installed	X		X		X		X	
	Check/replace ink	X	X			X	X		
	Check for paper jam		X		X				

CONDITION ENTRY

		RULE 1	RULE 2	RULE 3	RULE 4
CONDITION STUB	CONDITION 1	YES	YES	NO	NO
	CONDITION 2	YES	I	NO	I
	CONDITION 3	NO	YES	NO	I
	CONDITION 4	NO	YES	NO	YES
ACTION STUB	ACTION 1	YES	YES	NO	NO
	ACTION 2	NO	NO	YES	NO
	ACTION 3	NO	NO	NO	YES

ACTION ENTRY

Figure 3.a Printer troubleshooter Decision Table 3.b

3. c Troublesome Decision Table

	Rule 5	Rule 6	Rule 7	Rule 8
CONDITION 1	I	NO	YES	YES
CONDITION 2	I	YES	I	NO
CONDITION 3	YES	I	NO	NO
CONDITION 4	NO	NO	YES	I
DEFAULT ACTION	YES	YES	YES	YES

	RULE 1	RULE 2
CONDITION 1	YES	YES
CONDITION 2	I	NO
CONDITION 3	YES	I
CONDITION 4	NO	NO
ACTION 1	YES	NO
ACTION 2	NO	YES

RULE 1.1	RULE 1.2	RULE 2.1	RULE 2.2
YES	YES	YES	YES
YES	NO	NO	NO
YES	YES	YES	NO
NO	NO	NO	NO
YES	YES	NO	NO
NO	NO	YES	YES

3.d Immaterial transformation Decision table

Step 1: Define margin for output(O)

First off,What is the concept of O?What prominent attributes of this decision table are we concerned in ? here are three:
PRIN_on :-these are the actions based on conditions when the power supply embarks on printer changes state.
PRIN_off :-these are the actions based on conditions when the power supply keeping out and printer changes state.
PRIN_serve :- PRIN_on – PRIN_off

For stability, the printer device acquires a firm amount of hysteresis.

For the sake of easiness, Only PRIN-off has been analyzed and analysis of other two O's (outputs)has been taken as exercise. now focusing on user requirement when PRIN-off? These conditions and actions are immersed deep down and seems far off of his/her awareness. No any naïve user is cognizant of these states, conditions and actions, unless it fails to work properly, like printing paper or not.

These states, conditions and actions are for making the device dependable, proposed to prevent from undesired malfunctions. So the user demand for PRIN_off is to shut down the printer before these conditions become out of control. Therefore three conditions are minimum tolerance limit.
The maximum tolerance limit is set by the variation in the output(O) itself. If PRIN_on conditions are different then actions would be in inherent variations, device will not work correctly.

Step 2: Building the $_{transfer}$ function

As dozens of problems faces, this step can be unmanageable but some guidelines can make this easy.
Inputs (I) which have paltry impact should be avoided.

Intermediate values should be represented smartly as unexampled symbols etc.

Statements and expressions should be clear and short and there should have any substitute for the portions.

For the deserted device, there are many inputs that should be neglected. A wild action is required with engineering judgment. Risk of disregarding an input is really necessitated. Hence, two actions can take in situation of doubt either to leave it or to take other way and to measure carefully the significance of input.

Now, the impression of Toner Cartridge has been neglected with the Diode laser. As its name explicitly, "Diode lasers are compact and low cost alternatives to huge expensive dye…in research laboratories as well as in commercial instruments like laser

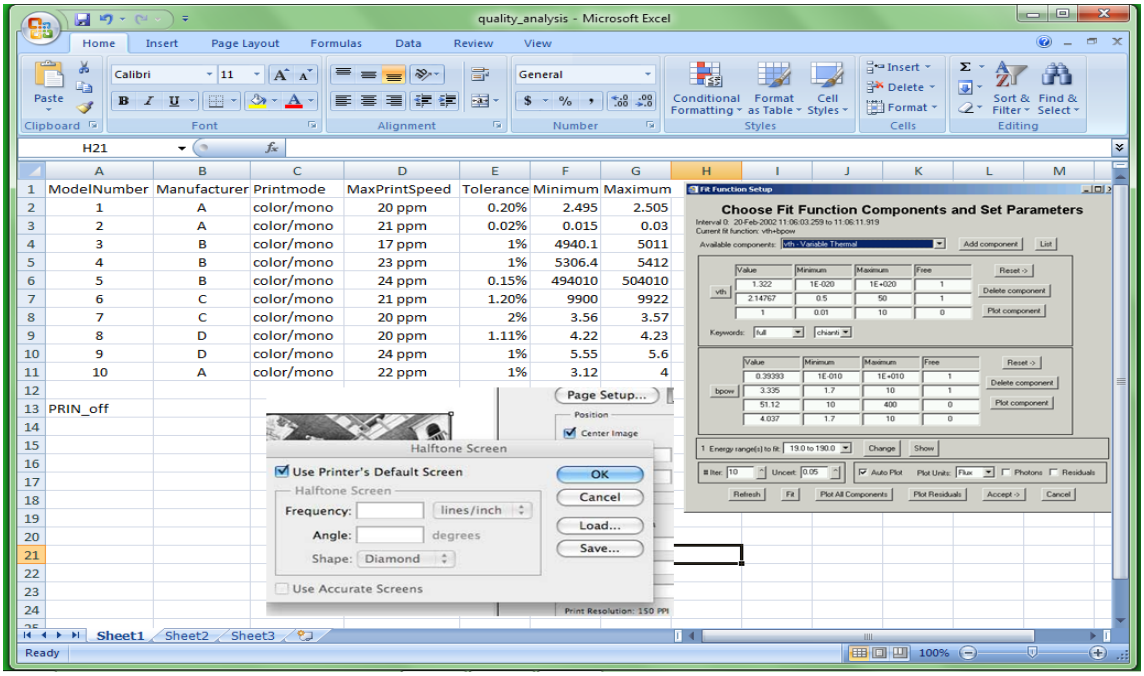
printer….against reference frequency preferably an absolute references in terms of atomic absorption such a laser system whose output frequency corresponds, over a period of time to the desired atomic transition."
The toner cartridge impression allowance can be calculated, but it drenched out by the tolerance of the diode lasers..So it is safe in ignoring this input.

Likewise, the print mode of the toner cartridge and the load impedance of the printer following the printer have effects but these are extremely slight among several models, so it can be ignored.

What follows is one way to derive the transfer function. In this filliation
To deduce the $_{transfer}$_function,in this derivation :
PRIN_on:-is the point where the printer changes state.

Step3: Accumulate Variation Data on Each Input(I)

In the perfect existence, Tester would have accession towards huge databases with real evaluated values from samples of all these parts. From this data, the most appropriate probability distribution has been selected. But in real life most testers have no data.
For the first in data poor real life, it is recommended that each component is consistent distributed between its specification limits. This is a conservative assumption , because it is usually worse than real data will be.



	A	B	C	D	E	F	G
1	ModelNumber	Manufacturer	Printmode	MaxPrintSpeed	Tolerance	Minimum	Maximum
2	1	A	color/mono	20 ppm	0.20%	2.495	2.505
3	2	A	color/mono	21 ppm	0.02%	0.015	0.03
4	3	B	color/mono	17 ppm	1%	4940.1	5011
5	4	B	color/mono	23 ppm	1%	5306.4	5412
6	5	B	color/mono	24 ppm	0.15%	494010	504010
7	6	C	color/mono	21 ppm	1.20%	9900	9922
8	7	C	color/mono	20 ppm	2%	3.56	3.57
9	8	D	color/mono	20 ppm	1.11%	4.22	4.23
10	9	D	color/mono	24 ppm	1%	5.55	5.6
11	10	A	color/mono	22 ppm	1%	3.12	4

Figure4: Print Mode and Maximum Speed of the Laser Printer Models

Step 4: Anticipative variation of Output (I)
Step 5: Optimize System

Distinctly, Improvement is required .tolerance PRIN_off can be revisited but only on the basis of above explicated reasons , no alterations are possible further. why the variations are needed? It is answered by Sensitivity Chart.
Target Forecast: PRIN_of

Through implementing Six Sigma it concludes that Six Sigma effectively predicts defect density

V. CONCLUSION

Certainly, Six-Sigma is a top-drawer measurement program and brings storming results. But any process improvement method undoubtedly can be made to work within organization and improves the skill but it is not fair to expect enchantment because no any band aid method is magical, till it is implemented at right time, right way and on right stage. It is not just to put a value and change the answer. It is an eternal process based on feedback to gain the desired benefits.

REFERENCES

[1] Stephen E. Clarke, J. Kenneth Feldman, Keith Johnson, "10 Challenges to Overcome when Deploying Lean Six Sigma in Pharmaceutical Sales and Marketing", 2010.

[2] Andy Sleeper, "Six Sigma Tolerance Design Case Study: Optimizing an Analog Circuit Using Monte Carlo Analysis, ,Successful Statistics",adopted from: andy@OQPD.com

[3] Dick Smith,Jerry Blakeslee,Richard Koonce, "Strategic Six Sigma Best Practices From The Executive Suite" John Wiley & Sons, 2002

[4] Daniel L. Quinn, "What Is Six Sigma?", 2002

[5] Jeannine M. Siviy, "The Effective Application of Six Sigma in Software Engineering", Software Engineering Measurement & Analysis Initiative, 2004

[6] S.Brey, "How Six Sigma Compares To Other Quality Initiative", 2000

[7] Sue Tan, "The challenge of Six Sigma", Mira group

[8] How effective can we implement six sigma principles in a very large software services organization? Software QA/Testing Technical FAQs

[9] Subir Chowdhury, "The Power of Six Sigma,An Inspiring Tale of How Six Sigma Is Transforming the Way We Work", Dearborn Trade Publishing, 2001

[10] C. Etienne, Eisen hower, " The Implementation Challenges Of Six-Sigma In Service Business" , , International Journal of Applied Quality Management: Volume 2 Issue 1

[11] An Application of Six Sigma and Simulation in Software Testing Risk Assessment, IEEE, Software Testing, Verification and Validation (ICST), 2010

[12] Garikapati Pavan Kumar, "Software Process Improvement –TRIZ and Six Sigma", Six Sigma in Software Testing, Nordic Test Management & QA Forum, 2008

[13] Six Sigma in Software Testing, Nordic Test Management & QA Forum, Euro project, 2008

[14] Zhedan Pan,Hyuncheol Park,Jongmoon Baik,Hojin Choi, "A six sigma framework for software process improvements and it implementation",14th Asia Pacific Software Engineering Conference [ASPEC],IEEE,2007

[15] Hathibelagal Roshan, "Process optimization as a tool in the analysis of steel casting defects",Maynard steel casting company.

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A 12 Week Yoga Exercise (A Part of Foot Reflexology and Acupressure 14 Points Exercise), Treatment Improves Biomagnetism, Sleep Quality, Reduces Hypertension among Women (45-60 Age) with Insomnia Associated Hypertension Problem; A Pilot Study

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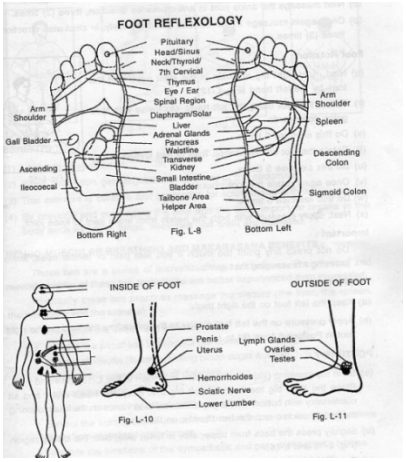
Abstract- Back ground: To evaluate the effects of Biomagnetism through yoga exercise among women patients with hypertension induced insomnia and its significant improvement in sleep quality and reduced hypertension. This novel concept was put forth by Swami Vethathiri Maharishi in south India. Method: A sample of 20 female patients comprised experimental group participated in 12 weeks yoga exercise. A sample of 20 female patients constituted control group underwent no exercise. The patients filled out a broad spectrum of questionnaire on the concept of yoga exercise and Biomagnetism before start of the exercise. The patients were subjected to physiological, Bio-magnetism and biochemical variables to assess the quality of life style, pre and post test. The hypertension and sleep quality were monitored pre and post test. Results: A significant ($p<0.05$) effect of yoga exercise was observed in improved sleep quality and reduced hypertension of experimental group subjects. However no significant effect of sleep quality was found for control group. Conclusion: This research study revealed that twelve weeks of training given to experimental group subjects under the strict supervision of yoga trained lady teacher assisted by the research scholar that yoga exercise s had demonstrated a marvelous change in the value of physiological, biochemical and biomagnetism variables enabled the subjects to an improved sleep quality and reduced hypertension.

Index Terms- Hypertension, Insomnia, Bio-magnetism, Quality of life, Broad spectrum

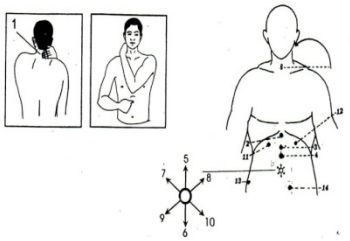
I. INTRODUCTION

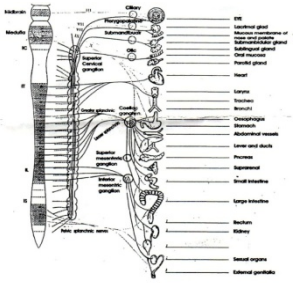
The main purpose of the study is to find an alternate pathway for hypertensive patients with insomnia problem found in women (45- 60) by enhancing their bio-magnetism by application of yoga exercise, envisaged by Swami Vethathiri Maharishi, a south Indian born, saint and savant (1911-2006) by his untiring and unintermittent 40 years of strenuous effort [1], passed on to mankind as a gift to get rid of diseases. Nowadays in modern society, sleep disorders are enormously increasing everyday around the world .This problem can be gradually rectified by strictly following the yoga activities. The hypertension induced insomnia problem can be brought under control by a mechanism of increased bio-magnetism existing in every human being. This concept of bio-magnetism is a new phenomenon explained very clearly by swami Vethathiri maharishi. According to him, the bio-magnetism is a fundamental vital force which determines the Physical health of the human being, depletion of which below a critical level will result in the development of various kinds of diseases including hypertension and insomnia problem .The bio-magnetism thus depleted below a certain minimum critical level can be enhanced to above the minimum critical level by strictly regulating the quantity and quality of food, work, sleep, sexual gratification and thought force which is otherwise called as five factors limit and method. In addition to the above, the Biomagnetism can also be boosted to above minimum critical level by a continuous practice of Simplified NINE types of Physical Exercises, namely Hand exercises, Leg exercises, Neuro -muscular breathing exercises, Eye exercises, Kapalapathi, Makarasana Part 1 & 2,Acu-pressure14 points exercise, out of these nine exercise the important in being given to leg exercise particularly foot reflexology and Acupressure 14 points exercise which come under the broad spectrum of sky yoga principles, which also includes Kayakalpa yoga, meditation and introspection methods as explained in SKY yoga. However our study is confined to foot reflexology and acupressure 14 points exercise only. [2]
LEG EXERCISE (Foot Reflexology)



Foot Reflexology is based on the ancient principles that all the organs and glands in our body are connected to reflex points on foot [3]. Pressure point techniques are used to focus on these reflex points, to release blocked Biomagnetism and stimulate the body's self-healing abilities, the perfect therapy for general wellness [4]. The foot represents the body which is divided into ten reflex zones, like a mirror image of the body. It is believed that foot reflexology exercise can be effective in helping to enhance the Biomagnetism to reduce effects and symptoms of anxiety, lack of sleep, restlessness and being overworked and helps to have a sound sleep. The science of reflexology is based on the theory of meridians. Our body has 14 imaginary meridians that carry Biomagnetism throughout the body. Each meridian starts with the tips of finger and toes, passes through the brain and gets connected to the respective organs [5]. When we have a problem related to any of the organs, it means that the meridian carrying Biomagnetism to those particular organs has an obstruction that slows down the normal functioning of the organ. If the obstruction is removed, the flow of Biomagnetism becomes normal, and the organ starts functioning properly. This is done through leg exercise otherwise called foot reflexology. The points on the body that run along the meridian are activated by applying mild pressure ,to remove the obstruction in the nerve so that Biomagnetism can flow with regularity and the particular organ resume its normal function and insomnia patients can have a good sleep.[6]

ACUPRESSURE 14 POINTS EXERCISE





To start with, we should use our index finger and thumb to apply pressure on particular meridians in our body. At the same time we should concentrate every point for 1 minute till the exercise is completed as shown in the following picture. [7]

Point1: The placing of the left hand across the nape and holding static there, over the 7th cervical spine area, which lies over on a fixed point which underlines parasympathetic ganglia via, the superior, middle and inferior cervical ganglion. By applying pressure on this fixed point with the help of either moving index finger or thumb finger to complete the bio magnetic electric flow by pressing specific points, concerned with different will be completed in the respective organs\nerve fibers. Thus energy flows through the body and the organs are stimulated and regulated.

Point 2: This point just which is lying below the Xiphisternum is very important point called "Nabi Chakra" or "Solar plexus". Here thousands of sympathetic nerve fibers form a plexus, supplying nerve fibers to organs below the diaphragm. Anatomically this is the "Coeliac plexus" woven around artery called "Coeliac Axis". The correction of solar plexus and its importance is well known to every Yoga and naturopathy teacher.

Point 3: In between 2 and 4, the point rests over the stomach with its nerve supply through both the anterior posterior nerves of later jet which controls the acid secretion of the gastric juice. The pressure here regulates in the digestive process of the stomach.

Point 4: Pointed pressure here directly rests on the organ pancreas as well as the superior mesenteric nerve plexus. The secretion of insulin and glucagon secreted by pancreas might be effected by applying pressure on this point.

Point 5, 6,7,8,9 and 10: (Denotes various positions) Application of pressure on these points around the umbilicus denoting specific points. Anatomically, in the embryonic stage or in the later stages, elements of anatomic structures related the concerned systems exist, which might be the reason that these pressure points are given importance:-

Point: 5 -12 O' clock position: Liver point: This point underneath have the falciforms ligament, with obliterate foetal umbilical vein, attached to the liver.

Point: 6 – 6 O' clock position: Bladder point: the partially obliterated remains of urachus persist as median umbilical ligament. Sometimes some remnant cysts may also be found at sub umbilical level called "urachus cysts'.

Point: 7&8- 11\2 and 10 1\2 Clock Positions: Adrenal Point: Pressure over here goes a little deeper to the glands of suprarenal's which secrete epinephrine\ nor epinephrine group and corticosteroids, all of which control the stress management system.

Point: 9&10 -4 1\2 and 7 1\2 Clock Positions: Inguinal points: Here the inferior epigastria vessels from the hernia orifices end along with lateral umbilical fold and the obliterated round ligament of uterus. Hence this position is called as hernia point.

Point 11: This point lies below the right coastal margin, and when deep pressure is applied the liver takes the pressure and energy. Liver functions get regulated.

Point 12: Similar point on left controls the functions of the Spleen.

Point 13: This point is called as 'Gall bladder' point. (Where Murphy signs may be elicited during gall stone disease syndrome) Proper practice with concentration on these points will streamline the working liver, regulating the chemical processes therein.

Point 14: The last point is situated somewhere near the inferior mesenteric plexus Supplying the sigmoid and rectum. Hence it may be called 'Rectal point'. Herein absorption of fluids takes place, motion may be regulated and a good diet habit can be brought out. [8]

Benefits:

1. Short circuit of electrical energy in any part of the body would be cleared.
2. Acupressure is a preventive measure for heart ailments. It reduces blood pressure.
3. It regulates the nervous system and reduces tension.
4. It is very helpful in alleviating insomnia.[9]

II. MATERIALS AND METHODS

The subjects were randomly divided into two groups. Group I is called a experimental group comprised of 20 women subjects who were exposed to foot reflexology and Acupressure 14 point exercise under the strict supervision of a trained lady yoga teacher assisted by the research scholar .In addition to foot reflexology and Acupressure 14 point exercise ,the experimental group subjects were given a brief out line philosophy behind the concept of biomagnetism and its highlight and its important role it plays in every individual's day to day life to lead a disease free happy and peaceful life. Accordingly before start of the exercise ,a questionnaire explaining the vital components that form the concept of biomagnetism(10) namely five factors limit and method process and if one does not neglect or over indulge or over use or improper use of these five concept of food,rest,sleep,sexual gratification and usage of thought would enable them to avoid the entry of diseases in to their body and also they could get cure from the diseases so attacked and thus to lead a disease free, happy life was explained to them.

To assess the understanding of the concept of biomagnetism at the end of 12 weeks training program, again the same questionnaire was distributed to the experimental group subjects and they were instructed to answer the questionnaire. On scrutinizing the answers, it was found that they had under stood the concept to a maximum extent and during interaction with them, they expressed with cheerfulness that they were not aware of this new concept of biomagnetism earlier and so they were suffering from health problems and after the 12 weeks training program made them to realize the significance of the concept of biomagnetism and all the subjects gave assurance that they would here after will be a changed personality and felt as if they had taken a new birth.So such tremendous change could be seen in the life style of the subjects .

The other group is called as experimental group II and also coined as control group. This group again comprised of 20 women subjects and these 20 women subjects were also explained in detail regarding the importance of executing the foot reflexology, Acupressure 14 point exercise and also the concept and the importance of biomagnetism by distributing the questionnaire to the experimental group and control before start of the training program.

III. RESULTS AND DISCUSSION

The pre- test values in respect of physiological and biochemical variables were measured with the assistance of an ISI certified medical laboratory. Similarly after a rigorous training of the yoga exercises for a continuous period of 12 weeks, the post test values in respect of physiological and biochemical were again obtained from the same medical laboratory. None of this 20 subjects from control group showed any interest whatsoever, either to perform the exercise nor showed any curiosity to follow the concept of biomagnetism involved in the five factors limit and method process. Hence the control group went without any exercise and did not follow the principles of biomagnetism during the training period of 12 weeks.

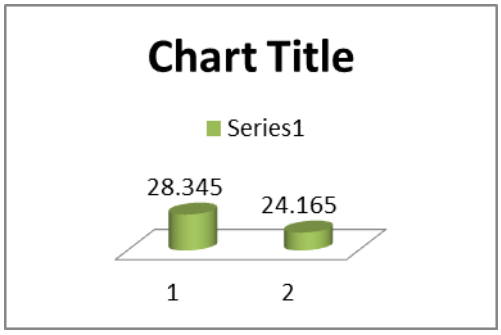
On these lines the questionnaire was prepared and distributed to the experimental group and control group subjects before start of exercise and also after 12 weeks completion of the exercise. The answers given by the subjects' pre and post test were evaluated. (Biomagnetism questionnaire attached). The data pertaining to the physiological, biochemical and biomagnetism variables for control group thus did not show any significant improvement in their health and also in their life style which could be easily inferred from the statistical analysis. The data thus obtained were verified for the validity of our research work by substituting these values statistically by employing Pearson correlation method and we were able to get a p value of less than or equal to 0.05 which showed that there is a significant improvement in increased sleep quality and a remarkable improvement in reduced hypertension for experimental group I. The statistical analysis has been shown in the tabular column.

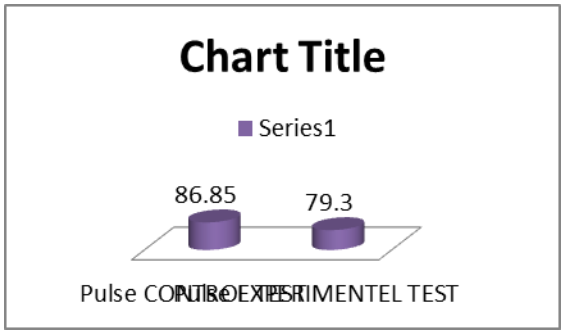
THE STATISTICAL DATA HAS BEEN ARRIVED AT COEFFICIENT FOLLOWING THE PEARSON CORRELATION

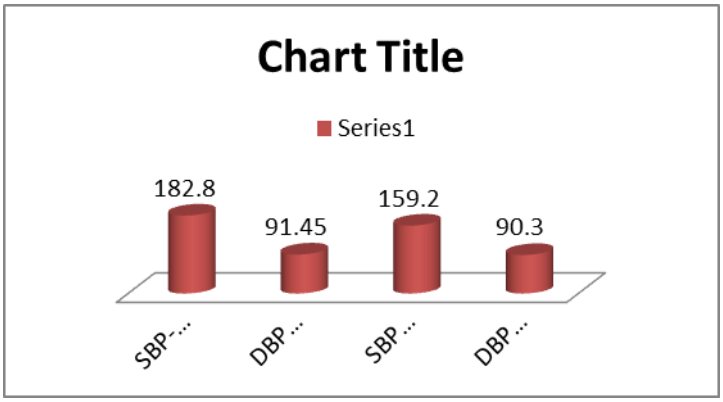
Table 1 PAIRED SAMPLES CORRELATION FOR PHYSIOLOGICAL MEASURES

S.NO	PARAMETER	CONTROL AND EXPERIMENT TEST	N	CORRELATION	SIG.
1.	BMI	BMI	20	0.702	0.001
2.	PULSE	PULSE	20	0.652	0.002
3.	SBP	SBP	20	0.651	0.002
4.	DBP	DBP	20	0.648	0.002

Figure1: PHYSIOLOGICAL MEASURES BMI, PULSE, SBP AND DBP





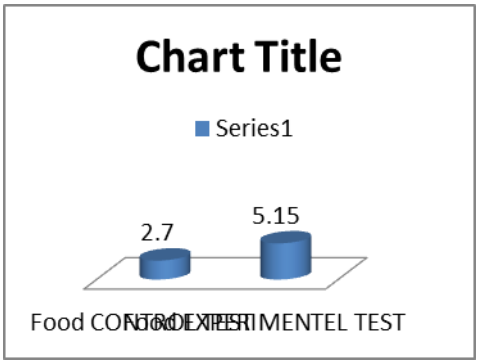


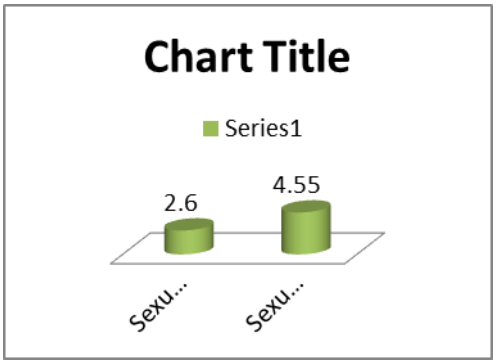
It is evident from the above table that comparing control group with that of the experimental group, there is a significant variation ($P < 0.05$) found as expected in the experimental group which is a clear indication of an enhanced Biomagnetism.

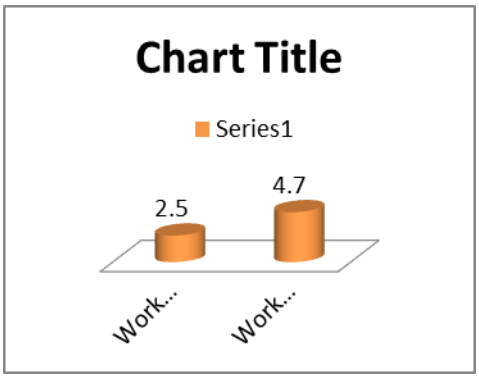
Table 2 PAIRED SAMPLES CORRELATION FOR BIOMAGNETISM INVENTORY QUESTIONNARIE METHOD

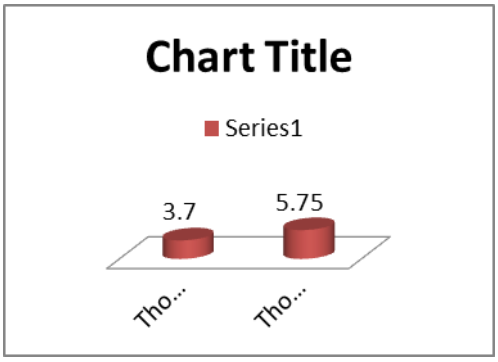
S.NO	PARAMETER	CONTROL AND EXPERIMENT TEST	N	CORRELATION	SIG.
1.	FOOD AWARENESS	FOOD	20	0.648	0.002
2.	WORK AWARENESS	WORK	20	0.997	0.001
3.	SLEEP AWARENESS	SLEEP	20	0.666	0.001

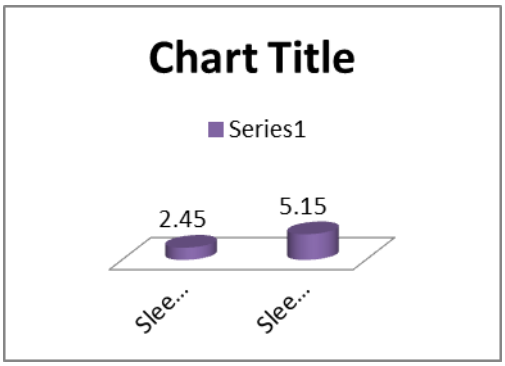
4.	SEXUAL GRATIFICATION AWARENESS	SEXUAL GRATIFICATION	20	0.823	0.001
5.	USE OF THOUGHT AWARENESS	THOUGHT	20	0.611	0.004









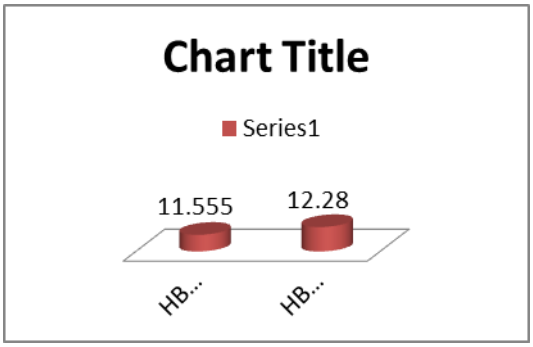


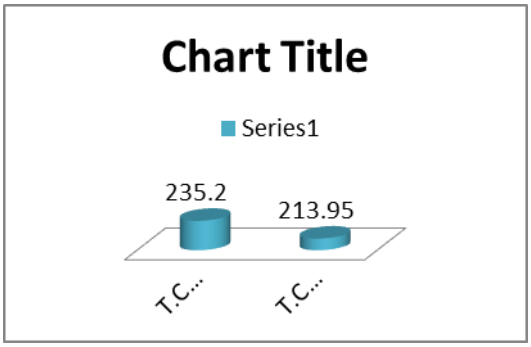
It is distinctly clear from the above table that comparing control group with that of the experimental group, there is a very high significant variation (P< 0.05) found as expected in the experimental group which proves that these patients had a thorough understanding and awareness and imposed a greater confidence on the five factors of limit and method process for an enhanced Biomagnetism.

PAIRED SAMPLES CORRELATIONS FOR BIOCHEMICAL MEASURES

S.NO	PARAMETER	CONTROL AND EXPERIMENT TEST	N	CORRELATION	SIG.
1.	HEMOGLOBIN	HB	20	0.742	0.001
2.	TOTAL CHOLESTEROL	T.CHOLESTEROL	20	0.840	0.001

Figure3: BIOCHEMICAL MEASURES HB, TOTAL CHOLESTEROL





It is found from the above table that comparing control group with that of the experimental group, there is a significant variation (P< 0.05) found as expected in the experimental group which shows a reduction in the amount of cholesterol and an elevated level of Hemoglobin (HB) which shows an increased Biomagnetism

IV. CONCLUSION

The results of our study showed that this kind of food reflexology and Acupressure14 points exercise is more effective at improved sleep quality and decreased hypertension. Of the 20 yoga group participants completing the exercise program, all of them expressed their high satisfaction with yoga exercise program and all of them reported an increased strength, flexibility, mobility, enhanced energy and well being, increased feeling of peace, tranquility and relaxation and greater body awareness. These preliminary findings suggest that this yoga exercise (FOOT REFLEXOLOGY AND ACUPRESSURE 14 POINTS EXERCISE) may offer a safe and beneficial interest for reducing sleep disturbance, stress, anxiety and blood pressure in insomnia patients through increased Biomagnetism by performing the yoga exercise regularly.

REFERENCES

[1] Arutselvar Dr .N.Mahalingam "Logical Solutions for the Problems of Humanity" Vethathiri publications 1999, pp- 7,

[2] Vethathiri Maharishi "SIMPLIFIED PHYSICAL EXERCISE" Vethathiri Publications, 2014, pp – 11

[3] Mohammed Shamshad Begum "A study to assess the effectiveness of foot massage in reduction of blood pressure among female hypertensive patients registered in selected hospitals of kolar district". Rajiv Gandhi University of Health Sciences, Bangalore, Karnataka.

[4] Hayes J "Immediate effects of five minutes of foot massage, on patients in critical care", Intensive critical care nursing, 15(2), 1999, pp. 77-82.

[5] Kaye A.D "The effect of deep tissue massage therapy on blood pressure and heart rate", Journal of alternative and complementary medicine, 14(2) ,2008, pp .125-8

[6] Cady S.H and G.E Jones, "Massage therapy as a work place intervention for reduction of stress", perceptual and motor skills, 84(1) , 1997,157-8.

[7] Vijayalakshmi,(2013) "Effect of 14 points Acupressure on blood pressure" International journal of yoga and Allied science Volume 2, Issue 2 pp 109-115

[8] Dr.M.N.Raman, M.B.B.S., M.S, Ooty Temple of Consciousness Book pp-161, 2004

[9] Vijayalakshmi,(2014)"Modern Day Benefits of Acupressure 14 Points Exercise in Alleviating Heart Related Ailments" Designed By Swami Vethathiri Maharishi: A Case Study (Observed on a 38 Year Old Woman with Mitral Valve Problem) Research and Reviews: Journal of Ayurvedic Science, Yoga and Naturopathy Volume 1, Issue 3 pp 19 - 25

[10] Mr. Nagarjuna Sangem Bio-Magnetism Of Life Force In Physical Body International Journal of Health, Physical Education and Computer Science in Sports Volume No.15, No.2 2012,,pp.117-119

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SUPPLIMENTARY MATERIAL TO BE ATTACHED

QUESTIONNAIRE ASSESSMENT FOR IMPROVING THE BIOMAGNETISM THROUGH FIVE FACTORS OF VARIABLES FOR LIMIT AND METHOD

C. Vijayalakshmi, Research Scholar, Bharathiar University, Coimbatore, Tamilnadu, South India

OBJECTIVE

The concept of bio-magnetism is a new phenomenon put forth by Swami Vethathiri Maharishi .According to him the bio-magnetism is a fundamental vital force which determines the physical health of a human being. Every individual is blessed with bio-magnetism by divine power. If the existing level of bio-magnetism is maintained as such to meet routine metabolic activities of the body, then it is said to be a balanced sensation felt as peace. On the other hand if bio-magnetism is depleted below critical level results in the development of various diseases.

The main reason for depletion of bio-magnetism are due to neglect or over indulgence or improper use of five factors i.e. Food, Rest, Sleep, Sexual Gratification and Use of thoughts. If these five factors are scrupulously followed by limit and method process, one can lead a disease free life. Hence to assess to what extent the patients suffering from various health diseases follow these five factors, a questionnaire was prepared and distributed to the patients.

On scrutinizing the answers given by the patients it was clear that they are convinced of the benefits of following the five factors limit and method process, to lead a disease free happy and contended life and expressed their whole hearted willingness to undergo twelve weeks rigorous treatment of Simplified Physical Exercise, Kayakalpa yoga, and meditation and introspection method.
On the other hand the answer given by the other patients clearly showed that they are not convinced of five factors limit and method process and were highly reluctant, to undergo yoga treatment and they went without any treatment.

Name_____ Age ____ Sex____
Date _____ Place _____

Using the worksheet

Patients are assigned a single score for each numbered group. For visual ease, we have designed the worksheet so that this score is entered next to the corresponding symptom severity level.

FOOD

1. Are you aware that only nutritious food should be taken in a limit and method scale?
   YES ☐ NO ☐
2. Are you aware that insufficient amount of intake of nutritious found will not supply required energy to the body?
   YES ☐ NO ☐
3. Are you aware that an excessive intake of food results in indigestion and leads to short circuit and ending in various, types of diseases?
   YES ☐ NO ☐
4. Are you aware that one should not indulge in cycling, sexual act, or hard work Immediately after eating which will ulcer incur formation?
   YES ☐ NO ☐
5. Are you aware that slaying of animals and eating their flesh for flattening of his/her body is against law of nature?
   YES ☐ NO ☐
6. Are you aware that imbalance in the intake of 6 tastes (salty food, hot chilly items, and sweets, bitter and sour taste) is one of the major factors for the diseases to creep in?
   YES ☐ NO ☐
7. Are you aware that food should be taken only after the food taken already was completely digested to avoid gas formation which leads to short circuit and gives way for the diseases to develop?.
   YES ☐ NO ☐
8. Are you aware that moderate amount of eating is the way to a prolonged life of an embodied soul?
   YES ☐ NO ☐
9. Are you aware of the fact that a disturbance in blood circulation is due to the formation of acidity from the food that is taken?
   YES ☐ NO ☐
10. Are you aware that one should not neglect to eat adequately and timely to maintain a disease free, mind, and health?
    YES ☐ NO ☐

WORK

1. Are you aware that either neglect of work or over indulgence or improper work disturbs your bio-magnetism?
   YES ☐ NO ☐
2. Are you aware that one should take care to work in moderation which has its special value?
   YES ☐ NO ☐
3. Are you aware that lack of work makes a person lazy?
   YES ☐ NO ☐
4. Are you aware that lack of work makes limbs to lose their efficiency and blood, air, heat circulation ,slows down disturbs bio-magnetism resulting in a variety of disease?
   YES ☐ NO ☐
5. Are you aware that no proper movement or improper movement of limbs results in stagnation of unwanted molecules/toxins in your body?
   YES ☐ NO ☐
6. Are you aware that stagnation of improper molecules/toxins in your body obstructs the flow of blood, air, heat circulation which disturbs bio-magnetism and leads to diseased life?

YES ☐ NO ☐

7. Are you aware that movement of body muscles due to moderate work will result in congenial, harmonious feeling which is essential for leading a disease free, happy and peaceful life?
   YES ☐ NO ☐
8. Are you aware of the fact that due to overwork or excessive hard work, some molecules leave the body and results in wear out of bones and joints?
   YES ☐ NO ☐
9. Are you aware that the negligence in limit and method in action or work with result in the development of various problems in life due to disturbance of bio-magnetism?
   YES ☐ NO ☐
10. Are you aware that if proper care is taken to maintain limit and method in movement of muscles /limbs, then there would be no more sensual intoxification or ill effect in life or diseases in your body?
    YES ☐ NO ☐

REST

1. Do you know that the physical systems that are exhausted or weakened are refreshed energized and repaired during deep or sound sleep and also you know that if one feels sleepiness constantly then it is a sign of ill health, which needs a treatment?
   YES ☐ NO ☐
2. Do you know that oversleeping slows down the body functions and retards excretion of toxins in our body and weakens the central nervous system?
   YES ☐ NO ☐
3. Do you know that neglect or overindulging and improper act in sleep deplete the stock of bio-magnetism and paves way for all types of diseases to enter the body?
   YES ☐ NO ☐
4. Do you know that performing acupressure 14 points exercise and relaxation techniques half an hour before going to bed gives one a sound, and deep sleep?
   YES ☐ NO ☐
5. Do you know that long hours of awakening during night hours with induce sleepiness during day time and lessen your longevity of life?
   YES ☐ NO ☐
6. Do you know that 8 hours of sleep for children, 7hours for adults and 6 hours of elderly people are essential to maintain good physique?
   YES ☐ NO ☐
7. Do you know that one should not cultivate the habit of reading excessive story books, detective novel book ,which induce sensory organs to get activates to an hour before going to bed which will induce sensory pleasures that might disturb a sound sleep?
   YES ☐ NO ☐
8. Do you know that one should avoid long hours of awakening during night time or watching TV program for prolonged hours or continued travel for several days?
   YES ☐ NO ☐
9. Do you know that insufficient hours of sound sleep results in loss of efficiency of man?
   YES ☐ NO ☐
10. Do you know that a sound sleep provides enough rest to body and assists in energizing the body again?
    YES ☐ NO ☐

SEXUAL GRATIFICATION

1. Are you aware that an excessive use of sensory organs in the long run causes pain, misery, disease and ultimately death?
   YES ☐ NO ☐
2. Are you aware that sensory pleasures should be deal with full awareness of limit and method scale?
   YES ☐ NO ☐
3. Are you aware that sex should neither are neglected nor indulged in excess?
   YES ☐ NO ☐
4. Are you aware of the fundamental fact that one should not indulge in sexual coitus during full moon, dark moon day and birth of Tamil month etc?
   YES ☐ NO ☐
5. Are you aware that one should not indulge in sexual act immediately after intake of food?
   YES ☐ NO ☐
6. Do you know that irrelevant thoughts and unwanted fear, false belief about sexual act will lead to mental dissatisfaction and diseased life?
   YES ☐ NO ☐
7. Do you have ever felt at any point of time that you are in captive of satisfying you life partner, and then he will depart you?
   YES ☐ NO ☐

8. Do you know that one should not indulge in sexual act at mid-day or mid-night?
   YES ☐ NO ☐
9. Do you know that to have a peaceful and contented life, to one should have sexual act in two weeks or even better an interval of one month?
   YES ☐ NO ☐
10. Do you know that for a noble life to lead and as a moral behavior a husband and wife should indulge in sexual act to quench the thirst and realize the meaning of life?
    YES ☐ NO ☐

USE OF THOUGHTS

1. Are you aware that the positive thinking will assist you to maintain good physique?

   YES ☐ NO ☐
2. Are you aware that refinement of six bad temperaments via introspection will pave way for attainment of easy meditation?

   YES ☐ NO ☐
3. Are you aware that Maintenance of harmonious relationship among fellow human being in your own family will result in development of cordial relationship, joy happiness and peaceful life?

   YES ☐ NO ☐
4. Are you aware that to realize DIVINE STATE one should purify his or her own GENETIC CENTRE devoid of blemishes?

   YES ☐ NO ☐
5. Are you aware that the thoughts play a major role in regulating the functioning of mind?
   YES ☐ NO ☐
6. Are you aware that the anger, fear and disappointment etc decrease the biomagnatism resulting in the development of diseases?
   YES ☐ NO ☐
7. Are you aware that a practice of creative, harmonious and positive thinking will lead to a peaceful, disease free life?
   YES ☐ NO ☐
8. Are you aware that a negative thinking decreases the potential body, mind and soul due to certain chemical changes in the body?
   YES ☐ NO ☐
9. Are you aware that a quality of noble thought, forgiveness and perseverance in achieving the main aim and purpose of life. ?
   YES ☐ NO ☐
10. Are you aware that Instead of struggling over petty things, one has to introspect and understand the purpose of life, proper method to attain that goal and to act in such a way in broad mindedness and awareness?
    YES ☐ NO ☐

Detection and Classification of Lung Disease – Pneumonia and Lung Cancer in Chest Radiology Using Artificial Neural Network

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Abstract- Chest radiology is the most common method used for diagnosis of lung diseases, the term lung disease refers to the abnormalities that effect the lung organ, diseases are such as asthma, COPD, lung cancer, pneumonia and many other breathing problems, in this paper, we develop a system that defects and classify the lung diseases as either pneumonia or lung cancer, this is accomplished by two stages they are feature extraction and classification, feature extraction is done through the use of Gabor filter, classification is through the use of neural network's like feed forward neural network(FFNN), Multi-layer perceptron neural network(MLPNN), Radial Basis Function(RBF).

Index Terms- feature extraction, classification, Neural Networks

I. INTRODUCTION

Lungs are the organs which are contained in the thoracic cavity, there are enveloped in two pleural membranes. There are two types of lung cancer, that is, small cell lung cancer and non-small cell lung cancer. The lungs are subdivided into lobes, compartments and fed by different parts of bronchial and vessel trees.

Lung cancer is a cancer that starts in the lungs. Lung cancer can start in the cells lining the bronchi and parts of the lungs such as the bronchioles or alveoli, changes in the genes (DNA) inside the lung cells may cause the cells to grow faster, they form a tumor.

Pneumonia is a other type of lung disease, which can be said as acute inflammation of lung parenchyma, inflammatory infiltrate in alveoli.

In this paper lung disease detection system is developed, this study classifies lung disease images as either lung cancer or pneumonia, this is accomplished by two stages of system, feature extraction and classification. Feature extraction is done through the use of Gabor filter, Gabor filters extract certain important features from the images Mean, Variance, Standard Deviation, Homogeneity, Energy, Contrast, Correlation. This set of extracted features are called as Gabor Feature set. Classification is done through the use of various types of Artificial Neural Networks. They are Radial Basis Function, Multi-Layer Perceptron and Feed Forward Neural Network.

II. PROPOSED WORK

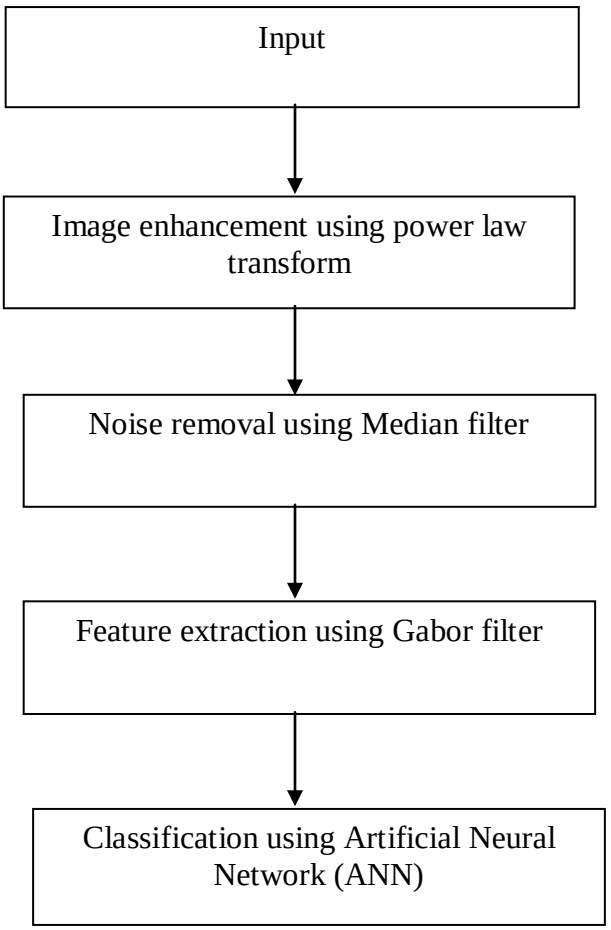


Figure: Flow chart of proposed work

The flow chart represents the developed system, which is used to detect and classify lung cancer and pneumonia lung disease from a collection of abnormal images, there are several stages in this system such as Enhancement of the image to improve the quality, removal of noise using Median filter, feature extraction using Gabor filter and finally classification using Artificial the flow chart of proposed system in detail.

The very first stage is to collect abnormal lung X ray images, the data set containing 116 images comprising lung cancer(58) and pneumonia(58) is been utilized.

Data preprocessing

Preprocessing is the process of improving or enhancing the quality of input image and make the feature extraction phase more reliable, main motive of preprocessing stages is to remove noise present in input image, here in the preprocessing stage median filter is used to remove noise from the input image and for image enhancement power law transform's is been used.

Median filter is another type of noise removal filter, it creates boundary of n*n in the noise input image, the n*n sub region is scanned over the entire image. The pixel values present in the n*n boundary is listed or arranged in the descending order, the middle value (median) is replaced with the centre pixel value of the n*n boundary. Usually n = 3 or 5 in median filter.

The above process is repeated for all the n*n sub regions of the input noisy image, such that the pixel value from which noise has to be removed will be the centre pixel value of each non boundary.

Feature extraction

Images have a huge number of features, it is important to recognize and extract such features from input images, feature extraction is the process done to reduce the complexity of processing, here for feature extraction we use Gabor filter, Gabor filter extract local pieces of information which are then combined to recognize an object or ROI 2D Gabor filter function.

$$\Psi(x, y) = f^2/\pi\Upsilon\eta e^{-(\frac{f^2}{\Upsilon^2}x'^2+f^2/\Upsilon^2 y'^2)}e^{j2\pi fx'}$$

$$x' = x\cos\theta + y\sin\theta$$
$$y' = -x\sin\theta + y\cos\theta$$

The Gabor filter will extract the features like Mean, Variance, Standard Deviation, Contrast, Correlation, Homogeneity, and Energy.

CLASSIFIER

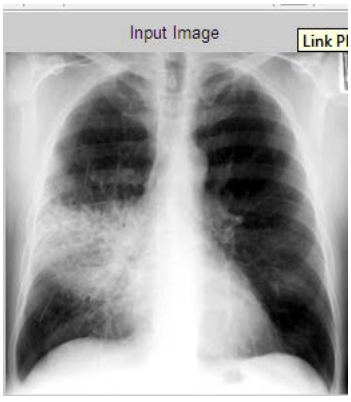
The classifier is a mathematical function which is implemented using classification algorithm which maps input data to a particular category. There are various types of classifiers. One such is Artificial Neural Network(ANN) which is used in this paper. Artificial neural network is a network of simple processing elements called neurons, which operates on their local data and communicates with other elements, three types of ANN is used here namely Feed forward Network, Radial Basis function and Multilayer perceptron Network.

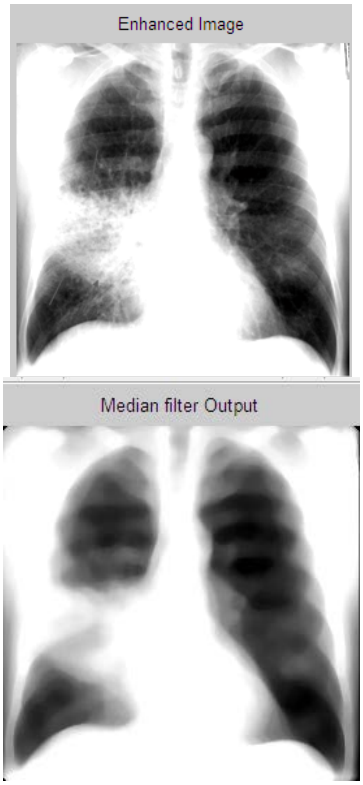
III. RESULTS AND DISCUSSION

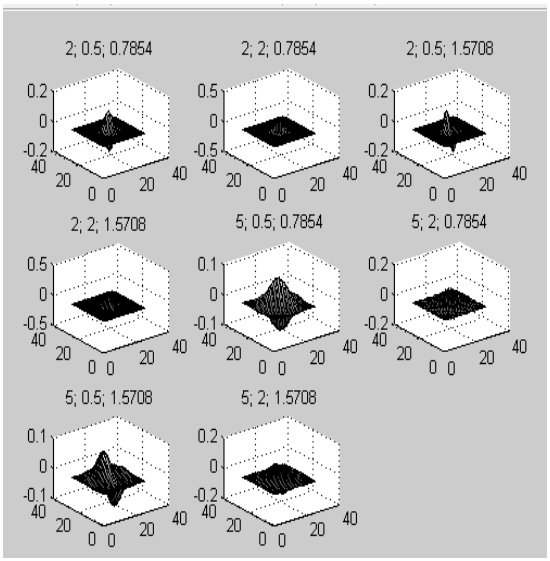
1. Preprocessing results for lung cancer detection

Case 1: lung cancer image

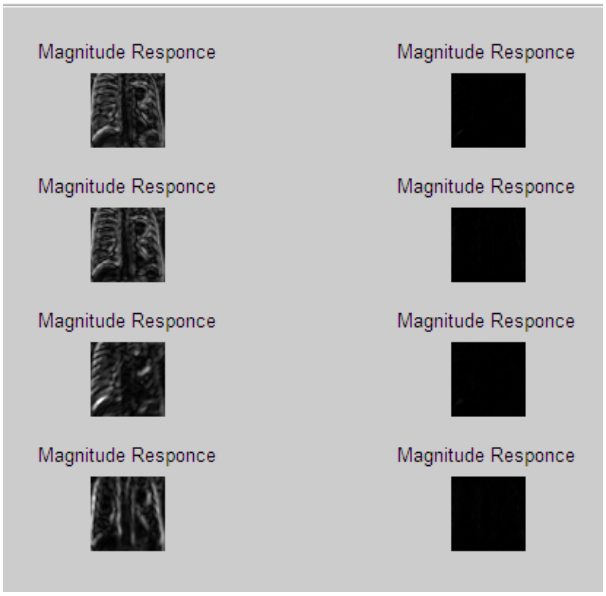
Case 2: Pneumonia image







Gabor filter response

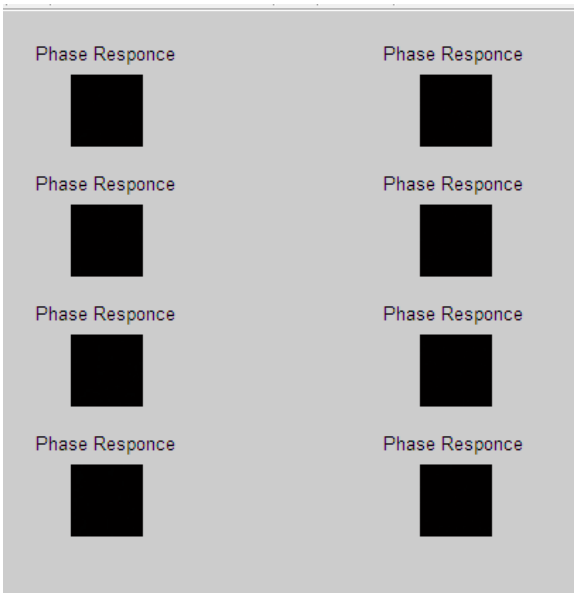


Magnitude response of chosen input abnormal image

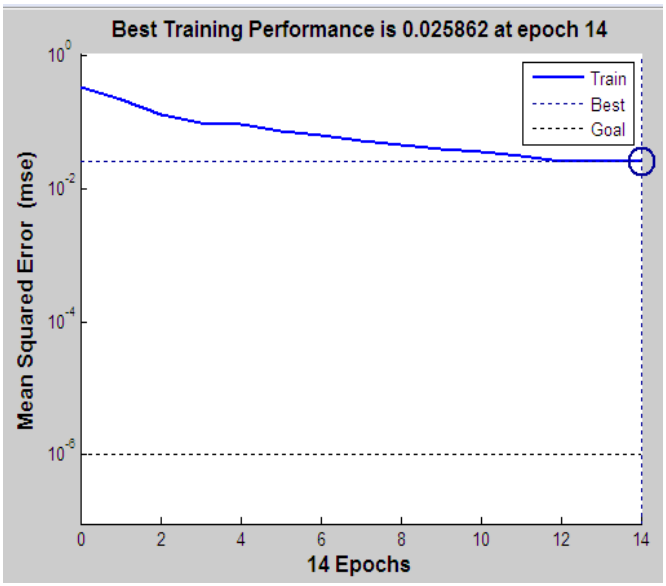
Feature extraction results:

	1	2	3	4	5	6	7	8	9
1	53.4401	59.9849	53.1754	60.7115	58.1471	62.4787	41.3473	76.0473	81.6538
2	2909	2496	2535	2451	2683	1697	1589	6706	4827
3	.0190e+03	8.7859e+03	1.1052e+04	9.6193e+03	1.0627e+04	8.6226e+03	1.0166e+04	9.9791e+03	8.6049e+03
4	0.0673	0.0114	-0.2268	-0.0181	-0.2224	-0.0108	-0.0016	0.0193	0.0825
5	1.7508e-05	3.1583e-05	3.5281e-05	3.1150e-05	3.3444e-05	2.6874e-05	3.5816e-05	3.4688e-05	3.1642e-05
6	0.0380	0.0390	0.0298	0.0373	0.0315	0.0439	0.0400	0.0359	0.0388
7	53.9344	49.9569	50.3482	49.5097	51.7952	41.1940	39.8593	81.8929	69.4754
8	0.7631	0.7435	0.8099	0.7853	0.9548	1.1278	0.6654	0.8498	0.9874
9	2	1	1	1	2	3	1	1	3
10	.3408e+03	8.9562e+03	1.1107e+04	9.1991e+03	9.5824e+03	8.7699e+03	8.0846e+03	8.4411e+03	9.6470e+03
11	-0.0149	-0.0444	-0.3168	5.2684e-04	-0.1101	-0.0843	0.0441	0.0688	0.0551
12	6.6227e-05	6.1008e-05	6.9900e-05	6.3841e-05	6.4348e-05	7.8858e-05	6.1201e-05	6.3584e-05	8.5408e-05
13	0.0317	0.0413	0.0291	0.0437	0.0380	0.0414	0.0435	0.0404	0.0422
14	1.2324	0.9825	1.1740	1.0395	1.3437	1.8631	0.7876	1.1608	1.6926
15	53.1765	61.2258	51.8611	63.6426	57.8600	68.1740	41.9395	72.4537	88.6724
16	3012	2653	2345	2707	2579	1900	1512	4947	5812

Feature Extraction Values



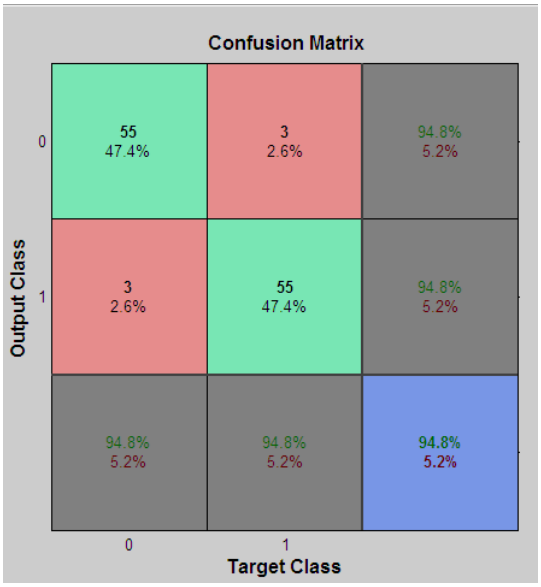
Phase response of chosen input abnormal image



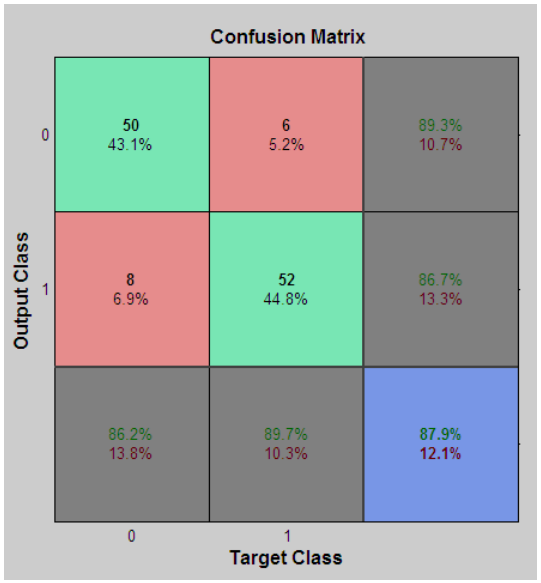
Graph of Mean Square Error for different iteration

Multilayer perceptron

Classifier results:
Feed forward neural network

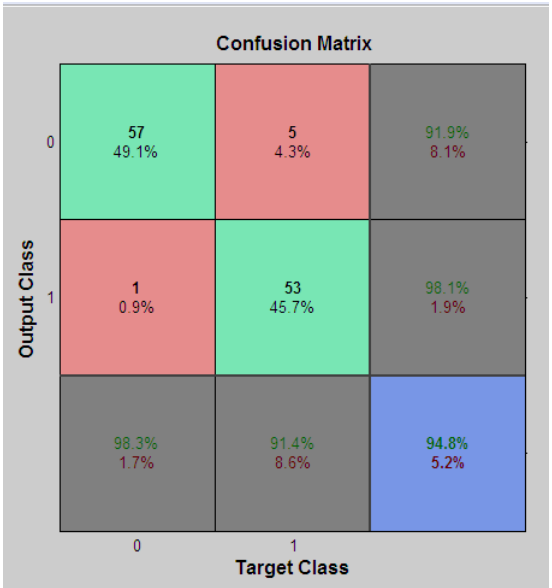


Confusion matrix

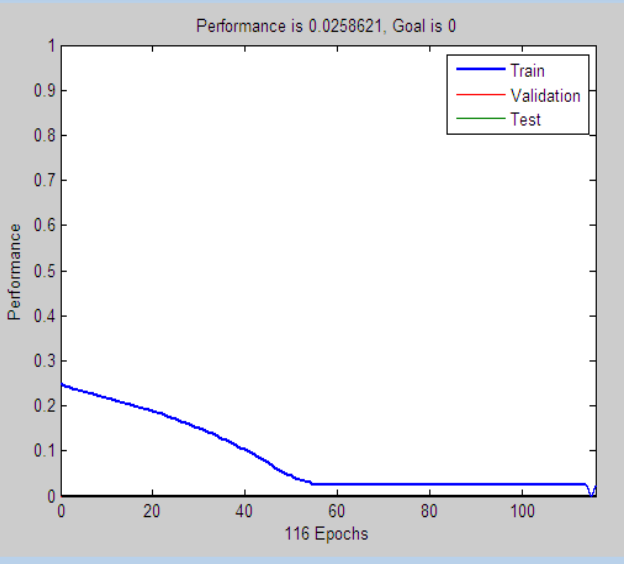


Confusion matrix

Radial Basis Function Neural Network



Confusion matrix



Graph of Mean Square Error for Different Iteration

IV. Conclusion

In this project work, lung disease detection system has been developed, abnormal images are considered as input, on which preprocessing techniques are applied using power law transform and median filter to remove noise, features extraction is done by Gabor filter and finally classification of images as either lung cancer or pneumonia is done by Artificial neural network, Radial Basis Function Neural Network, Multi Layer Perceptron Neural Network, Feed Forward Neural Network. Here three types of ANN classifiers have been used in this project out of which we have got best results for Feed Forward and Radial Basis Function Network than compared to all other existing methods of classifiers, percentage of accuracy been obtained is about 94.8% for Feed Forward and 94.82% for Radial Basis Function Network.

References

[1] Yetisgen-Yildiz M, Glavan BJ, Xia F, Vanderwende L, Wurfel MM. Identifying patients with pneumonia from free-text intensive care unit reports. Proceedings of Learning from Unstructured Clinical Text Workshop of the International Conference on Machine Learning 2011.

[2] Bejan CA, Xia F, Vanderwende L, Wurfel MM, Yetisgen-Yildiz M. Pneumonia identification using statistical feature selection. In submission.

[3] K.A.G. Udeshani, R.G.N. Meegama, T.G.I. Fernando, "Statistical Feature-based Neural Network Approach for the Detection of Lung Cancer in Chest X-Ray Images," International Journal of Image Processing (IJIP), Volume (5), Issue (4) , 2011.

[4] V.Krishnaiah, Dr.G.Narsimha, Dr.N.Subhash Chandra. 2013, "Diagnosis of Lung Cancer Prediction System Using Data Mining Classification Techniques," International Journal of Computer Science and Information Technologies, Vol. 4 (1), 2013, 39 – 45.

[5] S. A. Patil and V. R. Udupi, Chest X-rays features extraction for lung cancer classification, Journal of Scientific and Industrial Research, vol. 69, pp. 271-277, 2010.

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Dual Edge Adaptive Pulse Triggered Flip-Flop for a High Speed and Low Power Applications

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Abstract- Pulse-triggered flip-flops are mainly used to improve speed of operation (pipeline speed), though flip-flop robustness and system timing closure are challenging in a wide range of supply voltages. Usually pulse-triggered flip-flops have specific structures and transistor sizes to optimize the system performance. The transistor size, topology, and threshold voltage of the flip-flop make the timing characteristics sensitive to the supply voltage. The transparent windows generated and required in a pulse-triggered flip-flop may have mismatch under different supply voltages (scaling), which is likely to result in system timing and functional failures. in single edge adaptive pulse trigger flip-flops the latching speed is less, no of transistors are more and power dissipation also high so to overcome these limitations dual edge adaptive pulse triggered flip flop is proposed. Proposed structure improves the robustness of adaptive pulse-triggered flip-flops and promises this high-speed clocked element for wide range of supply voltages so data latching speed is increase, numbers of transistors were reduced and power dissipation also reduced. Transistor driving-strength mismatches are considered and overcome by Dual edge adaptive pulse trigger flip flop implemented in 130nm technology**.**
.

Index Terms- *Flip-Flop, Process variation, Standard cell, Sub threshold circuit*

I. INTRODUCTION

The Flip flops are basic memory elements which are used to store one bit memory. Flip flops are used to design sequential circuits. Similarities have been observed between high-speed and sub threshold circuits, such as having serious timing un certainty and high sensitivity to process variations. Therefore, an important clocked storage element, an adaptive pulse triggered flip-flop, is introduced from gigahertz pipelines to boost the speed of sub threshold operations. High-performance processors employ pulse-triggered flip-flops that have low latency means time interval between simulation and the result. High performance processors help to mitigate the influence of clock uncertainty however super- and sub-threshold circuits have critical differences in transistor models. Circuit topologies, transistor sizes, and threshold voltages have strong impacts on the circuit delay in near- and sub-threshold regions. Multi threshold circuit is nothing but single circuit consists of both high and low threshold transistors. These transistors are used to reduce the leakage problem especially high threshold transistors are used to suppress the sub threshold leakage current and low threshold transistors are used to achieve high performance. The flip-flop delay, setup time, and hold time have a nonlinear shift when he dynamic voltage scaling (DVS) Covers super-threshold and sub threshold voltages; therefore, timing closure is complicated. Sub threshold pulse-triggered flip-flops are less robust than sub threshold master–slave latches because the transparent window is hard to control. Prior works have surveyed and analysed conventional flip-flops operated at sub threshold voltages. Pulse-triggered flip-flops usually require structural revisions to be operated in the sub threshold region. In contrast, master–slave latches can use transistor sizing for the same robustness.

Pulse-triggered flip-flops have a positive hold time that maybe close to the clock-to-Q delay. Internal race immunity (IRI)is thus a major issue for sub threshold pulse-triggered flip-flops. IRI may be negative when the hold time increases faster than the clock-to-Q delay during DVS. Process variations are also factors that cause negative IRI. Simply reducing the hold time cannot solve the internal-race problem because short hold time indicates a narrow transparent window, which causes a lack of robustness to capture data. In contrast, master–slave latches are relatively stable with respect to the internal race since their hold time is close to zero or a negative number. However, master–slave latches are slow when a processing Element requires high performance at a high voltage. Pulse-triggered flip-flops reduce latency on critical paths and benefit the operating speed. Therefore, robust pulse-triggered flip-flops help processing elements to achieve high performance at near- to super-threshold voltages, while the sub threshold mode is still available to save energy. Above consideration motivates this work.

System performance has been known to be sensitive to the supply voltage selected for logic synthesis and optimization. The delay of each standard cell, including flip-flops, has individual sensitivity with respect to the supply voltage. Static timing analysis then becomes complicated because timing violations should be checked in a wide range of supply voltages. Optimization of flip-flops thus has to include both conventional performance-based objectives and new timing closure criteria considering possible operating voltages. Challenges of voltage-scalable pulse-triggered flip-flops and a novel structure are detailed in this brief, introducing a

solution for robust pipelines operated in a wide range of voltages. Section II discusses the major issues of single edge pulse-triggered flip-flop and proposes a novel structure.

II. CONVENTIONAL TRANSMISSION GATE FLIPFLOPS

Conventional transmission gate flip flops are single edge pulse trigger flip flops. Every flip flop is driven by the pulse generators. The operation of any flip flop mainly depends upon the clock generators.a standard explicit-pulsed transmission-gate flip-flop (TGFF), which usually uses a pulse generator consisting of an odd-stage inverter chain. The inverter chain creates a phase difference; the overall circuit generates a positive pulse at node C_1 and a negative pulse at node C_2 every clock rising edge.

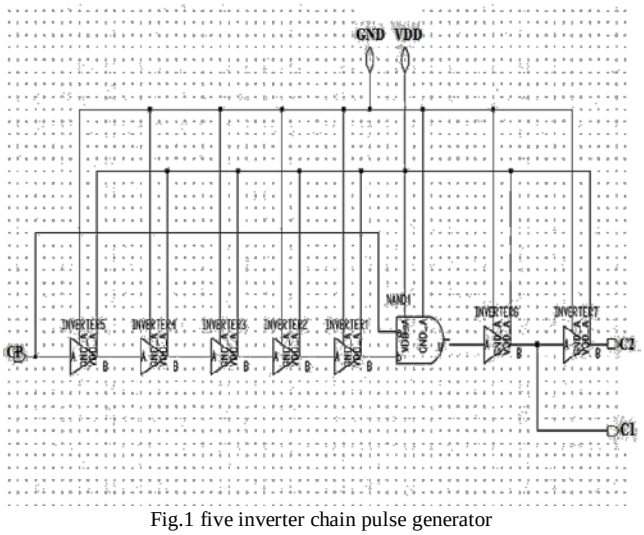

Fig.1 five inverter chain pulse generator

In this conventional pulse trigger flip flops mainly discuss about three inverter chain pulse generator flip flops, five inverter chain pulse generator flip flops, seven inverter chain pulse generator flip flops and replica path pulse generator flip flops. In three inverter chain pulse trigger flip flops due to insufficient delay unable to get exact simulation results. For getting exact simulation results need to increase number of buffer circuits (inverters) by increasing number of inverters due to these adding inverters produce exact simulation results. Even though got exact simulation results in both five inverter chain and seven inverter chain flip flops number of transistor is increase. These increase in number of transistors causes increase in area this is not good for any sequential circuit design. While coming to fourth one replica path pulse generator in this pulse generator uses transmission gate instead of inverter chains and in this some slight changes are happen.

The relation between the TGFF and D-Q delay and the pulse width. The flip-flop delay rapidly increases when the pulse width is narrow .The proper zone for the transparent window. A narrow transparent window increases the error rate of data latching and pipeline timing. Although a wide transparent window seems riskless for flip flop functions, it increases the hold time. A large hold time may lead to negative IRI and require extra delay cells to satisfy the minimum pipeline delay Wide-voltage-range operations thus introduce challenges in the design and optimization of pulse circuits. The transparent window optimized under a given supply voltage cannot guarantee error-free timing at a different supply voltage. Circuit optimization in the sub threshold region is quite different from that in the conventional super-threshold region.

Near- and sub threshold circuits have additional strategies to allocate transistor sizes and circuit topologies. A transistor with a long channel length may increase the driving strength due to the reverse short channel effect. The inverse narrow width effect another factor. Serial-connected structures have much weaker driving strength at lower voltage due to the stacking effect. The transparent windows generated and required in a flip flop may have mutual mismatches due to different circuit topologies between the pulse generator and flip-flop data path. For instance, the transmission gate delay in a TGFF has a time constant related to the drain capacitance and stacked transistors, different from that of an inverter chain. The stacking effect increases the DFF delay, while the pulse created by an inverter chain cannot simply reflect. Furthermore, the circuit optimization can be much more complicated because part of the transistors may have long channel lengths or multiple threshold voltages, and these specific elements are hard to simulate using an inverter chain.

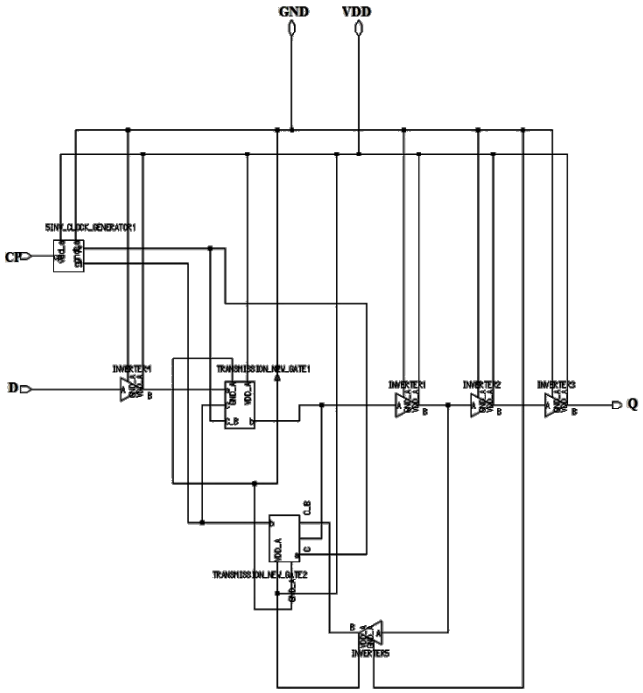

Fig.2 Five inverter chain pulse triggered flip-flop

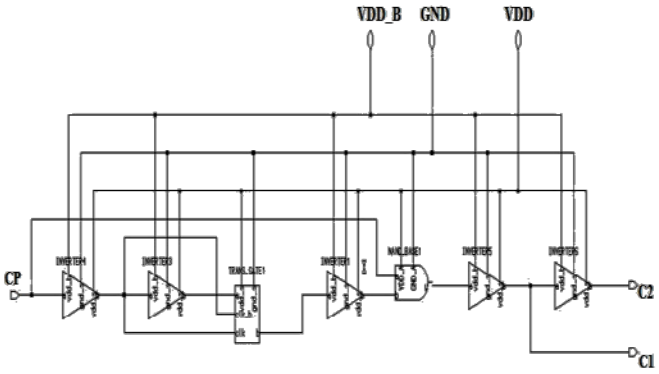

Fig.3 Replica path pulse generator

A replica-path pulse-triggered flip-flop is thus proposed to simplify design effort and achieve robust timing characteristics. The idea is to let the pulses generated and required have a high correlation in a wide range of operating voltages a replica delay circuit copies part of the critical path of the flip-flop, including the circuit topologies, transistor sizes, and threshold voltages. The replica simulates the latency of the flip-flop after being triggered, and the transparent window is guaranteed to open during the data propagation period. The proposed replica-path pulse-triggered flip-flop. The replica path requires simplification because there is no more pulse signal for the replica. Therefore, the replica transmission gate is fed by a signal from the front inverter to simulate the signal slew rate.

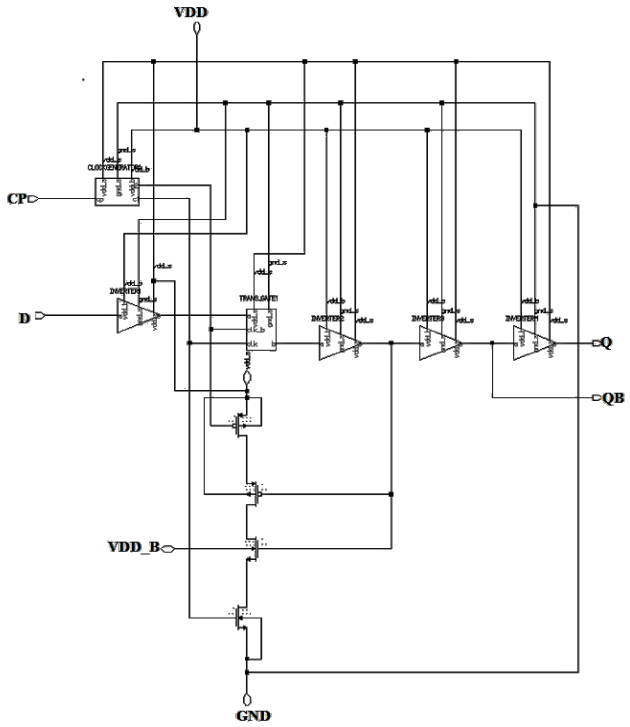

Fig.4 Replica path pulse trigger flip flop

This simplified replica path achieves an approximate flip-flop D-Q delay, especially similar to the D-Q falling delay. Therefore, balancing the rising and falling D-Q delay helps this replica to be more effective. The transistors of the proposed flip-flop are assigned with different threshold voltages based on the feature of a 130 nm technology, in which a standard-threshold-voltage (SVT) PMOS has lower driving strength than an SVT NMOS, and as does the relation between a low-threshold-transistor (LVT) PMOS and an LVT NMOS. The threshold voltages of SVT and LVT of this technology are about 0.4 V and 0.3 V respectively.

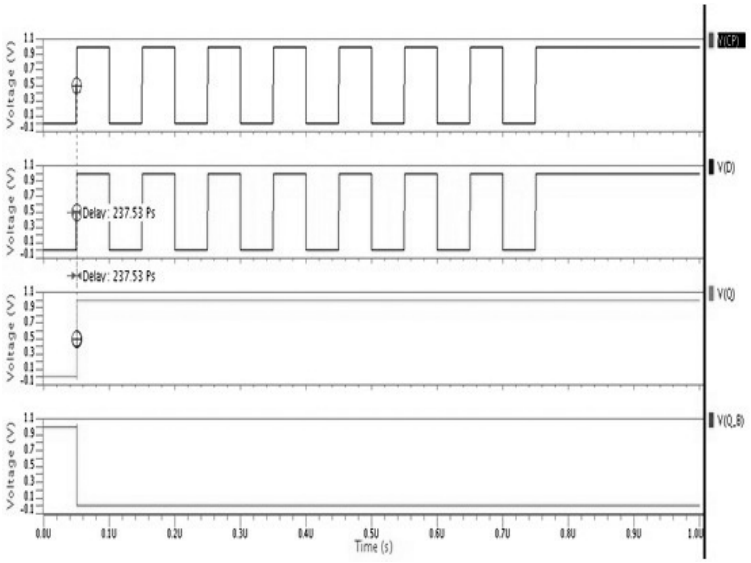

Fig.5 Simulation wave forms

III. PROPOSED DUAL EDGE ADAPTIVE FLIPFLOP

Dual-edge triggering, Data latching or sampling is used at both the rising and falling edges, usually allows the clock routing network to consume less power. For a system with at throughput of one operation per cycle and a clock frequency, double-

edge triggering results in two operations being executed in one cycle, if we use half the frequency, we can maintain the same throughput of the original system. With half the frequency, the clock switching activity is reduced by half, which leads to considerable power savings in the clock routing network. Dual edge triggered flip-flop design is used to reduce leakage current, it can receive input signal at two levels of the clock dual edge triggered flip-flop has ideal logic functionality, simple structure lower delay time, and higher maximum data rate compared to other existing flip. The figure 5 contains two transmission gates and five inverters. The overall circuit generates positive pulse at both rising and falling edge of pulse at C_1 and generates negative pulse at both rising and falling edge of pulse at C_2.

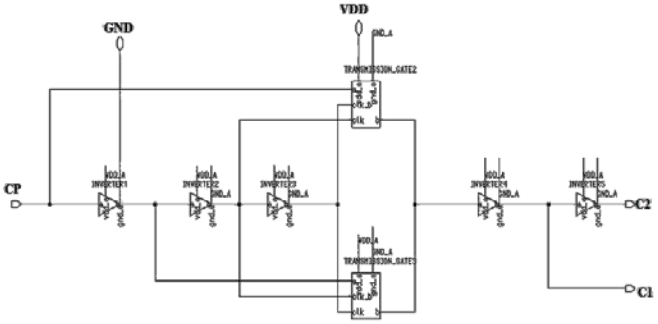

Fig.6 Dual edge pulse generator

The transistors of the proposed flip-flop are assigned with different threshold voltages based on the feature of a 130 nm technology, in which a standard-threshold-voltage (SVT) PMOS has lower driving strength than an SVT NMOS, and as does the relation between a low-threshold-transistor (LVT) PMOS and an LVT NMOS. The threshold voltages of SVT and LVT of this technology are about 0.4 V and 0.3 V respectively.

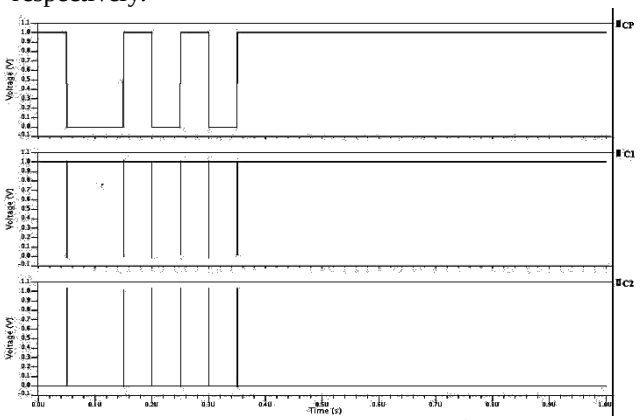

Fig.7 Dual edge simulation wave forms

A. Body bias concept:

In figure 8 The threshold voltage of the transistor changes by applying proper body voltage to the body terminal of the transistor. The body voltage of the transistor changes based on our threshold voltage requirement. Inverter contains PMOS threshold voltage (SVT) 0.4v and NMOS threshold voltage (LVT) 0.3vthe threshold voltage of all the transistors which are used in the flip flop fixed with 0.3v.For SVT PMOS case the threshold voltage is 0.4v so need to change the threshold voltage of the transistor by applying proper body voltage mentioned as VDD_B and VDD_B1.The transistors of the proposed flip-flop are assigned with different threshold voltages based on the feature of a 130 nm technology, in which a standard-threshold-voltage (SVT) PMOS has lower driving strength than an SVT NMOS, and as does the relation between a low-threshold-transistor (LVT) PMOS and an LVT NMOS. The threshold voltages of SVT and LVT of this technology are about 0.4 V and 0.3 V respectively.

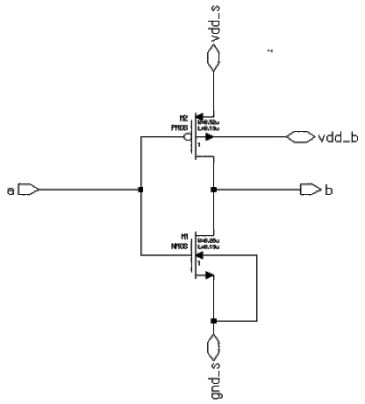

Fig.8 Inverter with body bias

An intrinsic mismatch in driving strength is one of the DVS limitations. Sizing transistor to compensate for this intrinsic mismatch is area-consuming and ineffective. Small and identical-sized LVT PMOS and SVT NMOS transistors are found to have a similar driving strength from near- to sub threshold supply voltages.

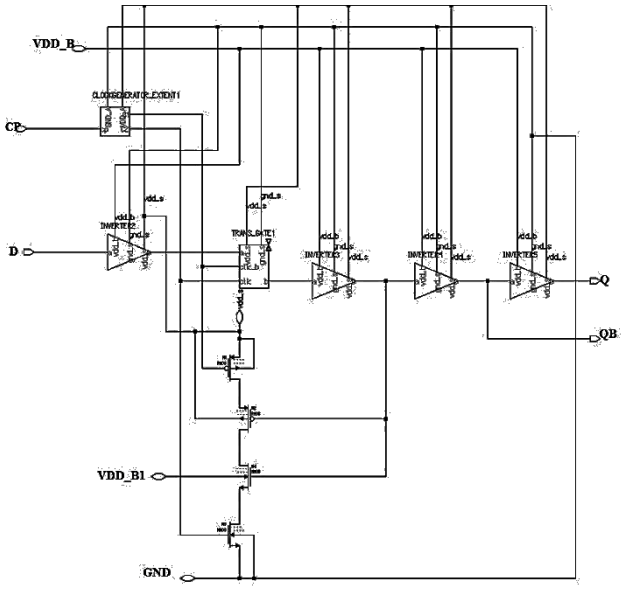

Fig.9 Replica path pulse trigger flip flop

Each inverter in the flip-flop thus incorporates an SVT NMOS and an LVT PMOS. Both cell area and noise margins are improved using this dual-threshold combination. The NAND gate in the pulse generator uses LVT NMOS due to the stacked pull-down network. LVT transistors are assigned to the pulse-controlled paths to boost the circuit speed. A tri-state inverter in the reverse direction of the latch is designed for sub threshold robustness considering process variations. Figure 8 shows the simulation results of proposed structure the data changes at every rising and falling edge of clock.

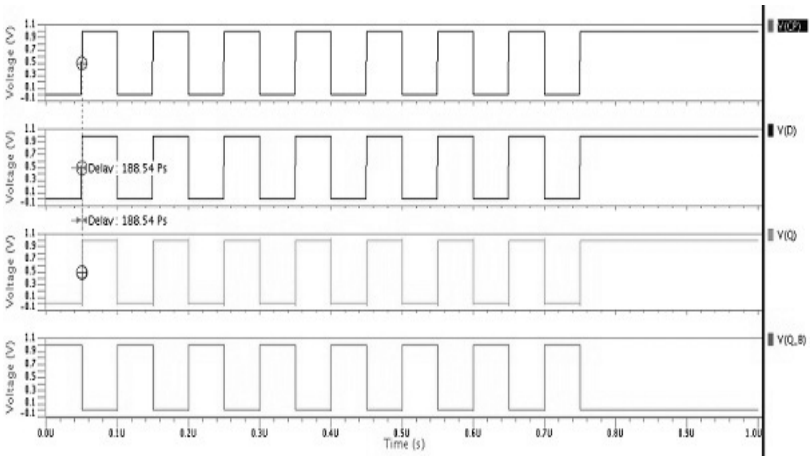

FiG.10 proposed simulation wave forms

TABLE I COMPARISON OF FLIP FLOPS:

Type of Flip Flop	D-Q Delay	CLK-Q Delay	Power Dissipation	No of Transistors
NAND Based FF	182.67 ps	158.6 ps	14.641 nw	-
Three inverter chain	41.21 ns	91.21 ns	53.867 uw	28
Five inverter chain	50.237 ns	237.21 ps	53.740 uw	32
Seven inverter chain	50.238 ns	237.76 ps	53.744 uw	36
Adaptive pulse	50.227 ns	226.65 ps	268.66 nw	32
proposed Dual edge flip flop	186.71 ps	186.71 ps	35.794 nw	28

B. Implementation of mod4 ring counter:

The figure 9 shows implementation of mod4 ring counter by using proposed adaptive dual edge adaptive flip flop. The synchronous Ring Counter is preset so that exactly one data bit in the register is set to logic "1" with all the other bits reset to "0". Pulse is applied to the input of the first flip-flop before the clock pulses are applied. This then places a single logic "1" value into the circuit of the ring counter. So on each successive clock pulse, the counter circulates the same data bit between the four flip-flops over and over again around the "ring" every fourth clock cycle. But in order to cycle the data correctly around the counter we must first "load" the counter with a suitable data pattern as all logic "0's" or all logic "1's" outputted at each clock cycle would make the ring counter invalid.

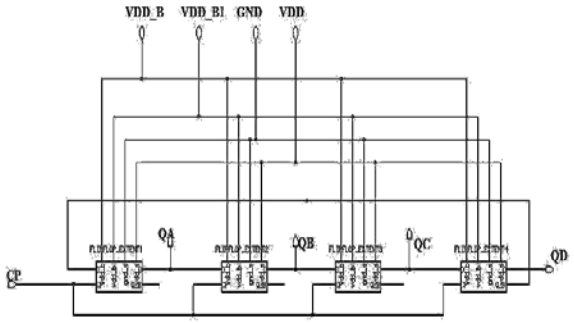

Figure 11 mod4 ring counter

This type of data movement is called "rotation", and like the shift register, the effect of the movement of the data bit from left to right through a ring counter.

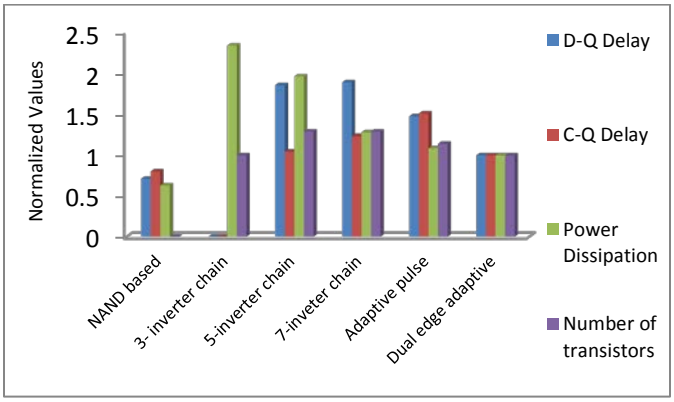

Figure 12 Comparison of different Flip-flop parameters

IV. CONCLUSION

In proposed dual edge triggered flip-flop even though the clock load increased the overall power dissipation is reduced. By reducing the power consumption in sequential elements the overall power consumption in circuits decreased drastically and by using dual edge pulse generator in place of single edge pulse generator the number of transistors reduced. So the complexity of adaptive pulse trigger flip flop reduced.

Dual edge adaptive pulse triggered flip flop mainly used in low power and high speed applications because of its high speed switching activity.

REFERENCES

[1] Shien-Chun Luo, Ching-Ji Huang, and uan-Hua Chu "An Adaptive Pulse-Triggered Flip-Flop for a High-Speed and Voltage-Scalable standard cell library" *IEEE* transactions on circuits and systems—ii: express briefs, vol. 60, no. 10, october 2013
[2] G. Oklobdzija, "Clocking and clocked storage elements in amulti-gigahertz environment," *IBM J. Res. Develop.*, vol. 47, no. 5.6,pp. 567–583, Sep. 2003.
[3] M. Alioto, "Ultra-low power VLSI circuit design demystified and explained:A tutorial," *IEEE Trans. Circuits Syst. I, Reg. Papers*, vol. 59,no. 1, pp. 3–29, Jan. 2012.
[4] H. P. Alstad and S. Aunet, "Three subthreshold flip-flop cells characterized in 90 nm and 65 nm CMOS technology," in *Proc. IEEE WorkshopDDECS*, Apr. 2008, pp. 1–4.
[5] F. Moradi, D. T. Wisland, H. Mahmoodi, A. Peiravi, S. Aunet, and T. V. Cao, "New subthreshold concepts in 65 nm CMOS technology," in *Proc. ISQED*, Mar. 2009, pp. 162–166.
[6] B. H. Calhoun, A. Wang, and A. P. Chandrakasan, "Modeling and sizing for minimum energy operation in subthreshold circuits," *IEEE J. Solid-State Circuits*, vol. 40, no. 9, pp. 778–1786, Sep. 2005.
[7] I. Chang, S. Park, and K. Roy, "Exploring asynchronous design techniques for process-tolerant and energy-efficient sub threshold operation," *IEEE J.Solid-State Circuits*, vol. 45, no. 2, pp. 401–410, Feb. 2010.
[8] J. Crop, R. Pawlowski, N. Moezzi-Madani, J. Jackson, and P. Chaing, "Design automation methodology for improving the variability of synthesized digital circuits operating in the sub/near-threshold regime," in *Proc.IGCC*, Jul. 2011, pp. 1–6.

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Investigation on Importance of Agency Banking in Provision of Banking Services in Kenya:

(A Case of Equity Bank) in Kitui Central District, Kitui County, Kenya.

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Abstract- Agency banking has become one of the essential services in the banking sector in bringing their services closer to the people at the grass -root or in remote areas where brick and mortar branches are not present. This study focuses on the role of agency banking in providing and availing the banking services to the customers. The purpose is to explore the functionality and contribution of agency banking. This study assessed the role of agency banking in increasing accessibility to banking services and helping in decongesting the banking halls in Kitui central district, through an analysis of the costs and benefits raised by agency banking and how these are distributed among the stakeholders. The researcher was guided by the following objectives:- To investigate the cost of banking transactions through agency banking, to investigate the efficiency of agency banking in time saving ,to investigate the convenience of banking products offered through agency banking and to investigate if availability of bank agents has increased the opening hours to increase accessibility for banking services. The study used descriptive survey design and the target population was six equity bank agents and one hundred (100) A/C holders in Equity bank in Kitui Central district. Data was collected using questionnaires and review of documentation. Data analysis was done quantitatively using inferential statistics mean, mode, median and percentages with the help of computer software statistical package for social scientist (SPSS) and then presented in tables, bar charts and graphs. Qualitative data was analyzed thematically according to the study objectives. The findings of this study are; The banking agency availed banking services closer to the customers leading to more accessibility hence saving the customers the transport cost, the Agency banking is efficient in terms of transaction cost and time saving and most of the respondents were impressed by their performance, the Agency banking like any other bank offered banking products which include; Cash withdrawal, cash deposit, bill settlement, and balance enquiry. The recommendations of the study are; Banks should do more advertising to sensitize the public on the availability and the services of Agency banking, Agency banking should increase the products they offer to their customers to include the credit facilities, and that the Agency banking should have more money so that those who wants to withdraw more would not be forced to go to physical banks.

Index Terms- Agent ,Agency ,Agency banking, Banking , principal

I. Background of Study

According to a banker (2011) Agency banking is not new in the world. It has been used very well in Latin America and Asia. There are few African countries that have taken up Agency banking. Agency banking has become an essential practice of financial institution in bringing their services closer to the people at the grass-root. Agency banking provide the opportunity for customers to access financial products and services at a location nearest to the customer, this breaking down certain barriers to financial inclusion such as cost and accessibility.

Agent Banking in Latin America

According to Alliance for financial inclusion (2012) they did a study that compared the experiences of four Latin American countries that have implemented agent banking, namely Brazil, Colombia, Peru and Mexico. The study focused on Mexico as the most recent case. The study examined the differences in the agent banking model and the possible impact these differences had on access and usage of financial services. The examples of Brazil, Colombia and Peru demonstrated that agent banking has a significant potential to increase access to financial services to remote areas. Mexico has had a successful first year in implementing agent banking, when compared to its neighbors. The successes recorded in Brazil , Mexico, and Peru is worth a note. Brazil alone has more than 140,000 banking agents, making it the largest deployment of third party banking correspondents in the world.

Agent Banking in Nigeria

Nigeria is actively promoting access to financial services to millions of unbanked and under banked throughout the nation. The regulator in Nigeria is developing policies and regulations that are creating access for more people through Micro finance banking, cash lite programs, mobile payment while reducing cost of entry for the unbanked population to gain access in a country of 70 M adult population under a total of addressable market of

140 M. There is no doubt that agency banking is adopted in Nigeria banking systems (see European Journal 2013) and has proved to have essential role in increasing accessibility to banking services.

Agency Banking in Kenya

In Kenya large number of the population is excluded from access to financial services in the financial sector with the situation being worse in rural areas. Most of the individuals in Kenya especially those living in rural or remote areas where infrastructural development is a problem, access to banking services has been a very disturbing problem. In the old times people used to travel for long distance so as to access financial services from banks and this was consuming most of their time and more spending on transport cost. According to Prof Njuguna Ndung'u, Governor of the CBK (2013) the aim of agent banking was to increase the level of formal financial inclusion in un-served and underserved areas. With the introduction of agency banking services in Kenya financial system, convenient and affordable banking services continue to be availed to the large masses without the mortar and brick branches. According to Gideon Kiarie (2012) since February 2011 the CBK allows banks to offer services through third party agents. CBK in 2011 released regulations allowing banks to offer services through third party agents approved by CBK. These agents may be Tel-com outlets, retail chain, supermarkets, and petrol stations among others. According to Ken Kigunda the use of the agency banking model by banks in Kenya has continued to improve access to banking services and has also increased financial deepening in the country since it was launched in 2010. Kigunda say that due to agency banking the financial sector has recorded an increase in growth with most Kenyans accessing finances at their convenience. Kigagah and Caroline (2012) have researched on challenges and factors influencing agency banking in Kitui central district but none of them have investigated the factors facilitating access to banking services through agency banking. The study aim to fill this gap by discussing how agency banking have helped in reducing the cost of banking transactions, how agency banking is efficient in time saving for the transaction, what banking products are offered through agency banking and how agency banking has increased the serving hours for the customers. The reduction of long queues especially in Equity bank though not at a high rate has made the researcher want to investigate how agency banking is expanding access to financial services.

Profile of Equity Bank

Equity bank started its operations in 1984 as Equity building society. The initial focus was to offer mortgage services but in the early 1990's EBS changed its focus to micro finance services. EBS grew to become a leading micro finance institution providing a wide range of products and services. The growth in business volume and outreach necessitated the conversion to a commercial bank. On 31st December 2004 Equity building society was converted to Equity bank limited. Equity Bank Ltd is a Kenyan-based bank engaged in the provision of retail banking, microfinance, and related services to individuals, and small and medium sized enterprises in Kenya, Uganda, Southern Sudan, and Rwanda. It offers various banking products, Including current, equity ordinary, super junior investment, jijenge, equity business and current accounts, and fixed deposit accounts. The bank also offer various types of loans and provides other various services comprising banker's checks, standing order and remittance processing among others .In addition it offers trade finance services, such as letters of credit ,documentary collections, guarantees and invoice discounting among others.

1.2 Statement of the problem

There before people moved from their rural areas to urban areas to search for the banking service at the towns. This made customers to spend most of their time of the day and more transport cost trying to access financial services. Globalization of banking is taking place at a very high rate more and more services are developed to make it even more attractive. This movement of banking service close to the customers has made banks to increase their market scope. In Kitui central district most of the banks are only located in Kitui town and this causes a problem for the people in rural areas or remote areas of kitui central district in accessing the financial services. Agency banking is then seen to bring the services closer to the customers and now days people in remote areas do not need to travel to towns to get the financial services .Before the introduction of agency banking, there were always long queues in the banking hall of Equity bank kitui for individuals waiting to receive financial services but now days the queues have reduced though at a low rate. According to Kenya Bankers Association CEO - ,Mr. HabilOlaka (2013) "Days are long gone when customers would queue in the banking halls waiting to pay their utility bills, school fees or any other financial transaction. They now days do this at their convenience by using Agents outlets''. Therefore the study is to investigate the factors facilitating access to banking services through agency banking in Kenya.

1.3 Objectives of the study

1.3.1 General objectives

To investigate the importance of agency banking in provision of banking services in Kenya.

1.3.2 Specific objectives of the study

1. To determine the cost of banking transactions through Agency banking.
2. To determine the efficiency of agency banking in time saving when serving customers.
3. To determine if availability of bank agents has increased opening hours to increase accessibility for banking services.
4. To determine the convenience of getting banking products offered through agency banking.

1.3.3 Research questions

1. How much cost do one incur to make transactions through agency banking?
2. How has agency banking increased efficiency in time saving for making bank transactions?
3. How has agency banking increased the availability of their services through long opening hours?
4. How convenient are the banking products offered through agency banking?

1.4 Significance of the study

The study is hoped to help to establish knowledge on agency banking in the area of Kitui central district. This knowledge is important to the banking agents providing banking service in Kitui and also it is important to the banks in Kitui County as they will know the importance of Agency banking in providing banking services to their customers. The information is also important to the customers who use agency banking in getting banking services.

1.5 Scope of the study

The research covered Kitui central district. Three locations from the district was considered in the research and this may include Kalundu , Township and Miambani locations. The study population of the research involved all the agents of Equity bank in Kitui central district and all the A/Cs holders from the same bank branch. One agent from kalundu and one from Miambani was picked and four agents from township location was picked randomly making a target sample of six respondents, also one hundred (100) A/Cs holders from Equity bank Kitui branch were selected to make up the target population, where they were selected through random sampling from all the A/Cs holders from the same bank.

1.6 Limitations of the study

There was a problem during the data collection as some respondents were not willing to fill the questionnaire as they felt that giving the financial information about their banking through agency is very sensitive as banking involves money which is very sensitive.

There was a problem in terms of getting secondary data because agency banking is a new phenomenon in Kitui central district and not all banks have adopted it and then little information was available.

1.7 Assumptions of the study

The study was guided by the following assumptions:-

i. The randomly selected sample of equity bank agents from Kitui central district was operational.
ii. The use of the agency banking model in Kitui central district has continued to expand its importance in providing banking services especially where there are no physical bank branches.
iii. The use of agency banking has decongested the banking hall of Equity bank Kitui branch though at a slow rate.

II. LITERATURE REVIEW

2.1 INTRODUCTION

This chapter gives an overview of the importance of agency banking in providing banking services to the customers. This literature review has been obtained from the newspapers, journals, CBK annual reports (2011 and 2012) textbooks, magazines and from the writings of other academicians.

Agency banking regulations passed in February 2011 enable banks to offer services through third –party agents approved by the CBK. Agents can be telecoms outlets, small and medium enterprises, retail chain, and even small shops among others. They must be a profit- making entity that has been in business for at least 18 months and can afford funds for a float account. The services that agents can offer include cash deposits, cash withdrawals, payment of bills, transfers (including benefits and salary payment) among others.

According to the bank supervision annual report 2011, adoption of agency banking has enhanced access to banking services. Developments within the banking sector are strongly guided by the medium-term objectives of the financial sector reform and development blueprint, vision 2030. In the year 2011, access to financial services continued to be enhanced, spurred by increased innovation in the delivery of financial products and services throughout the country. These developments have been a catalyst to fulfilling the goals of building an all-inclusive and efficient financial system. Despite 2011 being a year of accelerated inflation arising from high food and fuel costs the total population with access to financial services, which is key indicator of financial sector growth and development, increased. This was attributed to the cost-effective and efficient innovations within the banking sector, particularly through the mobile money revolution and the adoption of branchless banking models like the agency banking model.

Increasing access to finance has been increased with the use of innovation such as agent banking, which allows commercial banks to engage the services of third party outlets to deliver specified financial services on their behalf. Following the roll out of the agent banking model in May 2010, commercial banks have been able to contract varied retail entities. These entities, such as supermarkets, petrol stations, post offices, security companies, courier services among other act as third party agents to provide cash-in-cash out transactions and other services in compliance with the laid down guidelines. As at December 2011, there were 8 commercial banks that had contracted 9748 active agents facilitating over 8m transactions valued at ksh.43.6B.This represented 3 percent of the total deposit base in the banking industry. Tremendous growth has been evidenced in agency banking conducted by commercial banks; as at December 2012, there were 10 commercial banks that had contracted 16,333 active agents facilitating over 38M transactions valued at ksh.195.8B. The financial sector has recorded a tremendous growth with most Kenyans accessing finances at their convenience. This has reduced the cost of transactions and the time especially for the Kenyans in remote areas. The number of banking transactions undertaken through agents increased from 9.7M registered in the quarter ending March 2013 to 10.2 M transactions registered in the quarter ending June 2013. Similarly the value of banking transactions undertaken through agents increased from ksh.53.3B to ksh.60.4B over the same period. The increased number and value of transactions demonstrate the increased role of agent banking in promoting financial initiatives being championed by the central bank of Kenya. The increase is due to the fact that banks and financial related institutions in Kenya are increasingly deploying the use of payments using agencies to enhance the quality of their financial service and increase growth. The pace of transformation in the financial sector speeded up with more agency banking businesses realizing the potential of using the agencies in transacting payments in their service delivery. According to the bank supervision report 2012 the bank with highest number of customers is equity bank which has 5.3M customers and 2,851 agents followed by co-

operative bank with1.9M customers and 561 agents. This indicates that agent banking has an effect on financial deepening as the higher the number of agents, the higher the number of customers'. Agency banking is fast growing as banks spread financial services across Kenya. According to the supervision annual report by CBK 2012, in the year 2012 cash deposits through commercial bank agents stood at 13M transactions valued at 1.2B. On the other hand, cash withdrawals were valued at $591M. The agents also made transactions of payment of retirement social benefits worth $1.3M and bill payments worth $2.8M.the partnership of banks with third parties has seen banks in Kenya take financial services closer to the people; in particular to areas that lack banks .Agency banking in Kenya is the new way that banking in Kenya is using to take banking services to the unbanked and under banked at a cheaper rate. The banks are training agents who will engage in banking services on behalf of the banks. This means other than availing financial access to customers' agency banking also creates employment. The agency does not have to perform all the activities. These include but are not limited to:-

Cash deposits, cash withdrawals, bill payment, repayment of loan, salary payment, funds transfer, balance enquiry among others. Agency banking provide the opportunity for customers to access financial products and services at a location nearest to the customer, this breaking down certain barriers to financial inclusion such as cost and accessibility. According to micro saving Equity bank (2013) by the end of March 2013, over 2.3 million customers had registered for agency banking. Around 80,000 transactions were made each day at 6892 Agent outlets.

2.2THEORITICAL REVIEW

Agency theory

The first scholars to propose, explicitly, that a theory of agency, be created, and to actually begin its creation, were Stephen Ross and Barry Mitnick, independently and roughly concurrently. Ross is responsible for the origin of the economic theory of agency, and Mitnick for the institutional theory of agency, though the basic concepts underlying these approaches are similar. Indeed, the approaches can be seen as complementary in their uses of similar concepts under different assumptions; in short, Ross introduced the study of agency in terms of problems of compensation contracting; agency was seen in essence, as an incentives problem. Mitnick introduced the now common insight that institutions form around agency, and evolve a deal with agency, in response to the essential imperfection of agency relationships. Behavior never occurs as it is preferred by the principal because it does not pay to make it perfect.

Ross lays out the problem with great clarity as well as brevity in a paper he delivered at the December 1972 economics meeting. Ross clearly identifies the agency problem as generic in society, not merely as a problem in the theory of the firm. This sets his work apart from the existing stream on the theory of the firm(e.g Baumol 1959 ,Marris 1964, Williamson 1964, Alchian and Demset 1972) as well as the more general formal approaches on decision making under risk or uncertainty and under different information states(e.g Arrow 1963, Spence and Zeckhauser 1971, Marshak and Radner 1973)

Agency is a theory explaining the relationship between principals, such as a shareholders and agents such as a company's executives. In this relationship the principal delegates or hires an agent to perform work. The theory attempts to deal with two specific problems; first, that the goals of the principal and agent are not in conflict (agency problem), and second, that the principal and agent reconcile different tolerances for risk.

Agency theory explains how to best organize relationship in which one party determines the work while another party does the work .In this relationship, the principal hires an agent to do the work, or to perform a task the principal is unable or unwilling to do due to some factors. For example, in corporations, the principal are the shareholders of a company, delegating to the agent i.e the management of the company, to perform tasks on their behalf. Agency theory assumes both the principal and the agent are motivated by self- interest; this assumption of self-interest dooms agency theory to inevitable inherent conflicts. Thus, if both parties are motivated by self- interest, agents are likely to pursue self- interested objectives that deviate and even conflict with the goals of the principal: yet, agents are supposed to act in the sole interest of their principals.

To determine when an agent does and does not) act in their principal's interest, the standard of "agency loss" has become commonly used. Agency loss is the difference between the best possible outcome for the principal and the consequences of the acts of the agent for instance, when an agent acts consistently with the principal's interests the more agency loss increases. When an agent acts entirely in her own self –interest, against the interest of the principal, the agency loss becomes high. Agency loss is minimized when principal and agent share common interests and they desire the same outcome .Agency loss is also minimized if the principal is knowledgeable about the consequences of the agents' activities in other words; the principal knows whether their agent's actions serve in the principal's best interest .One objection to agency theory is that it relies on an assumption of self- interested agents who seek to:-
Maximize personal economic wealth (Bruce *et al*., 2005).The challenges is therefore to get agents to either set aside their self-interest, or work in a way in which they may maximize their personal wealth while still maximizing the wealth of the principal. Thus, a standard of agency duty and action is necessary, not because agents are universally selfish, but because the potential for differences between the principal's and the agent's interests exists. In agency relationships the agent has a moral responsibility for her actions which she cannot dismiss simply because she acts as an agent for another.

Agency theory and entry barriers in banking

Agency theory analyses the relationships between a business firm's owners and its managers who, under law are agents for the owners. The key issues in agency theory Centre upon whether adequate market mechanism exist that compel managers to act in ways that maximize the utility of a firm's owners where ownership and control are separated. Agency problems emerge because contracts between principals and their agents are neither costless written nor costless enforced. Managers as agents of a firm's shareholders may not devote their best efforts toward managing the firm unless those efforts are consonant with maximizing their own welfare.

In the commercial banking industry, ownership is becoming increasingly diversified among individual and institutional

shareholders and the dominance of individual stockholders in the industry appears, on the whole, to be decreasing (as noted by the Federal Reserve board) these trends may exacerbate "agency problems" in the banking industry if these problems truly exist. Under the terms of agency theory a principal (P) passes on authority to an agent (A) to conduct transactions and make decisions on behalf of the principal (P) in an effort to maximize p's utility preferences. Agency problems can arise if P and A have different goals or P and A have disparate skills in evaluating A's performance or P and A possess different sets of information relevant to the managerial decisions agent must make as a representative of principal or P and A have different degrees of risk aversion. Agency costs arise when information disparities exist that cannot be costlessly corrected or where preferences of principals and agents cannot be matched at zero cost, giving rise to moral- hazard or adverse- selection problem.
A problem that often exists when one person is acting on behalf of another that is created by the reality that the goals of the agent can differ from those of the principal to verify what the agent is doing.

Diffusion of innovations theory

The original diffusion research was done as early as 1903 by the French sociologist Gabriel Tarde who plotted the original S-shaped diffusion curve. Tarde 1903 S- shaped curve is of current importance because, Most innovations have an S-shaped rate of adoption (Rogers , 1995).Diffusion research centers on the conditions which increase or decrease the likelihood that a new idea, product, or practice will be adopted by members of a given culture .Diffusion of innovation theory predicts that media as well as interpersonal contacts provide information and influence opinion and judgments. Very little innovators adopt innovation in the beginning. Later Diffusion of innovation theory was developed by E.M. Rogers in (1962) and it originated in communication to explain how overtime an idea or product gains momentum and spreads through a specific population or social system. Researchers have found out that people who adopt an innovation early have different characteristics than people who adopt an innovation later. When promoting an innovation to a target population, it is important to understand the characteristics of the target population that will help or hinder adoption of the innovation. There are five established categories of adopters, and majority of the general population tends to fall in the middle categories .The five categories include:-

Innovators- These are people who want to be the first to try the innovation. They are venturesome and interested in new ideas. These people are risk takers.

Early adopters- These are people who represent opinion leaders .They enjoy leadership roles and embrace change opportunities. They are already aware of the need to change and so are very comfortable adopting new ideas. They do not need to be convinced so as to change.

Early majority- They are rarely leaders, but do adopt new ideas before an average person. They just need to see evidence that innovation works before they adopt it.

Late majority- These people are skeptical of change and will only adopt innovation after it has been tried by the majority. They need to be told how many other people have tried the innovation and have adopted it successfully.

Laggards- These are people bound by tradition and very conservative. They are very skeptical of change and are the hardest group to bring on board.

Relevance of the theories

Relating the diffusion theory to agency banking, the agency banking is clearly an innovation that requires time to reach critical mass. With regard to communication channels, banks have done well to popularize the agency banking with service names that resonate well the target population. Such names include; Equity ndio hii, Kcb mtaani, co-op kwa Jirani ,Family papo hapo and so on. Such names intended to create a sense of ownership and create confidence among the banks customers for a service that has been devolved to their neighborhood or brought closer to their doorsteps.

Agency theory relates well with agency banking as most of the banks have sought the services of third parties in offering the banking services to their customers. These bank Agents are paid some commission by the banks which they work for. The nearest branch of the bank provides necessary logistic support to their respective Agents.

III. EMPIRICAL EVIDENCE

According to Sandec Wycliffe (2012) in the past, poor people living in Nairobi slums experienced problems when attempting to gain access to financial services. This was because banks were not near their localities and they were forced to travel significant distances in search of a bank .What this meant, for someone living in an out-of-the- way informal settlement, was that they would have to cut out a large part of their day to travel and then stand in queues. Transportation costs also had to be taken into account; more often than not, the whole endeavor would prove extremely time-consuming and costly.

Since 2010, however, there have been significant improvement in the banking sector with the introduction of agent banking, an innovative delivery channel that seeks to bring access to financial services much closer to poor people.

According to Sande Wycliffe (2012) James Mwangi, the owner of a Kibera Equity bank agent outlet he said that the system has been a big boost to the community, especially for whom mobility out of the slum can prove challenging. Margret, a beauty salon owner, explains how the agent banking model has worked in her favor. According to Margret before this initiative came, she used to have a lot of trouble with her customers [getting calls all the time] asking where she was. Margret said that it always took her hours to make a transaction at the bank, and this only meant losing out customers who had come to have their hair done. Margret was also using more money on transport to access a bank branch.

According to Kenya Bankers Association CEO, Mr. HabilOlaka (2013) Days are long gone when customers would queue in the banking halls waiting to pay their utility bills, school fees or any other financial transactions. They now days do this at their convenience by using Agents outlets. Agency banking has enabled bank customers to access the banking services within the comfort of their neighbor-hood. Agency banking can dramatically reduce the cost of delivering financial services to unreached people. Agency banking can address the two main

problems of access to finance; the cost of roll-out (physical presence) and the cost of handling the low value transactions. This is achieved by leveraging networks of existing third party agency for cash transactions and account opening and by conducting all transactions on line. This sharp cost reduction creates the opportunity to significantly increase the share of the population with access to formal finance and, in particular, in rural areas where many people in developing countries live (Lyman, *et,al,*2008).

According to Ivantury and Timothy (2006).Agency banking could be of benefit to the clients in the following ways; lower transaction costs (closer to their homes), long opening hours, shorter lines than in branches ,more accessible to the poor who might feel intimidated in branches compared to agency. Agency banking enables the bank to extend their services not only in areas with poor branch penetration but also up to the doorstep of those who are reluctant or otherwise unable, to make a trip to the nearest branch.

The heavy cost of serving low value accounts and providing physical banking infrastructure to unbanked areas was a major impediment to financial inclusion in the past. This model was heavy on the pockets of poor customers, who had to spend time and money to travel long distance to the nearest branch. Agency banking rationalized banks operational expenditure, and reduced the cost to customers, while enabling wider reach. This research creates more awareness of agency banking to various bank customers so that the customers can make use of the bank agents near them to get financial services other than traveling to visit physical bank branches to get these financial services.

2.3 Conceptual framework

The study of importance of agency banking in providing financial services through the use of agency banking ; requires investigating the availability of banking agents ,the cost of transactions ,the opening hours and the kind of financial services offered through agency banking model.

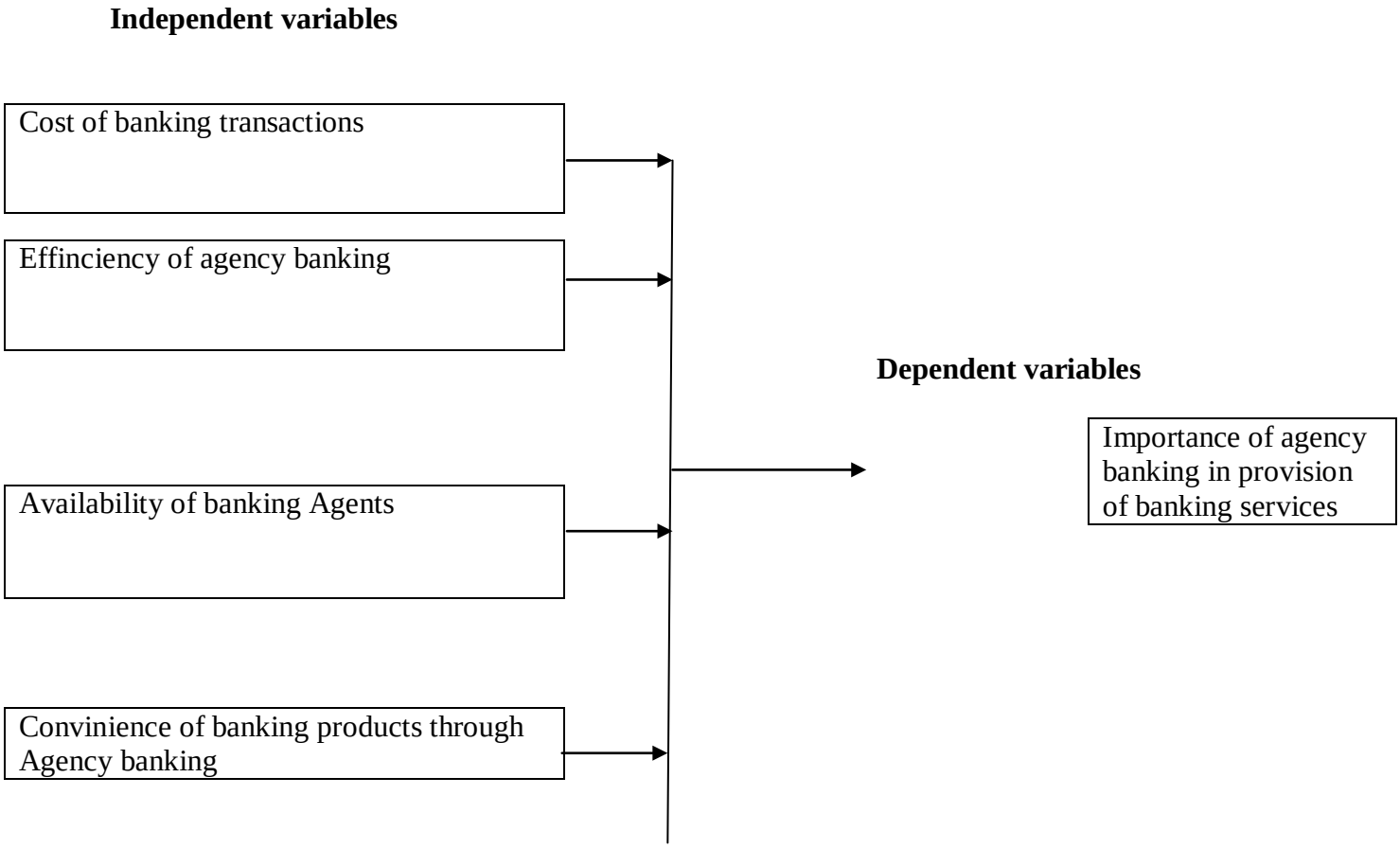

Figure 1: Conceptual frame work

The indicator for the dependent variables includes the following;

Customer deposits

According to a survey on agency banking carried out by Kenya bankers association (2013) for its centre of research on financial markets and policy,40.9% of agents operations are cash deposits. The survey revealed that customers are asking for additional services not on offer; including ATM card issuing, recommendations for loan among others.

Cost effective model

According to Fin Access National Survey (2013) the heavy cost of servicing low value accounts and providing physical banking infrastructure to unbanked areas was a major impediment to financial inclusion in the past worse; this model was heavy on the pockets of poor customers, who had to spend time and money to travel long distance to the nearest branch. Agency banking rationalized banks operational expenditure, and reduced the cost to

Payment of bills

According to CBK report (2011 and 2012) the other service that customers may use through agency banking areas is the payment of bills. According to ken kigunda (2013) Agency banking has helped to bring some banking services to rural areas where many people remain unbanked.

Distribution strategy

According to Fin Access National Survey (2013) Agency banking enables the banks to extend their services and reach not only into areas with poor branch penetration but also up to the doorstep of those who are reluctant or otherwise unable, to make a trip to the nearest branch. This makes it easy and convenient for bank customers to get the banking services at their closest areas.

4.3 Cost of transactions through Agency banking

The researcher sought to establish the cost of transactions through Agency banking. The respondents were then requested to indicate whether they agreed with the statement that the banking agency was worthwhile in availing banking services closer to the customers. The responses were presented in Table 4.5

Table 4.5: Transaction through agency avails services closer to customers

Category	Responses	Percentage
Strongly Agree	86	86%
Agree	14	14%
Total	**100**	**100%**

Majority of the respondents (86%) strongly agreed that the banking agency was worthwhile. This means that Agency banking was much important in providing and availing banking services closer to the customers. This reduced time wasting since the customers do not have to travel long distances as the agencies are close to their residences.

The research also used the Bar graph to represent opinion of respondents on whether agencies avails services closer top people**.**

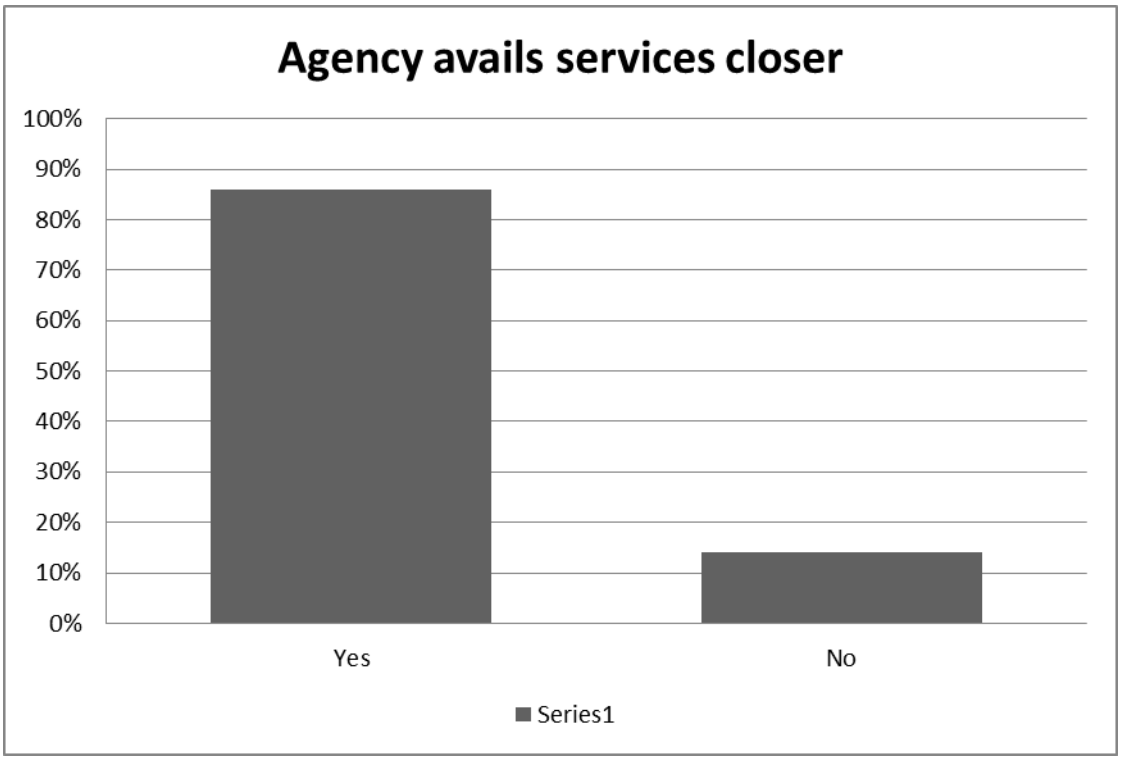

Figure 6: Transaction through agency avails services closer to customers

Further the researcher calculated the correlation coefficient between the transaction cost and agency banking. This was to establish the strength of the relationship between transaction cost and agency banking and to determine if there was effect of reducing banking cost on getting of Agency banking. The results were presented in Table 4.6.

Table 4.6 Relationship between transaction cost and Agency banking

		Transaction cost	Agency banking
Transaction cost	Pearson Correlation	1	-0.8
	Sig. (2-tailed)		0.04
	N	100	100
Agency Banking	Pearson Correlation	-0.8	1
	Sig. (2-tailed)	0.004	
	N	100	100

Table 4.6 revealed that there is a strong negative correlation between transaction cost and Agency banking ($r = -0.80$, $p = 0.04$). This implies that the more the banking Agencies the less the transaction cost.

This agrees with Ivantury and Timothy (2006) in the literature review who argued that Agency banking could be of benefit to the clients in the following ways; lower transaction costs (closer to their homes), long opening hours, shorter lines than in branches, more accessible to the poor who might feel intimidated in branches compared to agency. This is because the Agency banking enables the bank to extend their services not only in areas with poor branch penetration but also up to the doorstep of those who are reluctant or otherwise unable, to make a trip to the nearest branch.

They further argued that, the heavy cost of serving low value accounts and providing physical banking infrastructure to unbanked areas was a major impediment to financial inclusion in the past. This model was heavy on the pockets of poor customers, who had to spend time and money to travel long distance to the nearest branch. Agency banking rationalized banks operational expenditure, and reduced the cost to customers, while enabling wider reach.

4.4The efficiency of agency banking in time saving

The second objective for this study was to determine the efficiency of agency banking in time saving. The respondents were required to indicate the efficiency of banking industry. The responses were presented in Table 4.7.

Table 4.7: Efficiency of Banking Industry

Efficiency	Responses	Percentage
Very good	15	15%
Good	80	80%
Fair	5	5%
Total	**100**	**100%**

Table 4.7 indicated that majority of the respondents (80%) indicated the banking industry as good followed by 15% who indicated it as very good. The researcher further used a line graph to present the data above to make it clearer.

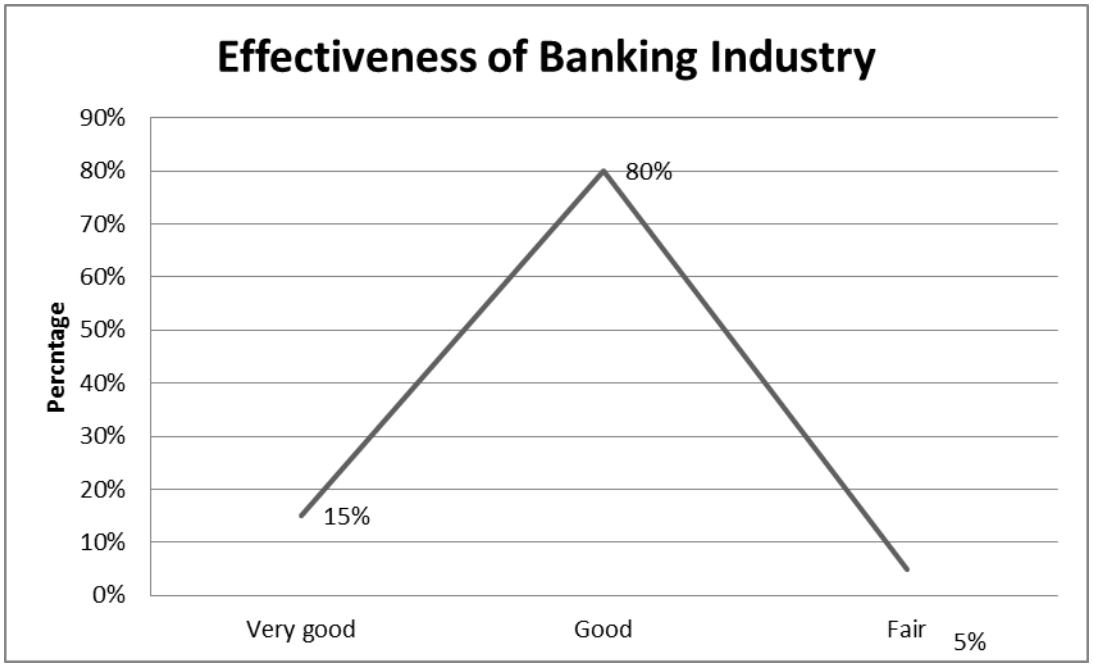

Figure 7: Efficiency of Banking Industry

The researcher further investigated whether Agency banking was time saving. The responses were presented in Table 4.8.

Table 4.8: Time saving and Agency banking

Category	Responses	Percentage
Strongly Agree	96	96%

Disagree	4	4%
Total	**100**	**100%**

Table 4.8 shows that 96% percentage of the respondents strongly agreed that the Agency banking was saving on time during transactions since there are no long queues which tend to take too long to serve the customers.

This agrees with Habilolaka (2013) who argued that days are long gone when customers would queue in the banking halls waiting to pay their utility bills, school fees or any other financial transactions. They now do this at their convenience by using Agents outlets. Agency banking has enabled bank customer to access the banking services within the comfort of their neighbor-hood. Agency banking can dramatically reduce the cost of delivering financial services to unreached people. Agency banking can address the two main problems of access to finances; the cost of roll-out (physical presence) and the cost of handling the low value transactions. This is achieved by leveraging networks of existing third party agency for cash transactions and account opening and by conducting all transactions on line. This sharp cost reduction creates the opportunity to significantly increase the share of the population with access to formal finance and, in particular, in rural areas where many people in developing countries live (Lyman, *et,al* 2008).

4.5 Agency banking opening hours and provision of banking services.

The third objective for this study was to determine how agency banking has increased opening hours to increase provision for banking services. The respondents were required to indicate if the agents provide banking services through long opening hours. The responses were presented in Table 4.9.

Table 4.9: Agency banking long opening hours

	Responses	**Percentage**
Strongly Agree	91	91%
Disagree	9	9%
Total	**100**	**100%**

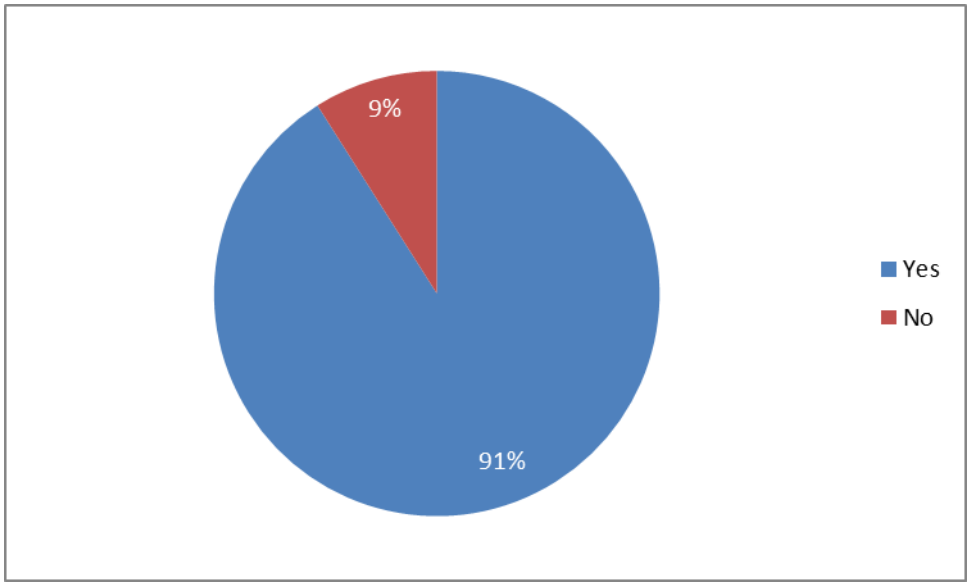

Table 8: Agency banking long opening hours

According to 91% of the respondents, they strongly agreed that; the banking agents avail banking services through long opening hours as opposed to the banks, with most of them opening from 7.00am to 6.00 pm and also opening during the public holidays. This has enabled customers to get banking facilities very early in the morning and also late in the evening and when the physical branches remain closed.

Table 4.10 Correlation between Long opening time and Agency banking

		Opening time	Agency banking
Opening time	Pearson Correlation	1	0.86
	Sig. (2-tailed)		0.03
	N	100	100
Agency Banking	Pearson Correlation	0.86	1
	Sig. (2-tailed)	0.003	
	N	100	100

Table 4.10 shows that there is a strong positive correlation between long opening time and Agency banking (r = 0.86, p = 0.03). This implies that the banking Agencies have improved the banking opening time.

According to the bank supervision annual report (2011), adoption of agency banking has enhanced provision of banking services for long hours. The financial sector reform and development blueprint, vision 2030 indicated that, access to financial services continued to be enhanced, spurred by increased innovation in the delivery of financial products and services throughout the country. These developments have been a catalyst to fulfilling the goals of building an all-inclusive and efficient financial system.

Agency banking provides the opportunity for customers to get financial products and services at a location nearest to the customer, this breaking down certain barriers to financial inclusion such as cost and accessibility. Despite the use of the agency banking for the banks to bring financial services closer to their customers it has been currently said that the long queues of people seeking services in banks especially in equity bank have reduced at low rate, hence the researcher's need to study the role of agency banking in expanding access to the financial services.

4.7 Regression Analysis

The researcher used regression analysis to test the effect of effect of a unit increase or decrease on the dependent variable.

Table 4 Regression Coefficients

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Std. Error	Beta		
1	(Constant) (a)	5.898	.072		.000	1.000
	Cost of transaction(X_1)	.500	.103	.434	4.873	.000
	Time saving (X_2)	1.561	.199	.000	.000	1.000
	Opening Hours (X_3)	1.777	.187	.000	.000	1.000
	Banking products (X_4)	.500	.055	.548	9.041	.000

a. Dependent Variable: Importance of Agency banking services (Y)

Regression model: $Y = a + b_1 X_1 + b_2 X_2 + b_3 X_3 + b_4 X_4$

$$Y = 5.898 + 0.5 X_1 + 1.561 X_2 + 1.777X_3 + 0.5 X_4$$

Interpretation of the Beta's

The regression analysis above shows how a unit changes in independent variable changes the dependent variable. All the betas' (B) are positive indicating that every unit change in the independent variables will course a positive change in the dependent variable with the following quantities; Cost of transaction (0.5), time saving (1.561), opening hours (1.777) and banking products (0.5).

IV. SUMMARY, FINDING AND CONCLUSIONS

5.1 Introduction

This chapter presents the summary of the finding, conclusions from the findings, recommendations and suggestions for further research.

5.2 Summary of the findings

This study investigated the importance of agency banking in providing banking services in Kenya. The objectives of the study were; to determine the cost of transactions through Agency banking, to determine the efficiency of agency banking in time

saving, to determine how agency banking has increased opening hours to increase accessibility for banking services, and to determine the banking products offered through agency banking.
It was established that Majority of the respondents (86%) strongly agreed that the agency banking was worthwhile in providing banking services closer to the customers. This reduced time wasting since the customers do not have to travel long distances as the agencies are close to their residences. The study revealed that there is a strong negative correlation between transaction cost and Agency banking ($r = -0.80$, $p = 0.04$). This implies that the more the banking Agencies the less the transaction cost.

The study revealed that majority of the respondents (80%) strongly agreed that the Agency banking was effective in time saving. This is because Agency banking were of benefit to the clients in the following ways; lower transaction costs (closer to their homes), long opening hours, shorter lines than in branches, more accessible to the poor who might feel intimidated in branches compared to agency.

The study also established that 96% percentage of the respondents strongly agreed that the Agency banking was saving on time during transactions since there are no long queues which tend to take too long to serve the customers.

Lastly the study revealed that the banking products provided by the banking Agencies include mainly; Cash withdrawal, cash deposit, bill settlement, and balance enquiry.

5.3 Conclusions from the findings

From the findings of this study the researcher concluded that:

i. The Agency banking availed banking services closer to the customers hence saving the customers the transport cost since Agents are located near their residence.
ii. The Agency banking is efficient in terms of transaction cost and time saving and most of the respondents were impressed by their performance.
iii. The Agency banking like any other bank offered banking products which include; Cash withdrawal, cash deposit, bill settlement, and balance enquiry.

5.4 Recommendations from the findings

Based on the findings of this study the researcher wishes to make the following recommendations;

i. Equity bank should do more advertising to sensitize the public on the availability and the services of Agency banking.
ii. Agency banking should increase the products they offer to their customers to include the credit facilities.
iii. The Agency banking should have more money so that those who want to withdraw more would not be forced to go to physical bank branches.

5.5 Suggestions for further research

This study investigated the importance of Agency banking in providing banking services in Kenya-a case of Equity bank. Further research can be done on the following:-

i. Factors influencing the opening of banking Agencies in rural areas.
ii. Factors influencing the profitability of banking Agencies.
iii. Factors affecting the operations of banking Agencies.

REFERENCES

[1] Abel G. Mugenda and Olive M. Mugenda,(2012), Research Methods Dictionary: Applied Research and Training services
[2] Blau, P.M. (1964), Exchange and power in social life (New York, John Wiley)
[3] Balman , Stanely, (1982), Agency research in managerial accounting: A survey. Journal of accounting literature. 1. 154-213
[4] Downs, Anthonny, (1957), An economic theory of democracy. New York: Harper and Row.
[5] Kothari C.R, (2005), Research methodogy: Methods and techniques. Daryaganj, New Delhi,New age international.
[6] Mester, Loretta J,(1991),"Agency cost among savings and loans", Journal of Financial intermediation, Eisevier,vol.1(3) pages 257-278,june
[7] Mitnick, Barry M , (1974), The theory of agency: The concept of fiduciary rationality and some consequences.
[8] Mugenda, O.M. and Mugenda, A.C (1999),Research methods, quantitative and qualitative approaches. Nairobi: Acts press.
[9] Mugenda, O.M. and Mugenda A.C (2003), Research methods, quantitative and qualitative approaches. Nairobi: Acts press.
[10] Orodho,J.A (2005). Techniques of –writing research proposals and reports in education and social sciences. Nairobi:Kanezja HP enterprises.
[11] Rees R (1985), The theory of principal and agent- part i. Bulletin of Economic Research 37(1) 3-26.
[12] Rees R,(1985),The theory of principal and agent – part ii.Bulletin of Economic research 37(2) 75-97.
[13] Rogers, E.M (1995). Diffusion of Innovations (4th Edition).The free press, New York.
[14] Rogers, E.M. (1976) New Product Adoption and Diffusion. Journal of consumer research,2 (March) 290-301
[15] Ross, Stephene A. (1973),The economic theory of agency: The principal's problem. American economic review 62(2) 134-139
[16] Shapiro, Susan P,(2005), Agency theory annual review of sociology 31 4.1-4.2.2
[17] Stightz, Joseph E,(1987), "Principal and agent, The Newpalgrave: A dictionary Economics v3 pp 966-971
[18] The Central bank of Kenya's annual supervision report for (2012)
[19] The Central bank of Kenya's annual supervision repot for (2011).

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Soiled Diapers Disposal Practices among Caregivers in Poor and Middle Income Urban Settings

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* Department, Institute Name
** Department, Institute Name, if any

Abstract- With the rise of Environmentalism in the 1960s, there was a growing realization by individuals, organizations and governments that the environment was being adversely affected by human activities. Nakuru for the last few years has seen a rapid population growth. This in turn, has seen an increase in the generation of non biodegradable solid waste. One type of such waste is disposable diapers. The purpose of this study was to investigate used diaper disposal practices among the care givers in Low and middle household income setting in Nakuru, Kenya. This type of setting was selected due to the fact that it houses the majority of the population. Specifically the study sought to identify the magnitude of diaper usage among this category of care givers as well as methods used in the disposal of the soiled diapers. The study also sought to determine the willingness of caregivers to make use of used diaper collection centre. This was a cross sectional research which used mixed research method methodology. Samples were taken from four low and middle income households in the town. Both quantitative and qualitative research method was used. Observational checklist and structured interview schedules with care givers were employed. Data analysis was done using Statistical Package for the Social Sciences version. The study established a high use of use of disposable diapers. Majority of the care givers disposed of diapers in the open field. Moreover, care givers were unwilling to transport used diapers to a collection centre. The study recommends that the public should be sensitized on the use of reusable diapers and need for separation of garbage from the source.

Index Terms- Biodegradable, Diapers, Garbage, Nakuru

I. INTRODUCTION

Waste management in the developed countries is safe and advanced compared to middle and low income countries. Less developed countries like Kenya, generally lack adequate means to handle and dispose off many wastes in an environmentally safe manner.

Disposable diapers have been introduced recently in our society and their use has been embraced by our generation without considering their impact. A report by transparency market research stated that due to increase birth rate and increased awareness in hygiene and demand for sanitary products, the diaper market in areas like India, West Asia and Africa is growing fast and it is expected that babies in this regions will use about 8billion diapers in a year by 2017 (African Market Potential, 2014).

In Kenya, as in many developing countries, it appears that little information is available regarding handling and the proper disposal of disposable diapers despite a significant rise in usage of such during the last decade by women of child bearing age.

Proper disposal of diapers reduces incidences of contamination of drainage water, which can subsequently lead to diarrheal diseases. Non-renewable energy, global warming, and respiratory effects from in organics are the most relevant of the potential environmental impacts for the diapers. Moreover, promotion of hygienic behaviours has been identified as a public health intervention likely to have considerable impact in the reduction of diarrheal diseases in young children in developing countries.

It is generally regarded that waste management is the sole duty and responsibility of local authorities, and that the public is not expected to contribute. Contrary to this statement however, there is need for community involvement and participation in decisions regarding proper disposal of waste material to maintain a health and safe environment. There is limited literature on the proper disposal of soiled diapers in households. Therefore, the study aims at identifying current practices regarding soiled diaper disposal and to recommend interventions that could improve the disposal of soiled diapers in the low and middle income settings. The results of this study may be used by policy makers to come up with policies and guidelines on proper disposal of soiled diapers to reduce contamination and environmental hazards

II. LITERATURE REVIEW

The environmental concern

Solid waste has been mounting in most developing countries, but their primary focus is on achieving high economic growth, paying little attention to waste management (Metet, 2009). Municipal solid wastes (MSW) is the waste produced from residential area and industries that are of non-process wastes, commercial and institutional sources with the exception of hazardous ones, construction and demolition wastes, and liquid wastes (Tchobanoglous & Kreith, 2002). In the light of the relationship between environmental factors and development, assessment of the impacts must be done because production and consumption patterns that stimulate growth are dependant on use or extraction of natural resources and ecosystem services as well as waste disposal to dumping sites, water or the atmosphere (NEMA, 2011).

Unsustainable patterns of production and consumption have resulted in a considerable garbage synthesis in both quantity and variety of waste. This is as a result of rapid urbanization,

economic growth and industrialization which are growing problems for national and local governments. These cause severe impacts on the environment in terms of pollution, natural resource depletion, public health and cost to the local economy (NEMA, 2011).

According to scientists, the combination of population growth, resource depletion and unrestricted use of industrial technology will disrupt the world ecology and economy. This will lead to mass starvation, widespread suffering and destruction of the physical environment (Meadows et al., 1973). This calls for new set of attitude and policies towards environmental protection, and if they will not be put in place then the environment will be permanently damaged and the people's living standards will fall (Rubenstein, 1999). There is also need for national accounting system that embraces the environmental accounting as accounting methods underestimates the natural capital hence the environmental cost of economic activities (Burnett and Hansen, 2008).

Gaps in our societal systems

Open dumping of solid waste seems to eliminate and contain pollution, but it may only hide it- temporarily. There is need for suitable control system to be put in place as diapers are new in our society and mitigation measurers should be enhanced before things get out of hand and blame games kick off with no one accepting responsibility. Chemicals released by decomposing solid wastes can leak from dumping site and landfills to ground water. They can contaminate water wells, soil and nearby water streams (Rubenstein, 1999). When we discard something, we never really eliminate it, but simply put it elsewhere. Our local authorities are too busy trying to get rid of the garbage that they do not worry in better ways of disposing them (Marshall, 1972). NEMA and Kenya Bureau of Standards (KEBS) have helped lessen the use of plastics, but have done little to encourage the recycling, reuse or proper disposal of the plastics (NEMA, 2011). Technology can produce almost anything but it is usually at a very high price of the consumption of resources and accumulation of waste (Mason and Flockerts, 1973). The diaper is of no exception to this phenomenal and as modern parents continue to celebrate the enjoyed convenience, there is a high price to pay.

Overlooked areas

Past studies have looked into the area of pollution but have overlooked the issue of involving some stakeholders like the consumers of the product. Most users of the disposable diapers have no idea of the hazard the product has on the environment. If they are enlightened on the same then they can own up and take responsibility of the waste being generated. "As individuals we must do what we can to cut down what we throw away. We must behave as we cared much about the whole world as we do about our living rooms" (Marshall, 1972: 92).

There is also need to consider how the product's consumption can be Reduced, Repaired, Reused and Recycled. In Kenya recycling is done on plastics, paper and glass. It is normally sold to private firms who buy at exploitative prices mainly due to absence of elaborate waste recycling, material recovery, and reuse policies and guidelines (NEMA, 2011). Recycling of solid wastes addresses problems of both pollution and resource depletion as it uses resources that had already been extracted.

Legislation.

The Kenyan environmental law consists of the legislation, standards, regulations, institutions and administrations adapted to control activities on environmental management. The government's concern on environmental and protection of human health from pollution is quite evident. Though contained in different government documents and executed by different arms, they all endeavor to protect the environment and human health.

Environmental Management and Co-ordination Act 1999

The EMCA came into force on 14th Feb 2000 and it provides an institutional framework and procedures for management of the environment, including provisions for conflict resolution. Section 3(1) of EMCA 1999 states that every person is entitled to a clean and healthy environment and has a duty to safeguard and enhance the environment. The new constitution also obligates the government to ensure sustainable exploitation, utilization, management and conservation of the environment and natural resources (NEMA, 2011). The environmental action planning committee recommends legislative measures for preventing, controlling or mitigating adverse environment impacts.

EMCA (Waste Management) Regulation, 2006

Section one states that no person shall dispose off any waste on a public highway, street, road, recreation area or in any public place except in a designated waste receptacle. A Waste generator shall collect, segregate and dispose such waste in a manner provided under these regulations.

A waste generator shall minimize waste generated by adapting the following cleaner production methods;

i. Improvement of production through conservation of raw materials and energy and eliminating the use of toxic raw materials.
ii. Monitoring the product's cycle from beginning to the end by identifying and eliminating potential negative impacts of the product. Enable recover and reuse of the product.

Reclamation, recycling and incorporating environmental concerns in the design and disposal of the product (Kenya gazette, 2000).

Public Health Act (Cap 242)

Part IX, Section 115, of the Public Health Act states that *"no person/institution shall cause nuisance or condition liable to be injurious or dangerous to human health"*. Section 116 requires that Local Authorities take all lawful, necessary and reasonably practicable measures to maintain their jurisdiction clean and sanitary to prevent occurrence of nuisance or condition liable to be injurious or dangerous to human health. Such nuisance or conditions are defined under Section 118 as waste pipes, sewers, drainers or refuse pits in such state, situated or constructed as in the opinion of the medical officer of health to be offensive or injurious to health.

The product under study

The word *diaper* originally referred to the type of cloth rather than its use; "diaper" was the term for a pattern of repeated, diamond shapes, and later came to describe a white cotton or linen fabric with this pattern (Webster, 2013). This has over time been used to refer to the disposable napkin. The word *nappy* is a diminutive form of the word napkin and is often used to refer to cloth diapers. The use of disposable diapers has been on the increase over the last few years in Nakuru Municipality and in Kenya as a whole. This could be due to the reduction in their price or an increase in the income of the parents in this generation compared to others who used cloth napkins.

A quick scan at the supermarket shelves and retail shops gives an indication of the high usage of the product. They are also more convenient especially when one is travelling or working hence preferred by most mothers as they are less bulky compared to the cloth ones. In the day care, caregivers require the little ones to wear them as they can be changed with ease and are of high hygiene. Unlike the cloth napkins that take time to dry especially during rainy seasons, disposable diapers are always dry and available. Pediatricians also advice parents to use them so that the little ones can have undisturbed sleep with minimal interference especially at night as they do not require changing very often compared to cloth napkins.

The composition of the disposable diaper

In the year 1984 introduction of a super absorbent material from polymers known as Sodium Polyacrylate was done, an improvement from what was originally developed in 1966 (Carl et al., 1991). The polymer is an amazing water absorber and can absorb 200 to 300 times its weight and hold it in a gooey gel. The vast majority of the polymeric material are based on petroleum which is a non-replaceable resource hence the need to preserve it (Morris et al., 1993). Man is said to be rapidly depleting non replaceable resources with half of the energy used in the past 2000 years being consumed in the past few years (Mason and Flokerts, 1973).

Polyethylene, a synthetic polymer where ethylene which is derived from petroleum is made to react with itself to form polyethylene as indicated in the formulae below

$$_{n}CH_2=CH_2 \longrightarrow {}_{n}CH_2CH_2CH_2CH_2(CH_2CH_2)_n CH_2CH_2CH_2CH_2$$

The polyethylene forms a breathable shell film of the diapers and another film that prevents wetness and soil transfer. The diapers also have a layered construction that allows transfer and distribution of urine to an absorbent core structure where it is locked in.

The synthetic petroleum materials remain in the environment for several years. Unlike natural polymers which are broken down by micro organisms to get smaller molecules, the C-C single bond of polymers like polyethylene cannot be metabolized by many pathogens (Morris et al., 1993). According to the US Environmental Protection Agency, a single diaper may take almost five hundred years to decompose.

Petroleum is a non-renewable resource and its depletion is at a very high rate. This calls for rapid measures to be put in place to replace the dwindling supplies. The plastics used, which are made from petroleum must be made with other materials (Calzonetti and Barry, 1985). The key issue is that it is a global phenomenal that requires individuals, organizations and governments to work together. Developing communities like China are said to be increasing their consumption of non-renewable resources at an alarming rate but they argue that they cannot forego increased standards of living which have been enjoyed by developed world for years who are the biggest polluters of the environment (Brinkman et al., 2010).

An average child will use thousands of diapers which are disposed after every single use leading to a disaster especially when it comes to their disposal. In the US it is estimated that an average child uses over 5,000 diapers in the period before being trained to use the toilet, hence a total of over 16 billion diapers (EPA, 1990.) The disposable diapers use more raw materials for production and generate more solid waste after use than cloth diapers. The inner absorbent layer of a disposable diaper is treated with chemicals, which can trigger allergic reactions. Disposable diapers often contain dyes and dioxin, which is formed as a by-product of the chlorine bleaching process. Dioxin is a carcinogen, which means it can cause cancer. When released into the environment, the toxin can accumulate in humans and animals.

Disposal of waste materials

Particular environmental concerns have been greatly affected by the residential and industrial expansion which has led to unplanned urbanization and demand for more land. This situation is aggravated by the fallen standards of urban services, increased pollution and increased health issues hence need for a new approach towards urban planning and management.

In Kenya, the responsibility of waste management lies with the local authority that are generally financially, technically and institutionally weak. This includes a poor on site storage, lack of onsite separation facilities, poor or unavailable transport system, poor formal recycling practices and plants and lack of appropriate waste disposal sites hence leading to crude dumping and open burning of waste (NEMA, 2011). As a county we have mixed, uncollected unsafe waste disposal methods that remain a serious problem. Waste separation is not considered as a priority as transporters and home owners would rather put all the rubbish together (Metet, 2009). This pose a great risk as most are disposed with general household garbage or in black bags yet they should be treated as biological waste. They have potential threat to the public health and the environment.

Transportation of waste is poor and ranges from makeshift hand carts, poorly serviced and maintained ordinary open trucks wastes that are inappropriate as they transport waste in an unsanitary manner where waste is likely to spill or get blown as the vehicle moves (NEMA, 2011). On site waste segregation, classification and quantification are not practiced in the country and thus domestic waste and hazardous waste are intermixed, rendering the entire waste stream potentially dangerous (NEMA, 2011). The local authority heaps the garbage at dumping sites and does not get any treatment to meet carbon reduction target. Another potential problem could be leachate, primarily from dumped waste, entering ground water supplies, pollution of air and of land.

Disposal of diapers

Diapers contain faecal matter and urine, and are likely to contain infectious material. Hazardous waste are a category of waste that have immediate or long term health effects including asthma, allergic reaction, skin rashes, cancer and other long term diseases (GOA, 2009). Viruses excreted in human faeces could pose health problems in the long term. Most diapers are dumped together with household garbage, others in compost pits and others litter the estates' streets posing a great danger of infection to those who come into contact with them.

According to the National Environmental Sanitation and Hygiene Policy (2007), 80 percent of hospital attendance in Kenya is due to preventable diseases. About 50 percent of the said illnesses are related to water, sanitation and hygiene (GoK, 2007). There is garbage heaps everywhere as evidence of management of solid waste is poorly handled. NEMA recommends that waste should be sorted to match the content for ease of disposal and recycling processes (Standard Newspaper 2014).

There is need to raise awareness among the people utilizing the product on proper disposal of the diapers. Most people are not aware of the plastics used in the products and manufacturers do not print a full list of materials used on the packaging. Waste reduction, involves redesigning products or changing societal patterns of consumption, use, and waste generation to prevent the creation of waste and reduce the toxicity of waste that is produced (USEPA, 1995).

Possible control measures

Waste is described as worthless material, but in nature nothing is discarded. Industrial ecology makes it clear that discarding material on the earth has a great cost and is caused by having a short sighted view (Enger and Smith, 2007).

In biodegradation the organic material is converted to environmentally accepted materials like water and carbon dioxide, minerals and biomass. The products are naturally broken down over time by saprophytes and other inorganic organisms like fungi and bacteria and can then be absorbed by living organism, completing the cycle. Materials that are no longer in use should be termed as residue. Residues are materials that our economy has not yet learnt to use efficiently (Enger and Smith, 2007).

Cuban mothers have come up with a recycling process where, they unfold the used diaper and remove the padding, and then they wash the diaper and leave it out to dry. Once it has dried, they fold pieces of cloth and stuff them into the pocket where the padding was. If the adhesive has worn off, they use two safety pins to keep the diaper on the baby (Havana times, 2013). This can be used by caretakers to give diapers another life.

A scientist named Alethia Vázquez-Morillas found a way to turn that 500-year span (which is the estimated time taken for a diaper to decompose) to a mere four months, by using oyster mushrooms to accelerate the breakdown (Cowan, 2011). Companies like Natra Care has done much to lessen the environmental impact of sanitary pads and liners made from biodegradable, totally chlorine free cellulose and bio plastics that are compostable under the correct conditions and are safe for septic tanks.

In the United Kingdom, two companies Versus Energy and Knowaste partnered to build the diaper recycling plant that converts the organic materials into energy. The bulk of the remaining materials will be separated to eventually find their way into various products.

The use of a modern cloth diaper is also possible. This is a custom-made baby pant which protects the child from experiencing leakage in case they soil themselves. The diaper is reusable and is made from natural fibres, man-made materials, or a combination of both (Leverich, 2011).

Theoretical framework

The study will adopt the Theory of Reasoned Action (TRA) model. The model addresses the internal determinants of peoples' behaviour across a wide range of physical and social situations. The TRA is founded on individuals' behaviour being strongly related to their attitudes towards the same. People form attitudes that result from his beliefs about the consequences of a particular action and his evaluation of those beliefs. If an individual expects that a particular behaviour has good consequences, then he will have a positive attitude towards that behaviour. In the same way, the more the person expects a behaviour to have undesirable consequences, and then they will have a negative attitude towards it. Educational and promotional tools such as staff education, event promotion and training are essential for the successful implementation of a waste management plan (CCME, 1996). Raising awareness about different waste management programs can have positive effects, but there are several methods which can be used to change behaviour to enhance participation or rectify problems (Timlett & Williams, 2009). Once new initiatives are introduced, people will need time to adjust until the new plan becomes normal behaviour, but once this behaviour is established it is difficult to break (Timlett & Williams, 2009).

Conceptual framework of disposal of diapers

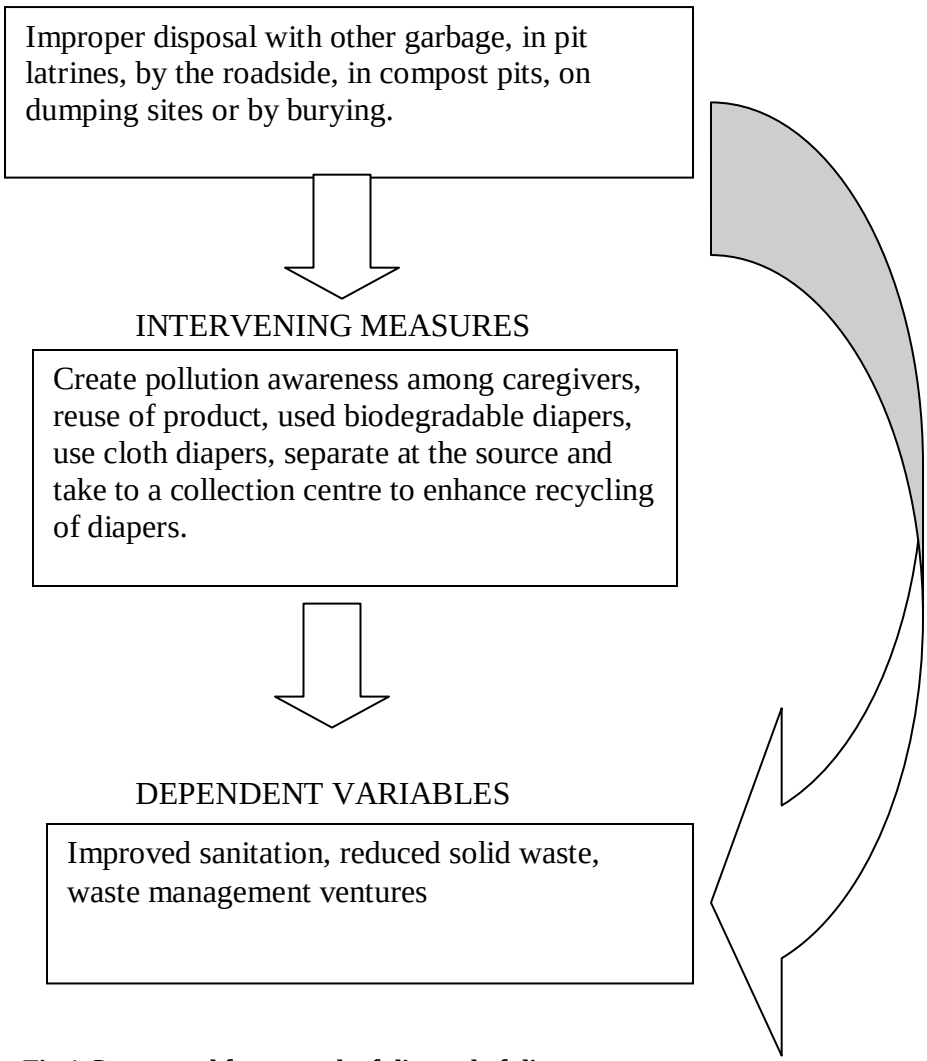


Fig 1 Conceptual framework of disposal of diapers

Improper disposal which includes disposal with household garbage, pit latrine, compost pit, by the roadside leads to impacts like spreading of diseases, pollution of land and water, rapid filling of latrines and compost pits, slow degradation of the plastics and other non biodegradable components in the product. Mitigation measures include creating awareness, establishment of collection centres, recycling the product, reusing the product, using more environmental friendly raw materials. Results will be improved sanitation, reduced solid waste and entrepreneurs can have waste management ventures.

III. METHODOLOGY

Study Area

The study was conducted in Nakuru Municipality, the fourth largest town in Kenya after Nairobi, Mombasa and Kisumu. It is 160 kilometres North West of Nairobi and has an altitude of 1859m above sea level. Nakuru is densely populated and has had a huge influx in 2009 due to the 2007/08 post election crisis that saw a number of internally displaced people come to the town. This influx and rapid population growth has presented the local authority with serious environmental challenges (Kopejo and Kirui, 2010).

Once dubbed "the cleanest town in East-Africa", Nakuru, has lost a lot of its past glory. The town generates about 200 tonnes of household waste daily; with an additional 20 to 50 tonnes generated from different markets within the town. Waste collection services are provided by three vehicles that collect two to three trips in a day, a total of about 70 tonnes. The waste surpasses the capacity of the council hence private institutions and community based organizations are involved. There are eight private sectors allocated different zones as provided by the Local Urban Observatory (LUO) (NEMA, 2005). They get the waste from the estates and disposal is done at the open dumping site at 'Gioto' near London estate in Nakuru town which comprises of an abandoned quarry, where most of the waste generated by the town dwellers ends up. The local government does not prioritize waste management in the financial budgetary allocation. This may be lack of information on potential economic value that waste has (NEMA, 2011).

The study included the following estates; Race track, Shaabab, Kenlands, Pipeline, and London estates. These are low and middle income estates. The estates were selected because their high population densities. Consequently, they were thought to be high users of disposable diapers as most are middle aged parents who live in rented flats or bungalows and are thought to have a average income. Most of them also comprise of working mothers who have no time to wash cloth napkins. While some areas in the states receive garbage collection services from privately owned companies that charge between a hundred shilling and five hundred shilling a month for the disposal of garbage, others do not and individual households have to device a way of disposing of they own waste. As a result of this its common to see open dump sites that are within residential.

Study Design

This was a cross sectional research that used mixed research method methodology involving the use of both quantitative and qualitative research methods. Observational check list and structured interviews with care givers was employed.

Study Population/Target Population

The target population of the study were caregivers of infants and toddlers who are still using diapers and have not been potty trained.

Sampling Method and Procedure

The study employed cluster sampling techniques in which the estates were picked using road passages to identify clusters. The purposive sampling was used to identify household, where indicative cases that offered in-depth information were selected.

Sample size determination

In survey research 100 observations are required for each major group and 20 to 50 for a minor group (Borg and Gall, 1989). Thirty samples were collected from the five estates giving a total of 150 as the sample.

Data Collection Tools/ Instruments

An observational checklist and structured interviews were used in the study. The closed ended questionnaire had questions relating to the gender of the care giver, household income, number of diapers used per day made of disposal and willingness to take soiled diapers to the collection center. The observational check list had items on mode of disposal, size of the residential, house type of the residential house, and the location of the house. Permission to collect data was obtained from the Ministry of Higher Education, National Council for Science and Technology (NCST) and acquired a research permit. Research assistants were trained to aid in collection of data so as to maximize on time. Both English and Swahili languages were used to get all the relevant information. Structured onterview was also used

Data Analysis, Presentation and Interpretation

Analysis and presentation of data was done with the aid of Statistical Package for the Social Sciences version 20. The raw data was coded and entered in to the software. Both descriptive and inferential statistics were used.

Ethical Issues

Ethical Clearance was sought from the Mount Kenya University's ethical committee. Moreover, the information that could not remain anonymous, research assistants were trained on the need of confidentiality. All the information obtained was stored in anonymous way.

FINDINGS AND DISCUSSIONS

The study was conducted on five estates namely Kenlands, Shabab, Pipeline, Race track and London. The expected target was achieved but there were two spoilt schedules as the information given contradicted and therefore they were not taken into account. Overall a response rate of 98% was obtained. Three estates (Kenlands, Shabab and Race track) had 29 samples while one had 31. This is as indicated in Table 1

Table 1: Sample distribution

Estate	Respondents	Percent
KENLANDS	29	19.6
SHABAB	29	19.6
PIPELINE	30	20.3
RACETRACK	29	19.6
LONDON	31	20.9
Total	148	100.0

The communities in which the study subjects were drawn are generally low and middle incomes. It was noted that Kenlands and Racetrack had similar kind of residential houses, with house units ranging from four to six family units in a plot. On the other hand Shabab had various types of houses which included bungalows with one unit in a plot, flats that had an average of ten units hence making it a middle class estate. London and pipeline estates did not have a consistent pattern of housing but had a mixture of both the middle class and the low income houses. Diapers usage was different across the estates in the study.

On gender results were as indicated in table 2 below.

Table 2 Gender of the caregiver

Gender	Frequency	Percent
Male	5	3.4
Female	143	96.6
Total	148	100.0

The study established there were more female who are caregivers compared to men. This was expected given the cultural back ground of the respondents.

In terms of education level majority of the respondents 72(48.6%), had secondary education, 51(34.5%) tertiary. The rest of the information is as indicated in the following table.

Table 3; Education level of the caregiver

Education Level	Frequency	Percent
No formal education	8	5.4
Primary	17	11.5
Secondary	72	48.6
Tertiary	51	34.5
Total	148	100.0

The study also sought to know the preferred type of diapers. The results were that majority of the respondents preferred to use disposable diapers (%). Some of the reasons given for this preference included that they are comfortable to the children, convenient especially while travelling, comfortable while sleeping and that they are good in situation where water is scarce. Other reason includes that diapers are not tiring as there is no washing and therefore requires less labour, they are safe for baby and caregiver as no pins are used, and that some diapers have colour indicator that shows when it is time to change the diaper.

This is similar to what the Euronometer found with the Thai parents who look for diapers that can offer infants more comfort, dryness, no irritation, flexibility and which sooth the skin (Passport, 2011)

A report by Mwololo indicated that rising in disposable income in Kenya had increased the use of tissues and hygienic products. Diapers benefited from the widening availability of single units packs which target low to mid income consumers who use nappies and diapers are used at night or when travelling (Mwololo, 2013).

According to Kenya Euromonitor report, 7% of mothers regularly used diapers in 2013 and there was a considerable scope for growth with the country's birth rate expected to remain high. (Country report, 2015).

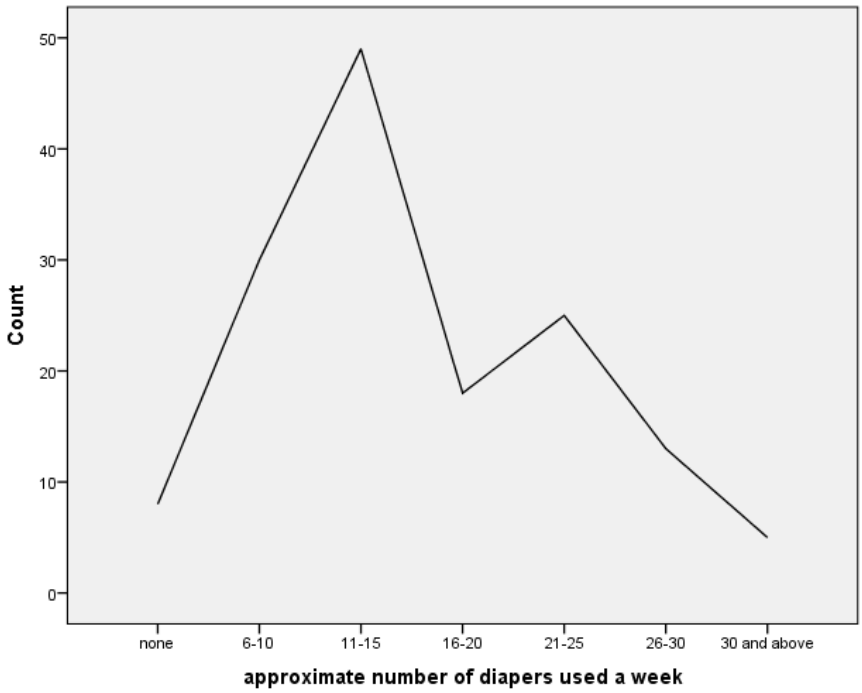
Mwololo also reported that diaper manufacturers have taken the diapering education to maternity facilities where they educate mothers with new born babies on importance of diapering, immunization, nutrition and skin protection and also attributed to rising of young educated working mothers who are more conscious on hygiene and health of their babies.

She also noted the refastened able straps of Velcro makes them easier and faster to use compared to napkins as they have no safety pins. These factors were also captured during the survey.

Water shortage in Senga/Nehosho suburbs in Zimbambwe was said to be a factor that contributes to use of disposable diapers, the area at times goes for three days without water (Remigios, 2014).

To estimate the number of disposable diaper used by the respondents, respondents were asked to state the number of diapers they used every day. Findings are as indicated in the figure below.

Fig 2 Approximate number of diapers used in a week



From the graph the mode is at the class 11-15 per week, which has a mid value of 13 and 33.8 % indicating most of the sampled population fall in this category

The mode of disposal

The study sought to know how caregivers dispose off diapers. Table 4 gives a summary of the same.

Table 4; Methods of diaper disposal method of diaper disposal used

Disposal site	Frequency	Percent
pit latrine	28	18.9
With other garbage	109	73.6
composite pit	1	0.7
Other	2	1.4
Total	148	100.0

It was observed that 5.4% of the population that was sampled used only cloth napkins and therefore the mode of diaper disposal was not applicable to them. Another category that comprised of 1.4% used other methods which included drying the diaper then later burning it while there were others who buried the used diapers. The largest population, which comprised of 73.6% disposed with other garbage. The remaining 0.7% disposed in compost pits and most live in their own compounds.

Table 5;Mode of disposal employed as compared to education level

Education level	Where is the diaper disposed?					
	0	pit latrine	With other garbage	composite pit	other	Total
No formal education	0	2	6	0	0	8
primary	3	4	8	1	1	17

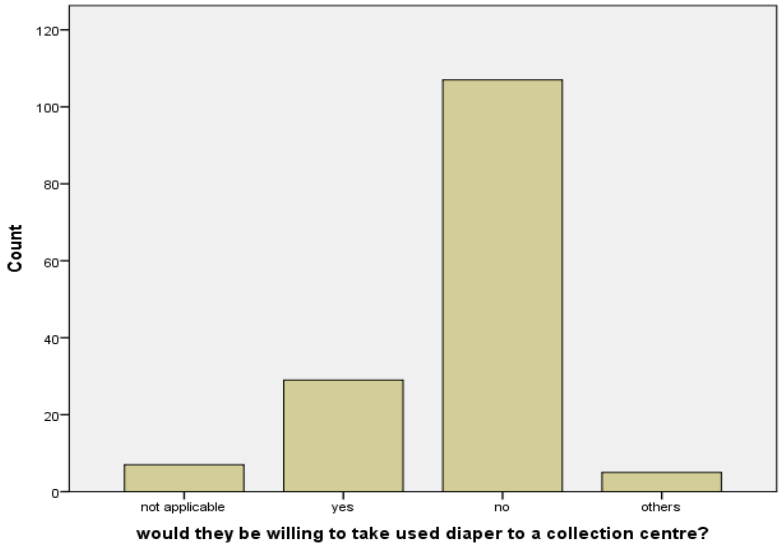
secondary	4	15	53	0	0	72
tertiary	1	7	42	0	1	51
Total	8	28	109	1	2	148

On running Chi square test there was a significant statistical relationship between the mode of disposal and the level of education of the caregiver, (x^2= 21.15, P= 0.048).

Willingness to take the diapers to a collection centre

The third objective was to determine the willingness of the caregivers to take the soiled diapers to collection centres. To achieve this, caregivers were asked whether they would be willing to take diapers at a collection centre. The following graph shows the results.

Fig 3;Would the caregiver be willing to take the soiled diaper to a collection centre?



Only 19.6% were willing to take the used diaper to a collection centre. Others would take to a centre if paid to do so. There was a significant statistical relationship between the education level and the willingness to take the soiled diaper to a collection centre (x2= 18.221, P= 0.033). People with more the education were more likely to be willing take diaper to a collection centres compared to those with low or no at all. There was a statistical significance relationship between residential estate that one lived in and the willingness to take to a collection centre (x^2= 31.195, P= 0.002).

IV. CONCLUSION

Disposable diapers are popular among the care givers in the study. Their usage is likely to grow due to the growing population in the Nakuru. Moreover, majority of the respondents dispose off diapers in the open. This may lead to contamination of water surfaces and therefore diarrhoea diseases. Further more, diapers do not degrade and when incinerated gases from the plastics are released into the air. The most obvious impact of disposable diapers on the environment is that they are thrown away pilling up garbage every day. For this reasons therefore awareness on proper disposal of diapers is the most practical strategy that can be used to manage refuse disposal.

REFERENCES

[1] Africa Potential Market for Baby Diapers, (June 2014). AdvaCare PHARMA, http:// www.advacarepharma.com/en/procedures.html

[2] Borg,W.R., Gall,D.M., & Gall, J.P.(1996) Educational Research; An introduction New York. Longman Publishers.

[3] Brinkman,J., Bateman,I.N., Harper,D.& Hodgson,C.(2010) Unlocking The Business Environment

[4] Burnett, R., & Hansen,D., (2008). Ecoefficiency: Defining a role for environmental cost management, Accounting, Organizations and Society. Volume 33, issue 6 August 2008.

[5] Calzonetti, F. J.,& Barry D. S. (1985) Geographic Dimensions of Energy. Dordrecht, Netherlands: D.Reidel Publishing Co.

[6] Canadian Council of Ministers of the Environment. (1996). Waste audit users manual: A comprehensive guide to the waste audit process.

[7] Carl L., Jones, C, V& Jocelyn,M (1991) Diapers: Environmental impacts and Life cycle Analysis.

[8] Carson, R. (1962) Silent Spring. Boston , MA: Houghton Mifflin.

[9] Cheruiyot.N.,(2015) Men baby sitting: why Kenya dad dislike spending time with their children Standard Newspaper magazine The Standard Group Centre, Mombasa Road, Nairobi.

[10] Country report (2015)Tissues and hygiene nappies/diapers/pants in Kenya Euromonitor International D.Reidel Publishing Co.

[11] Cowan,K.,L.(2011).Oyster-mushrooms-can-break-down-disposable-diapers-in-4-months/Retrieved from http://www.inhabitots.com.(June2011)

[12] Davidson,G.(2011)."WasteManagementPractices".Retrievedfromhttp://www.dal.ca/content/dam/dalhousie/pdf/sustainability/WasteManagementLiterature Reviewpdf

[13] EAP, (1990). Characterization of Municipal Solid Waste in the United States: U.S. Environmental Protection Agency, EPA 530 SW-90-042. Washington D.C.: U. S. Government Printing

[14] Enger, D., E. & Smith F., B, (2007). Environmental Science; A Study of Interrelationships 11th edition Mc Graw Hill NY 10020 Pg21-22, 27

[15] Environmental Management and Co-ordination (Waste Management) Regulation, 2006 Legal Notice No.121

[16] Galbraith,K.,(2009),Composting dirty diapers in Toronto April 2009 green energy, the environment and the bottom line, the New York Times

[17] GOA, (2009). Hazardous Material Management. Department of resources, energy and tourism, Government of Australia,GOA,Australia.

[18] GoK, (2007). Kenya Vision 2030: A globally competitive and prosperous Kenya. Government of Kenya (GoK),Nairobi. guide to the waste audit process

[19] Havana Times 29th May 2013, Cubans Recycle disposable diapers. www.havanatimes.org...(Date accessed 29th May 2013)

[20] Hodder Education, An Hachette UK Company,338 Euston Road, London NW1 3BH. Page 315-339.

[21] Keefer, A., (2015) Environmental impact of disposable diapers www.livestrong .com

[22] Keefer, A., (2014). SWaCH launches labels for appropriate disposal of diapers, Global alliance of waste pickers

[23] Kenya Gazette Supplement Acts 2000, Environmental Management and Co-ordination Act 1999

[24] Kenya National Bureau of Statistics, 2009 Census; population projected by county to 2012

[25] King, L. W. (1990). A Study of Municipal Solid Waste Composting on the Impact of Paper Diapers. The Procter and Gamble Company, Cincinnati, OH

[26] Kopenjo, J, Kirui D.(2010). Solid Waste Management in Nakuru, National Environmental Management Authority July-December publication.

[27] Lear, R.(1998) The Life and legacy of Rachel Carson: Rachel Carson's biography.(online)(Accessed July 2007)

[28] Lehrburger,C. (1998) Pure vision technology, Inc Whole earth review.

[29] Leverich, L. S. (August 4, 2011). Improved containment and convenience in a double gusset cloth diaper: Method of manufacture.

[30] Little, A. D.(1989). Disposable Versus Reusable (Cloth) Diapers: Environmental, Health and Economic Considerations. Cambridge, MA: Arthur D. Little, Inc.

[31] Marshall, J. (1972)Going to waste, where will all the garbage go? Coward, McCann and Geoghegan, inc. New York.

[32] Masese,W.(2013) Bitter price wars loom as demand for diaper rises, Standard News paper Nov 2013

[33] Meadows, D. H., Dennis, L. M, Jorgen R. & William, W. B. III (1973) 2nd edition. The Limits to Growth, New York: universe books

[34] Merchant, B.(2009). New Recycling Plant to be Powered 100% by Dirty Diapers http://www.treehugger.com/clean-technology/retrived June 2009

[35] Metet, C. O. (2009). Streaming Waste Management, Separation and Transportation page 13 A Publication of National Environmental Management Authority.

[36] Morawski,C.(2003).The poo on the diaper recycling Resource recycling North America resource and composting journal

[37] Morris, H., Leo, R., Scott, P., & Susan, A. (1993). Introduction to General, Organic and Biochemistry sixth edition pg 719

[38] Mwangi,S.W.,(2000) Environment and urbanization vol 12 no 2 Oct 2000. Partnership in urban environment management; An approach to solving environmental problems in Nakuru, Kenya. Universitert Van Amsterdam, AGIDS

[39] Mwangi,S.W.,(2002)Challenges of urban environmental governance; Participation and partnership in Nakuru Municipality, Kenya. Universitert Van Amsterdam, AGIDS.

[40] Mwololo,M.,(2013) Stiff competition see superior products enter the market, Ipsos synovate Kenya Acrom house james Gichuru road

[41] NEMA, (2011). Kenya State of Environment and Outlook 2010pg 154,155 Progress Printing press Co Ltd, Malta.

[42] NEMA,(2005). State of Environment Report 2005, Kenya; Pollution and Waste Management page 34-35 A Publication of National Environmental Management Authority, (NEMA) Kenya.

[43] New parents guide 1999/2000 date retrieved June 2015

[44] Pasteur,K,& Prabhakara,P.,(2015) Report by Kath Pasteur and Peetha Prabhakara CTLS foundation

[45] Practical action: Lessons in Urban community led total sanitation form Nakuru Kenya. April 2015

[46] Priebe,M.B,(2010). How to dispose diapers and other feminine hygiene products, Ecolife a guide to green living

[47] Rathje, W. L. (1989). "Rubbish" The Atlantic Monthly, 264 (6), 99-109.

[48] Rubenstein, M. J., (1999). Introduction to Human Geography, 6thedition. Prentice Hall, Upper Saddle River, NJ 0745.

[49] Science Direct (2013). "Waste Management". Volume 33, Issue 1 pp220-232.

[50] Standard,(2014). Recycle plastics for cleaner, healthier environment. The Standard Group Centre, Mombasa Road, Nairobi. Wednesday Life May 7 2014.

[51] Tchobanoglous, G., & Kreith, F. (2002). Handbook of solid waste management (2nd ed., p. 950). McGraw-Hill.

[52] Timlett, R., & Williams, I. (2009). The impact of transient populations on recycling behaviour in a densely populated urban environment. Resources, Conservation and Recycling, 53(9), 498-506. doi: 10.1016/j.resconrec.2009.03.010.

[53] United Nations Environmental Programme (2013)."Guidelines for National Waste Management Strategies Moving from Challenges to Opportunities." ISBN 978-92-807-3333-4.

[54] United Nations, (1987). Report of the World Commission on Environment and Development UNGA Res 42/187(11th Dec 1987)

[55] Webster's Dictionary.(1990) The University of Chicago Department of Romance Languages and Literature.

[56] Wiersma, W. (1995). Research Methods in education, An introduction. Boston: Allyn and Bacon.

[57] William, H. M.,& George, W. F., (1973) Environmental Problems. Pg 23.Wm.C.Brown company publishers

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A Holistic Presentation and recommendation of OpenFlow Its Challenges and Future Research Needed

Javier Coto

Abstract- OpenFlow could define flows and determine how packets are prioritized and forwarded through switches, reduce power consumption, and redesign data centers. You will find a holistic research of the current innovations, benefits, and future researched need in OpenFlow.

Index Terms- OpenFlow, New protocols for OpenFlow, How DDoS can be reduce through OpenFlow, Reduce datacenter power consumption through OpenFlow , Improved OpenFlow scalability with Ca-SDN, Implementing OpenFlow in a Wireless mesh network

I. Introduction

OpenFlow is one of the most important building blocks for software-defined networking (SDN). OpenFlow moves the control of the switch like routing to a centralized server, instead of the switch. With this a network can be programed allowing the system to be more flexible, and dynamic. With a centralized controller cloud computing power can be used.

OpenFlow can also be used to conserve power by turning off switches and ports off in peak hours, like at night. In data centers this reduces power consumption directly and indirectly in regards to cooling. With more demand for data centers and green computing OpenFlow provides and good solution.

The current solution to OpenFlow's issues will be presented here, many of the proposed solutions still raise more questions and research is needed. As you will read some solutions themselves create greater overhead that cancel out some of the benefits.

This rest of this paper is organized as follows. Section 2 looks at the Origins and Future of OpenFlow. Section 3 presents Power Consumption strategies to reduce carbon footprint. Section 4 takes a very important look into scalability. Section 5 explores the benefits of using the power of the cloud. Section 6 presents experiment with wireless mesh networks. Implementing and modifying OpenFlow headers for mobility. Section 7 shows how optical networks are taking advantage of OpenFlow-based control. Section 8 discusses the research environment and Tools to foster new innovations. Section 9 looks at domain-specific languages for OpenFlow. The final Section 10 uses OpenFlow to solve detection problems of denial of service attacks (DDoS).

II. Origins and Future

The origins of OpenFlow came from Martin Casado, a PhD student at Stanford University in 2006. Casado developed Ethane witch would later become OpenFlow.

2.1 Ethane

Casado 2006 paper [1] describes ethane as:

Ethane controls the network by not allowing any communication between end-hosts without explicit permission. It imposes this requirement through two main components. The first is a central Controller containing the global network policy that determines the fate of all packets. The second component is a set of Ethane Switches In contrast to the omniscient Controller, these Switches are simple and dumb. Consisting of a simple flow table and a secure channel to the Controller

This idea eventually leads to OpenFlow after joint research with Stanford and the University of Berkley.

2.2 Open Networking Foundation (ONF)

In February 2011 the Open Network Foundation was established, by Google , Facebook and Microsoft. It now includes many more members, like Cisco, Dell, HP, IBM, and many more.

ONF now oversees and retains controls over the specifications. In April 25, 2013 the latest version 1.3.2 was released [2].

III. Power Consumption

Large networks are typically provisioned for peak workloads, but the variation of workload varies greatly by day, week, or month. At night time the networks load could be 50% the load during the day [17]. In December the load will be higher than any other month due to Christmas and online shopping.

Figure 1 shows peak traffic during the day and night. Even though the traffic varies significantly with time, the rack, and aggregation switches associated with the 292 servers hosting an e-commerce application, the server draws constant power [9].

Power can be conserved by powering down switch or individual ports. One approach is Multilayer Traffic Engineering (MLTE) using adaptive link rates (ALR) and burst mode operation and another is Elastic tree. These are two ways propose to reduce power consumption

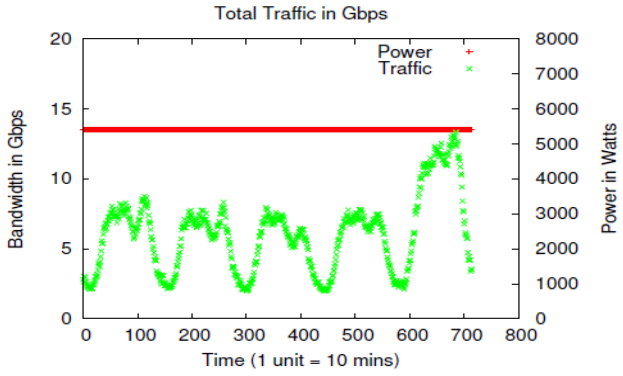

Fig. 1: Ecommerce website application Bandwidth and watts graph

3.1 MLTE with adaptive link rates and burst mode operation

MLTE can lead to power savings of 50% [9] Figure 2 illustrates how MLTE works

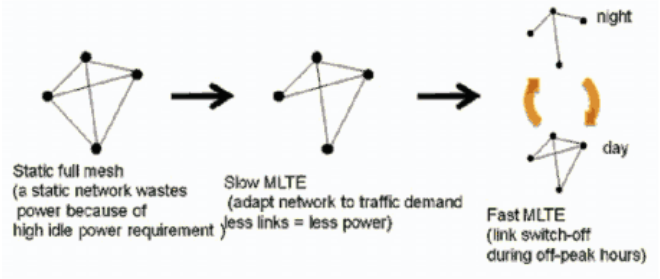

Fig. 2: Multilayer traffic Engineering

Since OpenFlow currently has limited support for the control of power in the switches adaptive link rates and burst mode operation are used to reduce power on the device [21].

Adaptive Link Rates is based on the principle that lower link rates lead to lower power consumption in the network equipment. In burst Mode packets are buffered in a network node and then sent over the link at the maximal rate. In between the bursts the line can be powered down. This works in a very small time scale, so the number of links that can be turned off is limited. This can be implemented by using OpenFlow Header OFPT_* (featured_request , featured_reply, port_mod, port_down) or Open flows OFPC_BURST_MODE header [17, 19]

3.2 Elastic Tree

Elastic tree suggest having router that can be put in sleep mode to be efficient at low loads. It states it can reduce energy consumption by 60% when demands are low. Elastic tree uses open flow to control dynamic routing of flows and measure traffic matrix [9].

IV. SCALABILITY

As OpenFlow uses a single controller that is centrally controlled, naturally question of scalability comes up. Several concerns related to scalability are: the amount of control traffic destined towards the centralized controller grows with the number of switches. If the network has a large diameter, no matter where the controller is placed, some switches will encounter long flow setup latencies. Since the system is bounded by the processing power of the controller, flow setup times can grow significantly as demand grows with the size of the network [11]. Cloud-assisted Software-defined Networking (Ca-SDN) can address the last problem but comes with other scalability issues. Some proposed solutions addressing scalability as well as other issues are, HyperFlow, DevoFlow but each has certain limitations. Another possible solution is Flowvisor. We will look at the benefits and challenges of each.

4.1 HyperFlow

HyperFlow is a distributed event-based control plane for OpenFlow. It is logically centralized but physically distributed, this gives it the ability to be scalable but retain the benefits of a centralized controller. HyperFlow does not require any change to the OpenFlow standard [22].

HyperFlow is implemented on top of NOX, NOX controllers will each be running an instance of the HyperFlow controller application. Each controller will have an event propagation system for cross-controller communication. Every controller operates as if it is in control of the entire system [11]. Figure 3 illustrates the High-level Overview of HyperFlow.

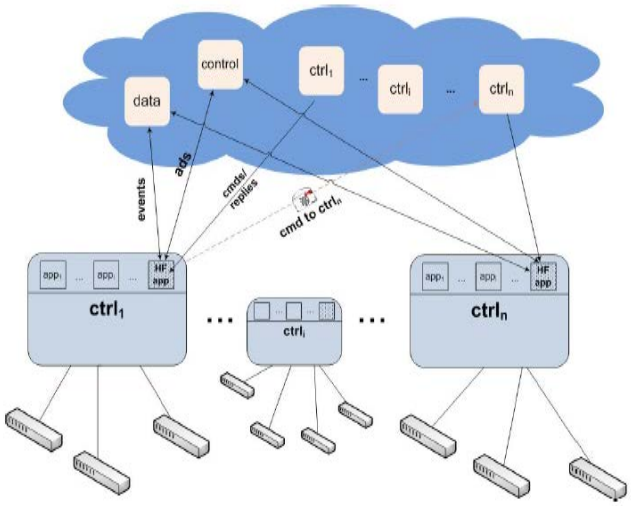

Fig. 3 HyperFlow Overview

HyperFlow's application uses a publish / subscribe system to let each controller achieve a constant network-wide view. Each controller publishes events that change the state of the system, while other controllers replay all published events to reconstruct the state.

HyperFlow uses WheelFS a distributed file system design [23] to propagate events. As illustrated in figure 3 each controller subscribes to three channels, the data channel, the control channel, and its own channel. All controllers can publish or subscribe to all channels. The data channel has the local network and applications events. The control channel is use to facilitate controller discovery and failure detection, each controller will periodically advertise itself to it. The controllers own channel is used for events and OpenFlow commands.

HyperFlow has several limitations. One, with applications that relies on temporal events, since different controllers perceive events in different orders. Two applications that query the switches perform poorly with HyperFlow. An example is discovery applications, they will need to be modified to use OpenFlow instead of protocols like LLDP.

Lastly and must important as regard to scalability. As HyperFlow uses WheelFS for event propagation. WheelFS has certain limitations with read speeds; it can read and deserialize 987 files [22]. This limitation can only guarantee abounded window of inconsistency among controllers, if the network changes trigger less than 987 events per second.

Future research is needed in developing an alternative to the publish / subscribe system, or modifications to WheelFS.

4.2 DevoFlow

As disused previously HyperFlow attempts to build on top of OpenFlow and NOX, without changing the basic premise. Contraire DevoFlow does not; DevoFlow believes OpenFlow excessively couples central control and complete visibility [24, 25]. DevoFlow states having full visibility over all flows is not quite the right goal. It focus instead, is to only have visibility over significant flows, while reducing the load of the controller. Its arguments are essentially an analysis of tradeoffs between centralization and cost; it is designed for simple and cost-effective hardware implementation.

DevoFlow introduces two new mechanisms for devolving control, Rule cloning and local actions. Rule Cloning augments the "action" past of the OpenFlow wildcard rule with a Boolean CLONE flag. If flag is clear, standard OpenFlow wildcard behavior is followed. If not the switch locally clones the wildcard rule to create new rules. With Local actions rules are augmented with a small set of possible "local routing actions". This will be done without invoking the controller. If the switch does not support the action only then will you invoke the controller.

DevoFlow also offers two different ways of collecting statistics information, sFlow and, Triggers and reports. sFlow uses sampling of header information at a rate of 1/1000 packets (this rate can be adjusted). Instead of OpenFlow's push-based or pull-based collection strategies. Since sFlow does not include the entire packet, the incremental load on the network is less than .1% [25]. An alternative to sFlow is Triggers and reports, this uses OpenFlow rules to include threshold-based triggers on counters. The switch only sends the report to the controller when the threshold is met. Research is still being done as to witch of the two collection strategies is better, as of now it is unsure.

DevoFlow uses the mechanisms mentioned above to reduce the number of flows that interact with the control-plane. By reducing the flows you enable scalability, greater than with OpenFlow itself. This does not solve your scalability issues; it only lets you have a bigger network then with OpenFlow alone. You still have all the constraints mentioned before. This is because you are only improving infrastructure for a system with one controller, as HyperFlow lets you add multiple controllers and is more scalable.

A good future research would be to implement HyperFlow with DevoFlow, expanding the network size of each controller, without addressing the limitations of WheelFS.

4.3 FlowVisor

FlowVisor has been address as a work around for scalability in OpenFlow [11]. FlowVisor was not specifically designs to address the scalability issues; it was design to enable multiple researchers to slice a production network for test bed and lab research [8]. We will go deeper into this in Section 8.

FlowVisor enables a way of placing multiple controllers on one physical network as shown in figure 4. Each controller will only have a globe view of its own network.

This is not a good solution is regards to scalability. Yes it allows you to use more controllers and reduce load but at the cost of sacrificing the overall goal of OpenFlow.

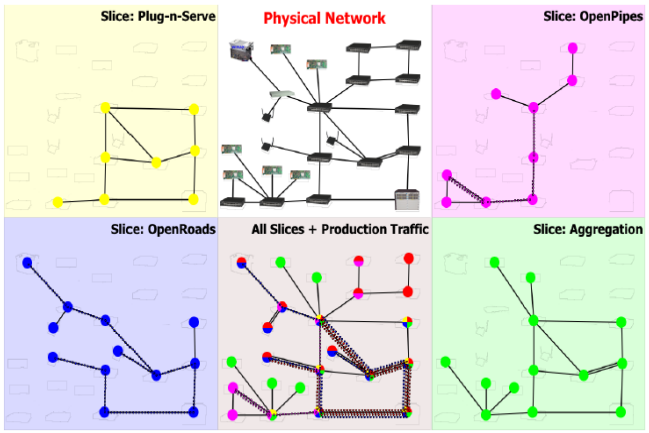

Fig. 4 FlowVisor network slicing

4.3 Global view and CA-SDN

In CA-SDN OpenFlow quires the switches to get a global view of the dynamic network, creating more packets gathering the information, and the extra overhead could outweigh the benefits.

A workaround has been proposed be putting a proxy controller that is co-located with the switch [4]. You can also consider your current topology and select a switch to gather information in a strategic location. This is still an open question that should be researched and a concern in regards to scalability

V. Using the Power of the Cloud

We have looked at how Cloud-assisted Software-defined Networking (Ca-SDN) helps with scalability and its shortcomings. Now we will look at the other advantages the cloud computing have for OpenFlow

There are several advantages one being Flexibility by functionality only requires a modification of the software implementation of the controller. In forwarding performances switches do most of the forwarding in hardware in contrast to the software routing. Additionally the time for setting up new entries can be reduced by utilizing the computational resources of the cloud, ease of administration, and cost reduction (by outsourcing complex functionality).

The flexibility and optimization of the disruption tree in Ca-SDN is excellent. The controller can calculate any kind of tree on the fly. This is where the real power is, calculating dynamic routing algorithms. By using the resources of the cloud you have many more routes that can be calculated compared to an inferior router or a single controller with finite resources. You now have the option of calculating thing like minimum spanning trees in parallel in different cores and can set a deadline for the calculation to avoid overloading [4].

CA-SDN uses two routing process reactive routing and proactive routing. In reactive a time is very critical as no distribution tree is installed on switch consequently this could cause the controller to get overloaded. An advantage of this is

there is not redundant flooding and pruning like in MOSPE protocols. The distribution tree is calculated only once. The OpenFlow switches do not need to implement any multicast routing protocol at all.

Proactive routing advantage is in reducing the flow table size in switches. The two disadvantages are one the latency for the first packet and two the controller may become overloaded if it takes too long. This is especially true with UDP where packet will begin to send without a handshake like TCP.

VI. Experimenting with Mobility and OpenFlow

Implementing OpenFlow in a Wireless mesh network (WMN) faces many different obstacles than wired networks. Due to variations in link qualities and nodes joining and leaving the network, the network topology changes at a much higher pace than any wired network [3]. In addition, as wireless networks do not have the clear notion of a point-to-point link, neighbor and topology discovery need to be adapted to wireless networks. Handovers between station also need to be addressed.

The study of [3] demonstrates how with a few lines of python code, a reasonable and useful service can be implemented for WMN.

Fig. 5 illustrates the Initial association of a wireless laptop and architecture design.

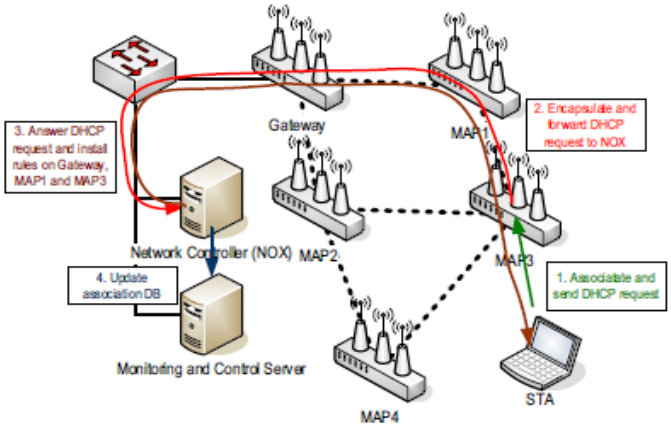

Fig. 5 Wireless Mesh Network with Openflow

This design has been shown to work in a small scale. Future research is needed in developing an algorithm to calculate the optimal STA/MAP associations and flow paths and evaluate it in a large scale scenario

VII. OpenFlow-based control of an optical network

Currently optical networks are controlled and managed through the element management system (EMS) and/ or the Network management system (NMS) as shown in figure 6 [5]. However this approach does not handle the rapid increase of dynamic networking traffic. An alternative choice to this has been developed called generalized multi-protocol label switching (GMPLS), but most network carriers seem to lack the confidence in it. OpenFlow has been proposed as a solution and received extensive attention worldwide. OpenFlow has been viewed as a positive replacement as illustrated in figure 7 , because of its centralized control scheme. It is easier to migrate and update current NMS/EMS architecture, unlike GMPLS.

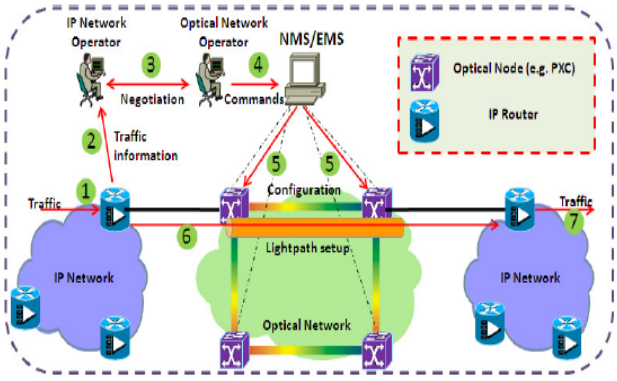

Fig. 6 NMS/EMS in current optical networks

To implement OpenFlow in optical network, they first created OpenFlow-enabled PXC (OF-PXC). PXC is a one of the devices used to switch high-speed optical switches. OF-PXC enables the NOX to control the cross-connections by using PXC.

To enable control of the node and a globe network view, virtual Ethernet interfaces were introduced to the OpenFlow switches (veths) [5]. Veths are virtualized from the physical interfaces of the PXC and each veth exactly corresponds to a physical interface of the PXC.

With the above mention methods in place the controller can effectively control flow in optic networks figure 7 illustrates the OF-PXC.

Now we will look at how the light path is setup and released. For each there are two proposed approaches, for light path setup, we can use the sequential approach or the delayed approach. For light path release we can use the active approach or the passive approach.

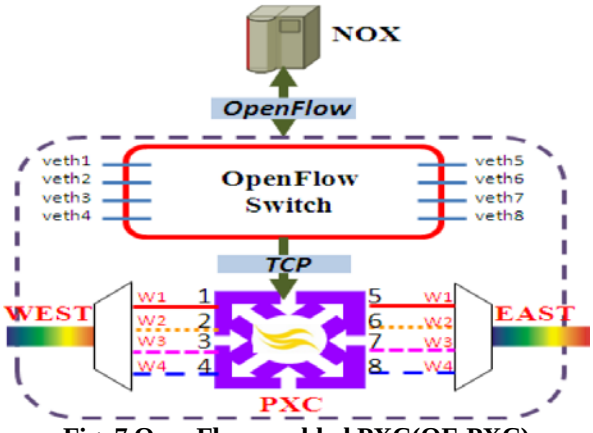

Fig. 7 OpenFlow-enabled PXC(OF-PXC)

The difference between the sequential and delayed approach is obvious by its name. The delay approach waits for an appropriate time delay for the successful lightpath in the optic

domain and then inserts a new flow entry. Where the sequential approach does not.

The sequential approach is the most straightforward but there is no guarantee that the lightpath in the optical domain is completely provisioned before the flow arrives. As the latency of the PXC needs to be considered, the delayed approach is recommended, but can also cause bottleneck with protocols like UDP.

With lightpath release the active approach is only applicable when the amount of data for the arriving traffic is known in advance. In the passive approach the lightpath is only release after the NOX receives confirmation that is was received.

Future research is still needed in restoring lightpath restoration, and investigating unified OpenFlow-based control for heterogeneous multi-layer optical switching networks. OpenFlow and optic networks is still in the early stage compared to GMPLS, but has very promising expectation and worldwide support.

VIII. Research Environment and Tools

In order to design and test new ideas in OpenFlow. Network administrators need a way of giving more than one researcher access at a time. We will again look at FlowVisor as a solution in carving research slices out of a production network [8]

After giving you a slice of the network, we will introduce a tool for finding bugs in OpenFlow

8.1 Carving research slices

OpenFlow has some limitation from the perspective of researching and testing, because only one researcher can innovate on the network at a time [8]. FlowVisor has been proposed as a way to "slice" the network resources to allow researchers to use them in parallel. Typically most networks would be "slice" with VLAN's, this approach complicates certain research like IP mobility and of wireless handoffs [3]. As mentioned in 4.3 FlowVisor has also been used as a workaround for scalability [11].

FlowVisor is a transparent virtualization layer between the OpenFlow switch and the controller. FlowVisor acts as a virtual controller to the switches and as a network of virtual switches to the research controller figure 8 and figure 4 illustrate the architecture.

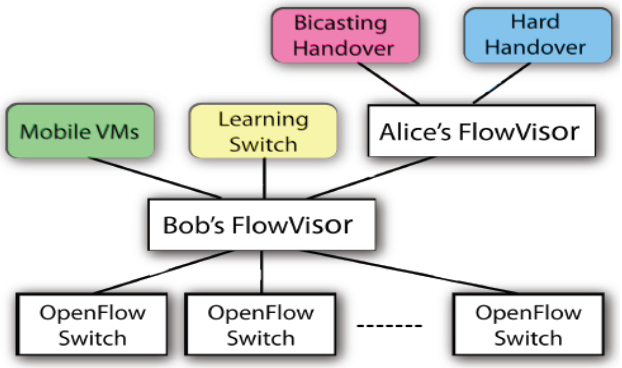

Fig. 8 FlowVisor architecture

FlowVisor is intentionally architecturally neutral, it does not know or make any assumptions about either the switches or the controller. FlowVisor was setup up this way for three reasons. One to make it centralized policy enforcement; all traffic passes through FlowVisor giving it a globe network view. Two recursive delegation, to allow FlowVisor to cascade instances and make recursive delegation when it needs to reclaim a subnet. Three Decouple control and virtualization technologies, this makes it possible to have advancement in each and independently, avoiding new forms or changes.

8.2 Testing OpenFlow for Faults (Bugs)

As Software Defined Networking (SDN) moves the control plane from the switches to the controller, software needs to be tested for faults (bugs). Even large corporation that extensively test software, release version with major bugs that affect and sometimes shutdown offices. Testing OpenFlow application is challenging because you are looking for bugs in a large environment that behavior dynamically.

A make the problem simple OpenFlow can require programmers to use domain-specific languages. Most OpenFlow applications have been written in Java and Python and adaptation of a domain-specific language will be difficult.

8.2.1 NICE

A tool has been developed to test OpenFlow application, NICE (No bugs In Controller Execution [6]. NICE test controller programs by generating carefully-crafted streams of packets under many possible event interleaving.

NICE test application written in Python that works with NOX platforms. To use the NICE tool a programmer will enter three thing; One the controller program. Two, the topology to use with all the switches and host. Lastly what to check for like no forwarding loops or no black hole. The programmer can also write his own properties to check. After NICE is done, it will output the results of the traces. Figure 9 illustrates each step.

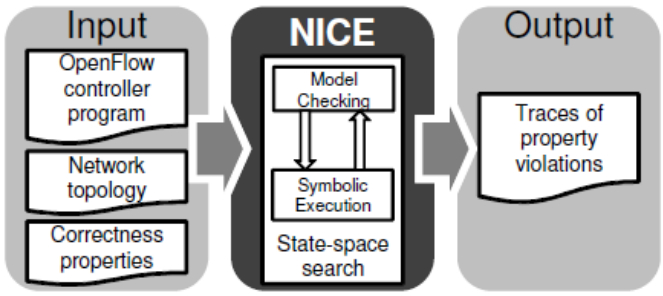

Fig. 9 How NICE is setup to use

NICE is built around two major components, the symbolic engine and the model checker. The symbolic engine is called by the model checker when the network model requires the generation of new packets to inject [27]. The model checker describes the network topology in terms of clients, switches, controller and links between them.

8.2.2 OFTEN

OpenFlow Testing Environment (OFTEN) is a tool for systematic testing of integrated OpenFlow networks with the goal of gaining confidence if controllers and real switches work together correctly in a deployment-like setting. OFTEN is built on top of NICE, but extends NICE by enabling communication between the model checker and real switches [26].

OFTEN adds necessary glue to synchronize the state used in NICE with a dual environmental model of the real switches. It gets the flow tables from the real switches and controls the timing of events. Than it reports both the testing and real switches correctness issues and inconsistencies.

This comes with several challenges; first the switches should be treated as a black-box. Since the OpenFlow switch is expected to grow rapidly, testing process should rely on a common standardized interface to reduce overhead. Second a corrective definition needs to be defined of the expected behavior for each test case. This should be defined two fold, one in network-wide and at a low level to aid in debugging.

OFTEN approach come with some limitation, since it is built on NICE the model checking forces sequential executions, this limits the ability to force high load situation for peak performance testing. Additional OpenFlow is not design with testability in mind. By introducing new mechanisms like barrier request forcing synchronization, standardized interface to get information about internal state, and something to determine when packet processing has ended. This is a good starting point for future research and discussions.

IX. Domain-Specific Programing Language

As mentioned in section 8.2, most OpenFlow application is written in general-purpose languages like Python or java [6]. Tools like NICE and OFTEN [26] have been developed to find bug in these languages as they are more prone to errors, than domain-specific languages that prevent certain classes of bug. One of this domain-specific languages is Frenetic witch is an extension of Python.

9.1 Frenetic

Frenetic is a domain-specific language for OpenFlow that aims to eradicate a large class of programing faults. Frenetic simplifies the task of programing OpenFlow networks, without compromising flexibility and efficiency [10].

Frenetic is based on functional reactive programing (FRP). By using FRP you do not need to write programs that are event drive as FRP see every packet.

Frenetic architecture consists of three pieces illustrated in figure 10. The Frenetic program witch implements the FRP operations. The run-time system and the NOX.

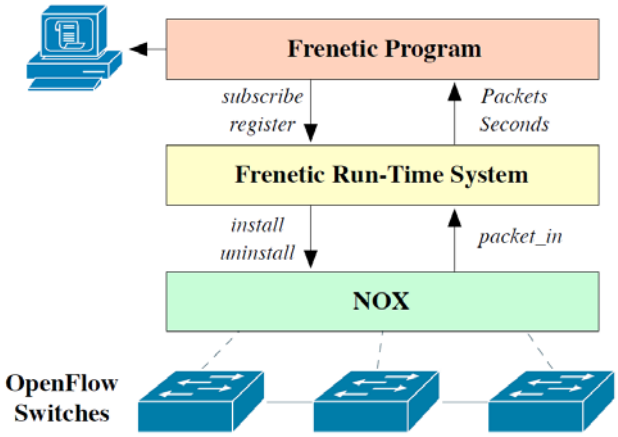

Fig. 10 Frenetic Architecture

Frenetic focuses exclusively on discrete stream. It uses a push-based strategy that propagates values from input to output streams. Even though Frenetic sees every packet, it does not send then to the controller, as this will limit frenetic scalability. Instead it developed optimizations that capture some common idioms. The run-time system is the back end that installs and uninstalls rules and communicates between the switch and the controller.

X. Internet Security and OpenFlow

Flooding-based distributed denial of service attacks (DDoS) have been difficult for security administrators to detect. Since packet headers fields are modified to look like normal traffic. So to tell the difference between a legitimate packet and a useless one is quite hard. Also with the overwhelming amount of packets sent in a DDoS, it makes it difficult to analyze each one. These two factors make detection of DDoS attack problematic.

The method proposes to detect DDoS attacks using OpenFlow switch and NOX is divided into three methods placed within the detection loop of the NOX controller.

The three modules are the flow collector, the feature extractor, and the classifier (SOM) (illustrated in figure 11). The flow collector periodically request flow entries from all flow tables of the OpenFlow switches. It communicates and transmits through a secure channel isolated from host connect to the switch. The feature extractor receives the collected flow from the flow controller, and extracts certain features important to analyze DDoS flooding attacks. The classifier analyzes weather the packet received by the featured extractor of DDoS flooding attacks or legitimate traffic. If it is legitimate traffic the classifier send the information to the flow collector to update tables appropriable, if not the classifier alerts detection of an attack [16].

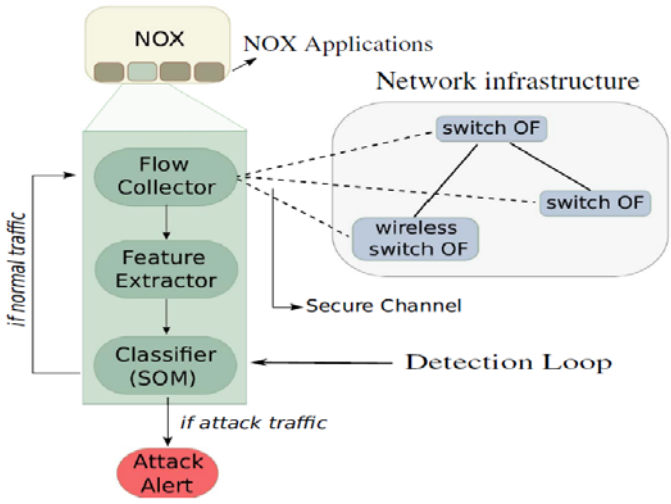

Fig. 11 Detection loop Operation

XI. Conclusion

As this paper shows OpenFlow has been embraced and implemented in many areas. It has been shown it can be applied in areas not initially intended for like optic networks and wireless mesh networks.

OpenFlow is still in its early stages. It will require further research but it seems like the future of network will derive from it. Especially in data centers where its application on large network, give the best return on investment.

Its biggest challenge still seems to be scalability. As it is a centralized approach, HyperFlow and DevoFlow is a good start but lacks solution adequate enough to implement on a large network.

XII. Future Research

As this paper has covered many topics related to OpenFlow. I will give a recap of where specifically research is needed by topic.

In power consumption reduction, more research is needed in hardware control of the switches. Sleep state, individual ports and the switch as a whole, in both powering down and up quicker and with remote control.

In Scalability, creating an alternative to HyperFlow's use of WheelFS seems very promising. Also as mentioned in the paper, I feel implement HyperFlow with DevoFlow may be a good combination.

In using the Ca-SDN, co-located controllers and addressing UDP protocol challenges.

In Wireless Mesh network, developing an algorithm to calculate the optimal STA/MAP associations and flow paths and evaluate it in a large scale scenario.

In Optical Networks, restoring lightpath restoration, and investigating unified OpenFlow-based control for heterogeneous multi-layer optical switching networks

In tools and research environments, implementing features from NICE and OFTEN into OpenFlow, creating a more testable design.

In Domain-Specific Programing Language, I feel if ONF should pick a standard for all switches. Giving consistency, and promote open source collaboration.

References

[1] M. Casado, Ethane: taking control of the Enterprise, Stanford University, 2006

[2] Open Network Foundation, www.opennetworking.org

[3] P. Delay , OpenFlow for wireless mesh networks, Karlstad Universality , 2009

[4] F. Durr, Toward cloud-assisted software-defined networking, IPVS Instite of parallel and distributed systems, 2012

[5] L. Liu, Experimental Validation and performance evalyation of OpenFlow-based wavelength path control in transparent optical networks, Universaty of Post and Telecommunications, 2011

[6] M. Canini, A NICE way to test OpenFlow applications, Princeton university, 2011

[7] S. Das, Packet and circuit network convergence with OpenFlow, Stanford university, 2010

[8] R. Sherwood , Carving Research slices out of your production Network with OpenFlow, ACM SIGCOMM, January 2010

[9] B. Heller, Elastic tree: Saving energy in data center networks, Stanford University, 2009

[10] N. Foster , Frentic: A high-level Language for OpenFlow networks, Princeton University, 2011

[11] A. Tootoonchian, HyperFlow: A distributed control plane for OpenFlow, University of Toronto, 2010

[12] N. Gude, NOX: Towards an operating system for network, Stanford University, ACM SIGCOMM, 2008

[13] www.computerweekly.com/feature/the-history-of-OpenFlow

[14] A. Bianco, OpenFlow switching: Data plane performance, IEEE, 2010

[15] Y. Luo , Accelerating OpenFlow witching with network processors, University of Massachusetts, 2009

[16] R. Braga, Lighweight DDoS flooding attack detection using NOX/OpenFlow, Universidade federal do amazonas, 2010

[17] D. Staessens, Software defined networking: meeting carrier grade requirements, Ghent university- 2008

[18] N.Mckeowen et al Openflow: Enabling innovation in campus networks, SIGCOMM, April 2008

[19] Open Networking Foundation, OpenFlow Switch Specification version 1.3.2, April 2013.

[20] J. He, Towards robust multi-layer traffic engineering: optimization of congestion control routing, Princeton University, 2007

[21] B. Nordman et al, reducing the energy consumption of networked devices, IEEE 802.3 tutorial, 2005

[22] OpenFlow Consortium, OpenFlow switch specifications version 1.1.0, www.openflow.org/documents , 2011

[23] Stribling, J., wide-area storage for distributed systems with WheelFS, USENIX Symposium on Networked Systems Design and Implementation, April 2009

[24] A. Curtis, DevoFlow: Scaling flow management for high-performance networks, University of Waterloo, 2010

[25] J. Mogul, DevoFlow cost-effective flow management for high performance enterprise networks, 2010

[26] M. Kuzniar, OFTEN testing OpenFlow Networks, European workshop on software defines networking, 2012

[27] NICE-OF, code.google.com/p/nice/of

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Utilization of Sugar Factory Waste as an Organic Fertilizer on Growth and Production of Baby Corn

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Abstract- The research purpose is to view and know the influence of giving blotong against growth and production of baby corn. This research was conducted in the village Borongloe Bontomarannu Gowa district. The research was arranged as a factorial experiment in completely randomized block design (RBD) with three replications. The first is fertilizer type: blotong (B1), blotong+EM4 (B2) and bokashi blotong (B3), while of the blotong dose assigned as the second factor: blotong 5 ton ha -1 (D1), blotong 10 ton ha-1 (D2) and blotong 15 ton ha-1 (D3). The research result indicated that bokashi blotong gives the best influence compare to blotong+EM4 against all parameters. Interaction between fertilizer dose 10 ton ha-1 to the bokashi. Blotong gives the best influence to the baby corn production 4.41 ton ha-1, bokasi blotong best anyway influence on baby corn vegetative growth, that is: plant height 113.00 cm, leaves number 8 (eight) pieces and stem diameter 6.02 cm. Results of analysis of variance showed that giving of bokashi blotong (B3) showed a better effect on the growth and production of baby corn and highly significant for plant height age of 60 days after planting, leaf number aged 60 days after planting, cob length cornhusk and without cornhusk, diameter stems and cobs, cob weight with cornhusk and without cornhusk and production are converted into ton ha-1. This is due to bokashi blotong has organic content of C, N, P, and K totaling more than the maximum treatment blotong (B1) and the blotong+EM4 (B2). Based on the research result, it can be summarised that sugar factory waste called blotong can be used to make bokashi as organic fertilzer, so the baby corn can growth and production better.

Index Terms- Bokashi, blotong, organic fertilizer, baby corn, sugar factory waste

I. INTRODUCTION

One form of corn production can be designed as an export commodity is baby corn. Baby corn is young cob corn is harvested, the vegetable material, which has a moisture content of nutrients such as 75.96 grams, 19.02 grams of carbohydrates, 1.18 grams of fat, 3.20 grams of protein, phosphorus 867 mg, 270 mg potassium, 28.00 mg calcium and vitamins A, B, and C. In addition, it also contains 5.43 mg/100 grams ascorbic acid and 670 mg/100 grams ß-carotene (Hooda and Kawatra, 2013).

Since baby corn is in great demand in international market and with its cultivation and exports foreign exchange could be earned by the country (Nandal *et al.*, 2010). Baby corn cuisine served in a special even baby corn Indonesia has begun to enter the international market with a relatively high number of requests compared to other vegetables (Palungkung, 2008).

Therefore, to create a system of sustainable agriculture business need to improve and maintain soil fertility, physical, chemical and biological soil, and organic amendments also enhanced the overall soil microbial activity (Hampton *et al.*, 2011). But until now the attention to improve soil fertility is merely chemical fertility only, while the physical and biological soil fertility is still less attention. Based on research of results Ranjan *et al.* (2013) stating that biological fertilizer significantly increased yield and yield attributing characters at baby corn.

Stating that organic materials such as crop residues, various industrial waste and manure natural produce compounds that can improve soil physical condition and nutrient availability (Jamil *et al.*, 2004). One of the industrial waste that is still under-utilized as a source of organic fertilizer is the *blotong*, which is the waste produced by the sugar mills. *Blotong* is used as organic material to add nutrients, improve soil pH, as well as improving growth of maize (Manoarfa, 1992).

Based on the above then the information on the filter cake as a source of organic fertilizer to the present still less that it is necessary carry out the assessment. This study aims to see and know the effect of *blotong* on the growth and production of crops especially baby corn.

II. MATERIALS AND METHODS

This study was conducted in two phases. The first stage *bokashi blotong* manufacturing and the second stage application to the crop. The second phase of the study was conducted in a factorial experiment, with a randomized block design (RBD), which consists of two factors. The first factor is the type of fertilizer (B), which consists of three types: *blotong* (B1), *blotong*+EM4 (B2) and *bokashi blotong* (B3). The second factor is the dose of fertilizer (D), which consists of three levels, namely: fertilizer dose 5 ton ha^{-1} (D1), fertilizer dose 10 ton ha^{-1} (D2) and fertilizer dose 15 ton ha^{-1} (D3). These two factors are combined so that there are nine of each treatment was repeated three times so that there are 27 experimental units.

The first phase of this research, conducted with three types of fertilizer variations are: *blotong* (B1), *blotong*+EM4 (B2) and the *bokashi blotong* (B3). The three types of fertilizer in

laboratory analysis, and applied to the field with the dose varies according to the treatment.

Materials used for the manufacture of *bokashi blotong* are: *blotong* 10 kg, chaff 5 kg, Bran 5 kg, EM4 150 cc, molasses 150 ml (or five tablespoons granulated sugar) and 20 liters of water. Making way is:

a. Mix evenly *blotong*, husk and bran → mix P
b. EM4 and Dissolve molasses in water → Solution Q
c. Q Pour the solution slowly into the dough mixture evenly while stirring until the moisture content reaches 35% (mixture of R). Water content can be checked by taking a handful of dough and kneaded R. If after the kneaded dough keep the dough together and when released will be destroyed again means the water level is good.
d. Mixed R piled on the cement floor as high as 15-30 cm, then covered with burlap sacks for 4-5 days. During the fermentation temperature is maintained 40-50°C. When the temperature is greater than 50°C and mixed open sack R behind and forth until the air in and the temperature drops. Checking the temperature otherwise performed every six hours. After four days of fermentation *bokashi* will ripe and ready to be used as organic fertilizer. Type is called aerobic *bokashi*.

The data collected covers the cob weight (kg) with and without the cob and the average production is measured at harvest, age 65 days after planting. Data processed by analysis of variance and the mean difference was tested by HSD at the level of 5%. Experimental plots were made measuring 2 m x 3 m total of 27 units. Spacing is between plots of 50 cm and 100 cm between groups. Planting is done with a drill spacing of 75 cm x 25 cm, each planting hole is left as many as three seed and one plant after the age of two weeks. *Blotong* fertilization application, given before planting by disseminated on irrigated land on the ground.

III. RESULTS AND DISCUSSION

The results of the analysis of the content of *blotong* management type C-organic, N-total, P and K are presented in Table 1.

Table 1: The results of the analysis used in the *blotong* management research

Management of type C-Organic *blotong*	C-Organic (%)	N Total (%)	Phosphorus (%)	Potassium (%)	C/N
Blotong	6.97	0.43	0.14	0.04	16.21
Blotong + EM4	5.82	0.38	0.15	0.02	22.96
Bokashi blotong	21.59	0.94	0.56	0.35	15.32

In Table 2, the higher dose of fertilizer applied to the soil, especially on the type of filter *bokashi blotong* fertilizer (B3), the vegetative growth of plants (plant height and leaves number) the better.

Table 2: Average Plant Height (cm) and leaves number (pieces) at Age 30 days after planting

Treatment:	Plant height	Leaves Number
Type of fertilizer:		
Blotong (B1)	96.71 a	7.56 a
Blotong+EM4 (B2)	96.69 a	8.00 a
Bokashi Blotong (B3)	113.04 b	8.33 b
	HSD 0.05 = 15.70	HSD 0.05 = 0.70
Doze of Fertilizer :		
5 ton ha^{-1} (D1)	95.67 a	7.78 a
10 ton ha^{-1} (D2)	103.64 a	8.00 a
15 ton ha^{-1} (D3)	107.13 a	8.00 a
	HSD 0.05 = 15.70	HSD 0.05 = 0.70

Description : The numbers in the same column followed by the same letter do not differ on the real level 0.05

Fertilizer 5 - 15 ton ha^{-1} did not cause changes in stem diameter and cob diameter, but the highest dose of 15 ton ha^{-1} (D3) causes a significant change in the cob diameter, in Table 3. Fertilizer types significantly affect long-cob, especially the type of filter *bokashi blotong* fertilizer (B3).

Table 3: The average diameter of stem and diameter of cob (cm) at harvest

Treatment:	stem diameter	cob diameter
Type of fertilizer:		
Blotong (B1)	5.55 ab	6.95 a
Blotong+EM4 (B2)	5.27 a	8.72 ab
Bokashi Blotong (B3)	6.02 b	11.28 b
	HSD 0.05 = 0.50	HSD 0.05 = 2.36
Doze of Fertilizer :		
5 ton ha^{-1} (D1)	5.56 a	7.86 a
10 ton ha^{-1} (D2)	5.75 a	9.26 a
15 ton ha^{-1} (D3)	5.52 a	9.83 a
	HSD 0.05 = 0.50	HSD 0.05 = 2.36

Description : The numbers in the same column followed by the same letter do not differ on the real level 0.05

Treatment with a dose of 15 ton ha^{-1} gives a good effect on plant height, leaves number and stem diameter (Tables 2 and 3). This situation suggests that the higher dose of fertilizer given the better growth. The increase in leaf number as well as size due to enough nutrition can be explained in terms of possible increase in nutrient absorption capacity of plant as a result of better root development and increased translocation of carbohydrates from source to growing points (Singh and Agarwal, 2001).

Test results HSD α0.05 indicates that treatment of the interaction between B3 and D2 generate cob with cornhusk heaviest weight. Thus, the *bokashi blotong* fertilizer dose 10 ton ha^{-1} produces cob with cornhusk heaviest weight at harvest in Table 4.

Table 4: The average weight of cobs with cornhusk (g) at harvest

Treatment:	Doze of Fertilizer : (ton ha^{-1})		
	5 (D1)	10 (D2)	15 (D3)
Type of fertilizer:			
Blotong (B1)	82.67 a	110.67 ab	140.67 bc
Blotong+EM4 (B2)	170.67 cd	198.67 de	226.67 ef
Bokashi Blotong (B3)	274.00 f	440.67 h	352.00 g
HSD 0.05 = 49.67			

Description: The numbers in the same column followed by the same letter do not differ on the real level 0.05

Test results HSD α0.05 indicates that treatment of the interaction between B3 and D2 generate cob without cornhusk heaviest weight. Thus, the *bokashi blotong* fertilizer dose 10 ton ha^{-1} produces cobs without cornhusk heaviest weight at harvest in Table 5.

Table 5: The average weight of cobs without cornhusk (g) at harvest

Treatment:	Doze of Fertilizer : (ton ha^{-1})		
	5 (D1)	10 (D2)	5 (D1)
Type of fertilizer:			
Blotong (B1)	34.00 a	46.00 ab	56.67 b
Blotong+EM4 (B2)	76.00 c	90.67 cd	102.00 de
Bokashi Blotong (B3)	118.00 ef	160.67 g	134.00 f
HSD 0.05 = 16.85			

Description: The numbers in the same column followed by the same letter do not differ on the real level 0.05

Based on the description it can be seen that the *bokashi blotong* have the ability to provide the optimal nutrients in the soil that is used as a food ingredient for growth and production. This is in line with Djanuar and Justika (1985), states that if the macro and micro nutrients available to the plants enough, the process of forming and running a reshuffle in plant cells rapidly in actively growing plants, resulting in the formation of cells and tissues also characterized by a rapid increase plant height, leaf number and flower and fruit formation.

Treatment *blotong*+EM4 (B2) showed different effects are not apparent with treatment *blotong* (B1). This is presumably due to the use of *blotong*+EM4 can meet nutrient requirements in sufficient quantity, and soil fertility incorporating organic inputs into the soil (Agyeman *et al.*, 2012), which organic fertilizers can also improve the physical and biological conditions of the soil as *blotong* contains EM4+ C/N is higher than with other treatments. This is presumably because the ingredients used are fresh. Organic materials that undergo the composting process and a good organic fertilizer has a ratio of stable C/N between 10/1 to 22/1, the ratio C/N is high on the final product showed microorganisms will actively utilize nitrogen to form proteins, when the ratio C/N is low then the nitrogen will be lost through volatilization ammonium (Sutanto, 2003).

Test results HSD α0.05 indicates that treatment of the interaction between B3 and D2 yield baby corn production the highest. Thus, the *blotong* with bokashi fertilizer dose of 10 ton ha^{-1} baby corn production were highest at the end of the study conducted in Table 6.

Table 6: Average Production (ton ha^{-1}) at harvest

Treatment:	Doze of Fertilizer : (ton ha^{-1})		
	5 (D1)	10 (D2)	5 (D1)
Type of fertilizer:			
Blotong (B1)	0.8 a	1.11 ab	1.42 bc
Blotong+EM4 (B2)	1.71 cd	1.99 de	2.27 fg
Bokashi Blotong (B3)	2.74 g	4.41 i	3.52 h
HSD 0.05 = 16.85			

Description: The numbers in the same column followed by the same letter do not differ on the real level 0.05

Optimal fertilization efficiency is the fertilizer should be given in sufficient quantities of plants, not too much and not too little. Giving too much will result in soil solution is too thick so it can cause toxicity in plants, if slightly; the effect is not visible (Rinsema, 1986).

Interaction treatment *bokashi blotong* (B3) with a dose of 10 ton ha^{-1} gives a significant influence on the production of plant, cob weight with cornhusk and without cornhusk and production are converted ton ha^{-1}. This is because the dose and *bokashi blotong* (B3) provide nutrients in optimal condition under conditions of high pH and low soil organic matter which can contribute to reduce the supply of micronutrients (Diaz and Mueller, 2011), so by giving *bokashi blotong* adding nutrients that contribute to metabolism in plants progressing well. While Gaswono (1983), states that the macro and micro nutrients can spur the growth and development of corn plants, which embodies the pattern of farming systems that have high productivity.

Results Analysis of variance showed that the interaction effect dose management *blotong* no significant effect on plant height, number of leaves, stem diameter and length of cobs and cobs. It is alleged that the management of *blotong*, dose should be influenced by biotic and a biotic factors. Interaction with less dose *blotong* management, significantly affect the cornhusk cob, cob weight without cornhusk and production are converted into ton ha^{-1}, this is because the growing media has a high nutrient content and can increase productivity at the plant.

IV. CONCLUSION

Based on data analysis and discussion of the main thrust of this research can be concluded. *Bokashi blotong* give the best effect compared with the *blotong* and the *blotong*+EM4 for all parameters observations. Dose of 15 ton ha^{-1}, the *bokashi blotong* give the best effect on the vegetative growth of baby corn is plant height 113.00 cm, number of leaves 8 pieces and stem diameter 6.2 cm. Interaction between *bokashi blotong* a dose of 10 ton ha^{-1} gives the best effect on the growth and production of baby corn that yields as much as 4.41 ton ha^{-1}. To cultivate baby corn suggested using *bokashi blotong* by 10 ton ha^{-1}, and need further research to determine the level of fertilization management *blotong* most optimal and efficient for growth and crop production in the achievement of sustainable organic agriculture.

REFERENCES

[1] Agyeman, K., J.J. Afuakwa, E.O. Danquah, and K.O. Asubonteng, 2012. Improving Soil Fertility for Maize (Zea mays L.) Production Using Inorganic and Organic Fertilizer: a Case of N: P: K 15: 15: 15 and Biomass of Agro Forestry Trees. South Asian Journal of Experimental Biology, 2(1): 329-340

[2] Diaz, D.R., and N. Mueller, 2011. Starter/Foliar Fertilizers Improve Corn/Soybean Yields. Journal of the Fluid Fertilizer Foundation, 20(4): 10-13

[3] Djanuar D., dan B. Justika,1985. Dasar-dasar Ilmu Fisiologi Tanaman. Suryadaru, Semarang, (In Indonesian).

[4] Gaswono, 1983. Ilmu Tanah. Fakultas Pertanian, Universitas Sumatera Utara, Medan, (In Indonesian).

[5] Hampton, M.O., P.A. Stansly, and T.P. Salame, 2011. Soil Chemical, Physical, and Biological Properties of a Sandy Soil Subjected to Long-term Organic Amendments. Journal of Sustainable Agriculture, 35(3): 243-259

[6] Hooda, S., and A. Kawatra, 2013. Nutritional Evaluation of Baby Corn (Zea mays). Nutrition and Food Science, 43(1): 68–73

[7] Jamil, M., M. Qasim, M. Umar, and A. Subhan, 2004. Impact of Organic Wastes (Bagasse Ash) on the Yield of Wheat (Triticum aestivum L.) in a Calcareous Soil. International Journal of Agriculture, 6(3): 468-470

[8] Manoarfah, W.D., 1992. Pemanfaatan Limbah Pabrik Gula (Blotong) dalam Produksi Kakao pada Tanah Bertekstur Liat. Tesis, Program Pascasarjana Universitas Hasanuddin, Ujung Pandang, (In Indonesian).

[9] Nandal, J.K., G. Vishal, Partap P.S., and Tehlan S.K., 2010. Potential of Baby Corn Cultivation in Crop Diversification under Rice-Wheat Cropping System. Indian Journal of Horticulture, 67: 276 – 278.

[10] Palungkung, R., 2008. Sweet Corn. Baby Corn. Penebar Swadaya, Jakarta, (In Indonesian).

[11] Ranjan, J. K., N. Ahmed, B. Das, P. Ranjan, and B.K. Mishra, 2013. Green Technology for Production Of Baby Corn (Zea mays L.) under North-West Himalayan Conditions. International Journal of Cham Tech Research, 5(2): 880-885

[12] Rinsema, 1986. Pupuk dan Pemupukan. Barata Karya Aksa, Jakarta, (In Indonesian).

[13] Singh, R., and Agarwal S. K., 2001. Analysis of Growth and Productivity Of Wheat in Relation to Levels Of FYM and Nitrogen. Indian Journal of Plant Physiology, 6: 279-83.

[14] Sutanto, R., 2003. Penerapan Pertanian Organik, Pemasyarakatan dan Pengembangan. Kanisius, Yogyakarta, (In Indonesian).

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Influence Policy Financial Services Authority (FSA) Return of Shares in the Banking Sector Sub 2014

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Abstract- Financial Services Authority (FSA) is an independent agency and out of from interference by other parties. FSA has the functions, duties and authority of regulation, supervision, inspection and investigation in the financial services sector. FSA to function organized system of regulation and supervision is integrated to the overall activities in the financial services sector. The purpose of this study was to Determine the abnormal return (AR) on stocks in the banking sub-sector and the effect of policies FSA. Method of research is event study that could see the influence before and after the event, and then were Analyzed by t-test pired. The result showed that there was no influence of the events under investigation on stock returns in the banking sub-sector and stock movement patterns that tend range more towards the negative visible from Cumulative Average Abnormal Return (caar).

Index Terms- Financial Services Authority (FSA), Abnormal Return (AR), Banking Sub-Sector, Event Study, Cumulative Average Abnormal Return (caar).

I. INTRODUCTION

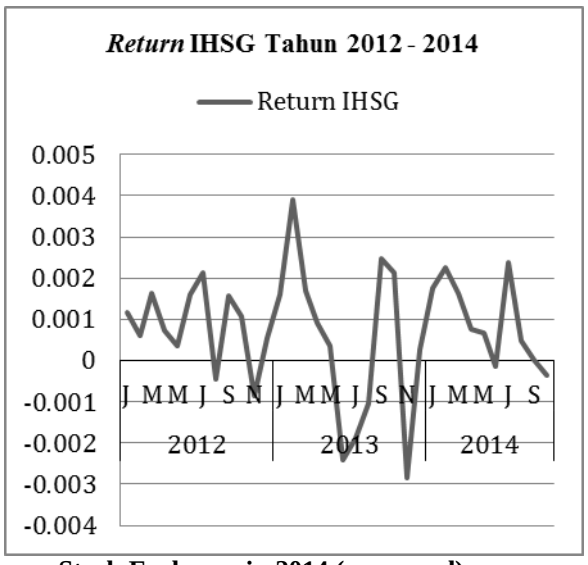
The price of the securities indicates information that is important for investors to invest in a particular stock. One of the announcements that can affect the price of securities is government-related announcements (Jogiyanto 1998), such as: (1) The impact of the new regulations, (2) investigations on activities of the company, (3) Decisions and other regulators. The new regulations have a positive or a negative effect for the investor in making an investment decision.

A signal theory states that the content of the information contained in the announcement of any information that could be a signal for investors and other potential parties in making an economic decisions. The announcement contain of an information that could trigger a market reaction and it can be affect for stocks price or it can be called as abnormal return. The announcement will give a positive impact if the stocks price increase, then it could be called as positive signal, vice versa for the a negative impact. The FSA policy is an important information, that could influence the decision-making process.

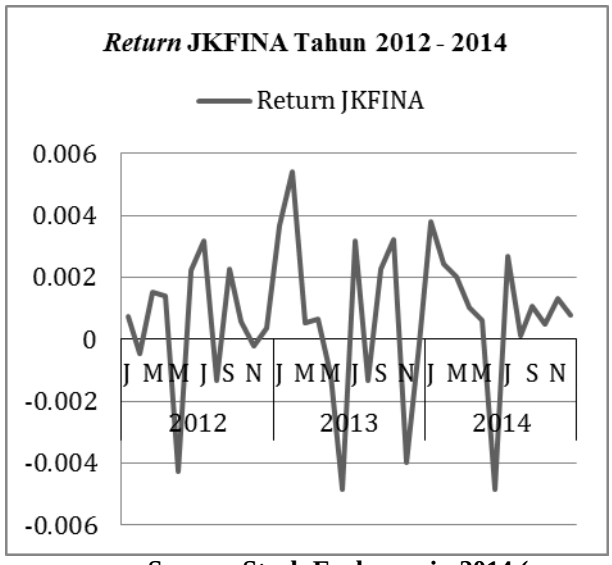
Indonesia entered a new development in making banking law by establishing a financial services supervisory agency. Supervision of the banking sector which was originally performed by Bank of Indonesia turned into the independent agency called the Financial Services Authority (FSA). The reason for the separation of bank supervision functions with central banks is to avoid a possible conflict of interest between the duties of maintaining monetary stability and bank supervision duties (Indaryanto 2012). The establishment of independent institutions is not only in Indonesia, but it has already done in other countries, such as the United Kingdom, Australia, France, Japan, and South Korea.

The plan to form the FSA has long proclaimed by regulation "article 34 UU No. 23 Tahun 1999" of concerning Bank of Indonesia. However, the FSA has not been established at that time although it has been mandated that the FSA is formed before the end of 2002. Regulation "No. 3 tahun 2004" changed to regulation "No. 3 Tahun 1999" explains that the FSA will be formed before 31st December 2010. In 2011, the official new released of the regulation of the FSA institutions. Under regulation "No. 21 Tahun 2011", the FSA is an independent institution and free from interference by other parties, which it has a functions, duties, and authority of regulation, supervision, inspection, and investigation. This institution will conduct supervision in the financial services sector to replace the function of supervision by Bank of Indonesia and the Capital Market Supervisory Agency and Financial Institution and it called Bapepam-LK to be integrated and comprehensive, as well as to protect the consumer services industry (Rahyani 2012). In 2014, the policy was issued by the FSA rules levies which originally was funded by using the budget will be charged to the levies on the financial industry are already listed on the Stock Exchange. The regulation "article 32 Ayat 1 RUU OJK" mentioned that FSA works plan and budget will be financed from the financial services industry *fees.* While the financial industry are institutions and financial services activities.

In Indonesia Composite Stock Price Index is well-known as IHSG. IHSG between the years 2012-2014 is likely to increase in December 2012, December 2013 and April 2014 which is reflected in a positive return of IHSG shares. On the other hand, at the end of 2013, IHSG is in position 4274.18 or decreased by 0.98% compared with the end of 2012 (FSA 2014). The stock price movement of IHSG and JKFINA Year 2012 – 2014 will be shown in Figure 1 and Figure 2:



Source: Stock Exchange in 2014 (processed)
Figure 1 *Return* Index (JCI)



Source: Stock Exchange in 2014 (processed)
Figure 2 *Return* Financial Sector Index (JKFINA)

The return results of the financial sector index (JKFINA) between the years 2012-2014 is likely to increase in December 2012 and April 2014 which is reflected in *a* positive return of JKFINA. However, the negative return is reflected in December 2013. It means that the movement of stocks JKFINA tends to decline during the year. The end of 2013, JKFINA is in position 540.33 or decreased by 1.77% compared with the end of 2012. The analysis of the returns can be seen that in the year 2013 are likely to decrease. It also coincided with the transfer of the functions of banking supervision by the central bank to the FSA. Furthermore, we will see the effect of the events the FSA in 2014.

II. RESEARCH METHODS

Data used is secondary data, such as: (1) The financial statements of the FSA in 2014, to be used as the information needed in research; (2) Data on the daily stock price with 28 stocks in the banking sector in the period of October 2013- May 2014; (3) Data of IHSG in the period of October 2013- May 2014, which it can be accessed on the website Indonesia Stock Exchange. To determine whether the events the FSA in the shares in the banking sector, the data used is daily stock closing price in the period of October 2013- May 2014. The actual return is obtained from the data of closing price. To test the occurrence of FSA use a paired t-test abnormal return. The list of 28 stocks in the banking sector which all of them are already doing an IPO in the period of 2012-2014 and all of them will be shown in Table 1:

Table 1 Issuer Name Sub Sector Banking

No.	Issuer Name	No.	Issuer Name
1.	Bank Central Asia Tbk	15.	Bank International Indonesia Tbk
2.	ICB Bank Bumi Putra Tbk	16.	Bank Permata Tbk
3.	Bank Capital Indonesia Tbk	17.	Bank Sinar Mas Tbk
4.	Bank Ekonomi Raharja Tbk	18.	National Pension Savings Bank Tbk
5.	Bank Bukopin Tbk	19.	Bank Victoria International Tbk
6.	Bank Negara Indonesia (Persero) Tbk	20.	Bank Artha Graha International Tbk
7.	Bank Rakyat Indonesia (Persero) Tbk	21.	Bank Mayapada International Tbk
8.	State Savings Bank (Persero) Tbk	22.	Bank Windu Kentjana International Tbk
9.	Bank Danamon Indonesia Tbk	23.	Bank Mega Tbk
10.	Pundi Bank Indonesia Tbk	24.	Bank OCBC NISP Tbk
11.	Bank Jabar Banten Tbk	25.	Bank Pan Indonesia Tbk
12.	Bank Mandiri (Persero) Tbk	26.	1906 Civil Society Bank Tbk
13.	Bank Bumi Arta Tbk	27.	Bank Rakyat Indonesia Agro Niaga Tbk
14.	Bank CIMB Niaga Tbk	28.	East Java Regional Development Bank Tbk

Source: Stock List 2014

A. Data and Information Processing Techniques

This research was used event study. Banking sector stock prices were observed around the period of the event to determine the occurrence of abnormal return. There are ten stages according MacKinlay event study (1997), namely: (1) defines the events that are of interest; (2) develop a theory to justify or explain the financial response to new information; (3) identify the set of companies that experienced the incident and identify the date of the event (event Dates); (4) selecting a suitable event window and justification of the distance; (5) eliminating or adjusting firms experiencing other relevant events during the event window; (6) calculate abnormal returns during the event window and test its significance; (7) reported the percentage of negative returns and statistical test t, binomial Z or Wilcoxon; (8) to sample a bit, use the method boostrap and discuss the impact of outliners; (9) describes a theory that explains the cross-sectional variation in abnormal returns and test the theory in econometrics; and (10) presented the results of the empirical. The next step tests the abnormal return on t-test. The steps in this study as follows:

1. Analyze the impact of FSA policy with ***Event Study***

Event date used in this study, namely: the implementation of the rules of the FSA levies which *event* such *date* is denoted as t = 0. This study used three observation points *event window*, among others: 30 days (-30, + 30), 20 days (-20, + 20) and 10 days (-10, + 10) with the *estimation window* for 90 days. Period of observation for events levies FSA rules between the date of October 18th, 2013 until May 16th, 2014. The three observation points used in the study is shown in Figure 4:

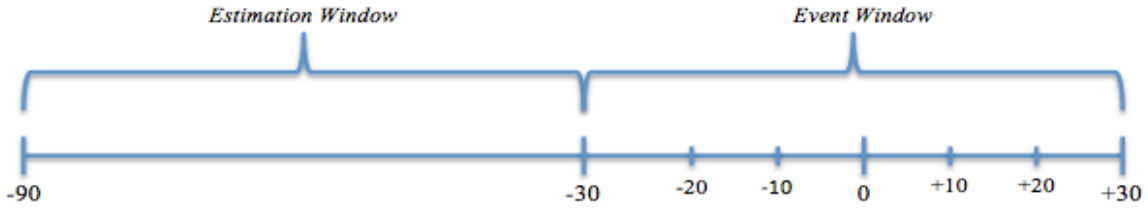


Figure 4 Three Point Observation Used

2. Variables Research

The actual return is calculated on a daily basis during the estimation period and the period of the event. The formula used actual *return* listed banks are as follows:

$$Ri,t = \frac{(Pi,t - Pi,t-1)}{Pi,t-1} \quad (3.1)$$

descriptions:
Ri, t = actual return to the bank issuer-i on day t
Pi, t = price index of banking issuers to-i on day t
Pi, t-1 = the price index of listed banks to-i on day t-1

Expected Return

To estimate the level of the yield expectation at the time of occurrence can not be used market model, namely:

$$E(Rt) = a\,i + b\,IRM,t + ut \quad (3.2)$$

description:
E (Rt) = expected *return* to the bank stock index-i in period t
a i = intercept banking stocks to-i
ut = error term
b I = beta of banking stocks to-i
(Rm, t) = *return* on the market index period t

Alpha and beta values obtained from an OLS regression between the rate of return on stocks with yield rate Composite Stock Price Index, as a proxy of the level of market returns, which is done by using the data in the estimation period. To get the expectation value at time t, used alpha and beta values obtained from OLS regression using the data and the market return at time t.

Abnormal Return

Abnormal return or excess return is the excess of the return that is really going to return to normal (Jogiyanto 1998). If an announcement contains of information, it is expected that the market will react to the timing of the announcement is received by the market.

Mathematically abnormal return is expressed as follows:

$$AR_{it} = R_{it} - E(R_{it}) \quad (3.3)$$

description:
AR_{it} = abnormal return of bank stocks to-i at time to t
R_{it} = return of bank stocks to-i at time to t
$E(R_{it})$ = expected return of bank stocks to-i at time to t

Cumulative Abnormal Return (CAR)

Cumulative Abnormal Return (CAR) is the sum of the abnormal returns during the event window. Mathematically Cumulative Abnormal Return is expressed as:

$$CAR_i = \sum_{t=-S}^{t+S} AR_{it} \quad (3.4)$$

Average Abnormal Return (AAR)

Average Abnormal Return is the average abnormal return of stock portfolio consisting of n-shares. Each stock is assumed to have the same proportion in the portfolio. Average Abnormal Return can be calculated by the following formula:

$$AAR_t = \frac{1}{N}\sum_{i=1}^{N} AR_{it} \quad (3.5)$$

description:
AAR_t = average abnormal return
$\sum_{i=1}^{N} AR_{it}$ = the number of abnormal returns during the event period

N = the number of occurrences of abnormal return

Cumulative Average Abnormal Return (CAAR)

CAAR is the sum of average abnormal return of the portfolio during the event window. Calculation of average cumulative abnormal return is done by adding the average abnormal return portfolio on day t with the average abnormal return on a portfolio of previous days. CAAR can be expressed as follows:

$$CAAR_i = \sum_{t=t-5}^{t+5} \overline{AR}_{it} \quad (3.6)$$

Testing abnormal return is done by using paired samples t-test. Hypotheses used are as follows:

H_1 : There is a noticeable difference in average abnormal stock returns were significantly different before and after the announcement of the rules of the FSA levies

III. RESULTS AND DISCUSSION

A. *Abnormal return* Before and After Charges FSA Rules Announcement

In this *event* analyzed with three observation points. Analysis at the observation point (-30, + 30) and (-10, + 10) shows that the AR (average) negative tends to fluctuate before and after the *event* occurs. Unlike the two previous points, observation points (-20, + 20) shows that the AR (average) positive tend to fluctuate before and after the *event* occurs. At the point (-30, + 30) highest reaction occurs in H + 6 at 0.0142 and the lowest occurred in the H-11 amounted to -0.0108. At the point (-20, + 20), the highest reaction occurs in H + 6 at 0.0138 and the lowest occurred in the H-11 amounted to -0.0098. At the point (-10, + 10), the highest reaction occurs in H + 6 at 0.0137 and the lowest at H + 5 by -0.0065. The three graphs results of AR, CAR, AAR and caar 2013 of (-30, + 30), (-20, + 20), and (-10, + 10) are shown in Figure 5, 6, and 7:

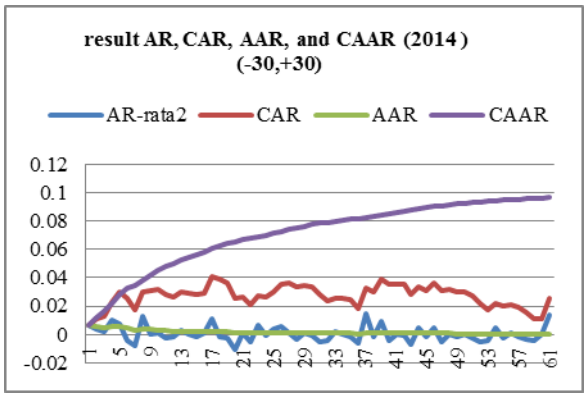


Figure 5 Graph 2014 at (-30, + 30)

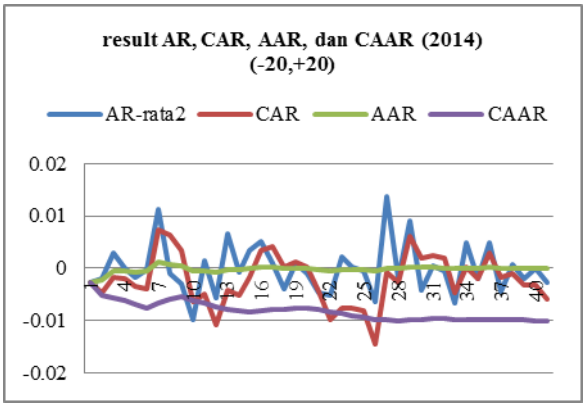


Figure 6 Graph 2014 at (-20, + 20)

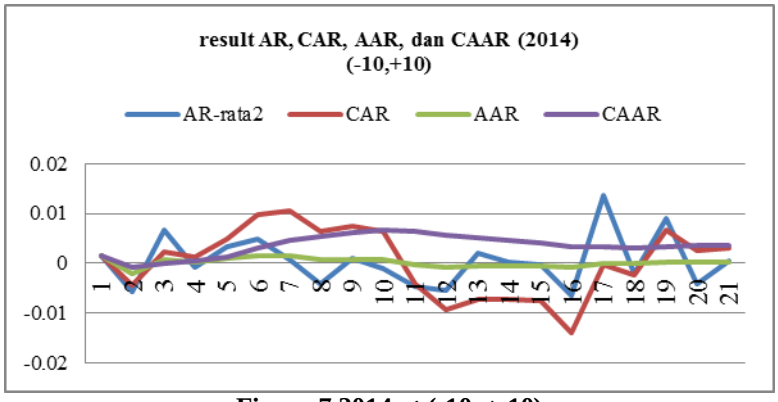


Figure 7 2014 at (-10, + 10)

In Figure 5, 6, and 7, the results of the 2014 AAR seen that fluctuations before and after the announcement of the rules of the FSA levies. CAR values tend to be higher before the event and begin to move lower after the event. This is illustrated by the number of shares in the banking sector has a negative AR before the event. The stock in the sector of banks which the CAAR value has negative movement or it is above the chart CAR on the third point of observation, namely: BBRI and the rest of the stocks have a negative movement. Furthermore, AR at 28 issuers will be analyzed to determine the presence or absence in the third significant observation point. The following Table 2 Results of one sample test in AR 2014:

Table 2 Results of Test One Sample Test on AR 2014

Observation point	Day	Date	Test One Sample Test		Description
			T	Sig (2tailed)	
(-30, + 30)	H-14	17/03/14	2,484	0019	Significant positive
	H-11	03/20/14	-2134	0042	Significant negative
	H + 2	**04/08/14**	-2123	0043	Significant negative
	H + 12	04/22/14	-2291	0.030	Significant negative
(-20, + 20)	H-14	17/03/14	2,489	0019	Significant positive
	H + 2	**04/08/14**	-2027	0053	Significant negative
	H + 12	04/22/14	-2309	0029	Significant negative
(-10, + 10)	H + 2	**04/08/14**	-2105	0045	Significant negative

Source: Results of data processing 2015
Description: **08/04/14 =** the same date at the observation point 30, 20, and 10

Observation points (-30, + 30) in four days are significant before and after events levies FSA rules, among others: (1) H-14 with a value of 0.019 t 2.484; (2) H-11 amounted to 0,042 with the value t -2.134; (3) H + 2 with a value of 0.043 t -2.123; and (4) H + 12 amounted to 0,030 with a value of t -2.291. At the observation point (-20, + 20) in three days, the result also significant before and after the *event*, among others: (1) H-14 with a value of 0.019 t 2.489; (2) H + 2 at 0,053 with a value of t -2.027; and (3) H + 12 amounted to 0,029 with a value of t -2.309. Further observation points (-10, + 10) came a day significant after the *event,* namely: H + 2 at 0,045 with a value of t -2.105. From one sample test results at each point of observation, there is bad news at before and after the analyzed. The event is visible from t significant negative value, it is proved by the same date every observation point, namely: on 8th April 2014. The (Press Release FSA 2014) on the 8th April 2014 stated that no publication of the FSA rules on how billing administrative sanctions such as fines. FSA Regulation No. 4/POJK.04/2014 on the procedures for billing administrative sanctions such as fines in the financial services sector. This regulation was issued as part of the implementation of Article 8 letter i Law No. 21/2011 on the FSA. The existence of a negative response from the listed banks are reflected in the movement of stock around *the event* being analyzed because of the rules of the FSA involve direct payments listed banks to comply with these rules.

Levy required of the financial services industry is believed to benefit the back by industry with various work programs FSA value added in the field of integrated regulation and supervision, consumer protection and *good governance.* Value-added work program was geared for improving the understanding and consumer confidence in the financial services sector so as to create and establish the growth of sustainable financial services industry. FSA levy is intended to advance the financial services industry in accordance with the purpose and function of the establishment of the FSA. If the levy is charged to consumers or the public then has the potential to reduce the industry's competitiveness that ultimately hurt the company itself.

B. Different test Average Abnormal Return

Formulation of research hypothesis, namely: there is the influence of the rules of the FSA policy to the banking levy on market efficiency in the banking sector. Different test average abnormal return before and after the announcement of the FSA policy on the banking sector in 2014 was processed using paired t-test analysis with a significant 95%. The results of different test average abnormal return before and after the policy announcements on stock returns FSA banking sector in 2014 is shown in Table 3:

Table 3 different test results in *average abnormal return* before and after the announcement of the FSA policy on stock *returns* in the banking sector sub period in 2014

No.	FSA events in 2014	(-30, + 30)		Ket	(-20, + 20)		Ket	(-10, + 10)		Ket
		t	Sig (2-tailed)		t	Sig (2-tailed)		t	Sig (2-tailed)	
1	AAR 2014	1,381	0179	(-)	0565	0577	(-)	1,008	0322	(-)

Source: though 2015
Description: (+) = There is a Difference
(-) = There are Differences

Test results vary in average abnormal return before and after the policy announcement of the FSA on the event in question was no difference as seen in Table 3. The table shows there is no difference or no effect at each point of observation. In the paired t-test shows that the 2014 AAR at the point (-30, + 30) has a

value of 0.179 with 1.381 t; at the point (-20, + 20) has a value of 0.577 with 0.565 t; and at the point (-10, + 10) has a value of 0322 with 1,008 t. The third point of the analysis in 2014 showed consistent results. At the point observations 30, 20, and 10 showed no effect before and after the announcement of the rules of the FSA levies on stock *returns* in the banking sector in 2014. Such as Murogi research in 2014 there is no significant difference in *abnormal returns* in the period before and after the event. Prastowo (2007) said that inadequate responses of financial market instruments to an event, and Ikram and Nugroho (2014) have a statement that the Indonesian stock market is efficient in the form of a strong half. Due to the fact that the Indonesian stock market is efficient in the form of a strong half then there is no difference in the performance of the stock before and after the announcement, because in an efficient market is impossible for investors to outperform the market every time. In contrast to the results Sirait, Tiswiyanti, and Mansur (2012) have a statement there is a difference or an effect of an event change of finance minister to *return* banks listed on the Stock Exchange and Armour, Mayer, and Polo (2011) have a statement that there is influence the policy of a fine by the FSA to *return* issuers fined and listed on the London Stock Exchange.

IV. CONCLUSIONS

The research conclusion is at the point (-30, + 30), (-20, + 20), and (-10, + 10) in the event there are no real differences in average abnormal return in 2014. There no effect on the banking sector returns, it reflects that the banking sector stocks already efficient form of half strong.

REFERENCES

[1] Armour J, Mayer C, and Polo A. 2011. Regulatory Sanctions and Reputational Damage in Financial Markets. Http: //ssm.com.abstract=1678028. [Accessed on 1 September 2014].

[2] [List of Stocks]. 2014 List of Stocks Blue Chips 2013. http // sahamok.com. [accessed on 1 September 2014].

[3] Ikram F and Nugroho AB. 2014. Cumulative Average Abnormal Return and Semistrong Form Efficiency Testing in Indonesian Equity Market Restructuring Over Issue. International Journal of Management and Sustainability. 3 (9): 552-566.

[4] Indaryanto W. 2012. The establishment and the Authority Financial Services Authority. Journal of Legislation Indonesia. 9 (3): 333-342.

[5] Jogiyanto. 1998. Portfolio Theory and Investment Analysis. Yogyakarta (ID): BPFE-Yogyakarta.

[6] MacKinlay AC. Event 1997. Studies in Economics and Finance, Journal of Economic Literature. 35 (1): 13-39.

[7] Murogi A. 2014. Effect of Stock Split Announcement (Stock Split) Return On Equity Company In Indonesia Stock Exchange in 2010 - 2013. [thesis]. Bogor (ID): School of Graduate School, Bogor Agricultural University.

[8] [FSA]. 2014 Financial Report 2013. http://ojk.go.id Financial Services Authority. [accessed on 1 September 2014].

[9] Prastowo. 2007. Impact of BI Rate Against Financial Markets: Measuring Instruments Financial Market Response Significance Of Monetary Policy, Working Paper. 21 (1): 1-55.

[10] Rahyani WS. 2012. The independence of the Financial Services Authority and Perspective of Law Number 21 Year 2011 on the Financial Services Authority. Journal of Legislation Indonesia. 9 (3): 361-372.

[11] [Press Release FSA]. 2014 Press Release On the Implementation Rules of the FSA levy. Http://ojk.go.id. [accessed on 1 September 2014].

[12] Sirait RS, Tiswiyanti W, and Mansur F. 2012. Impact Substitution Finance Minister in 2010 Against Abnormal Return Banking Companies Listed in Indonesia Stock Exchange. E-Journal of Accounting sparkle. 1 (1): 15-22.

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Sanitation and Its Impact on Health: A Study in Jorhat, Assam

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Abstract- Sanitation is a burning problem of our society. About 1/7th of the world's population still defecates in the open in absence of toilets, of which 60% lives in India[1]. According to the latest estimates of the WHO/UNICEF Joint Monitoring Programme for Water Supply and Sanitation (JMP), released in early 2013 (collected in 2011), 36 per cent of the world's population – 2.5 billion people – lack improved sanitation facilities, and 768 million people still use unsafe drinking water sources[2]. The lack of adequate sanitation and safe water has significant negative impacts on health. This is a cause of great concern as 88% of deaths in diarrhoea occur because of unsafe water, inadequate sanitation and poor hygiene. Inadequate access to safe water and sanitation services, coupled with poor hygiene practices, kills thousands of children every year.

According to the father of our nation M.K. Gandhi – "Sanitation in a community is more important than independence". He said "Sanitation is based upon common spiritual effort in a community like ours, and it is also a basic human right". Gandhi was an environmentalist of remarkable foresight and vision. He was aware that toilets are the link between good and bad environment. Sanitation is one of the most neglected sectors in India even today. More people have access to mobile phones than to a toilet according to a UN Study on how to improve sanitation globally. The goal of UNICEF is to halve, by 2015, the proportion of people without sustainable access to safe water - has been achieved globally, but the same target for sanitation is so far off track that it is unlikely to be met by 2015. The WHO/UNICEF joint monitoring programme for water supply and sanitation has said that at its present pace, India would take time till 2054 to meet its millennium development goals 2015 on sanitation.

A survey, published by the Urban Development ministry shows how basic infrastructure, especially sanitation, cannot keep up with the fast growth of Indian cities. The survey examined 1405 cities in 12 different States and found out that around 50% of these cities don't have a proper water supply system. Even if the households have access to piped water in around 80% of these households the average supply is less than five hours per day. Concerning sanitation the numbers are even worse: Over 70% of the households in the analyzed cities don't have access to toilets or a sewerage system. A researcher in Mumbai linked toilet situation directly to their health, especially a high incidence of urinary tract and bladder infection for which water is vital to stave off such infections[3].

In Assam, there are more than 12 lakh households, which have not had access to toilets. Human sewage poses the biggest threat to our rivers, lakes, ponds and the ground water table. It is seen that 80% pollution in Indian rivers is due to excreta and the impact of this on public health is catatrosphic. Poor quality drinking water and santitation is the second largest killer in India, malnutrition being the first[4]. In this paper, an attempt is being made to assess the status of sanitation and its impact on the health of the people in Jorhat. Three areas have been identified to make a comparative study, i.e. a rural area on the outskirts of Jorhat ie Pokapura village, a tea garden ie Hunwal tea estate in the district and two pockets from the slums of Jorhat municipal area.

Index Terms- Sanitation, health, facilities, neglected sectors

I. Introduction

According to WHO, "Sanitation generally refers to the provision of facilities and services for the safe disposal of human urine and faeces"[5]. It refers to the maintenance of hygienic conditions through services such as garbage collection and waste disposal. Sanitation is the hygienic means of promoting health through prevention of human contact with the hazard of wastes as well as the treatment and proper disposal of sewage waste water[6].

However, in India, sanitation remains the most neglected sectors whereas human sewage poses the biggest threat to our rivers, lakes, ponds and the ground water table. Every river that passes through a city or a town today becomes a stinking sewer. Proper sanitation thus not only means clean toilets but also a healthy environment for the citizens, as there is proper disposal of physical and microbiological agents causing diseases. It has been estimated that less than 48% of urban and just about 3.15% of rural population in India have access to toilets.

No doubt access has also increased significantly. For example, in 1980 rural sanitation coverage was estimated at 1% and reached 21% in 2008. Also, the share of Indians with access to improved sources of water has increased significantly from 72% in 1990 to 88% in 2008. One of the most significant

[1] UNO & UNOCEF - www.healthissuesindia.com/poor-sanitation visited on 30th Jan, 2014
[2] UNICEF – Water, Sanitation & Hygiene www.unicef.org/wash visited on 28th Jan, 2014
[3] Research by Kamakshi Bhatti on Health of female residents in Mumbai.
[4] Muck Tale on Down to Earth, October, 2006.
[5] en.wikipedia.org/wiki/**Sanitation visited on 29jan, 2014**
[6] en.wikipedia.org/wiki/Sanitation visited on 29jan, 2014.

diseases that arise from poor sanitation is diarrhoea. Deaths resulting from diarrhoea are estimated to be between 1.6 and 2.5 million deaths every year (Mara, Lane and Scott and Trouba). Most of the affected are young children below the ages of five. Other diseases that are caused by poor sanitation include schistosomiasis, trachoma, and soil transmitted Helminthiases. Poor sanitation accounts for almost 50 percent of underweight child since it has a direct link to diarrhoea.

In Assam, the Public Health Engineering Department (PHE) is implementing the Total Sanitation Campaign. The department had set a target of bringing 22,20,017 BPL households under the sanitation programme. Of this, so far 16,59,966 households have been covered and 5,60,051 households remain to be covered. The PHE department had set a target of covering 11,61,020 Above Poverty Line (APL) households under the Total Sanitation Campaign. Of these, 4,31,720 APL households have been covered and 7,29,300 households remain to be covered. The PHE Department must work rapidly to provide sanitation facilities to these households in order to achieve the ambitious sanitation target under the Total Sanitation Campaign.

II. Objectives

1. To assess the status of sanitation and drinking water in and around Jorhat.
2. To study its impact of sanitation and drinking water on the health of the people.

III. Methodology

Sample Design: This study has been carried out with primary survey at the designated areas i.e. the two selected slum pockets in an urban area, a typical rural village and a tea garden. This has been done so that three different areas are represented and at the same time three different samples are collected. The slum area represents a mixed group of people coming from different areas of not only Assam but also different parts of India. Jorhat Municipality has identified 7 slum pockets of which 2 has been chosen, one from the central area and the other from the peripheral area of Jorhat city. The tea garden population again shows 3rd & 4th generation immigrants brought by the British in 19th century as well as Nepali people. The rural village shows original Assamese inhabitants living in the area with traditional occupations, mostly farming for generations.

Sample Selection & Size: The samples were selected with judgement sampling, so that different income groups of people get represented in the surveyed area. An equal number of samples i.e. 30 samples were selected to represent each area, with a total of 120 samples and a sampled population of 675 in this study. The collected samples were tabulated and processed and presented in the form of written text supplemented by illustrations as and when required. Secondary data were collected from books, journals, newspapers, and concerned government and private offices.

Jorhat municipal area covers 9.20sq.km. and comprises of 19 wards and has a population of 85,704 persons and the slum population is 65,949 persons covering an area of 1.39 sq.km. (Source: Municipal Record, 2001). There are seven slum pockets of which two areas Harijan Colony and Puja Dubi area have been chosen.

Hunwal Tea Estate is a plantation under Williamson Magor group, which is the largest tea plantation group producing over 75 million kg annually. It is located in southern part of Jorhat district near the foothills of Nagaland.

Pokamura Kuhiaboria Brahmin Gaon is situated at the south west of Jorhat and is a plain region lying away from the Brahmaputra & the Bhogdoi rivers at a height of 83 metres above sea level. The population of the village is 200 with a household number of 40.

IV. Study Area

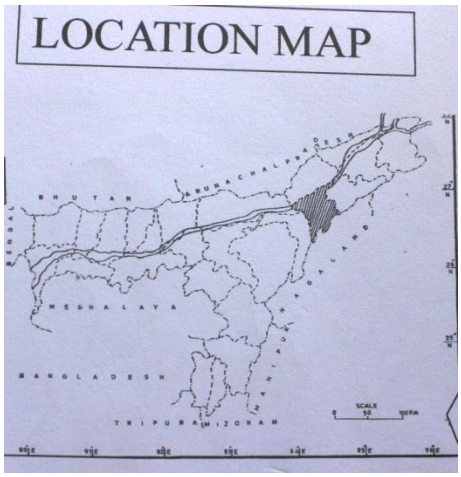

Fig. 1(A) :The Study Area – Jorhat District

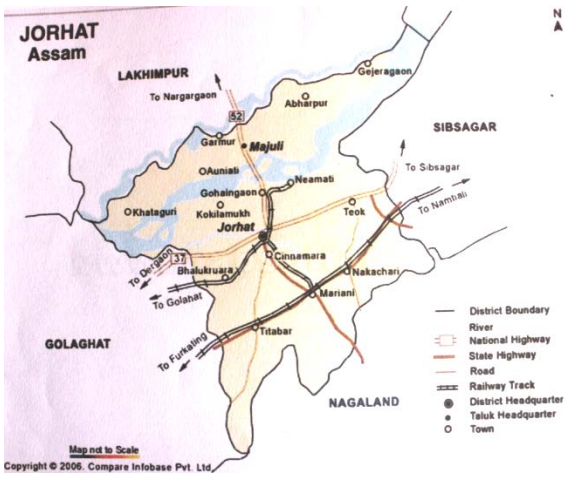

Fig 1 B): Jorhat District Map

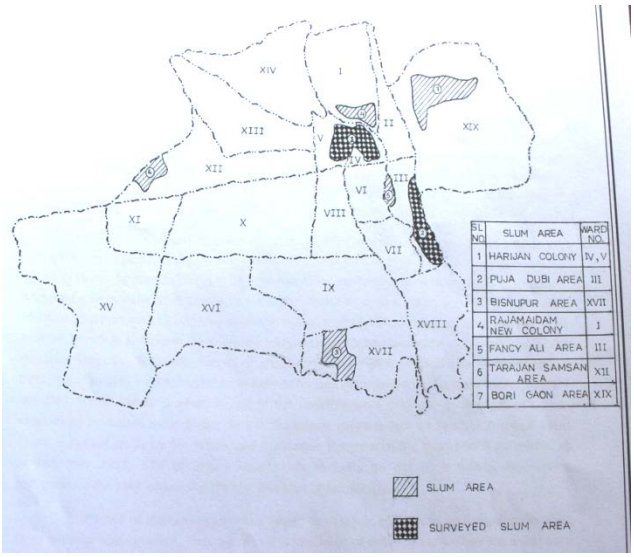

Fig. 1 (C): Study Area - Slum Pockets in the Municipal Area

Analysis

This study is carried out in Jorhat which falls under Jorhat district of Assam. It is located between $26^0 45^/$ to $26^0 75^/$ N latitude and $94^0 13^/$ to $9422^/$ E longitude and at a height of 86 metres above sea level. It is the second largest city in Assam after Guwahati and its history can be traced down to two joint markets i.e Macharhat & Chowkirhat. "Jor" meaning joined and "hat" meaning market. It was the last capital of the Ahom Kingdom and home to many historical monuments – namely Rajamaidan, Lachit maidan, big water tanks dug by the Ahom rulers. At present it is also known as the tea capital of the state with tea gardens in and around it and the Tea Reseach Centre being located at Jorhat. Its a vibrant place today with a thriving cosmopolitan city with a strong sense of character and identity. It is also called the cultural capital of Assam with the indigeneious tribes trying to preserve their tradition and culture. This district has been the most literate for the last 3 decades with the present literacy rate being 82.15% with male literacy at 87.63% and female literacy at 76.45% according to the 2011 census.

This district occupies an area of 2851sq.km. and the municipal area is 9.20km with 19 wards . The new masterplan for the city has been formulated with 31 wards but has not yet been implementd. This ditrict lies on the south of the river Brahmaputra (as shown by Fig 1A) with the largest inhabited riverine island Majuli located on the river Brahmaputra. There are several other rivers flowing down the Naga hills through Jorhat into the Brahmaputra. In fact the main river Bhogdoi passing through this city Jorhat is one whose course has been diverted from Disai river by the Ahom rulers when they shifted their capital to Jorhat. The climate of this region is subtropical monsoon with hot and humid summers and dry & cool winters. The average rainfall received is around 20" and the humidity level is as high as 83%. Summer temperatures are as high as 25^0 to 37^0 celsius and winter 10^0- 22^0 celsius.

The total population of the district has crossed 1 million with 1,009,197 with a decadal growth rate of 9.31% which is more or less at par with that India's growth rate of 9.05% between 2001 and 2011. The urban population is 2,19,565 which is 20.2% of the district, which includes population of Mariani, Titabor and Teok. This is so, as Jorhat has been expanding horizontally and the master plan with 31 wards includes a much wider area whose population is not added to the present one.(Source: Municipal record, 2011)

Sampled Population

A total of 120 households with 675 samples were surveyed, 30 samples each in each area i.e. the slums, the tea garden and the village in the rural area. The percentage of male members is more in the slums and the tea garden marginally with 51 and 51.5 percent whereas in the rural area females account more than males with 52.3 percent. The following table 1 gives the age wise classification of the sampled population.

Table No. I: Sampled Population in the three different areas age wise.

Population Group	Male		Female		Total
Slums	Number	%age	Number	%age	Number
0 month to 4 years	8	3	13	5.8	21
4yrs to 15yrs	19	8.2	20	8.8	39
15yrs to 22 yrs	26	11.5	21	9.3	47
22yrs to 60 yrs	62	27.3	56	24.6	**118(51.8%)**
More than 60yrs.	2	1	1	0.5	3
Total	**117**	**51**	**111**	**49**	**228**
Tea Garden					
0 month to 4 years	12	4.7	10	3.9	22
4yrs to 15yrs	18	7.0	15	5.9	33
15yrs to 22 yrs	43	16.8	42	16.4	**85(33.2%)**
22yrs to 60 yrs	58	22.7	53	20.7	**111(43.4%)**
More than 60yrs.	1	0.3	4	1.6	5
Total	**132**	**51.5**	**124**	**48.5**	**256**
Rural Area					
0 month to 4 years	2	1.0	7	3.7	**9**
4yrs to 15yrs	7	3.7	14	7.3	**21**
15yrs to 22 yrs	13	6.8	15	7.8	**18**
22yrs to 60 yrs	58	30.4	60	31.4	**118(61.8%)**
More than 60yrs.	11	5.8	4	2.1	**15**

Total	**91**	**47.7**	**100**	**52.3**	**191**
Grand Total	**340**		**335**		**675**

In the slums it is seen that the sampled population are either inter (53.3%) or intra state (46.7%) migrants. In case of inter-state migration 30% have come from different parts of Bihar and the rest 16% from Odisha. In case of intra-state migration 12% each have migrated from Dhubri and Nagaon and 4% each have come from Tezpur and Golaghat and the rest 22% of the slum population are originally from Jorhat.

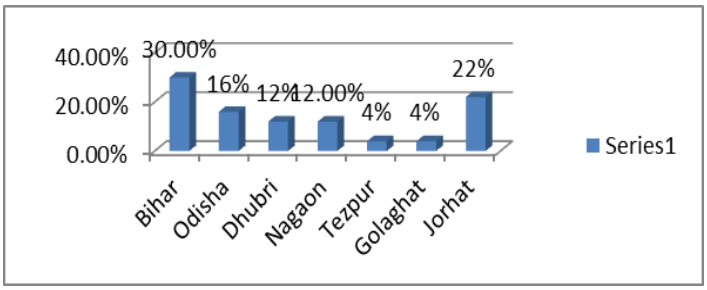

Figure 2: Sampled Population from the Slum Pockets

In the tea garden again we have migrant population and can see that 36.7% are from Bihar, 40% from Odisha, 20% from West Bengal and 3.3% are indigeneous Nepali speaking people. All of them are employed in the tea estate and are working as tea garden labourers either in the field or at the factory.

And in the village of course, we have indigeneous Assamese people who have been living there for generations. The diagrams above shows that we have a mixture of people who are settled in Assam due to work purposes. The tea garden labourers have been living here for the last 3-4 generations, however the slum population have migrated either first generation or are just second generation samples. They have relocated themselves from different part of Assam as well searching for new opportunities.

Figure 3: Sampled Population in the Tea Estate from different States

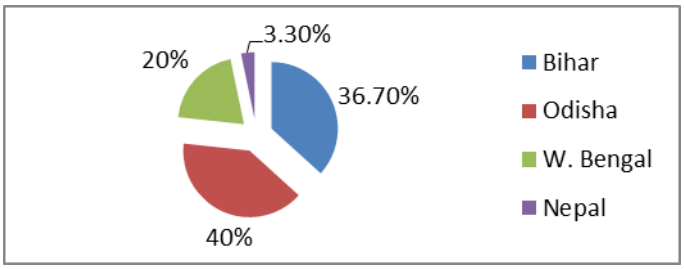

Table II: Migrants Information

Slums	Bihar	Odisha	Dhubri	Nagaon	Tezpur	Golaghat	Jorhat
(in %age)	30	16	12	12	4	4	22
Tea Garden	Bihar	Odisha	Bengali	Nepali			
(in %age)	36.7	40	20	3.3	-	-	-

Table III: Occupational Classification of All The Sampled Population (in %age)

Daily wage labourer	Sweeper	Business	Service	Household Labourers	Others
33	5	18	19	4	20

Maximum i.e. 33% of the sampled population are engaged as daily wage labourers followed by the category of other workers. By other workers, the samples are engaged in part time occupation or are temporary. A majority (19%) of them are also service holders followed by business persons (18%) and a very minor sample comes from household labourer (4%) and sweeper (5%). They come from the slum pockets.

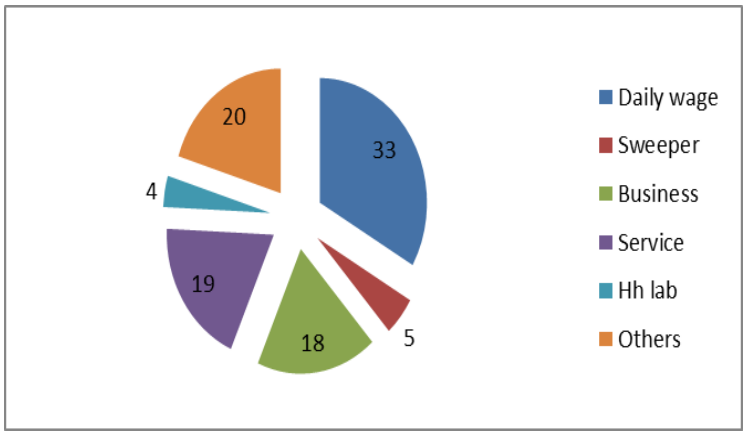

Figure 4 Sampled Occupational Classification of Population

As such the income classification shows that majority i.e. 43.3% comes from the second monthly income group of Rs. 5000/- to Rs. 10,000/- followed by the third income group (26.7%) earning between Rs.10,000 – 20,000/- a month. There's also a sizeable sample (8.7%) from the highest income group earning more than Rs. 30,000/- a month. So in other words here's a mixed sampled population comprising different communities with different cultures as well as different economic status.

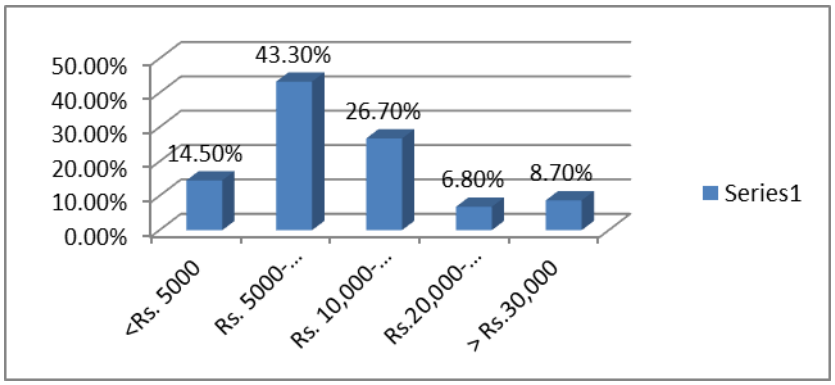

Figure 5: Income Classification of the Sampled Population

Household Condition – The samples were selected in such a way so that both kutcha, semi-pucca (cemented) pucca and RCC households get represented in each of the areas. Of course the condition of houses in slums are purely temporary with materials which are to be used for other purposes. They are squatters occupying the most neglected part of the city with narrow lanes, unhygienic conditions etc.

In the slums it is seen that 45% of the population live in houses with less than 2 rooms. This figure for tea gardens is 17% while in the rural area, no houses were found with less than 2 rooms.

Again if we see the ventilation in houses, it is found that in the slums only 15% houses have ventilation whereas in the other two areas all houses have proper ventilation. Regarding drains in the slums only 13% households have covered drains and the rest are uncovered which is again a health hazard to them. While in the tea garden and the village 47% and 87% have drains. The socio-economic indicators based on household amentities provides a background to understanding the health and status of the people under survey. All the houses surveyed in three different areas have access to electricity.

Table IV: Housing Condition of the Sampled Areas

Category	Slums			Tea Estate		Rural Area		
No. of Rooms	<2 rooms	>2rooms		<2 rooms	>2rooms	<2 rooms	2-4 rooms	>4 rooms
	45%	55%		17%	83%		32%	68%
Ventilation	With	Without		With	Without	With	Without	
	15%	85%		100%		100%		

Drainage	Open	Covered		Drains	No drains	Drains	No drains	
	87%	13%		47%	53%	87%	13%	
Kitchen	Gas	Chulha		Gas	Chulha	Gas	Chulha	
	55%	45%						
Garbage Disposal	Street	M/Bin	Burn	Street	Dump	Street	Dump	Burn
	48%	15%	37%	17%	83%	35%	42%	23%

Fig 6 (A): Garbage Disposal at Hunwal T.E. **Fig 6 (B): At Pokamura village**

Regarding garbage disposal majority of them dispose it in either the streets or within their compound which lies untreated. As can be seen all kinds of garbage are disposed off at the same place. The practice of throwing it into a municipal bin is very less (15%). Maybe because there aren't enough bins and roughly about 30% burn their garbage without sorting which again is harmful for the environment.

Regarding fuel for cooking nearly 45% samples in the slum areas cook on firewood in just 1 or 2 room tenements without adequate ventilation. But the good aspect is that still quite a major chunk of the samples use gas as their fuel for cooking.

Fig7 (A & B): Source of Water i.e. Pond and Government Water Supply Scheme in the Rural Area

Slum dwellers – The major source of water for them is the tap water provided by The Urban Water Supply (62.5%). For 10% samples their source of drinking water is the river Bhogdoi by the side of which they reside in squatters. Another interesting aspect of their drinking water is that, when water from the urban water supply is not available the residents there naturally draw water from the river alongside their houses. A few of the toilets were also seen to drain into the river from which they drink water. A few of the slum dwellers also have tube well as their source of water (27.5%)

A bacterial analysis of water was done by the researcher at North East Institute of Science & Technology (NEIST), Jorhat to check the impurities in the water. The sample was drawn from the water container (bucket) of a household Renu Basfar, Harijan Colony and the result is –

i) Number of bacteria in per ml of water is more than 200.
ii) This water sample has more than 1800 intestinal origin group of bacteria.
iii) It has 5 MPN (Most Probable Number) of pathogenity.

Fig 8 Water Source in Tea Garden

Thus, this sample of water was found to be contaminated with faecal coliforms and as such unfit for human consumption. It can cause several water borne diseases, which the slum dwellers are unaware as they are consuming the water without adequate filtration.

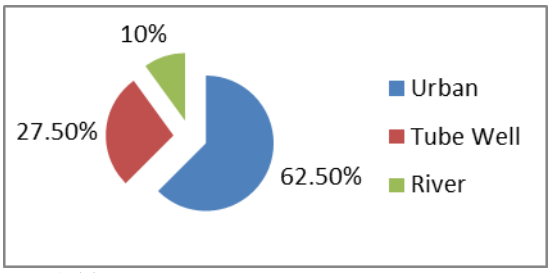

Fig. 6 (a)

Fig. 6 A: Source of Drinking Water in Slums

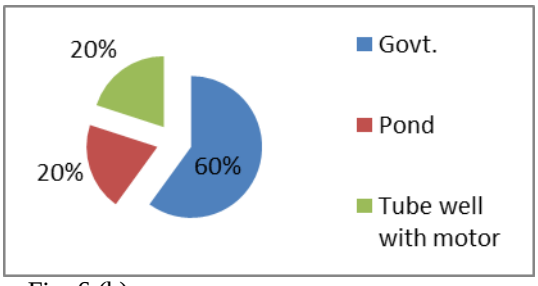

Fig. 6 (b)

Fig. 6 B: Drinking Water in Rural Area

Rural Village – Most of the people (60%) here prefer drinking water from government water supply scheme available in their area. Some of the households (20%) take pond water which they have within their compound. Apart from the pond some households (20%) also have tube well with motor pumps. The water from the pond and the tube well have high iron content but otherwise is not contaminated. Nearly half of the sampled population (45%) drink water after boiling and filtration, another 45% only filter water before drinking and the rest 10% boil the water before drinking.

Hunwal Tea Estate – In the tea garden the water supply is provided by the tea garden authorities.

a) Number of bacteria in per ml of water is more than 200.
b) This water sample has more than 1600 intestinal origin group of bacteria.
c) It has 4 MPN (Most Probable Number) of pathogenity.

Sanitation The availability and cleanliness of toilets is a reflection of the society, which in turn reflects the spread of diseases especially gastro-intestinal and skin etc. Recently a study conducted by C-NES Centre for North East Studies & Policy Research found that 67% of the people in Jorhat have access to toilet facilities according to the district level household and facility survey of 2007-08 [7]. The fact that millions in India are still forced to defeacate in the open ought to be a matter of national shame. It is shameful not only from the angle of human health but from human dignity, sense of aesthetics and cleanliness.

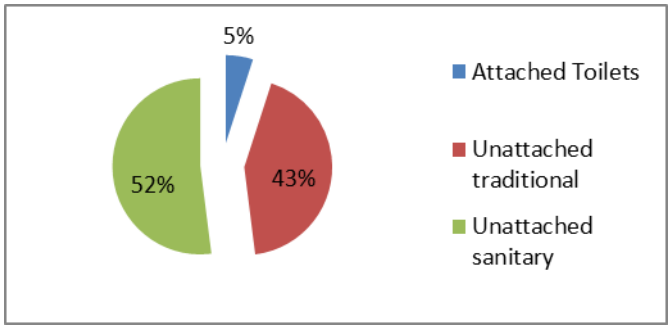

Fig. 11 Type of Toilets in Slums

i) Slums – In this study 5% samples have their own toilets and the rest 95% share their toilets between families, out of which 52% are sanitary toilets and the rest 43% are traditional toilets. Regarding cleaning their toilets 78% of the samples do not at all clean their toilets but the rest clean it every 2-3 days with disinfectant. Simply by washing our hands with soap before meals also

Fig12 (A) & (B) :Toilets (Traditional & Mordern)

ii) prevent us from several diseases and it was seen that only 20% samples wash their hands with soap and the rest (67%) just wash their hands with water and 13% samples said they its not part of their daily routine and so do not remember to wash their hands before eating. None of the sampled population in the slums have running water in their toilets.

iii) Rural Village – In the village 58% people have attached toilets and clean it daily and also weekly using disinfectant. The rest 42% have traditional toilets away from their house. In these toilets 31% have running water inside their toilets and the rest don't.

[7] The Assam Tribune Oct. 29, 2013, "Call for action on potable water, sanitation".

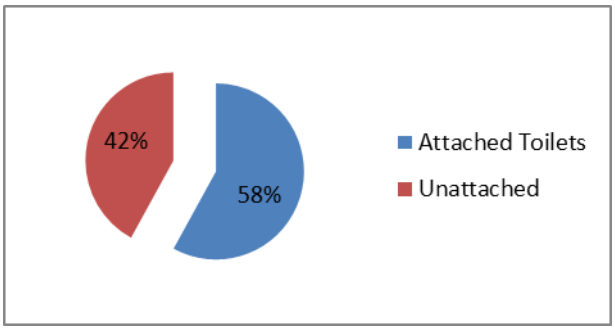

Fig. 13: Toilets in the Rural Village

Percentage of Toilets with and without running water

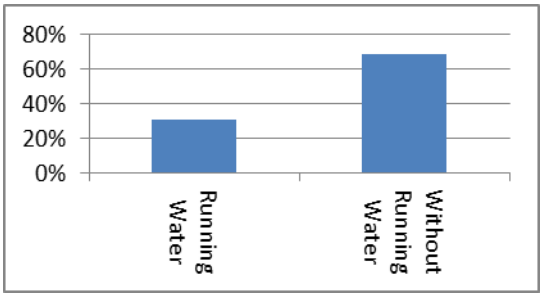

Fig. 14: Household with and without running water.

iv) Hunwal Tea Estate – Only 13% of the households have attached toilets, and 23% have unattached but proper toilets, 47% use traditional toilets and 17% samples still defecate in the open.

V. FINDINGS

1. A total of 120 samples were collected of which 47.7% are male and 52.3% are female. There are 60 samples from the slums since the slums are represented by two pockets.
2. a) In the slums it is seen that the sampled population are either inter (53.3%) or intra state (46.7%) migrants. In case of inter-state migration 30% have come from different parts of Bihar and the rest 16% from Odisha. In case of intra-state migration 12% each have migrated from Dhubri and Nagaon and 4% each have come from Tezpur and Golaghat and the rest 22% of the slum population are originally from Jorhat.

b) In the tea garden again we have migrant population and can see that 36.7% are from Bihar, 40% from Odisha, 20% from West Bengal and 3.3% are indigeneous Nepali speaking people. All of them are employed in the tea estate and are working as tea garden labourers either in the field or at the factory.

c) And in the village of course, we have indigeneous Assamese people who have been living there for generations.

3. Occupation wise classification shows that 33% of the samples are daily wage labourers followed by (19%) service holders followed by business persons (18%) and a very minor sample comes from household labourer (4%) and sweeper (5%). They come from the slum pockets. 21% of the samples are part time workers who otherwise work in the fields or are engaged in house hold chores.
4. Economic classification of the sampled population shows that 43.3% comes from the monthly income group of Rs. 5000/- to Rs. 10,000/- followed by the third income group (26.7%) earning between Rs.10,000 – 20,000/- a month. There's also a sizeable sample from the highest income group earning more than Rs. 30,000/- a month, though 14.5% of the samples earn less than Rs. 5000/- a month. So in other words here's a mixed sampled population comprising different communities with different cultures as well as different economic status.
5. In the slums it is seen that 45% of the population live in houses with less than 2 rooms. This figure for tea gardens is 17% while in the rural area, no houses were found with less than 2 rooms.
6. Again, if we see the ventilation in houses, it is found that in the slums only 15% houses have ventilation whereas in the other two areas all houses have proper ventilation.
7. Regarding drains in the slums only 13% households have covered drains and the rest are uncovered which is again a health hazard to them. While in the tea garden and the village 47% and 87% have drains while the rest don't.
8. Regarding garbage disposal majority of them dispose it in either the streets or within their compound which lies untreated. The practice of throwing it into a municipal bin is very less (15%). Maybe because there aren't

enough bins and roughly about 30% burn their garbage without sorting which again is harmful for the environment.

9. Regarding fuel for cooking nearly 45% samples in the slum areas cook on firewood in just 1 or 2 room tenements without adequate ventilation. But the good aspect is that still quite a major chunk of the samples use gas as their fuel for cooking.
10. The major source of water is The Urban Water Supply (62.5%). For 10% samples their source of drinking water is the river Bhogdoi and 27.5% samples draw water from tube wells. Another interesting aspect of their drinking water is that, when water from the urban water supply is not available the residents there naturally draw water from the river alongside their houses. A few of the toilets were also seen to drain into the river from which they drink water. This sample of river water tested at NEIST shows that it contains bacterial coliforms and as such unfit for human consumption.
11. In the rural area, most of the people (60%) here prefer drinking water from government water supply scheme available in their area. Some of the households (20%) take pond water which they have within their compound. Apart from the pond some households (20%) also have tube well with motor pumps. Nearly half of the sampled population (45%) drink water after boiling and filtration, another 45% only filter water before drinking and the rest 10% just boil water before drinking.
12. In the slums only 5% samples have their own toilets and the rest 95% share their toilets between families, out of which 52% are sanitary toilets and the rest 43% are traditional toilets. Regarding cleaning their toilets 78% of the samples do not at all clean their toilets but the rest clean it every 2-3 days with disinfectant. Simply by washing our hands with soap before meals also prevent us from several diseases and it was seen that only 20% samples wash their hands with soap and the rest (67%) just wash their hands with water and 13% samples said they do not wash their hand before eating. None of them have running water in their toilets. In the tea garden, only 13% of the households have attached toilets, and 23% have unattached but proper toilets, while 47% use traditional toilets, 17% samples still defecate in the open.
13. Rural Village – In the village 58% people have attached toilets and clean it daily and also weekly using disinfectant. The rest 42% have traditional toilets away from their house. In these toilets 31% have running water inside their toilets and the rest don't.

VI. Conclusion

From this study it is revealed that, although much has been achieved a lot still needs to be done to improve the sanitation situation. Moreover, its the women folk who fetch water for the household and looks after the hygiene and cleanliness of the house. So their education and awareness regarding safe drinking water and clean toilets is very important. Equally important is the awareness regarding the benefits of good health, as the whole i.e. good health can be achieved only by fulfilling the parts.

The total sanitation campaign (TLC) launched by the government of India in 1991 is indeed commendable but the speed & success of implementation is very slow. The target of achieving total sanitation by 2012 has not been achieved except for five states in India accordning to statistics. In fact women are most affected by the lack of proper sanitation, which is also one of the causes of girls drop out in school because of lack of toilets in school.

References

[1] Bhagabati, A.K., Kar B.K., Bora A.K. (2001):"Geography of Assam, Rajesh Publication.

[2] Bhatti Kamakshi Health of female residents in Mumbai.

[3] Chabria Anjali, (2011): One India One People, Vol.15/4 Published by Suchitra R. Hegde.

[4] Down to Earth, October, 2006. "Muck Tale"

[5] Jaiswal, Rajesh (2013): "Research Promoter – Micro Credit for Small Tea Grower of Assam".

[6] Kothari, C.R. (2008): "Research Methodology", New Age International (P) Limited Publisher.

[7] Mandal, R.B. (1999): "Urban Geography", Concept Publishing Company, New Delhi.

[8] Mara, Lane and Scott and Trouba (2010): Water & Sanitation for the Urban Poor, Evaluation of the costs and benefits of water and sanitation improvements at the global level, and Mara D, Lane J, Scott B, Trouba D (2010) 'Sanitation and Health'. PLoS Med 7(11): e1000363.

[9] Santra Prakasnaryan, (2013): Geographical Review of India, "Status of Maternal and Child Health in West Bengal".

[10] Sharma, H.N. (2008): "Jorhat Town during the Nineteen Sixties" pp 1-8.

[11] Taher, M. Ahmed, P. (2005): "A Geographical Profile", Published by Mani Manik Prakash.

[12] The Sentinel, Guwahati, April 14, 2013 "Assam yet to achieve target under Total Sanitation Campaign".

[13] The Sentinel, Jan 28, 2014 "Assam yet to achieve target under Total Sanitation Campaign", by a Staff Reporter.

[14] The Assam Tribune Oct. 29, 2013, "Call for action on potable water, sanitation".

[15] The Seven Sister's Post, Guwahati, June 19, 2012" Basic Right: Campaign against restroom injustice" original article came out in The New York Times.

Websites

[16] http/History of Jorhat

[17] http/ Health of India

[18] http/ Sanitation in India

[19] UNO & UNOCEF - www.healthissuesindia.com/poor-sanitation visited on 30th Jan, 2014

[20] UNICEF – Water, Sanitation & Hygiene www.unicef.org/wash visited on 28th Jan, 2014

[21] en.wikipedia.org/wiki/Sanitation visited on 29jan, 2014.

[22] en.wikipedia.org/wiki/Sanitation visited on 29jan, 2014.

[23] www.biotoilet.org

Wikipedia the free encyclopaedia Drinking water supply and sanitation in India

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Better Governance and inclusive reforms: A key towards Rural Development in India

(Challenges to Inclusive Growth in the Emerging Economies)

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Abstract- We have developed two scenarios to see how rapidly India can raise people to the standards of living implied by the Empowerment Line. The first, which we call "stalled reforms", assumes that no bold policy measures are taken and that slow economic growth continues. The second considers an alternative path of "inclusive reforms". The path of inclusive reforms envisages a far more positive alternative, one in which the nation takes steps to stimulate investment, job creation, and farm productivity, as well as dramatically improve the delivery of basic services. These reforms could potentially allow India to achieve an average GDP growth rate of 7.8 percent between 2012 and 2022. This could lift 580 million people above the Empowerment Line, leaving 100 million (7 percent of the population) below it in 2022 and 17 million (just 1 percent) below the official poverty line—virtually eliminating extreme poverty in just a decade. The higher GDP growth inherent in the inclusive reforms scenario generates more tax revenue that can be ploughed back into spending for basic services— and it simultaneously ensures that India meets its fiscal objectives more quickly. To achieve this goal, India will need to increase its investment rate from nearly 36 percent of GDP since 2005 to an average of 38 percent over the next ten years. The combination of higher investment, faster economic growth, and increased tax revenue could allow India to bring its fiscal deficit to 6 percent of GDP from 2017 onward while enabling a moderate but steady increase in social spending, in line with GDP growth, that could bring access deprivation in basic services down from 46 percent to just 17 percent. Although these goals are aspirational, they are feasible based on successes already demonstrated by India's better-performing states.

"India can bring more than 90 percent of its people above the Empowerment Line in just a decade by implementing inclusive reforms"

Index Terms- Inclusive Growth, Inclusive Reforms, Governance, Rural Development

I. INTRODUCTION

In the stalled reforms scenario, poverty is likely to maintain its grip on a large share of India's population. India's economic engine has been sputtering since 2011, and there has been a growing sense of legislative and administrative paralysis. In the absence of major reforms, the scenario assumes that India's GDP grows at just 5.5 percent from 2012 to 2022 and that the effectiveness of social spending remains unchanged. In such a scenario, some 470 million Indians (36 percent of the population) would remain below the Empowerment Line in 2022, and 12 percent of the population would still be trapped below the official poverty line. At this rate, the goal of eliminating extreme poverty would not be reached until the mid-2030s. The lack of decisive reforms also makes it unlikely that India would convincingly address gaps in access to social infrastructure. Lower GDP growth implies lower fiscal resources, limiting public spending for basic services. As a result, India's access deprivation would only come down to 26 percent by 2022. The path of inclusive reforms envisages a far more positive alternative, one in which the nation takes steps to stimulate investment, job creation, and farm productivity, as well as dramatically improve the delivery of basic services.

II. RESEARCH ELABORATIONS

"Better governance: key to implementing inclusive reforms"

A failure to execute well on vital programmes has prevented India from achieving its full economic potential. The government's performance in all its roles—from regulatory oversight to providing services to businesses and citizens—is too often marked by inefficiency, unresponsiveness, or even outright corruption. Today, however, there is growing conviction across India that the time has come to demand greater accountability. The problem of poor governance can be overcome by efforts on two parallel tracks: building stronger institutional capabilities and strengthening systems to ensure accountability in the public sector. Institutional capabilities can be improved by creating appropriate organisational structures, attracting the right talent to government roles, managing performance, and streamlining processes. Accountabilities can be strengthened by creating multiple checks and balances— whether democratic, reputational, legal, or regulatory—for government agencies and institutions. Three promising ideas, outlined below, can set this process in motion:

1) **Empowered agencies for high-priority initiatives**, given operational flexibility but held strictly accountable for outcomes. These agencies (led by externally recruited "change agents" or high-performing civil servants) can be set up with a specific mandate—perhaps building a health-care or drinking water system or creating a tourism circuit. The Unique Identification Authority of India, for example, is a quasi-independent agency mandated to issue personal identification numbers to citizens; it has significant flexibility in running its operations while reporting to a high authority. Such empowered agencies in the central and state governments, focused on the most important priorities, could dramatically improve outcomes and governance in focus areas. Similar efforts, with "chief executive"–style leadership, have been employed in Singapore, the United Kingdom, Chile, and elsewhere.
2) **Public transparency**. The Right to Information Act was an important start on the journey to greater public transparency. The next steps are more voluntary government disclosure (by, for instance, putting draft policies and legislation online for public debate) and a massive digitisation effort to get government data into open, shareable form. The imperative for more openness and transparency in government can be strengthened by extending the Right to Public Services, now enacted in 17 states, to a host of citizen and business services. Using this framework, performance metrics can be defined and ongoing feedback loops (such as digitized public scorecards at the state, local authority, and specific desk/office levels) can be instituted.
3) **Decentralisation.** Through the 73rd and 74th Constitutional Amendments in 1992, India sought to devolve powers to *gram panchayats*. In several areas, such as the PDS in Chhattisgarh, panchayats have played a constructive role. Giving them substantial independence in revenue and expenditure, greater autonomy over how to implement programmes, and more training can strengthen their capabilities; the same point applies to local bureaucracies.

"From poverty to empowerment: India's imperative for jobs, growth, and effective basic services"

The first instance is demonstrated by McKinsey Global Institute:

1) **Talent and performance management in government**: Performance management systems can ensure that public officials fulfill their duties. Government commissions on administrative reform have pointed out that India's bureaucracy tends to be more focused on internal processes than on results. To reverse this, bureaucrats should have *incentives for good performance and penalties for consistently poor performance*.
   - **Teacher absenteeism in public schools**, for instance, can be reduced if the consequence is strict disciplinary action.
   - **Senior bureaucratic positions** can be filled through a competitive application-based process, even from within the **civil service**, to create incentives for delivering outcomes.
2) A **robust anti-corruption framework**. India ranked 94th among 174 countries in Transparency International's 2012 Corruption Perceptions Index. Mass protests against corruption culminated in the Lokpal and Lokayuktas Act of 2013. While the impact of this move remains to be seen, more can be done (such as establishing whistle-blower protection). International best practices, such as the model set by Hong Kong's Independent Commission against Corruption, can be used as a template in India.
3) **Simplifying laws and building legal and judicial capacity**. *Speedy access to justice* at a reasonable cost is critical to empowering households and enterprises economically. To achieve this, India would need to increase the number of courts and judges, review a host of archaic laws, and build greater institutional capacity in its legal and regulatory arms. This will create an ecosystem in which citizens can claim their rights.

III. RESEARCH FINDINGS: FOUR CRITICAL ELEMENTS ARE KEY TO THE PATH OF INCLUSIVE REFORMS

The inclusive reforms scenario hinges on four key elements:

1) **Accelerating job creation**. India needs reforms that unlock the economy's potential to add 115 million non-farm jobs by 2022 (about 40 million more than the stalled reforms scenario would generate). This would absorb the expected growth of 69 million in the working-age population, raise the labour force participation rate by some 2 to 3 percentage points, and reduce the share of farm jobs from 49 percent of total employment in 2012 to 37 percent in 2022.
2) **Construction** will need to be the biggest contributor, adding some 50 million jobs. The **manufacturing sector** will need to accelerate growth to create some 21 million to 27 million jobs, while some 35 million to 40 million jobs will need to come from the services sector.
3) Raising **farm productivity**. **Increasing investment in agricultural infrastructure, research, and extension services** can help raise the average farm yield per hectare from 2.3 tonnes in 2012 to about 4.0 tonnes in 2022. This would bring India's yields in line with those in other emerging Asian countries. Gains in agricultural productivity would also accelerate the transition of labour to more productive non-farm jobs.
4) **Increasing public spending on basic services**. India cannot fully realize the potential of its human capital until its population has wider access to affordable basic services. In absolute, real terms, public spending on social services needs to nearly double from Rs. 570,000 crore ($118 billion) in 2012 to Rs. 1,088,000 crore ($226 billion) in 2022 to fill critical gaps in social infrastructure. This entails an annual real growth rate of about 6.7 percent.
5) **Public spending for basic services** (which is actually lower than the 11 percent annual rate of increase from 2005 to 2012). If India can achieve the higher rates of economic growth assumed in the inclusive reforms scenario, this would continue to represent about 6 percent of GDP. The share allocated to health, water, and sanitation services, however, needs to increase from 21 percent in 2012 to nearly

50 percent of total social spending in 2022. Just as expanding access to primary education was given top priority in the past decade, India needs a concerted push to build more extensive health-care infrastructure in the decade ahead.

6) **Making basic services more effective**. The impact of higher public spending on basic services is magnified if more of that spending reaches its intended beneficiaries. The inclusive reforms scenario assumes that the nation as a whole can raise the effectiveness of social spending from 50 percent to at least 75 percent by 2022, matching the levels already demonstrated by India's best-performing states. If India increases funding for basic services.

IV. INCLUSIVE REFORM POLICY FOR THE CURRENT BUDGET PERIOD 2014-2015 BY FINANCE MINISTRY

"Government is committed to the principle of **"MINIMUM GOVERNMENT MAXIMUM GOVERNANCE**".

1) URBANISATION

Smart Cities. Unless, new cities are developed to accommodate the burgeoning number of people, the existing cities would soon become unlivable. The Prime Minister has a vision of developing **'one hundred Smart Cities'**, as satellite towns of larger cities and by modernizing the existing mid-sized cities.

2) EMPLOYMENT

Skill India. It would skill the youth with an emphasis on employability and entrepreneur skills. It will also provide training and support for traditional professions like welders, carpenters, cobblers, masons, blacksmiths, weavers etc.

3) SANITATION

Swatchh Bharat Abhiyan. The need for sanitation is of utmost importance. The Government intends to cover every household by total sanitation by the year 2019, the 150th year of the Birth anniversary of Mahatma Gandhi through Swatchh Bharat Abhiyan.

4) WOMEN AND CHILD

Women & child development. Women's safety is a concern shared by all the honorable members of this House. An outlay of Rs. 50 crores will be spent by Ministry of Road Transport & Highways on pilot testing a scheme on "Safety for Women on Public Road Transport". It is also proposed to set up "Crisis Management Centres" in all the districts of NCT of Delhi this year in all government and private hospitals. The funding will be provided from the Nirbhaya Fund.

5) BETI BACHAO, BETI PADHAO YOJANA. The apathy towards girl child is still quite rampant in many parts of the country.

6) SAFE DRINKING WATER

7) HEALTH AND FAMILY

Health and family welfare. *"Health for All",* the two key initiatives i.e. the Free Drug Service and Free Diagnosis Service would be taken up on priority. In order to achieve universal access to early quality diagnosis and treatment to TB patients, two National Institutes of Ageing will be set up at AIIMS, New Delhi and Madras Medical College, Chennai.

9) A plan to **set up four more AIIMS like institutions**. In addition, dental facilities would also be provided in all the hospitals.

10) EDUCATION

School education. There is a residual gap in providing minimal school infrastructure facilities.

Government would strive to provide **toilets and drinking water in all the girls' school** in first phase.

To take advantage of the reach of the IT, setting up virtual classrooms as Communication Linked Interface for Cultivating Knowledge (CLICK) and online courses.

Higher education. The country needs a large number of Centres of higher learning which are world class. Government also proposes to ease and simplify norms to facilitate education loans for higher studies.

11) HOUSING INFRASTRUCTURE

"Housing for all". Our government is committed to endeavour to have housing for all by 2022. For this purpose, extend additional tax incentive on home loans to encourage people, especially the young, to own houses.

12) CONSERVATION OF RESOURCES

The world's soils are getting degraded due to erosion, compaction, soil sealing, salinization, soil organic matter and nutrient depletion, acidification, pollution and other processes caused by unsustainable land management practices, the Food and Agriculture Organization (FAO) of the UN said, *"One- third of all soils in the world are degraded and unless new approaches are adopted, globally, arable and productive land per person in 2050 will be only one-fourth of the level in 1960"*. "It can take up to 1,000 years to form one centimeter of soil".

Every year 5 December is celebrated as World Soil Day**. "FAO will observe 2015 as the International Year of Soil".**

13) RURAL DEVELOPMENT

Aims to cater all groups of the society with a motto, "***Sab ka Saath Sab ka Vikas"*.**

14) "**DEEN DAYAL UPADHYAYA GRAM JYOTI YOJANA**" for power supply to the rural areas.

15) "**START UP VILLAGE ENTREPRENEURSHIP PROGRAMME**" for encouraging rural youth to take up local entrepreneurship programs.

16) "**NEERANCHAL**" to give impetus to watershed development in the country.

V. CONCLUSION AND RECOMMENDATION

Let me end with a vision of how the RBI can speed up and enhance financial inclusion of the kind I have just outlined.

"*Financial inclusion in my view is about getting five things right:*

Five Ps of Financial Inclusion- "Product, Place, Price, Protection, and Profit."

If we are to draw in the poor, we need **products** that address their needs; a safe place to save, a reliable way to send and receive money, a quick way to borrow in times of need or to escape the clutches of the moneylender, easy-to-understand accident, life and health insurance, and an avenue to engage in saving for old age. Simplicity and reliability are key – what one thinks one is paying for is what one should get, without hidden clauses or opt-outs to trip one up. The RBI is going to nudge banks to offer a basic suite of Products to address financial needs.

Two other attributes of products are very important. They should be *easy to access at low transactions cost.*

In the past, this meant that the **Place of delivery**, that is the bank branch, had to be close to the customer. So a key element of the inclusion program was to expand bank branching in unbanked areas. Today, with various other means of reaching the customer such as the mobile phone or the business correspondent, we can be more agnostic about the means by which the customer is reached. In other words, '*Place' today need not mean physical proximity; it can mean electronic proximity, or proximity via correspondents.* Towards this end, we have liberalized the regulations on bank business correspondents, encouraged banks and mobile companies to form alliances, and started the process of licensing payment banks.

The **transactions costs of obtaining the product, including the Price and the intermediary charges, should be low.** Since every unbanked individual likely consumes low volumes of financial services to begin with, the provider should automate transactions as far as possible to reduce costs, and use employees that are local and are commensurately paid. Furthermore, any regulatory burden should be minimal. With these objectives in mind, the RBI has started the process of licensing small local banks, and is re-examining KYC norms with a view to simplifying them. Last month, we removed a major hurdle in the way of migrant workers and people living in makeshift structures obtaining a bank account, that of providing proof of current address.

New and inexperienced customers will require **Protection**. The RBI is beefing up the Consumer Protection Code, emphasizing the need for suitable products that are simple and easy to understand. We are also working with the government on expanding financial literacy. Teaching the poor the intricacies of finance has to move beyond literacy camps and into schools. Banks that lend to the entrepreneurial poor should find ways to advise them on business management too, or find ways to engage NGOs and organizations like NABARD in the process. We are also strengthening the customer grievance redressal mechanism, while looking to expand supervision, market intelligence, and coordination with law and order to reduce the proliferation of fly-by-night operators.

Finally, while mandated targets are useful in indicating ambition (and allowing banks to anticipate a large enough scale so as to make investments), **financial inclusion cannot be achieved without it being Profitable.** So the last 'P' is that there should be profits at the bottom of the pyramid. For instance, the government should be willing to pay reasonable commissions punctually for benefits transfers, and bankers should be able to charge reasonable and transparent fees or interest rates for offering services to the poor.

VI. TO CONCLUDE

One of the greatest dangers to the growth of developing countries is the middle income trap, where crony capitalism creates oligarchies that slow down growth. If the debate during the elections is any pointer, this is a very real concern of the public in India today. To avoid this trap, and to strengthen the independent democracy our leaders won for us sixty seven years ago, we have to improve public services, especially those targeted at the poor. A key mechanism to improve these services is through financial inclusion, which is going to be an important part of the government and the RBI's plans in the coming years. I hope many of you in this audience will join in ensuring we are successful.

REFERENCES

[1] Inclusive Growth in India: Challenges and Prospects Dr. Yogeshwar Shukla Faculty in Economics. The Daly College, Indore, M.P., India
[2] Inclusive Growth: What is so exclusive about it? M.H. Suryanarayana
[3] Indira Gandhi Institute of Development Research, Mumbai, October 2008 http://www.igidr.ac.in/pdf/publication/WP-2008-019.pdf
[4] "Fostering Inclusive Growth" by N. B. Rao published in Prospectus. Asian Development
[5] economictimes.indiatimes.com
[6] en.wikipedia.org/wiki/
[7] www.thehindu.com
[8] http://ww.planningcommissionofindia.com
[9] http://jstor.org.com
[10] http://www.slideshare.com
[11] http://www.pci.com
[12] http://www.economictimes.com
[13] http://www.hindu.co.in
[14] McKinsey Global Institute analysis
[15] What is inclusive growth?K. C. Chakrabarty, Deputy Governor of RBI in this speech clarifies the meaning of inclusive growth.

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An Analytical Study of FDI in India (2000-2015)

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Abstract- Foreign Direct investment plays a very important role in the development of the nation. Sometimes domestically available capital is inadequate for the purpose of overall development of the country. Foreign capital is seen as a way of filling in gaps between domestic savings and investment. India can attract much larger foreign investments than it has done in the past. The present study has focused on the trends of FDI Flow in India during 2000-01 to 2014-15 (up to June, 2015).

The study also highlights country wise approvals of FDI inflows to India and the FDI inflows in different sector for the period April 2000 to June 2015. The study based on Secondary data which have been collected through reports of the Ministry of Commerce and Industry, Department of Industrial Promotion and Policy, Government of India, Reserve Bank of India, and World Investment Report. The study concludes that Mauritius emerged as the most dominant source of FDI contributing. It is because the India has Double Taxation Avoidance Agreement (DTAA) with Mauritius and most of the foreign countries like to invest in service sector.

Index Terms- foreign direct investment; economic growth, FDI 2000 to 2015.

I. INTRODUCTION

Foreign Direct Investment (FDI) is a type of investment in to an enterprises in a country by another enterprises located in another country by buying a company in the target country or by expanding operations of an existing business in that country. In the era of globalization FDI takes vital part in the development of both developing and developed countries.

FDI has been associated with improved economic growth and development in the host countries which has led to the emergence of global competition to attract FDI.

FDI offers number of benefits like overture of new technology, innovative products, and extension of new markets, opportunities of employment and introduction of new skills etc., which reflect in the growth of income of any nation.

Foreign direct investment is one of the measures of growing economic globalization. Investment has always been an issue for the developing economies such as India. The world has been globalizing and all the countries are liberalizing their policies for welcoming investment from countries which are abundant in capital resources. The countries which are developed are focusing on new markets where there is availability of abundant labors, scope for products, and high profits are achieved. Therefore Foreign Direct Investment (FDI) has become a battle ground in the emerging markets.

Foreign investment plays a significant role in development of any economy as like India. Many countries provide many incentives for attracting the foreign direct investment (FDI). Need of FDI depends on saving and investment rate in any country. Foreign Direct investment acts as a bridge to fulfill the gap between investment and saving. In the process of economic development foreign capital helps to cover the domestic saving constraint and provide access to the superior technology that promote efficiency and productivity of the existing production capacity and generate new production opportunity.

India's recorded GDP growth throughout the last decade has lifted millions out of poverty & made the country a favoured destination for foreign direct investment. A recent UNCTAD survey projected India as the second most important FDI destination after China for transnational corporations during 2010-2015. Services, telecommunication, construction activities, computer software & hardware and automobile are major sectors which attracted higher inflows of FDI in India. Countries like Mauritius, Singapore, US & UK were among the leading sources of FDI in India.

FDI inflow routes: An Indian company may receive Foreign Direct Investment under the two routes as given under:

1. Automatic Route: FDI in sectors /activities to the extent permitted under the automatic route does not require any prior approval either of the Government or the Reserve Bank of India.

2. Government Route: FDI in activities not covered under the automatic route requires prior approval of the Government which are considered by the Foreign Investment Promotion Board (FIPB), Department of Economic Affairs, and Ministry of Finance.

FDI is not permitted in the following industrial sectors:

- Arms and ammunition.
- Atomic Energy,
- Railway Transport.
- Coal and lignite.
- Mining of iron, manganese, chrome, gypsum, sulphur, gold, diamonds, copper, zinc.
- Lottery Business
- Gambling and Betting
- Business of Chit Fund
- Agricultural (excluding Floriculture, Horticulture, Development of seeds, Animal Husbandry, Pisciculture and cultivation of vegetables, mushrooms, etc. under controlled conditions and services related to agro and

allied sectors) and Plantations activities (other than Tea Plantations) .

- Housing and Real Estate business.
- Trading in Transferable Development Rights (TDRs).
- Manufacture of cigars, cheroots, cigarillos and cigarettes, of tobacco or of tobacco substitutes.
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II. REVIEW OF LITERATURE

Singh Kr. Arun and Agarwal P.K., (2012) "Foreign direct investment: The big bang in Indian retail". In this article they have studied the relation of foreign investment and Indian retail business. The study is based on different literatures, case studies and analysis of organised retail market. The author discusses the policy development for FDI in the two retail categories: single brand and multi brand. The author concludes that FDI in multi brand retail should be considered, better technology and employment. The paper also concludes that openness of FDI in India would help India to integrate into worldwide market.

Dr. Mamata Jain and Mrs. Meenal Lodhana Sukhlecha, (2012), "FDI in multi brand retail: Is it the need of the hour?" The paper studies the need of the retail community to invite FDI in retailing. The study is under taken through analysis of positive and negative impacts of reforms. The study shows various advantages of FDI, which suggests for foreign participation in retailing, but the author also suggests that the ceiling should not exceed 51% even for single brands to ensure check and control on business operations.

Rajalakshmi K. and Ramachandran F., (2011), "Impact of FDI in India's automobile sector with reference to passenger car segment." The author has studied the foreign investment flows through the automobile sector with special reference to passenger cars. The research methodology used for analysis includes the use of ARIMA, coefficient, linear and compound model. The period of study is from 1991to 2011. This paper is an empirical study of FDI flows after post liberalisation period. The author has also examined the trend ad composition of FDI flow and the effect of FDI on economic growth. The author has also identified the problems faced by India in FDI growth of automobile sector through suggestions of policy implications.

Dr. S N Babar and Dr. B V Khandare, (2012), "Structure of FDI in India during globalisation period". The study is mainly focused on changing structure and direction of India's FDI during globalisation period. The study is done through analysis of benefits of FDI for economic growth. The study has been done through sect oral analysis of FDI participation, as well as through study of country wise flow of foreign inflow in India till 2010.

Singh (2009) stated in their study that foreign direct investment (FDI) policies play a major role in the economic growth of developing countries around the world. Attracting FDI inflows with conductive policies has therefore become a key battleground in the emerging markets. The paper highlighted the trend of FDI in India after the sector-wise economic reforms.

Devajit (2012) conducted the study to find out the impact of foreign direct investments on Indian economy and concluded that Foreign Direct Investment (FDI) as a strategic component of investment is needed by India for its sustained economic growth and development through creation of jobs, expansion of existing manufacturing industries, short and long term project in the field of healthcare, education, research and development.

Sharma Reetu and Khurana Nikita (2013) in their study on the sector-wise distribution of FDI inflow to know about which has concerned with the chief share, used a data from 1991-92 to 2011-2012 (post-liberalization period). This paper also discusses the various problems about the foreign direct investment and suggests the some recommendations for the same. In this study found that, Indian economy is mostly based on agriculture. So, there is a most important scope of agriculture services. Therefore, the foreign direct investment in this sector should be encouraged.

III. FDI POLICY FRAMEWORK IN INDIA

Policy regime is one of the key factors driving investment flows to a country. Apart from underlying overall fundamentals, ability of a nation to attract foreign investment essentially depends upon its policy regime - whether it promotes or restrains the foreign investment flows.

This section undertakes a review of India's FDI policy framework. There has been a sea change in India's approach to foreign investment from the early 1990s when it began structural economic reforms about almost all the sectors of the economy.

a) Pre-Liberalisation Period:

Historically, India had followed an extremely careful and selective approach while formulating FDI policy in view of the governance of „import-substitution strategy" of industrialisation. The regulatory framework was consolidated through the enactment of Foreign Exchange Regulation Act (FERA), 1973 wherein foreign equity holding in a joint venture was allowed only up to 40 per cent. Subsequently, various exemptions were extended to foreign companies engaged in export oriented businesses and high technology and high priority areas including allowing equity holdings of over 40 per cent. Moreover, drawing from successes of other country experiences in Asia, Government not only established special economic zones (SEZs) but also designed liberal policy and provided incentives for promoting FDI in these zones with a view to promote exports.

The announcements of Industrial Policy (1980 and 1982) and Technology Policy (1983) provided for a liberal attitude towards foreign investments in terms of changes in policy directions. The policy was characterised by de-licensing of some of the industrial rules and promotion of Indian manufacturing exports as well as emphasising on modernisation of industries through liberalised imports of capital goods and technology. This was supported by trade liberalisation measures in the form of tariff reduction and shifting of large number of items from import licensing to Open General Licensing (OGL).

b) Post-Liberalisation Period:

A major shift occurred when India embarked upon economic liberalisation and reforms program in 1991 aiming to raise its growth potential and integrating with the world economy. Industrial policy reforms slowly but surely removed restrictions on investment projects and business expansion on the one hand and allowed increased access to foreign technology and funding on the other. A series of measures that were directed towards liberalizing foreign investment included:

1) Introduction of dual route of approval of FDI–RBI‟s automatic route and Government's approval (SIA/FIPB) route.

2) Automatic permission for technology agreements in high priority industries and removal of restriction of FDI in low technology areas as well as liberalisation of technology imports.

3) Permission to Non-resident Indians (NRIs) and Overseas Corporate Bodies (OCBs) to invest up to 100 per cent in high priorities sectors.

4) Hike in the foreign equity participation limits to 51 per cent for existing companies and liberalisation of the use of foreign "brands name".

5) Signing the Convention of Multilateral Investment Guarantee Agency (MIGA) for protection of foreign Investments.

These efforts were boosted by the enactment of Foreign Exchange Management Act (FEMA), 1999 [that replaced the Foreign Exchange Regulation Act (FERA), 1973] which was less stringent. In 1997, Indian Government allowed 100% FDI in cash and carry wholesale and FDI in single brand retailing was allowed 51% in June, 2006. After a long debate, further amendment was made in December, 2012 which led FDI to 100% in single brand retailing and 51% in multiple brand retailing.

IV. OBJECTIVES AND METHODOLOGY

A. Research Objectives :

- To discuss the FDI policy framework in India.
- To identify the various determinants of FDI.
- To understand the need for FDI in India.
- To Study the trends of FDI Flow in India during 2000-01 to 2014-15 (up to June, 2015).
- To analysis the FDI flows as to identify country wise approvals of FDI inflows to India.
- To analysis sector wise inflow of FDI in India.
- To identify the problems relating to low inflow of FDI and to make suitable suggestions for attracting more FDI inflow to India.

B. RESEARCH METHODOLOGY :

- **Type of research: -** Quantitative & Analytical Research.
- **Data: -** Data of Manufacturing, Services & Construction, Real estate, mining sectors etc. from year April 2000 to June 2015 is considered for the study.
- **Data Collection Method: -** Secondary data from different web sites & reports of RBI, CEDAR-USIBC report on FDI, reports of Asian development bank.
- **Sources of data collection: -**

The study is based on published sources of data collected from various sources. The data was extracted from the following sources:

- Handbook of Statistics on the Indian economy, RBI.
- Economic Survey, Government of India.
- Department of Industrial Policy and Promotion (DIPP).
- Secretariat of Industrial Assistance (SIA).
- Central Statistical Organization (CSO).

This research is a descriptive study in nature. The secondary data was collected from various journals, magazines, and websites particularly from the Department of Industrial Policy & Promotion, Ministry of Commerce and Industry, India stat etc. Simple percentages have been used to defect the growth rate of India. Graphs and tables have also been used where ever required to depict statistical data of FDI during the study period. The time period of the study has been taken from the April 2000 to June 2015.

CURRENT STATUS OF FDI IN INDIA RETAIL SECTOR:-

As of June 2015, the Government of India allowed FDI in single and multi brand retailing along with the following conditions:-

1) Up to 100% FDI in single brand retail trading.

- By only one non-resident entity whether owner or the brand or otherwise.
- 30% domestic sourcing requirement eased to preferable sourcing rather than compulsory.
- Further clarification on FDI companies that cannot engage in B2C e-commerce.
- Products to be sold should be of a "single brand". Product should be sold under the same brand internationally.
- "Single brand" product retailing would cover only products, which are branded during manufacturing.

2) Up to 51% FDI in multi brand retail trading.

- At least 100 million US$ must be invested into Indian company.
- At least 50% of the total FDI is to be invested in back end infrastructure within 3 years.
- At least 30% of the value of procurement of processed product shall be sourced from Indian small industry.
- Fresh agriculture produce is permitted to be sold unbranded.
- Indian states have been given the discretion to accept of refuse the implementation of FDI.
- Retail outlets can be set up in cities having population of at least 1 million.
- Application needs to be approved by two levels at Department of Industrial Policy and Promotion and Foreign Investment Promotion Board.

CURRENT STATUS OF FDI IN INDIA SERVICE SECTOR:-

FDI plays a major role in the dynamic growth of the service sector. The service sector in India has tremendous growth potential and as a result it attracts huge FDI.

- The Computer Software and Hardware enjoy the permission of 100% FDI under automatic route.
- The limit of FDI in Telecom sector was increased from 49% to 74%. FDI up to 49% is permissible under automatic route but FDI in the licensee company/Indian promoters including their holding companies shall require approval of FIPB.

PROBLEMS FOR LOW FDI FLOW TO INDIA:-

India, the largest democratic country with the second largest population in the world, with rule of law and a highly educated English speaking work force, the country is considered as a safe haven for foreign investors.

Yet, India seems to be suffering from a host of self-imposed restrictions and problems regarding opening its markets completely too global investors by implementing full scale economic reforms. Some of the major impediments for India's poor performance in the area of FDI are: political instability, poor infrastructure, confusing tax and tariff policies, Draconian labour laws, well entrenched corruption and governmental regulations.

1. Lack of adequate infrastructure:

It is cited as a major hurdle for FDI inflows into India. This bottleneck in the form of poor infrastructure discourages foreign investors in investing in India. India's age old and biggest infrastructure problem is the supply of electricity. Power cuts are considered as a common problem and many industries are forced to close their business.

2. Stringent labor laws:

Large firms in India are not allowed to retrench or layoff any workers, or close down the unit without the permission of the state government. These laws protect the workers and thwart legitimate attempts to restructure business. To retrench unnecessary workers, firms require approval from both employees and state governments-approval that is rarely given. Further, Trade Unions extort huge sums from companies through over-generous voluntary retirement schemes.

3. Corruption:

Corruption is found in nearly every public service, from defense to distribution of subsidized food to the poor people, to the generation and transmission of electric power. The combination of legal hurdles, lack of institutional reforms, bureaucratic decision-making and the allegations of corruption at the top have turned foreign investors away from India.

4. Lack of decision making authority with the state governments:

The reform process of liberalizing the economy is concentrated mainly in the Centre and the State Governments are not given much power. In most key infrastructure areas, the central government remains in control. Brazil, China, and Russia are examples where regional governments take the lead in pushing reforms and prompting further actions by the central government.

5. Limited scale of export processing zones:

India's export processing zones have lacked dynamism because of several reasons, such as their relatively limited scale; the Government's general ambivalence about attracting FDI; the unclear and changing incentive packages attached to the zones; and the power of the central government in the regulation of the zones. India which established its first Export Processing Zone (EPZ) in 1965 has failed to develop the zones when compared to China which took initiative for establishment only in 1980.

6. High corporate tax rates:

Corporate tax rates in East Asia are generally in the range of 15 to 30 percent, compared with a rate of 48 percent for foreign companies in India. High corporate tax rate is definitely a major disincentive to foreign corporate investment in India.

7. Indecisive government and political instability:

There were too many anomalies on the government side during past two decades and they are still affecting the direct inflow of FDI in India such as mismanagement and oppression by the different company, which affect the image of the country and also deject the prospective investor, who is very much conscious about safety and constant return on their investment.

DETERMINANTS OF FDI:-

The determinant varies from one country to another due their unique characteristics and opportunities for the potential investors. In specific the determinants of FDI in India are:

1) Stable policies:

India stable economic and socio policies have attracted investors across border. Investors prefer countries which stable economic policies. If the government makes changes in policies which will have effect on the business. The business requires a lot of funds to be deployed and any change in policy against the investor will have a negative effect.

2) Economic factors:

Different economic factors encourage inward FDI. These include interest loans, tax breaks, grants, subsidies and the removal of restrictions and limitation. The government of India has given many tax exemption and subsidies to the foreign investors who would help in developing the economy.

3) Cheap and labour:

There is abundant labour available in India in terms of skilled and unskilled human resources. Foreign investors will to take advantage of the difference in the cost of labour as we have cheap and skilled labours. Example: Foreign firms have invested in BPO's in India which require skilled labour and we have been providing the same.

4) Basic infrastructure:

India though is a developing country, it has developed special economic zone where there have focused to build required infrastructure such as roads, effective transportation and registered carrier departure worldwide, Information and communication network/technology, powers, financial institutions, and legal system and other basic amenities which are must for the success of the business.

A sound legal system and modern infrastructure supporting an efficient distribution of goods and services in the host country.

5) Unexplored markets:

In India there is large scope for the investors because there is a large section of markets have not explored or unutilized. In India there is enormous potential customer market with large middle class income group who would be target group for new markets.

Example: BPO was one sector where the investors had large scope exploring the markets where the service was provided with just a call, with almost customer satisfaction.

6) Availability of natural resources:

As we that India has large volume of natural resources such as coal, iron ore, Natural gas etc. If natural resources are available they can be used in production process or for extraction of mines by the foreign investors.

V. NEED FOR FDI IN INDIA

As India is a developing country, capital has been one of the scare resources that are usually required for economic development. Capital is limited and there are many issues such as Health, poverty, employment, education, research and development, technology obsolesce, global competition.

The flow of FDI in India from across the world will help in acquiring the funds at cheaper cost, better technology, employment generation, and upgraded technology transfer, scope for more trade, linkages and spillovers to domestic firms. The following arguments are advanced in favour of foreign capital.

1) Sustaining a high level of investment:

As all the under-developed and the developing countries want to industrialize and develop themselves, therefore it becomes necessary to raise the level to investment substantially. Due to poverty and low GDP the saving are low. Therefore there is a need to fill the gap between income and savings through foreign direct investments.

2) Technological gap:

In Indian scenario we need technical assistance from foreign source for provision if expert services, training of Indian personnel and educational, research and training institutions in the industry. It only comes through private foreign investment or foreign collaborations.

3) Exploitation of natural resources:

In India we have abundant natural resources such as coal, iron and steel but to extract the resources we require foreign collaboration.

4) Understanding the initial risk:

In developing countries as capital is a scare resource, the risk of investments in new ventures or projects for industrialization is high. Therefore foreign capital helps in these investments which require high risk.

5) Development of basic economic infrastructure:

In the recent years foreign financial institutions and government of advanced countries have made substantial capital available to the under developed countries. FDI will help in developing the infrastructure by establishing firm's different parts of the country.

There are special economic zones which have been developed by government for improvising the industrial growth.

6) Improvement in the balance of payments position:

The inflow FDI will help in improving the balance of payment. Firms which feel that the goods produced in India will have a low cost, will produce the goods and export the same to other country. This helps in increasing the exports.

7) Foreign firm's helps in increasing the competition:

Foreign firms have always come up with better technology, process, and innovations comparing with the domestic firms. They develop a completion in which the domestic firms will perform better it survive in the market.

VI. DATA ANALYSIS AND INTERPRETATION

Fact sheet on foreign direct investment (FDI)

Table No. 1
Total FDI Inflows
(From April, 2000 to June, 2015):-

1	**CUMULATIVE AMOUNT OF FDI INFLOWS** **(Equity inflows + 'Re-invested earnings' +'Other capital'**)	-	**US$** **380,215** **Million**
2	**CUMULATIVE AMOUNT OF FDI EQUITY INFLOWS** **(excluding,** amount remitted through RBI's NRI Schemes)	Rs. **1,293,303** Crore	**US$** **258,020** **Million**

Source: FDI Statistics, Department of Industrial Policy& Promotion, Ministry of Commerce & Industry, Government of India, 2015.

Table 1 shows the amount of FDI inflows from April, 2000 to June, 2015. It shows the cumulative amount of FDI Inflows both in terms of Crore and in US $ million.

Point 1 shows the sum of equity inflows, reinvested earnings and other capital. Cumulative amount of inflows are 380,215 in US $ million. Other than this, cumulative FDI equity inflows which excludes amount remitted through RBI's-NRI schemes are 1,293,303 in Crore and 258,020 in US $ million.

Table No. 2
FDI Inflows during Financial Year
2015-16 (June, 2015):-

1.	**TOTAL FDI INFLOWS INTO INDIA** **(Equity inflows + 'Re-invested earnings' + 'Other capital')** (As per RBI's Monthly bulletin dated: 10.08.2015).	-	**US$** **2,929** **Million**
2.	**FDI EQUITY INFLOWS**	Rs. **13,115** Crore	**US$** **2,054** **Million**

m

Source: FDI Statistics, Department of Industrial Policy& Promotion, Ministry of Commerce & Industry, Government of India, 2015.

Table 2 shows the amount of FDI inflows during the Financial Year, 2015(June). It shows the total amount of FDI Inflows both in terms of Crore and in US $ million.

Point 1 shows the sum of equity inflows, reinvested earnings and other capital. Total amount of inflows are 2,929 in US $ million. Point 2 shows the FDI equity inflows amounted 13,115 in Crore and 2,054 in US $ million.

Table No. 3
FDI Equity Inflows (Month-wise) during the Financial Year 2015-16:-

Financial Year 2015-16 (April-March)		*Amount of FDI Equity inflows (In Rs. Crore)*	*(In US$ mn)*
1.	**April, 2015**	**22,620**	**3,605**
2.	**May, 2015**	**24,564**	**3,850**
3.	**June, 2015**	**13,115**	**2,054**
2015-16 (from April, 2015 to June, 2015)		**60,299**	**9,508**
2014-15 (from April, 2014 to June, 2014)		**43,171**	**7,235**
%age growth over last year		**(+) 40 %**	**(+) 31%**

Source: FDI Statistics, Department of Industrial Policy& Promotion, Ministry of Commerce & Industry, Government of India, 2015.

The above Table 3 shows the amount of FDI inflows during Financial Year from April, 2015 to March, 2016 (up to June, 2015). It shows the amount in Rs Crore and in US $ mn. The highest FDI inflows in the country is in the month of May 2015 i.e. 24,564 in Rs Crore and 3,850 in US $ mn. Followed by April, 2015 and June, 2015 with inflows 22,620 in Rs. Crore (3,605 in US$ mn) and 13,115 in Rs. Crore (2,045 in US$ mn) respectively. It can also be observed that there is 40% growth over last year.

Table No. 4
FDI Equity Inflows (Month-wise) during the Calendar Year 2015:

Calendar Year 2015 (Jan.-Dec.)		*Amount of FDI Equity inflows (In Rs. Crore)*	*(In US$ mn)*
1.	**January, 2015**	**27,880**	**4,481**
2.	**February, 2015**	**20,397**	**3,288**
3.	**March, 2015**	**13,221**	**2,117**
4.	**April, 2015**	**22,620**	**3,605**
5.	**May, 2015**	**24,564**	**3,850**
6.	**June, 2015**	**13,115**	**2,054**
Year 2015 (up to June, 2015) #		**121,797**	**19,394**
Year 2014 (up to June, 2014) #		**90,876**	**14,975**
%age growth over last year		**(+) 34 %**	**(+) 30%**

Source: FDI Statistics, Department of Industrial Policy& Promotion, Ministry of Commerce & Industry, Government of India, 2015.

The above Table 4 shows the amount of FDI inflows during the Calendar Year January, 2015 to December, 2015(up to June, 2015). It shows the amount in Rs Crore and in US $ mn. The highest FDI inflows in the country is in the month January 2015 i.e. 27,880 in Rs

Crore and 4,481 in US $ mn. Month like January 2014 have 13,589 in Rs Crore and 2,189 in US $ mn. Comparing both we can observe that there is 34% growth in FDI inflow.

Table No. 5
Share of Top Investing Countries FDI Equity Inflows (Financial Years):-

Amount Rupees in Crores (US$ in millions)

Ranks	*Country*	*2013-14 (April - March)*	*2014-15 (April – March)*	*2015-16 (April,15 – June, 15)*	*Cumulative Inflows (April '00 - June '15)*	*%age to total Inflows (in terms of US $)*
1.	**MAURITIUS**	29,360 **(4,859)**	55,172 **(9,030)**	**13,236 (2,089)**	**438,892 (89,644)**	**35 %**
2.	**SINGAPORE**	35,625 **(5,985)**	41,350 **(6,742)**	**23,320 (3,673)**	**190,477 (35,861)**	**14 %**
3.	**U.K.**	20,426 **(3,215)**	8,769 **(1,447)**	**755 (119)**	**110,409 (22,329)**	**9 %**
4.	**JAPAN**	10,550 **(1,718)**	12,752 **(2,084)**	**2,916 (459)**	**96,312 (18,811)**	**7 %**
5.	**NETHERLANDS**	13,920 **(2,270)**	20,960 **(3,436)**	**4,123 (652)**	**81,381 (15,323)**	**6 %**
6.	**U.S.A.**	4,807 **(806)**	11,150 **(1,824)**	**3,959 (627)**	**70,839 (14,378)**	**6 %**
7.	**GERMANY**	6,093 **(1,038)**	6,904 **(1,125)**	**3,497 (554)**	**42,007 (8,198)**	**3 %**
8.	**CYPRUS**	3,401 **(557)**	3,634 **(598)**	**608 (96)**	**39,971 (8,140)**	**3 %**
9	**FRANCE**	1,842 **(305)**	3,881 **(635**)	**877 (138)**	**23,465 (4,651)**	**2 %**
10.	**SWITZERLAND**	2,084 **(341)**	**2,066 (337)**	**598 (94)**	**15,812 (3,139)**	**1 %**
TOTAL FDI INFLOWS FROM ALL COUNTRIES *		**147,518 (24,299)**	**189,107 (30,931)**	**60,298 (9,508)**	**1,293,836 (258,141)**	-

Source: FDI Statistics, Department of Industrial Policy& Promotion, Ministry of Commerce & Industry, Government of India, 2015.

The above Table No.5 depicts the country having the highest FDI in India. The report shows that the MAURITIUS country has the highest foreign investor in India with 34%. After Mauritius, Singapore and U.K. invest the highest FDI in India with 14% and 9% respectively. Japan also gets 4th position with 7% FDI in India.

Table No. 6
SECTORS ATTRACTING HIGHEST FDI EQUITY INFLOWS:

Amount in Rs. Crores (US$ in millions)

Ranks	*Sector*	*2013-14 (April - March)*	*2014-15 (April-March)*	*2015-16 (April,15 – June, 15)*	*Cumulative Inflows (April '00 - June '15)*	*% age to total Inflows (In terms of US$)*
1.	**SERVICES SECTOR**	13,294 **(2,225)**	19,963 **(3,253)**	**4,036 (636)**	**209,578 43,350)**	**17 %**
2.	**CONSTRUCTION DEVELOPMENT: TOWNSHIPS, HOUSING, BUILT-UP INFRASTRUCTURE**	7,508 **(1,226)**	4,582 **(758)**	**216 (34)**	**113,355 (24,098)**	**9 %**
3.	**COMPUTER SOFTWARE & HARDWARE**	6,896 **(1,126)**	13,564 **(2,200)**	**16,245 (2,556)**	**89,481 (17,575)**	**7 %**
4.	**TELECOMMUNICATIONS** (radio paging, cellular mobile, basic telephone services)	7,987 **(1,307)**	17,372 **(2,895)**	**2,517 (395)**	**86,609 (17,453)**	**7 %**
5.	**AUTOMOBILE INDUSTRY**	9,027 **(1,517)**	15,794 **(2,570)**	**6,914 (1,094)**	**70,906 (13,477)**	**5 %**
6.	**DRUGS & PHARMACEUTICALS**	7,191 **(1,279)**	9,211 **(1,523)**	**1,370 (215)**	**66,652 (13,336)**	**5 %**
7.	**CHEMICALS (OTHER THAN FERTILIZERS)**	4,738 **(878)**	4,077 **(669)**	**1,598 (251)**	**50,909 (10,588)**	**4 %**
8.	**POWER**	6,519 **(1,066)**	3,985 **(657)**	**1,717 (271)**	**48,357 (9,828)**	**4 %**
9.	**TRADING**	8,191 **(1,343)**	16,962 **(2,761)**	**5,679 (897)**	**49,479 (8,958)**	**4 %**
10	**METALLURGICAL INDUSTRIES**	3,436 **(568)**	2,897 **(472)**	**845 (133)**	**41,992 (8,680)**	**3 %**

Source: FDI Statistics, Department of Industrial Policy& Promotion, Ministry of Commerce & Industry, Government of India, 2015.

The above Table No.6 depicts the sector having the highest FDI equity inflow in India. The report shows that Service sector has the highest FDI Equity inflow 17%, followed by Construction development, Computer Software and Hardware, Telecommunication, Automobile Industry sector having 9%, 7%, 7%, and 5% respectively.

Other sectors like Drugs and Pharmaceuticals carries 5% and Chemicals, Power, Trading Industries carries 4% FDI inflow each , whereas the least is of Metallurgical industries – 3%.

Table No. 7
FINANCIAL YEAR-WISE FDI INFLOWS DATA:

I. **As per International Best Practices**

Amount in (US$ in millions)

S. No.	*Financial Year (April-March)*	*FOREIGN DIRECT INVESTMENT (FDI)*						*Investment by FII's*
		Equity		*Re-invested earnings +*	*Other capital +*	*FDI FLOWS INTO INDIA*		
		RBI's Automatic Route/ Acquisition Route	*capital of unincorporated bodies*			*Total FDI Flows*	*%age growth over previous year (in US$ terms)*	*Foreign Institutional Investors Fund (net)*
FINANCIAL YEARS 2000-01 to 2015-16 (up to JUNE, 2015)								
1.	**2000-01**	2,339	61	1,350	279	**4,029**	-	**1,847**
2.	**2001-02**	3,904	191	1,645	390	**6,130**	**(+) 52 %**	**1,505**
3.	**2002-03**	2,574	190	1,833	438	**5,035**	**(-) 18 %**	**377**
4.	**2003-04**	2,197	32	1,460	633	**4,322**	**(-) 14 %**	**10,918**
5.	**2004-05**	3,250	528	1,904	369	**6,051**	**(+) 40 %**	**8,686**
6.	**2005-06**	5,540	435	2,760	226	**8,961**	**(+) 48 %**	**9,926**
7.	**2006-07**	15,585	896	5,828	517	**22,826**	**(+) 155 %**	**3,225**
8.	**2007-08**	24,573	2,291	7,679	300	**34,843**	**(+) 53 %**	**20,328**
9.	**2008-09**	31,364	702	9,030	777	**41,873**	**(+) 20 %**	**(-) 15,017**
10.	**2009-10**	25,606	1,540	8,668	1,931	**37,745**	**(-) 10 %**	**29,048**
11.	**2010-11 (P)**	21,376	874	11,939	658	**34,847**	**(-) 08 %**	**29,422**
12.	**2011-12 (P)**	34,833	1,022	8,206	2,495	**46,556**	**(+) 34 %**	**16,812**
13.	**2012-13 (P)**	21,825	1,059	9,880	1,534	**34,298**	**(-) 26%**	**27,582**
14	**2013-14 (P)**	24,299	975	8,978	1,794	**36,046**	**(+) 5%**	**5,009**
15.	**2014-15 (P)**	30,933	952	8,983	3,423	**44,291**	**(+) 23%**	**40,923**
16.	**2015-16 (P) (Apr - June 2015)**	**9,508**	**223**	**2,059**	**572**	**12,362**		**(-) 1,642**
CUMULATIVE TOTAL (from April, 2000 to June, 2015)		**259,706**	**11,971**	**92,202**	**16,336**	**380,215**	-	**188,949**

Source: ***RBI's Bulletin July, 2015 dt.10.08.2015 (Table No. 34 – FOREIGN INVESTMENT INFLOWS).***

Table No. 8

II. **DIPP's – Financial Year-wise FDI Equity Inflows:**

(As per DIPP's FDI data base – equity capital components only):

S. No.	*Financial Year (April – March)*	*Amount of FDI Inflows*		*%age growth over previous year (in terms of US $)*
FINANCIAL YEARS 2000-01 to 2015-16 (up to June, 2015)		*In Rs Crores*	*In US$ million*	
1.	**2000-01**	10,733	**2,463**	-
2.	**2001-02**	18,654	**4,065**	**(+) 65 %**
3.	**2002-03**	12,871	**2,705**	**(-) 33 %**
4.	**2003-04**	10,064	**2,188**	**(-) 19 %**

5.	**2004-05**	14,653	**3,219**	**(+) 47 %**
	2005-06	24,584	**5,540**	**(+) 72 %**
7.	**2006-07**	56,390	**12,492**	**(+)125 %**
8.	**2007-08**	98,642	**24,575**	**(+) 97 %**
9.	**2008-09**	142,829	**31,396**	**(+) 28 %**
10.	**2009-10**	123,120	**25,834**	**(-) 18 %**
11.	**2010-11**	97,320	**21,383**	**(-) 17 %**
12.	**2011-12**	165,146	**35,121**	**(+) 64 %**
13.	**2012-13**	121,907	**22,423**	**(-) 36 %**
14.	**2013-14**	147,518	**24,299**	**(+) 8%**
15.	**2014-15**	189,107	**30,931**	**(+) 27%**
16.	**2015-16 (Apr - June 2015)**	**60,298**	**9,508**	
CUMULATIVE TOTAL (from April, 2000 to June, 2015)		**1,293,836**	**258,142**	**-**

Source: ***RBI's Bulletin July, 2015 dt.10.08.2015 (Table No. 34 – FOREIGN INVESTMENT INFLOWS).***

The above Table No. 8 shows the total amount of FDI inflows in India during the last 15 years i.e. 2000 to 2015. The FDI inflow from 2000-2001 i.e. 10,733 Crore Rs. in 2001-02 it was 18,654 Crore rupees.

It shows the Good result in the FDI inflows in India. Little bit ups and downs in FDI inflows up to 2005-06, but after that great hike in the year 2007-08 i.e. 98,642crore rupees as compare to earlier years.

In 2008-2009 there was a huge investment in FDI in 142,829 Crore Rupees and so on. But again there were some fluctuations in inflow of FDI in the years between 2010-2014,soon giving the highest figures in last 15 years 1,89,107 Crore Rupees FDI in 2014-2015 So we can say that the foreign investment have been on rise in India. Currently the inflow of FDI from April, 2015 to June, 2015 figures 60,298.

Table No. 9

III. RBI'S REGIONAL OFFICES (WITH STATE COVERED)
RECEIVED FDI EQUITY INFLOWS

(From April, 2000 to June, 2015)

Amount Rupees in Crores (US$ in millions)

S. No.	***RBI's - Regional Office[2]***	***State covered***	***2013-14 (April - March)***	***2014-15 (April - March)***	***2015-16 (April,15 – June, 15)***	***Cumulative Inflows (April '00 - June '15)***	***%age to total Inflows (in terms of US$)***
1	MUMBAI	**MAHARASHTRA, DADRA & NAGAR HAVELI, DAMAN & DIU**	20,595 **(3,420)**	38,933 **(6,361)**	12,538 **(1,979)**	365,560 **(75,097)**	29
2	NEW DELHI	**DELHI, PART OF UP AND HARYANA**	38,190 **(6,242)**	42,252 **(6,875)**	19,892 **(3,128)**	268,915 **(52,539)**	20
3	CHENNAI	**TAMIL NADU, PONDICHERRY**	12,595 **(2,116)**	23,361 **(3,818)**	5,828 **(924)**	94,595 **(17,938)**	7
4	BANGALORE	**KARNATAKA**	11,422 **(1,892)**	21,255 **(3,444)**	8,447 **(1,336)**	90,569 **(17,456)**	7
5	AHMEDABAD	**GUJARAT**	5,282 **(860)**	9,416 **(1,531)**	4,732 **(745)**	58,529 **(11,786)**	5
6	HYDERABAD	**ANDHRA PRADESH**	4,024 **(678)**	8,326 **(1,369)**	2,681 **(422)**	51,921 **(10,437)**	4
7	KOLKATA	**WEST BENGAL, SIKKIM, ANDAMAN & NICOBAR ISLANDS**	2,659 **(436)**	1,464 **(239)**	689 **(108)**	15,316 **(3,089)**	1
8	CHANDIGARH`	**CHANDIGARH,**	562	234	91	6,452	1

		PUNJAB, HARYANA, HIMACHAL PRADESH	**(91)**	**(39)**	**(14)**	**(1,345)**	
9	JAIPUR	**RAJASTHAN**	233 **(38)**	3,237 **(541)**	109 **(17)**	6,904 (1,281**)**	1
10.	BHOPAL	**MADHYA PRADESH, CHATTISGARH**	708 **(119)**	601 **(100)**	9 **(2)**	6,105 (1,217**)**	1
11	KOCHI	**KERALA, LAKSHADWEEP**	411 **(70)**	1,418 **(230)**	35 **(6)**	6,186 (1,216**)**	1
12	PANAJI	**GOA**	103 **(17)**	211 **(35)**	81 **(13)**	3,949 **(836)**	0.3
13	KANPUR	**UTTAR PRADESH, UTTRANCHAL**	150 **(25)**	679 **(110)**	137 **(22)**	2,581 **(504)**	0.2
14	BHUBANESHWAR	**ORISSA**	288 **(48)**	56 **(9)**	3 **(0.4)**	1,964 **(398)**	0.2
15	GUWAHATI	**ASSAM, ARUNACHAL PRADESH, MANIPUR, MEGHALAYA, MIZORAM, NAGALAND, TRIPURA**	4 **(0.6)**	29 **(5)**	37 **(6**	418 **(89)**	0.03
16	PATNA	**BIHAR, JHARKHAND**	9 **(1)**	68 **(11)**	234 **(37)**	501 **(87)**	0.03
17	JAMMU	**JAMMU & KASHMIR**	1 **(0.2)**	25 **(4)**	**0.00 (0.00)**	26 (4)	0.00
18	REGION NOT INDICATED		50,283 **(8,245)**	37,544 **(6,211)**	4,754 **(**750**)**	312,814 (62,700**)**	24
SUB. TOTAL			**147,518 (24,299)**	**189,107 (30,931)**	**60,298 (9,508)**	**1,293,303 (258,020)**	
19	**RBI'S-NRI SCHEMES *(from 2000 to 2002)***		0	0	0	533 **(121)**	-
GRAND TOTAL			**147,518 (24,299)**	**189,107 (30,931)**	**60,298 (9,508))**	**1,293,836 (258,141)**	-

The above table represents region-wise FDI equity inflows from 2000-15 both in terms of ` Crore and US $ million. Table shows that Mumbai has registered largest FDI inflow (365,560 Crore) amounting to 29% of total inflow received in last 15 years. New Delhi is the second preferred region for FDI inflow (268,915 Crore) with 20% of total inflows received in last 15 years. This is due to good quality infrastructure and better quality of life provided in these cities.

Other regions like Bangalore (90,569 Crore), Chennai (94,595 Crore), Ahmedabad (58,529 Crore), Hyderabad (51,921 Crore) have also recorded FDI with 7%, 7%, 5% and 4% of total FDI in the country respectively.

Bangalore is the primary destination for property investment and the city has riding high on the Information Technology (IT). Other regions like Kolkata (15,316 Crore), Chandigarh (6,452 Crore), Jaipur (6,904 Crore) and Bhopal (6,105 Crore) have been able to attract very less FDI because they lack in infrastructure and information technology (IT) developments.

Sectors like service, construction developments, telecommunications and computer software & hardware have been registering highest FDI inflows in India. Therefore, Mumbai, New Delhi, Bangalore and Chennai are the favourite destinations for FDI in India.

Table No. 10
Statement on Country-wise FDI Equity Inflows
From April 2000 to June 2015

Sr. No.	*Name of the Country*	*Amount of Foreign Direct Investment Inflows*		*%age with Inflows*
		(In Rs Crore)	*(In US$ million)*	
1.	Mauritius	438,892.83	89,644.04	34.74
2.	Singapore	190,477.19	35,860.84	13.90
3.	United Kingdom	110,409.19	22,329.12	8.65
4.	Japan	96,312.05	18,811.08	7.29
5.	Netherlands	81,381.00	15,323.43	5.94
6.	U.S.A	70,838.85	14,377.97	5.57
7.	Germany	42,006.79	8,197.45	3.18
8.	Cyprus	39,971.34	8,139.55	3.15
9.	France	23,464.77	4,651.30	1.80
10.	Switzerland	15,812.31	3,138.47	1.22
11.	UAE	15,633.58	3,125.58	1.21
12.	Spain	10,938.49	2,115.93	0.82
13.	Italy	8,207.00	1,651.98	0.64
14.	South Korea	8,097.50	1,602.61	0.62
15.	Hong Kong	7,970.71	1,557.56	0.60
16.	Luxembourg	7,345.75	1,306.38	0.51
17.	Cayman Islands	5,861.47	1,214.92	0.47
18.	China	6,941.05	1,160.64	0.45
19.	Sweden	5,342.40	1,103.84	0.43
20.	Russia	5,874.87	1,070.57	0.41
21.	British Virginia	3,993.91	858.89	0.33
22.	Belgium	4,255.84	814.58	0.32
23.	Malaysia	3,894.87	744.14	0.29
24.	Australia	3,463.02	695.21	0.27
25.	Indonesia	2,902.07	623.09	0.24
26.	Poland	3,300.58	619.56	0.24
27.	Canada	2,776.75	559.60	0.22
28.	The Bermudas	2,252.20	502.07	0.19

29.	Denmark	2,085.54	417.37	0.16
30.	Oman	1,797.55	380.15	0.15
31.	Finland	1,799.71	354.10	0.14
32.	Ireland	1,759.34	332.37	0.13
33.	South Africa	1,537.33	290.01	0.11
34.	Austria	1,292.03	252.68	0.10
35.	Thailand	1,105.29	207.27	0.08
36.	Seychelles	1,107.50	183.69	0.07
37.	Norway	941.15	181.16	0.07
38.	Chile	710.49	150.23	0.06
39.	Morocco	654.96	137.85	0.05
40.	Philippines	765.53	129.03	0.05
41.	Turkey	696.10	127.70	0.05
42.	British Isles	463.88	100.65	0.04

Sr.No	***Name of the Country***	***Amount of Foreign Direct Investment Inflows***		***%age with Inflows***
		(In Rs Crore)	***(In US$ million)***	
43.	Taiwan	512.88	99.78	0.04
44.	Israel	445.28	87.02	0.03
45.	Mexico	438.76	80.08	0.03
46.	West Indies	348.17	78.28	0.03
47.	Saudi Arabia	300.70	58.13	0.02
48.	St. Vincent	277.61	53.44	0.02
49.	New Zealand	266.11	52.01	0.02
50.	Virgin Islands(US)	278.61	50.73	0.02
51.	Bahrain	275.46	52.86	0.02
52.	Panama	204.45	43.69	0.02

53.	Bahamas	190.35	38.66	0.01
54.	Sri Lanka	189.72	37.71	0.01
55.	Korea(North)	188.88	37.22	0.01
56.	Saint Kitts & Nevis	148.66	33.66	0.01
57.	Channel Islands	173.21	31.90	0.01
58.	Portugal	160.21	31.75	0.01
59.	Jordan	159.58	29.30	0.01
60.	Kuwait	143.68	27.96	0.01
61.	Kazakhstan	134.16	26.11	0.01
62.	Brazil	116.68	23.60	0.01
63.	Kenya	102.52	21.75	0.01
64.	Czech Republic	99.97	21.37	0.01
65.	Iceland	93.72	21.14	0.01
66.	Bermuda	127.07	20.31	0.01
67.	Gibraltar	85.36	19.79	0.01
68.	Hungary	90.77	17.23	0.01
69.	Isle of Man	82.23	15.58	0.01
70.	Malta	69.10	14.65	0.01
71.	Liberia	64.54	14.56	0.01
72.	Nigeria	66.39	13.22	0.01
73.	Scotland	73.29	12.83	0.00
74.	Belarus	50.52	12.27	0.00
75.	SAMOA ISLANDS	74.13	11.83	0.00
76.	Argentina	46.35	10.17	0.00
77.	Liechtenstein	47.69	9.49	0.00
78.	Myanmar	35.75	8.96	0.00
79.	Slovenia	40.58	8.49	0.00
80.	Ghana	40.53	7.68	0.00

81.	Romania	37.86	7.01	0.00
82.	Greece	36.07	6.52	0.00
83.	Maldives	26.85	5.84	0.00
84.	Belize	25.68	5.61	0.00
85.	Slovakia	23.89	5.42	0.00
86.	Qatar	28.51	5.16	0.00
87.	Rep. of Fiji Islands	22.30	5.07	0.00
88.	Uruguay	21.38	4.49	0.00

Sr.No	***Name of the Country***	***Amount of Foreign Direct Investment Inflows***		***%age with Inflows***
		(In Rs Crore)	***(In US$ million)***	
89.	Tunisia	19.84	4.31	0.00
90.	Guernsey	23.84	4.30	0.00
91.	Ukraine	21.80	3.81	0.00
92.	Egypt	17.90	3.30	0.00
93.	Colombia	14.18	2.59	0.00
94.	West Africa	12.31	2.47	0.00
95.	Trinidad & Tobago	12.73	2.34	0.00
96.	Nepal	9.71	2.03	0.00
97.	Yemen	7.74	1.87	0.00
98.	Tanzania	8.35	1.74	0.00
99.	Lebanon	9.70	1.67	0.00
100	Monaco	7.49	1.52	0.00
101	SAN MARINO	9.41	1.52	0.00
102	Bulgaria	8.21	1.41	0.00
103	Uganda	5.07	1.10	0.00
104	Cuba	4.73	1.04	0.00
105	Guyana	4.60	1.00	0.00

106	Vanuatu	4.41	0.94	0.00
107	Togolese Republic	4.65	0.86	0.00
108	Botswana	3.79	0.60	0.00
109	Iran	3.30	0.57	0.00
110	Estonia	2.99	0.57	0.00
111	Congo (DR)	2.41	0.54	0.00
112	Croatia	2.29	0.52	0.00
113	Jamaica	2.70	0.50	0.00
114	TAJIKISTAN	2.87	0.46	0.00
115	Vietnam	2.33	0.43	0.00
116	Aruba	1.96	0.43	0.00
117	Anguilla	1.47	0.29	0.00
118	Lithuania	1.84	0.29	0.00
119	Yugoslavia	1.13	0.24	0.00
120	Iraq	1.02	0.22	0.00
121	Zambia	0.88	0.18	0.00
122	Peru	0.82	0.14	0.00
123	Latvia	0.52	0.10	0.00
124	Georgia	0.62	0.10	0.00
125	St. Lucia	0.61	0.10	0.00
126	SURINAME	0.54	0.09	0.00
127	Libya	0.28	0.07	0.00
128	Mongolia	0.27	0.06	0.00
129	Bangladesh	0.31	0.05	0.00
130	Sudan	0.24	0.05	0.00
131	Costa Rica	0.29	0.05	0.00
132	Afghanistan	0.12	0.03	0.00

133	Muscat	0.06	0.01	0.00
134	Venezuela	0.03	0.01	0.00

Sr.No	*Name of the Country*	*Amount of Foreign Direct Investment Inflows*		*%age with Inflows*
		(In Rs Crore)	*(In US$ million)*	
135	Algeria	0.03	0.00	0.00
136	East Africa	0.02	0.00	0.00
137	Cameroon	0.01	0.00	0.00
138	Bolivia	0.01	0.00	0.00
139	Barbados	0.01	0.00	0.00
140	Kyrgyzstan	0.01	0.00	0.00
141	Djibouti	0.00	0.00	0.00
142	Paraguay	0.00	0.00	0.00
143	MOZAMBIQUE	0.00	0.00	0.00
144	SENEGAL	0.00	0.00	0.00
145	Ivory Coast	0.00	0.00	0.00
146	FII's	0.25	0.06	0.00
147	NRI	20,383.66	4,684.25	1.82
148	Country Details Awaited	30,875.37	6,964.32	2.70
Sub Total		**1,293,302.75**	**258,020.10**	
149	RBI'S-NRI SCHEMES (2000-2002)	533.06	121.33	
Grand Total		**1,293,835.81**	**258,141.43**	

Source: ***(i) RBI's Bulletin July, 2015 dt.10.08.2015.***

Table No. 11
STATEMENT ON SECTOR-WISE FDI EQUITY INFLOWS

FROM APRIL, 2000 TO JANUARY, 2015

Sr. No	Sector	Amount of FDI Inflows		%age of Total Inflows
		(In Rs Crore)	(In US$ millions)	
1	Services Sector	201,728.28	42,101.98	17.32
2	Construction Development: Townships, Housing, Built-Up Infrastructure And Construction-Development Projects	112,916.36	24,028.19	9.88
3	Telecommunications	83,697.07	16,994.68	6.99
4	Computer Software & Hardware	67,693.78	14,125.19	5.81
5	Drugs & Pharmaceuticals	63,629.47	12,856.02	5.29
6	Automobile Industry	60,725.08	11,857.11	4.88
7	Chemicals (Other Than Fertilizers)	48,641.77	10,229.69	4.21
8	Power	46,358.87	9,512.02	3.91
9	Metallurgical Industries	40,737.61	8,480.90	3.49
10	Hotel & Tourism	40,198.41	7,774.03	3.20
11	Trading	41,315.28	7,660.73	3.15
12	Petroleum & Natural Gas	31,650.29	6,519.53	2.68
13	Food Processing Industries	36,360.11	6,215.46	2.56
14	Miscellaneous Mechanical & Engineering Industries	20,572.50	3,948.17	1.62
15	Information & Broadcasting (Including Print Media)	19,156.59	3,890.94	1.60
16	Electrical Equipments	18,298.41	3,786.22	1.56
17	Non-Conventional Energy	18,524.21	3,521.78	1.45
18	Industrial Machinery	18,420.29	3,515.67	1.45
19	Cement And Gypsum Products	14,625.29	3,085.60	1.27
20	Construction (Infrastructure) Activities	14,807.38	2,923.64	1.20
21	Hospital & Diagnostic Centers	14,565.34	2,793.72	1.15
22	Consultancy Services	13,908.16	2,786.52	1.15
23	Fermentation Industries	11,347.67	2,137.36	0.88

24	Agriculture Services	8,625.15	1,744.02	0.72
25	Rubber Goods	9,445.03	1,722.64	0.71
26	Mining	8,460.61	1,668.50	0.69
27	Ports	6,730.91	1,637.30	0.67
28	Textiles (Including Dyed, Printed)	7,710.42	1,555.69	0.64
29	Electronics	6,752.74	1,417.42	0.58
30	Sea Transport	6,546.83	1,368.93	0.56
31	Prime Mover (Other Than Electrical Generators)	6,299.78	1,200.92	0.49
32	Education	5,649.81	1,071.50	0.44
33	Paper And Pulp (Including Paper Products)	4,327.04	910.25	0.37
34	Medical And Surgical Appliances	4,608.04	887.09	0.36
35	Soaps, Cosmetics & Toilet Preparations	4,430.06	848.74	0.35
36	Machine Tools	3,511.68	711.51	0.29
37	Ceramics	3,321.89	699.57	0.29

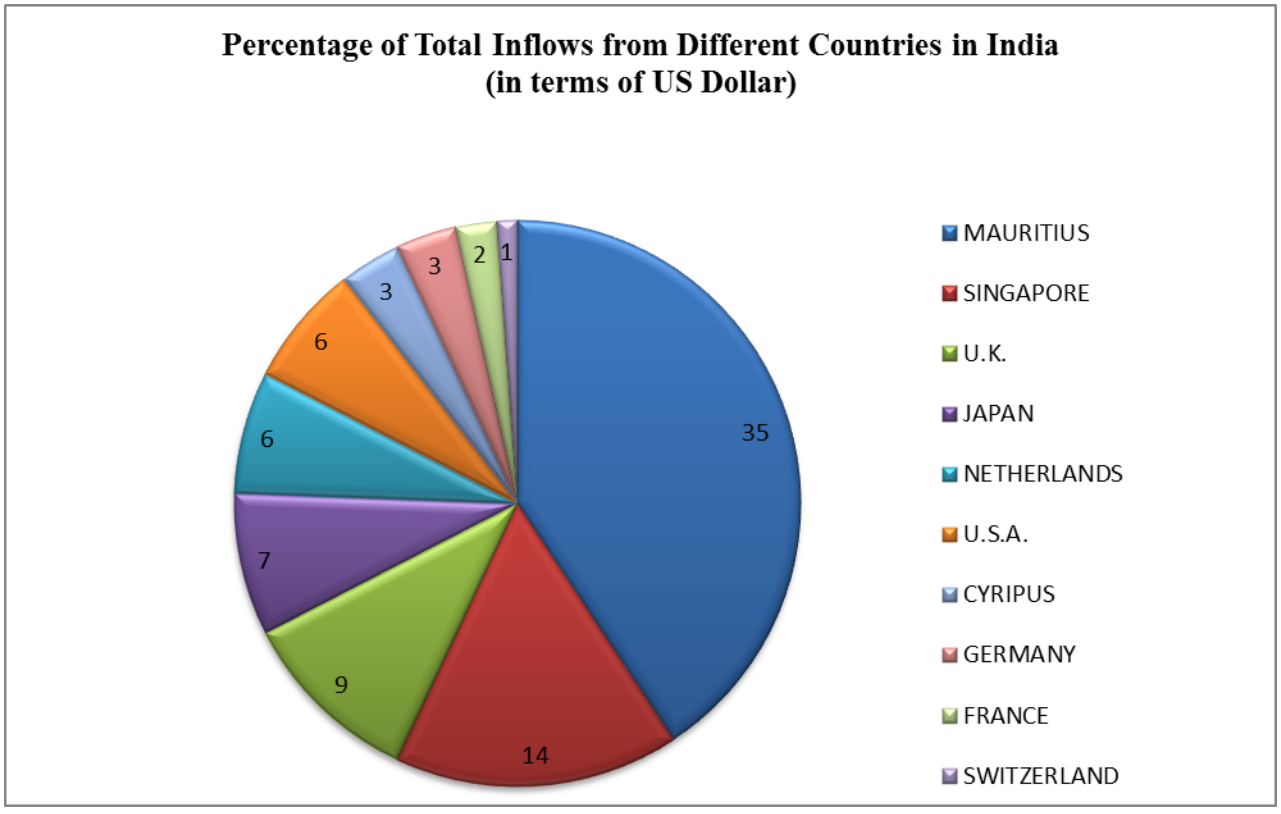
Sr.No	Sector	Amount of FDI Inflows		%age of Total Inflows
		(In Rs Crore)	(In US$ millions)	
38	Railway Related Components	3,425.97	634.20	0.26
39	Diamond, Gold Ornaments	2,904.78	569.14	0.23
40	Air Transport (Including Air Freight)	2,720.46	562.65	0.23
41	Fertilizers	2,915.62	543.14	0.22
42	Vegetable Oils And Vanaspati	2,861.12	541.65	0.22
43	Glass	2,362.19	459.16	0.19
44	Printing Of Books (Including Litho Printing Industry)	2,326.52	446.09	0.18
45	Agricultural Machinery	2,127.62	413.93	0.17
46	Commercial, Office & Household Equipments	1,516.81	309.34	0.13
47	Retail Trading (Single Brand)	1,549.92	275.38	0.11
48	Earth-Moving Machinery	1,138.86	234.81	0.10
49	Scientific Instruments	960.98	171.98	0.07
50	Leather, Leather Goods And Pickers	709.83	137.92	0.06
51	Tea And Coffee (Processing & Warehousing Coffee & Rubber)	497.78	108.41	0.04
52	Timber Products	537.09	101.93	0.04
53	Sugar	405.65	78.07	0.03
54	Dye-Stuffs	417.28	74.38	0.03
55	Photographic Raw Film And Paper	273.76	67.29	0.03
56	Industrial Instruments	310.86	67.11	0.03
57	Boilers And Steam Generating Plants	314.80	63.33	0.03
58	Glue And Gelatin	211.68	37.86	0.02
59	Coal Production	119.19	27.73	0.01
60	Mathematical, Surveying And Drawing Instruments	39.80	7.98	0.00

61	Defense Industries	24.84	5.02	0.00
62	Coir	22.05	4.07	0.00
63	Miscellaneous Industries	42,392.57	8,975.05	3.69
	Sub Total	**1,199,386.19**	**243,106.84**	100
64	**RBI's- NRI Schemes (2000-2002)**	**533.06**	**121.33**	-
	Grand Total	**1,199,919.25**	**243,228.17**	

Source: ***(i) RBI's Bulletin July, 2015 dt.10.08.2015.***

- GRAPHICAL REPRESENTATION OF THE ABOVE TABLES :-

I. Graph 1(Table 5) :-



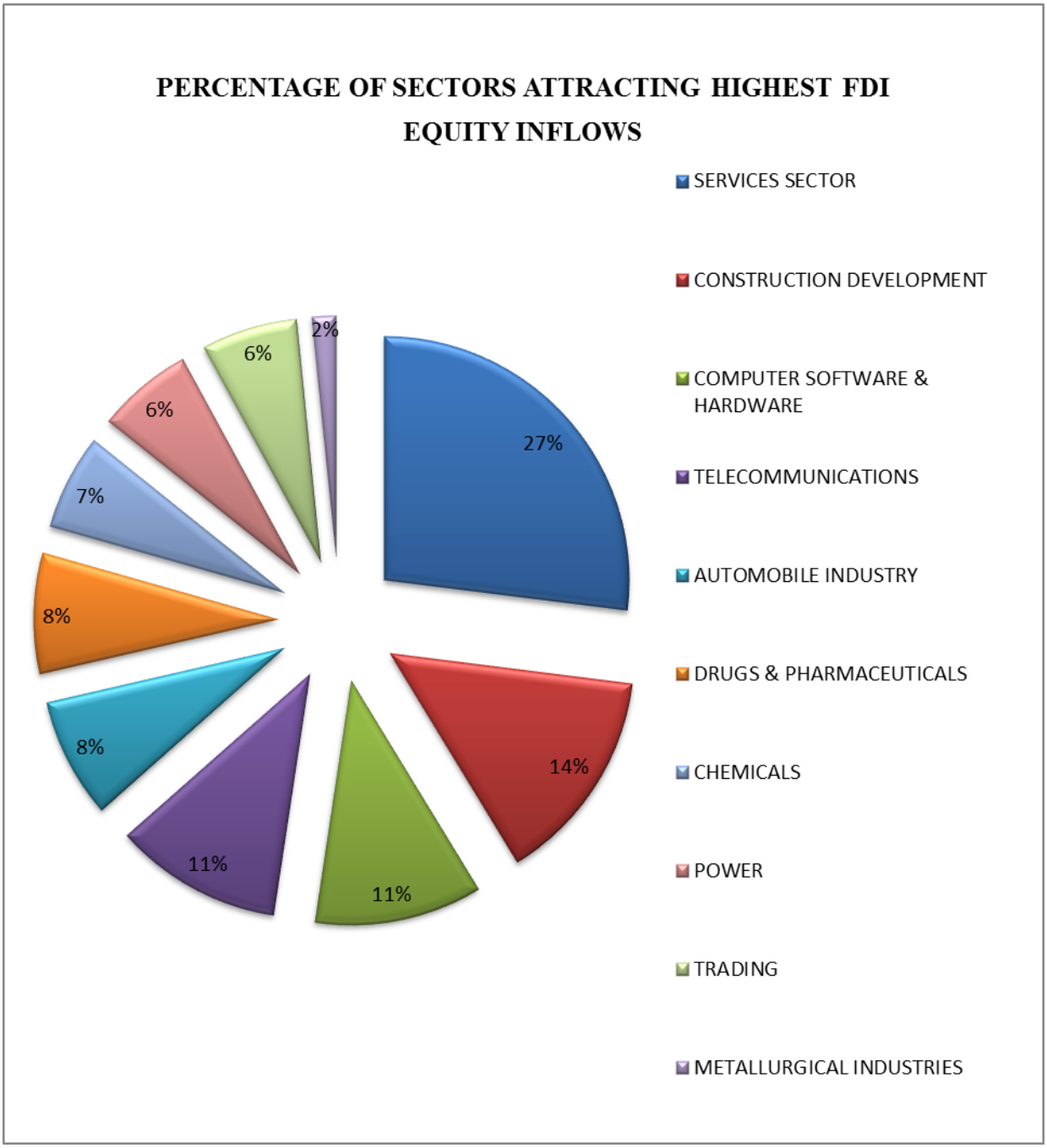
The largest inflows of FDI's over the period of April 2000 to June 2015 have been received from Mauritius, its share in these inflows have being as high as 35%. Singapore is second with a share of 14%. The other major sources of foreign direct investment are from UK, Japan, Netherlands, U.S.A., Cyprus, Germany, France, Switzerland and their respective share of inflow of FDI are 9%, 7%, 6%, 6%, 3%, 3%, 2%, and 1`% respectively.

The inflows from U.S.A are routed through Mauritius due to tax advantage. The tax advantage emanates from the double tax avoidance agreement that India has with that country USA. This agreement means that any foreign investor has the option of paying tax either in India or in Mauritius.

The tax rates in Mauritius are amongst the lowest in the world. The other big investors included Singapore, the US, Britain and the Netherlands. While investors get higher returns on their money in India, those from Mauritius "get even higher returns on their capital as we have a double taxation avoidance treaty (DTAT) (with the island nation)," Crisil principal economist, Mr. D.K. Joshi.

There have been changes in the source countries due to the change of policies in 1991. Prior to 1991, India depended on a few developed western countries for capital. These included countries like Israel, Australia, South Korea, Malaysia; Singapore etc. after the policies have been implemented countries which did not had any share in India's FDI such as Thailand, Saudi Arabia and South Africa etc.

II. Graph 2(Table 6) :-



SECTORAL COMPOSITION OF FDI:-

The Sectoral composition of FDI over the period of April 2000 to June 2015, we can find that the largest recipient of such investment is service sector (Financial and non-financial services). The share of this sector in cumulative FDI flows is 27 % of the inflow total foreign direct investment.

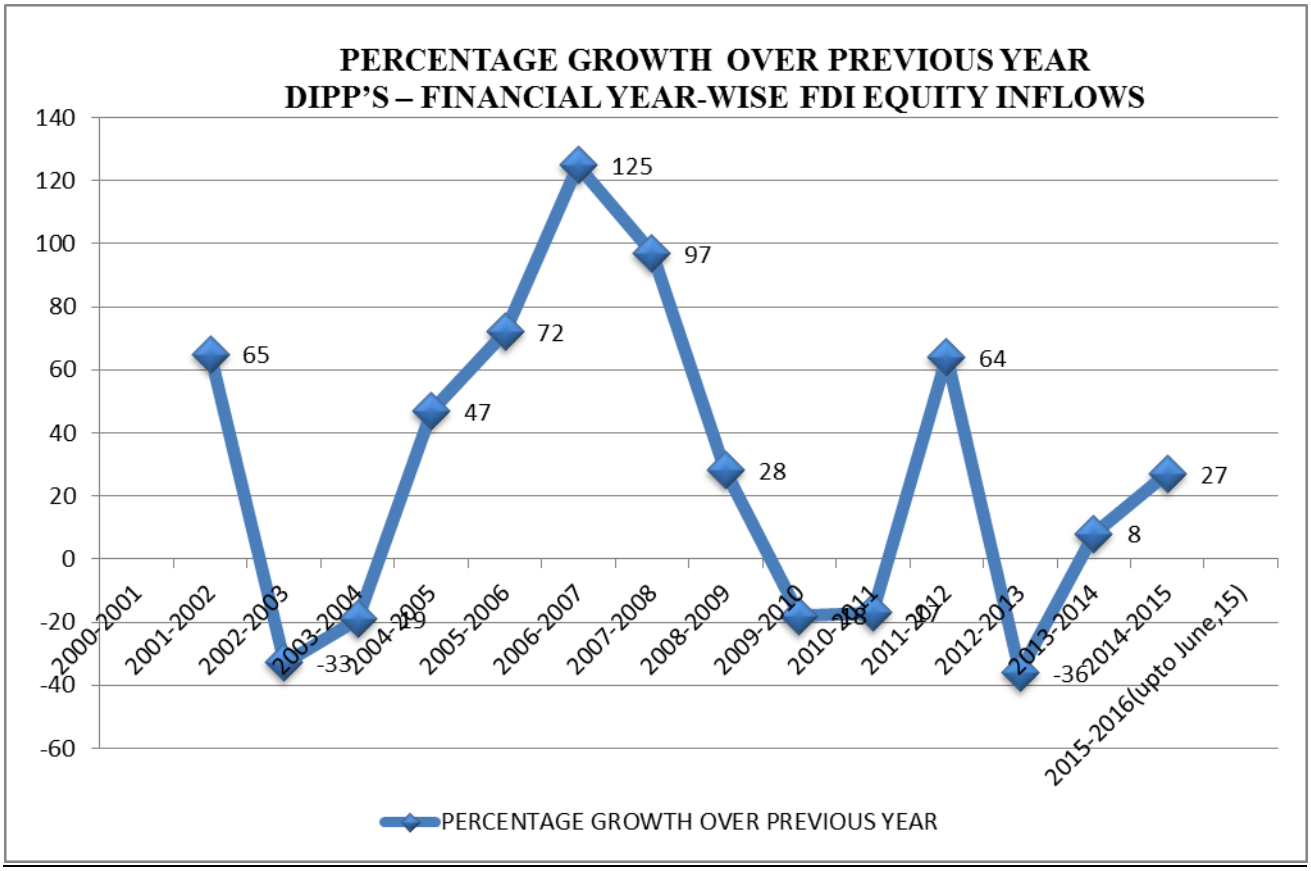
The foreign investors are interested in mainly financial services due its profit generating advantage. This sector gives scope for the foreign investor to takes back the profits to the home country. As service sector the services are consumed in the host country and there by generating outflow of funds from the host country.

The second recipient is Construction Development sector which shares 14% of total FDI. Telecommunication, Computer software and hardware, Drugs and pharmaceuticals, Automobile industry, Chemical (Other than Fertilizers),Power, Metallurgical industries, Hotel and tourism contribute 11%,11%,8%,8%,7%,6%,6%2% respectively.

The keys takeaways regarding global flows are – the increase in the relative share of developing countries as both destination and sources and flow to the sector gaining over manufacturing.

There are Sectoral limits or caps designed by the RBI to limit the foreign direct investments. 100% investment has been allowed to the following sectors- private sector banking, NBFC'S, petroleum, housing and Real estate, Hotel and tourism, road and highways, ports and harbors, advertising, films, mass raped transportation, power, drug and pharmaceuticals, pollutions control and management and special economic zones. Other sectors such as airports are allowed with 74% caps and telecommunication with 49% and insurance with 26%.

III. Graph 3(Table 8) :-



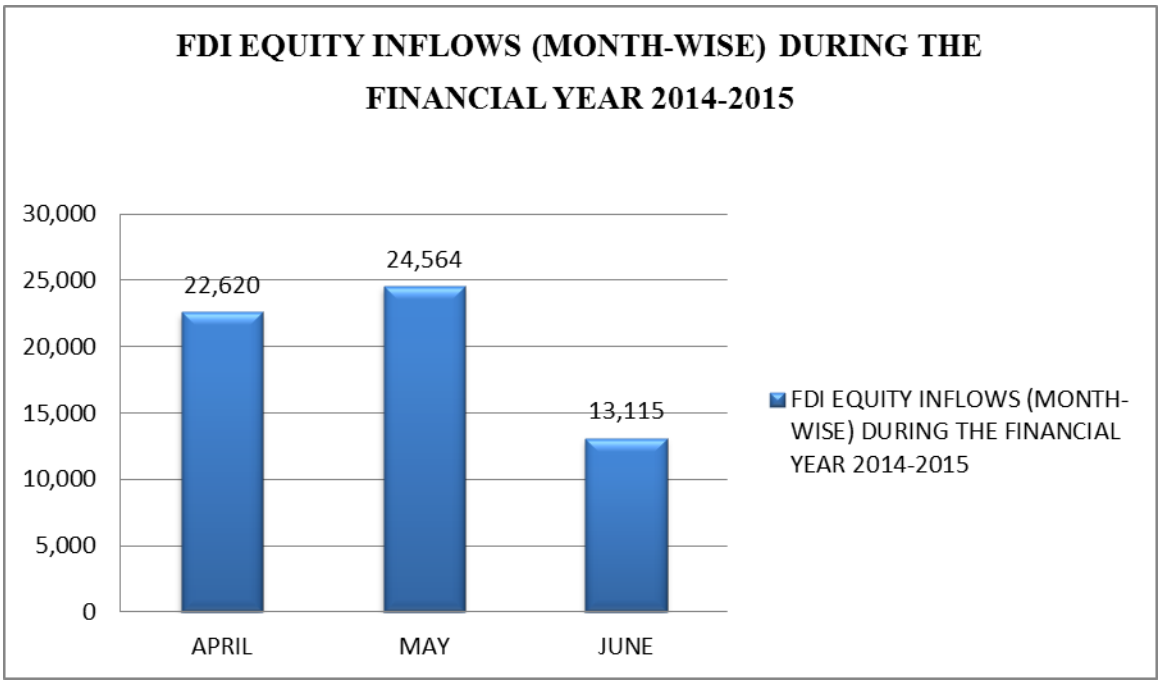
PERCENTAGE GROWTH ANALYSIS (YEAR WISE):

The above graph shows the total amount of FDI inflows in India during the last 15 years i.e. 2000 to 2015. The FDI inflow from 2000-2001 i.e. 10,733crore Rs. in 2001-02 it was 18,654 Crore rupees. It shows the Good result in the FDI inflows in India. Little bit ups and downs in FDI inflows up to 2005-06, but after that great hike in the year 2007-08 i.e. 98,642crore rupees as compare to earlier years. In 2008-2009 there was a huge investment in FDI in 142,829 Crore Rupees.

But then there was a downfall in Inflow of FDI in two consecutive years 2009-2010 and 2010-2011, with figures 123,120 and 97,320 respectively. We can analysis from the graph that in the year 2011-2012 the inflow of FDI was second highest of last 15 years i.e. 165,146.Year 2012-13 and 2013-14 the FDI inflow fluctuated from 121,907 to 147,618 respectively. In last Financial Year i.e. 2014-2015 the amount of FDI Inflow were 189,107 which is the highest FDI inflow in last 15 years. Recently in the month of June 2015 there was inflow of 60,298 Crore Rs. .

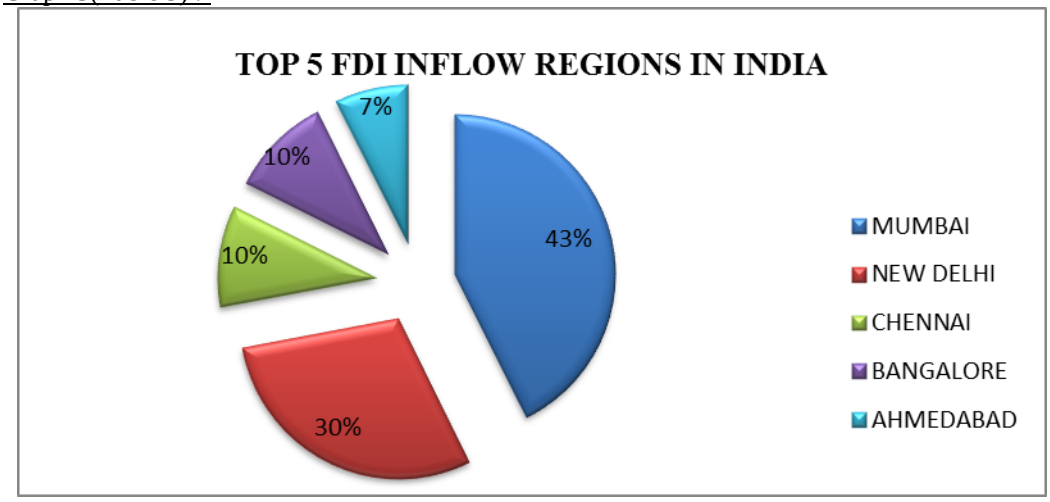
So we can say that the foreign investment have been fluctuating but rising as well in India.

IV. Graph 4(Table 3) :-



The above bar graph represents the amount of FDI inflows from April 2015 to June, 2015. It shows the amount in Crore Rs. The highest FDI inflows in the country is in the month May 2015 i.e. 24,564 in Rs Crores and 3,850 in US $ mn. Other months shows the fluctuating trend.

V. Graph 5(Table 9) :-



The above Figure shows the top five regions in India attracting FDI. It shows that out of 51,437 of Cumulative FDI inflow in the financial year April, 2015 to June, 2015, 43% share of the total investment is carried by Mumbai region; also it continues to attract maximum foreign investments followed by 30% - New Delhi, 10% - Chennai, 10% - Bangalore and 7% - Ahmedabad.

VI. Attracting Larger FDI Inflows in India- Problems and Challenges

Both India and China are competing to get a larger share in world trade and investment. Although China continues to be India's major competitor, many new economies like Indonesia, Vietnam and Philippines have emerged as strong competitors. India's main competitive advantage lies in its lower labour costs and remunerative domestic markets. But India is fast losing its competitive advantage to countries like Indonesia and Vietnam as investors are shifting FDI away from known growth engines towards these new emerging economies.

No doubt Indian government has implemented several reform measures in order to attract greater FDI but there are several studies which have highlighted India's weak spots. One such report is "Doing Business 2014", an annual report co-published by the World Bank and International Finance Corporation that brings out the differences in business regulations and their implementation across economies.

Table:

Doing Business in India	Rank
Ease of doing business	134
Starting a business	179
Dealing with construction permits	182
Getting electricity	111
Registering property	92
Getting credit	28
Protecting investors	34
Paying taxes	158
Trading across borders	132
Enforcing contracts	186
Resolving insolvency	121

Analysis of Inflows of Foreign Direct Investment in India:

The table above indicates that India is performing well only on two indicators, namely, getting credit and protecting investors. India's performance on three indicators, namely, starting a business, dealing with construction permits and enforcing contracts shows a dismal picture of the investment climate in India.

Another report "Global Competitiveness Report" published annually by "World Economic Forum" ranks 148 economies on their competitiveness with respect to indicators like infrastructure, institutions, macro-economic stability, innovation etc. India's overall rank for 2013-14 on the Global Competitiveness Index was 60.

The most problematic factors for doing business identified in the report are inadequate supply of infrastructure, corruption, inefficient government bureaucracy, policy instability, tax regulation and restrictive labor regulations.

❖ MAJOR IMPEDIMENTS:

The major deterrents to larger flows of FDI to India are listed below:

1) **Weak infrastructure:** Infrastructural bottlenecks continue to be a major cause of concern in India. When it comes to competition, India doesn't stand against other emerging markets in terms of ports, roads, skills sets, education etc. Even after six decades of planned economic development, India suffers from poor transport links, inadequate power supply, poor roads, and frequent power cuts, delays in ports, water and sewerage problems and so on.

A study conducted by the Federation of Indian Chambers of Commerce and Industry in 2013, revealed that each day Indian companies are losing up to Rs. 40,000 because of power shortages; and due to power cuts, 61% companies suffer more than 10% loss in production. Warehousing and cold storage facilities are also in short supply, because of which 40% of the fruits, vegetables and other perishable products get destroyed before reaching the markets. In the World Competitiveness Index for 2013-14, India ranked 85 out of 148 countries for its infrastructure, much behind China which ranked 48.

2) **Complicated tax structure:** Stability and transparency in tax regime along with clarity in tax laws can have far reaching impact on investments in any country. The taxation policies in India remain inherently complex despite the fact that government has taken several steps to simplify and redesign it. In the recent years, India has witnessed several tax disputes with respect to cross border transactions involving big MNCs. According to a report in 2011-12, 30 corporations which comprise the BSE Sensex had USD 7 billion clogged in tax law suits. Again, while corporate tax rates in most of the nations are in the range of 15 to 25%, in India foreign companies are taxed at a rate of 40%.

The corporate tax rate for foreign companies is 25% in China along with tax holidays for qualified tax payers. India's indirect tax regime is also very complex, imposing several taxes such as central sales tax, VAT, service tax, central excise duty, octroi etc. and calls for a number of compliances increasing the burden on companies. Moreover, there is a lack of uniformity in the tax rates across the country increasing the complexities for tax payers.

3) **Restrictive labor laws:** India is known worldwide for its stringent and rigid labor laws and over-regulated labor market. Over the years, Indian government has enacted a large number of legislations to protect the interests of labor covering different aspects namely fixation and revision of wages, worker's health and safety, mode of payment of wages, payment of compensation in the event of industrial accident, provision of social security such as provident fund, gratuity, insurance and so on. Indian economy has turned highly inflexible due to these laws. These laws contain strict rules regarding overtime and imposes financial obligation on the employer upon worker retrenchment.

Laws such as taking prior permission from the government before firing any worker in an organization employing more than 100 workers continues to haunt corporations. On several occasions OECD and World Bank studies have highlighted the need to bring reforms in Indian labor laws.

4) **Bureaucracy, regulations and corruption:** Yet another handicap that India suffers from is bureaucracy, red tapism and corruption. It takes months to obtain licenses, approvals and permits. As per the doing business report, it takes 67 days for a company to obtain electricity connection, 16 days to obtain clearances and export goods from India, 182 days for dealing with construction permits and 1420 days for enforcing contracts. It takes 4 to 8 weeks for a new company to get itself registered in India as compared to few days in most developed and developing markets.

Many a times, the FDI approvals are kept pending for months that prompts the investor to drop out. With respect to FDI policies, even though several liberalization measures have been undertaken by the government but FDI regulations continue to remain restrictive as compared to many other nations. India has been selective in opening sectors for FDI and FDI in India is subject to sectoral caps ranging from 20 to 100%. The FDI Regulatory Restrictiveness Index 2013, prepared and published by OECD has ranked India 6th (indicate restrictive FDI policies) out of 58 countries. Again, corruption in India is rampant where; licenses, clearances, and contracts are given not on merit basis but based on bribes. Uncertain government policies and frequent changes in them, inefficient administrative, overlapping jurisdictions, excessive governance increases the transaction costs for companies making India a less preferred destination.

❖ **4.1. There are two types of implications i.e. positive and negative as per following:**

➢ **Positive Implications:**

a) FDI provides capital which is usually missing in the target country-Long term capital is suitable for economic development.
b) Foreign investors are able to finance their investments projects better and often cheaper.
c) Foreign corporations create new workplaces.
d) FDI bring new technologies that are usually not available in the target country-There is empirical evidence that there are spill-over effects as the new technologies usually spread beyond the foreign corporations.
e) Foreign corporations provide better access to foreign markets-Ex. Foreign corporations can provide useful contacts even for their domestic subcontractors.
f) Foreign corporations bring new know-how and managerial skills into the target country- Again, there is a spill-over effect – as people leave the corporations they leave with the knowledge and know-how they accumulated.
g) Foreign corporations can help to change the economic structure of the target country- With a good economic strategy governments can attract companies from promising and innovative sectors.
h) "Crowding in" effect-The foreign corporations often bring additional investors into the target country (ex. their usual subcontractors).
i) Foreign corporations improve the business environment of the target country-Ethical business or rules of conduct.
j) Foreign corporations bring new "clean" technologies that help to improve the environmental conditions.
k) Foreign corporations usually help increase the level of wages in the target economy.
l) Foreign corporations usually have a positive effect on the trade balance.

➢ **Negative Implications:**

a) Foreign corporations may buy a local company in order to shut it down (and gain monopoly for example).
b) "Crowding out" effect- We can see this effect if the foreign corporations target the domestic market and domestic corporations are not able to compete with these corporations.
c) Foreign corporations may cut working positions (privatization deals or M&A transactions).
d) Foreign corporations have a tendency to use their usual suppliers which can lead to increased imports (no problem if the production is export driven).
e) Repatriation of the profits can be stressful on the balance of payments.
f) The high growth of wages in foreign corporations can influence a similar growth in the domestic corporations which are not able to cover this growth with the growth of productivity- The result is the decreasing competitiveness of domestic companies.
g) Missing tax revenues- If the foreign corporations receive tax holidays or similar provisions.
h) The emergence of a dual economy- The economy will contain a developed foreign sector and an underdeveloped domestic sector.
i) Possible environmental damage.
j) "Incentive tourism".

❖ **SUGGESTIONS FOR INCREASED FLOW OF FDI INTO THE COUNTRY:-**

1) Flexible labour laws needed:

China gets maximum FDI in the manufacturing sector, which has helped the country become the manufacturing hub of the world. In India the manufacturing sector can grow if infrastructure facilities are improved and labour reforms take place. The country should take initiatives to adopt more flexible labour laws.

2) Re look at sectoral caps:

Though the Government has hiked the sectoral cap for FDI over the years, it is time to revisit issues pertaining to limits in such sectors as coal mining, insurance, real estate, and retail trade, apart from the small-scale sector. Government should allow more investment into the country under automatic route.

Reforms like bringing more sectors under the automatic route, increasing the FDI cap and simplifying the procedural delays has to be initiated. There is need to improve SEZs in terms of their size, road and port connectivity, assured power supply and decentralized decision-making.

3) Geographical disparities of fdi should be removed:

The issues of geographical disparities of FDI in India need to address on priority. Many states are making serious efforts to simplify regulations for setting up and operating the industrial units. However, efforts by many state governments are still not encouraging. Even the state like West Bengal which was once called Manchester of India attracts only 1% of FDI inflow in the country. West Bengal, Bihar, Jharkhand, Chhattisgarh are endowed with rich minerals but due to lack of proper initiatives by governments of these states, they fail to attract FDI.

4) Promote Greenfield projects:

India's volume of FDI has increased largely due to Merger and Acquisitions (M&As) rather than large Greenfields projects. M&A's not necessarily imply infusion of new capital into a country if it is through reinvested earnings and intra company loans. Business friendly environment must be created on priority to attract large Greenfields projects. Regulations should be simplified so that realization ratio is improved (Percentage of FDI approvals to actual flows). To maximize the benefits of FDI persistently, India should also focus on developing human capital and technology.

5) Develop debt market:

India has a well developed equity market but does not have a well developed debt market. Steps should be taken to improve the depth and liquidity of debt market as many companies may prefer leveraged investment rather than investing their own cash. Therefore it is said that countries with well-developed financial markets tend to benefits significantly from FDI inflows.

6) Education sector should be opened to FDI:

India has a huge pool of working population. However, due to poor quality primary education and higher education, there is still an acute shortage of talent. FDI in Education Sector is lesser than one percent.

By giving the status of primary and higher education in the country, FDI in this sector must be encouraged. However, appropriate measure must be taken to ensure quality education. The issues of commercialization of education, regional gap and structural gap have to be addressed on priority.

7) Strengthen research and development in the country:

India should consciously work towards attracting greater FDI into R&D as a means of strengthening the country's technological prowess and competitiveness.

❖ **FINDINGS:**

1) FDI is an important stimulus for the economic growth of India.
2) Service sector is first and banking and insurance sector is second segment of which pick the growth in second decade of reforms.
3) FDI create high perks jobs for skilled employee in Indian service sector.
4) Mauritius and Singapore is the 2 top countries which has maximum FDI in India.
5) FDI plays an important role in the development of infrastructure because many countries invest in the infrastructure sector and service and banking finance sectors.
6) Atomic Energy and Railway Transport are some important and life line of any country. Therefore India also restricted FDI in this sector.
7) After above analysis, we can say that FDI has good future growth in Retailing and Real estate sector in India.

A. India is attracting foreign investment at a good rapid rate of growth. The growth rate of FDI over last year was found to be 40 %. The main reason for this substantial growth in FDI was opening up of Indian economy to foreign investment, relaxation of norms for foreign investments and enhancing sector wise limit.
B. In region wise analysis, Mumbai was on the top with 29% to total FDI of India. The reason behind this was the availability of service sector, infrastructure and construction development. Six regions offices which are at the top contribute 71% to the total FDI while rest of the regions add 29% to total FDI.
C. As per the data, the sectors that attracted higher inflows were Services (17%), Construction activities (9%), Telecommunications (7%) and Computer Software and Hardware (7%).
D. A country wise FDI inflows show that Mauritius is the country that has invested highly in India followed by Singapore, UK, Japan Netherland and USA and so on. Nine countries contribute 83% to cumulative FDI in India while remaining contributes only 17%.
E. FDI plays an important role in the development of infrastructure because many countries invest in the infrastructure sector and banking finance sector.

VII. CONCLUSION

FDI in India has a significant role in the economic growth and development of India. FDI in India to various sectors can attain sustained economic growth and development through creation of jobs, expansion of existing manufacturing industries. The inflow of FDI in service sectors and construction and development sector, from April, 2000 to June, 2015 attained substantial sustained economic growth and development through creation of jobs in India.

Computer, Software & Hardware and Drugs & Pharmaceuticals sector were the other sectors to which attention was shown by Foreign Direct Investors (FDI). The other sectors in Indian economy the Foreign Direct Investors interest was, in fact has been quite poor.

FDI has helped to raise the output, productivity and employment in some sectors especially in service sector. Indian service sector is generating the proper employment options for skilled worker with high perks. On the other side banking and insurance sector help in providing the strength to the Indian economic condition and develop the foreign exchange system in country.

So, we can conclude that FDI is always helps to create employment in the country and also support the small scale industries also and helps country to put an impression on the world wide level through liberalization and globalization.

REFERENCES

[1] Aggrawal, S., Singla, A., Aggrawal, R. (2012). Foreign direct investment in India. International Journal of Computational Engineering & Management, 15 (5), 93-105.

[2] Azhar, S., Marimuthu, K.N. (2012). An overview of foreign direct Investment in India. International Journal of Multidisciplinary Management studies, 2 (1), 202-214.

[3] Department of Industrial Policy and Promotion, (April 2000 to June 2015) Annual Report.

[4] Devajit, M. (2012). Impact of foreign direct investment on Indian economy. Research Journal of management Sciences, 1(2), 29-31.

[5] Kumar, P. (2011). FDI in India and its impact- "A critical evaluation". VRSD International Journal of Business & Management Research, 1(3), 185-196.

[6] Manual on Foreign Direct Investment in India by Secretariat for Industrial Assistance (SIA) DIPP.

[7] Mahajan, D. (2008). FDI in India not as per her potential. The Economic Challenger, 41 (11), 59-63.

[8] Press notes of Department of Industrial Policy and Promotion (DIPP) (2010-15).

[9] Ramachandran, A., Kavitha, N., Veni, N.K. (2008). Foreign direct investment and the economic scenario. The Economic Challenger, 39 (10), 43-49.

[10] Reserve Bank of India (2015), Monthly Bulletin, July.

[11] Sahni, P. (2012). Trends and determinants of foreign direct investment in India: An empirical investigation. International Journal of Marketing and Technology, 2 (8), 144-161.

[12] UNCTAD (2015), World Investment Report.

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Competitive Positioning Strategies in Response to Changing Rice Demand Patterns in Kenya

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A Research Project Submitted To The School Of Economics And Commerce In The College Of Human Resource Development In Partial Fulfillment Of The Requirement For The Award Of The Masters Of Business Administration Of Jomo Kenyatta University Of Agriculture And Technology.

Abstract- The general objective of the study was to establish competitive positioning strategies in response to changing rice demand patterns in Kenya. This study was guided by three specific objective which were; the effect of product differentiation in response to changes in rice demand patterns in Kenya, to establish the effects of cost leadership in response to changes in rice demand patterns in Kenya and finally to determine the effects of market segmentation strategies in response t changes in demand patterns in Kenya. The target population was the employee from MRM. The sample size drawn from this population was 50 was identified through stratified random sampling. Primary data was collected from the respondents using questionnaires. The data was then coded and edited for completeness and accuracy before being analyzed using Statistical Package for Social Scientists (SPSS). The data was represented in the form of tables. The study revealed that product differentiation using innovation, quality, packaging collectively contributed to 65% of the organizations performance in MRM. It was however noted that MRM used more of packing in the differentiation strategy but had not changed the packaging style in the last five years. The study also revealed that leadership strategies where not employed significantly in MRM. It was established using four variables which were use of economies of scale, reduction in the cost of production, utilization of the machines to capacity and use of new production technology contributed to 13.9% of MRM market share. Finally, it was established that MRM did not use of the market segmentation strategies. This was established when the researcher used four variables; identifying specific groups and their needs, specialization of service to suit the specific groups, using of specialized group adverts and specialization of goods and services, to test segmentation and they correlated insignificantly to market performance based on segmentation. The researcher recommended that product differentiation was important for MRM and therefore should be applied wholly since MRM had partially concentrated on packaging. It was also recommended that MRM would concentrate on cost leadership which would be made possible through fully utilizing the available capacity, innovation and reduction in the cost of production.

Index Terms- Product Differentiation, Cost Leadership, Market segmentation, Competitive Positioning

I. INTRODUCTION

1.1 Background of the study

Organizations were faced with the challenge of strategically positioning themselves in the changing business environment, however despite the experience it possible to strategically position, more so to deal with changing demands. It was therefore important to consider how, and what affects strategic positioning in organizations. Porter (2001) viewed strategic positioning as the source of competitive advantage; however Keller (2008) suggested that strategic positioning was based on the difference and similarities between the unique selling propositions and sustainable competitive advantage. It was generally observed that companies position themselves based on their strength and the advantages they have compared to the competitors, therefore it can be agreed that strategic competitive advantage plays a major role in the superior positioning of the organization in the market. The major question at this point was how an organization would achieve and maintains superior competitive positioning? According to Cockburn *et al* (2000), superior competitive positioning meant higher profits, which is the willingness of customers to pay and can be referred to as economic value of the organization. Through a sustainable economic value the organization is considered to have achieved sustainable competitive positioning. Porter (2001) argued that sustainable profitability was the only measure of economic value and hence sustainable competitive advantage. In his argument porter brought about two factors that determined sustainable profitability which is the sustainable competitive positioning; industrial structure and sustainable competitive advantage. As proposed by Cockburn *et al.* (2000) competitive position is a equal to high level profits in for the firm in the industry, Grant (2008) in agreement argues that firms that earn higher profit levels than others in the same industry seem to be at a better competitive advantage than its counter parts in the same industry. According to Mintzberg (1994), positioning strategies are driven by market or industry structure that the firm operates in.

A firm that was able to competitively position itself is one that was able to supply goods and services at the right price, right quality and right packaging. The main benefit of dominating in the market was to gain and maintain high profit margins as compared to the competitors (Bech-Larsen, Esbjerg, Grunert, Juhl, and Brunso, 2007). High profit margin difference give the competitor the power and the ability to push other players from the market. In his argument Barney (1995) stated that strategic positioning required more complex business operations, to manage this complex business costs would increase due to the requirement of better management techniques, tools and information. For a firm to be able to strategically position itself and deal with the cost that comes with strategic positioning the farm may consider targeting specific segments of the market (Davidson, 2008). By selecting a specific segment the farm is

able to adopt a narrow competitive scope within the industry. At the same time the firm may consider product differentiation.

With this strategy of product differentiation a company will achieve cost effectiveness in positioning through concentrating in providing unique products or services (Bauer and Colgan, 2001). Through the provision of unique goods and service the firm is able to win customer loyalty and therefore cut its niche. (Reilly, 2002) argued that through product differentiation a firm can add their cost to the final cost therefore attracting sophisticated customers. Finally, competitive strategic positioning in an industry can be achieved through cost leadership this is aimed at gain competitive advantage by having the lowest cost in the industry (Hyatt, 2001). According to (Malburg, 2007), to achieve this, the firm must have a low cost strategy that begins with low cost manufacturing for their products Malburg (2007) continues to argue that the firm must discontinue any production process or activity in the firm that is not cost effective and by doing so the firm is able to reduce on the overall cost of production.

1.1.1 Rice Industry

According to world Trade organization (WTO, 2009) statistics, China was the largest producer of rice and Thailand is the largest exporter of rice while Philippines was the largest importer of rice. According to West African Rice Development Agency (WARDA, 2009) African rice is grown in 75% of the African countries. Despite the high potential of the continent having such a high potential to produce rice for its population and even for export, African has been importing more than 60% of its rice requirements from Thailand, China and Pakistan (WARDA,2009). Kenya being an African country has not been left behind in the worrying trend. In Kenya there have been unresolved issues of competitiveness in its rice production and sales systems compared to those of those of the competitors. This has led to the constant import of rice. The National Irrigation Board (NIB) statistics indicate that consumption of rice has increased by 12%. According to the Economic Review of Agriculture (2010) Kenya imports half of its rice requirements from Pakistan.

Statistical Abstract (2010) showed that expenditure on imported rice in Kenya has risen by 100% between the year 2003 and 2008. The increase in expenditure on the imported rice was due to the widening gap between demand, production and supply. It is evident that most of the rice produced by the farmers went to waste in the production process. Rice in Kenya is produced by small scale farmers through irrigation schemes. This includes the Mwea Irrigation Scheme, Bunyala Irrigation scheme, Ahero and finally West Kano Irrigation scheme. Rice is traded by both the large scale and small scale traders. The large scale traders include the National Cereals and production Board (NCPB). National Irrigation Board (NIB) and Lake Basin Development Authority (LBDA). There are major mills based at the Schemes and are government owned, however there are a small scale mills that were a major threat to the main mills. Among the challenges faced by the rice industry in Kenya is the production cost. According to Mwea Irrigation Agricultural Development (MIAD) the cost of production was more than half the revenue they get for a bag of rice produced. Secondly is that the production process was labor intensive. All this costs contribute to the final product. On the competitiveness of the local rice compared to imported rice, due to the high cost of producing rice locally imported rice from Pakistan tend to be cheaper to the buyer. The cost of rice was also determined by the scale of production. Most of the rice producers in Kenya are small scale producers; this means they do not enjoy the reduction in cost that comes with large scale production. These in turn translate to the selling price of rice. It has also be realized that rice produced locally is not readily available in local outlets such as super markets hence being unknown to the buyer.

In Mwea Rice Mills (MRM) the challenge was the presence of other competitors who have been present form 1993 when the price controls in the rice industry was raised. The small scale millers have growth over the time and it was estimated that by 2001 around 200 small scale millers were operating around MRM (FAO, 2004). The small scale mills had posed a threat by reducing the supply to MRM and producing low quality rice due to their cheaper ways of producing and hence sold it to the buyers at a cheaper price than MRM. The second major challenge being faced by MRM was the readily available imported Pakistan rice which is cheaper than the local Rice. It was estimated that an imported bag of rice would cost 2500 Kenya shillings in Nairobi while a locally produced bag of rice would cost 3500 Kenya shillings (FAO 2004). MRM has its ownership shared between National Irrigation Board (NIB) and the rice farmers. The farmers control 45% of the shares while NIB controls the remaining 55%. MRM had been faced by the challenges of product differentiation, it had also been unable to be cost leader making other suppliers to be the lead and finally MRM had not segmented its market and therefore posing a challenge on its competitive position in the rice industry. From this background the researcher was able to find ways in which MRM could position itself strategically and competitively in the industry by improving the three areas that MRM was most challenged, namely; product differentiation, cost leadership and market segmentation.

1.2 Statement of the problem

Studies carried out by Paulraj & Chen (2007) showed that through supply chain management an organization is able to competitively position itself in the industry. A study carried in Thailand by Thongrattana, (2012) showed that the major setbacks to achieving a competitive position in the rice industry was fluctuating demand, poor planning and control in the mills, external competition and government policy contributed significantly to decline in performance of the mills in Thailand. These studies however had not been carried out in Kenya and therefore they would not be relevant to the Kenyan rice industry that may have be faced by different challenges. In Africa one of the most significant challenges that local rice mills suffered is the significant price discount that is given to the imported rice, this making the imported rice more affordable to the locals than the locally produced rice (Lancon and Benz, 2007). In their study Campbell, Schiff, Snodgrass, Neven, Downing & Sturza (2009) showed that another challenge that faces the African rice industry is the lack of consistency in production whereby the supply chain is cut short at a point as rice production goes off season. These research studies however concentrated on the production and the consumption of rice however, none of the study explored the competitive posture of the rice Mills that play a co-role in the

manufacturing and marketing of the rice. This study therefore sought to establish possible ways of Mwea Rice Mills establishing its niche and competitively maintaining the niche in the rice industry. The study also sought to cover the knowledge gap that existed on government owned organizations. The findings and conclusions of the study would be used by the government in policy formulation and implementation. The study will also provide references and sources that can be used by other researchers who are willing to carry out further studies.

1.3 Objectives of the Study

1.3.1 General Objective

The general objective of the study was to establish competitive positioning strategies in response to changing rice demand pattern in Kenya.

1.3.2 Specific Objectives

1. To examine the effects of product differentiation in response to changes in rice demand pattern in Kenya.
2. To establish the effects of cost leadership in response to changes in rice demand pattern in Kenya.
3. To determine the effects of market segmentation strategy in response to changes in rice demand pattern in Kenya.

1.4 Research Questions

1. How does product differentiation in response to changes in rice demand pattern in Kenya?
2. How does of cost leadership in response to changes in rice demand pattern in Kenya?
3. How does market segmentation in response to changes in rice demand pattern in Kenya?

1.5 Justification

Most studies that had been carried out on rice had concentrated more on the production. An example off (WARDA 2009) concentrated more on the research of how African would produce more rice so as to increase on food security hence alleviate poverty. Other studies carried out by the United Nations concentrated on increasing food security through the production of more stable food in developing world an example of FAO (2004). Within Kenya studies carried out in the rice producing and manufacturing industry concentrated more on the growth of rice and the causes of poor production of rice in Kenya an example of Statistical Abstract (2010). A study carried out in on market of rice by Mwai (2010) concentrated on the marketing of rice by small scale producers of rice and therefore none of the studies that have been carried out has concentrated on the strategic position of Mwea Rice Mills which is not a small producer of rice.

This study therefore focused on the area that has not been identified by other researchers. The study aimed at finding the challenges faced by MRM and their possible solutions. The information gathered in this study aims at benefiting the government who can legislate with aim of promoting growth in MRM. The study will also benefit the management in MRM in the decision making process especially for strategic reason. Finally, scholars who intended to study more with on competitive positioning in government parastatals had a basis for reference.

1.6 Scope

The study was carried out in Mwea Rice Mills that is located in Kirinyaga County in Kenya. Mwea Rice Mills was the largest NIB managed mill in Kenya and therefore most appropriate to provide the required competitive positioning strategies employed and the challenges faced by NIB managed mills in positioning themselves in the market with changing demand patterns. The target population for the study was 57 permanent employees and the study was carried out over a period of 2 months.

1.7 Limitation

The researcher encountered a number of challenges during the study. One of the challenges was the respondents being reluctant to answer the questionnaires due to the fear of the information licking to the authorities. This challenge was dealt with by ensuring that no name or individual personal information appeared in the questionnaire, the respondent was also assured of only the analyzed results would be shared with the organization. The second challenge was on timing of answering questionnaire. This was however dealt with by ensuring that the questionnaires were pretested and therefore just took a few minutes of the respondents' time.

II. LITERATURE REVIEW

2.1 Introduction

This chapter covered the literature review beginning with the conceptual frame work of the study. The literature review was based on Product differentiation, cost leadership, market segmentation. A critique review was then provided followed by a summary. Finally a research gap was established.

2.2 Theoretical Review

2.2.1 Porter's Five Forces

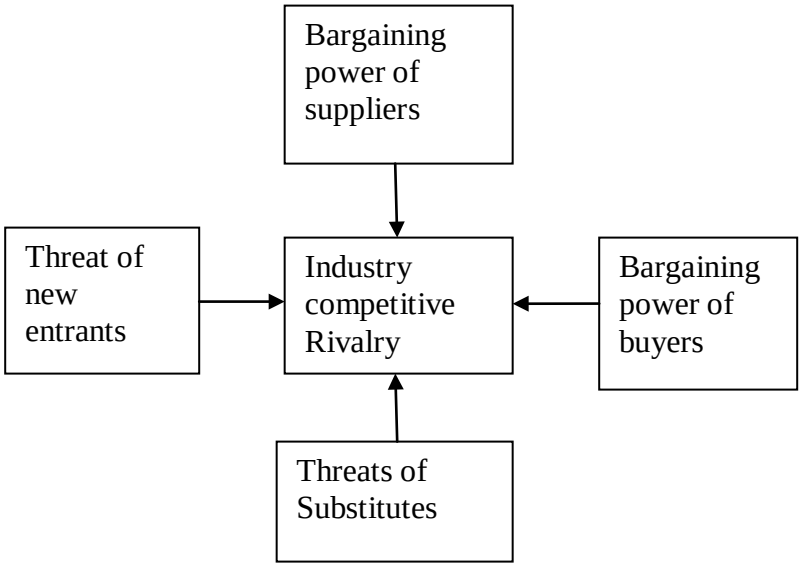

Figure 2.1: Porter, (Revised 2004)

New entratnts was the first force in the porters five forces. This happens when an industry is profitable and therefore attracting new firms. By entering an profitable industry, the new entrants reduce the profitability of the industry. This can however

can be delt with through blocking the entry of new firms in the industry, which is mostly done by the largest player in the industry, leading to monopoly. Threats of substitutes was the second force, the existence of other products other than the common one that are supplied by a specific player in the industry increases the chance of customers switching to other products, hence reducing the profitability of the firm.

The third force was the bargaining power of the customers, which is the ability of the customers to put the firm under pressure. The buyers power is higher when they have more otions of similar products. The buyer on the other hand is considered to have lesser power when there are few options to choose from. The bargainging power of the customers can be reduced through the organization coming up with a loyalty program through which they get loyal customers. Besides the bargaining power of the customers the suppliers also have a bargainig power. This is possible through the supplier having the ability to supply certain raw materials, labour and services that are not readily available from other suppliers. Finally the intensity of competitive rivary determines the profitability of the industry and the number of player that will be found in the industry.

2.2.2 Porter's Diamond Framework

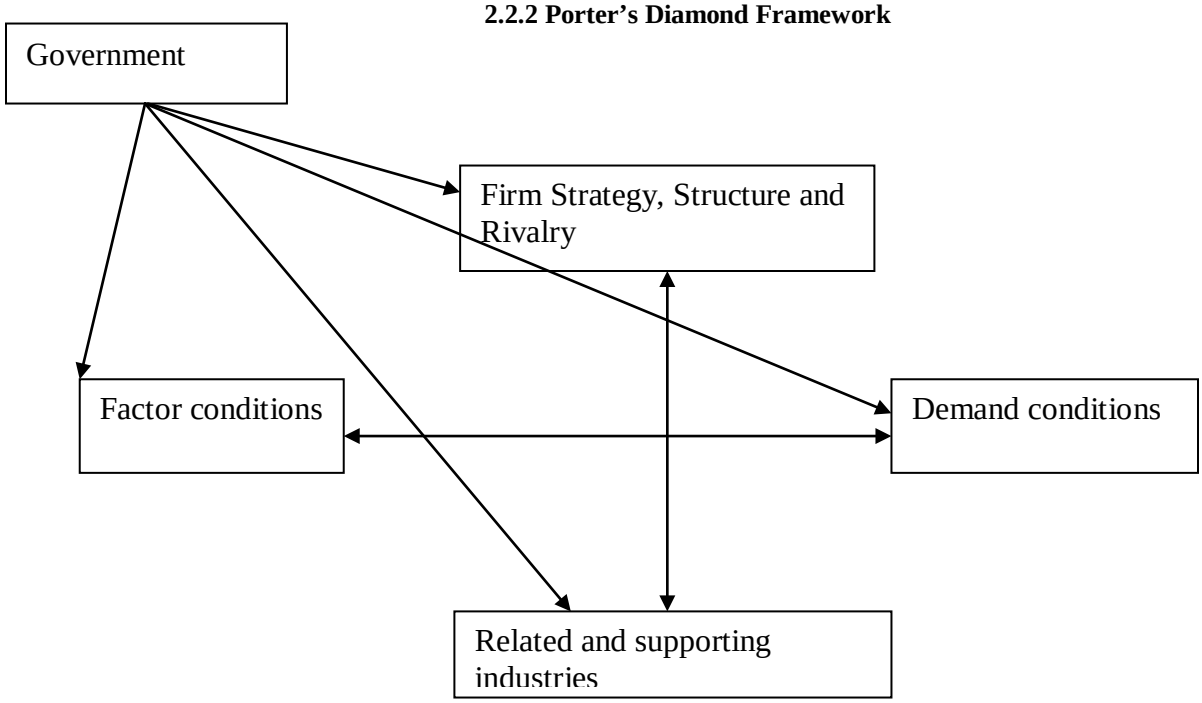

Figure 2.2: Porter, (Revised 1998)

The diamond framework consists of five factors. The first factor is the firm strategy, structure and rivalry. The firms strategy, structure and rivalry is dictated by the changing conditions of doing business and direct competition that forces the firm to be more innovative and to increase on productivity. Demand conditions is the second and this are the demands of the customers that put pressure on the organization to becoming more innovative so as to remain competitive in the industry hence attracting more customers. Third pillar of the diamond model is the factor conditions, this are the specific factors that enable the firm to produce goods and services. When a firm uses high quality products the higher the quality of its goods and services and therefore making the firm to be more competitive. Related and supporting industries deals with those industries that enable the organization to produce goods and services either through exchange of information and exchange of ideas for innovation. The government is the final pillar and it acts as a catalyst that encourages and pushes the organization towards achieving its competitiveness.

2.3 Conceptual Framework

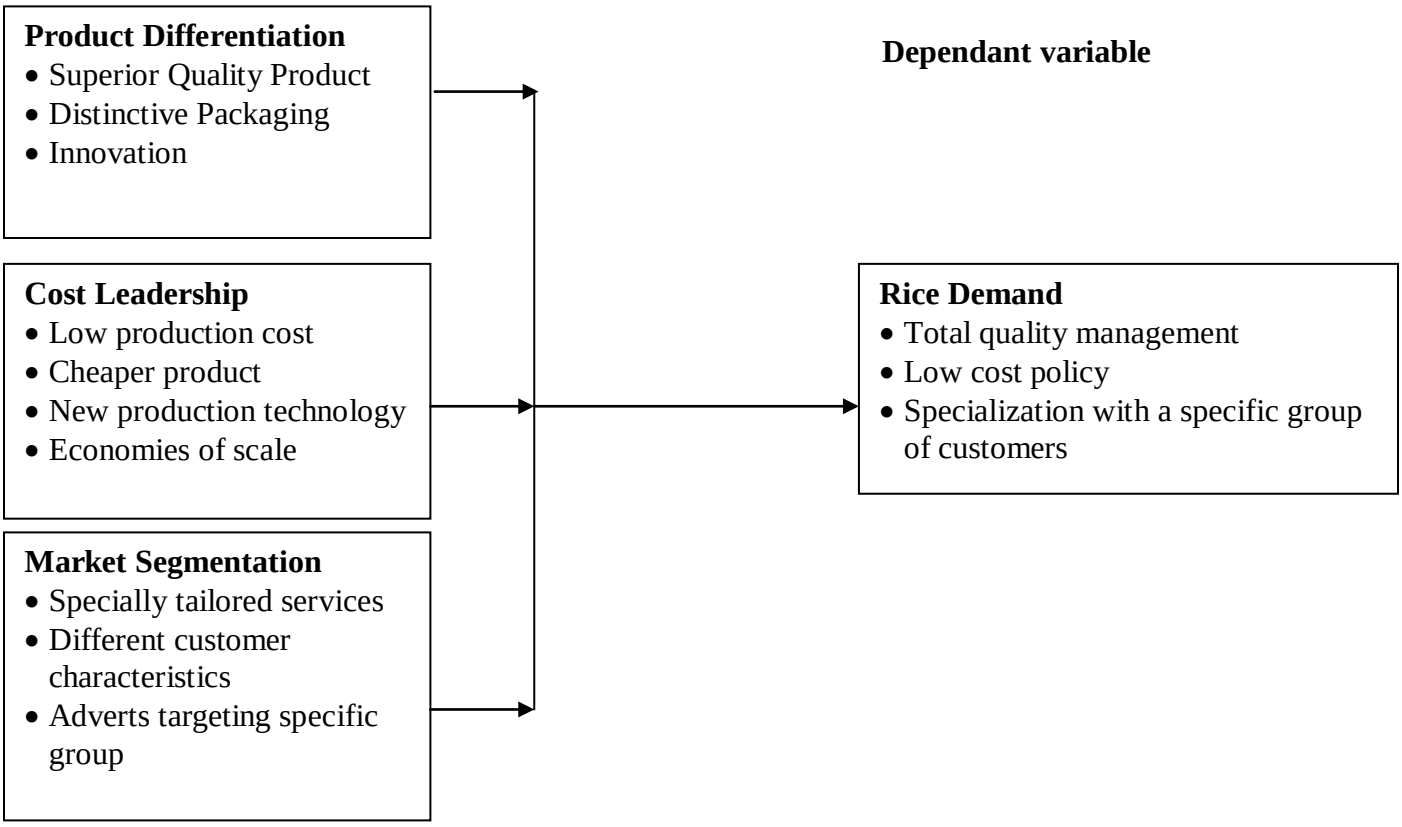

Figure 2.3 Competitive Positioning Model

2.2.1 To Examine the Effects of Product Differentiation on Changes in Rice Demand Patterns

Sharp & Dawes (2001) defined differentiation as when a firm outperforms its competitor by adding features on its products and services in such a way that the competitors products looses face sensitivity to the customers. On his part Garbelli (2005) defined differentiation as the activity that is undertaken by a firm to have its products look unique through addition of unique elements and features that can be perceived by the customer. Differentiation is done by the firm in order to achieve competitive advantage positioning and therefore enhance their organization performance as compared to the competitors (Raduan, Jegak, Haslinda and Alimin, 2009). According to Morgan, Kaleka & Katsikeas (2004) product differentiation can be measured using high product quality, packaging design and style. On his side Abu-Aliqah (2012) in his study used high product quality, fast delivery, design and new products and unique product features as variables for the study.

Product differentiation has been considered over time as a tool for achieving competitive advantage. According to Shammot (2011), achieving individual customer satisfaction and product quality, are among the major factors of differentiation. Aydin (2010) argued that the major feature of industrial economy was the internal quality execution and not price, and therefore quality is viewed as a market differentiator and therefore the need of the organization improving on their processes and adopting total quality management (TQM) (Sumutka, 2011). According to Masta (2009) lowest price may not be the main motivation for customers to buy a certain product but product quality was the determining factor.

On product design, according to Koter and Keller (2011) a well designed product offers both aesthetic benefits and functional benefits to the customer. Therefore, constant innovation is important to ensure introduction of new or similar things in the organization. Baregheh, Rowley & Sambrool (2009) defined innovation as a multi stage process in which organization changes ideas to improved products and services. Dirisu. Iyiola & Ibidunni (2013) argued position that attaining a competitive against the competitors was the main objective of every organization, and to achieve this industrial performance is key other than just marching up to the industrial rivalry. It has been established by researchers that there is a significant relationship between competitive advantage positioning and sales performance (Dirisu *et al* 2013). When Wang & Lo (2003) measured performance using level of sales revenue, profitability, return on investment, added value of products, market share, productivity and product growth they concluded that competitive advantage and sales based performance had a significant positive correlation. Strandholm & Kumar (2003) on the other hand argue that there is a positive relationship between external environment and organizations performance ability to gain competitive advantage.

Total quality management has been found to have positive significant relations with differentiation strategy Prajogo & Sohal's (2006) indicating that TQM plays an important role in differentiation and hence competitive positioning of the organization. Prajogo (2007) goes ahead to state that product quality is predicted by differentiation and through an improved product quality the organization is able to gain competitive positioning. It can therefore be agreed that there is a relationship between manufacturing strategy and firm performance which is competitive positioning of the firm in its industry (Amoako-Gyampah & Acquaah 2008). This argument is also in agreement with Allen & Helms (2002) who in their research found that product differentiation strategy had a significant positive relationship with organization performance. It can therefore be concluded that product differentiation contribute significantly to the organizations performance (Garbelli, 2005). According to Spencer, Joiner & Salmon (2009) an organization that is facing domestic and international competition and with changing customer demands should employ product differentiation instead of trying strategies that are based on efficiency and prices. This is agreement with Yasai-Ardekani (2008) who in his study found out that by implementing a competitive strategy the firm is able to gain performance benefits over the time.

2.2.2 To Establish the Effects of Cost Leadership on Changes in Rice Demand Patterns

According to grant (2005) cost leadership is the ability of the firm to maintain significantly lower prices as compared to those of the competitors in the same industry. However Ireland, Hokisson & Hitt (2011) defined cost leadership as a set of actions taken by a firm to produce products either goods or services that have features that are appealing to the customer at the lowest cost in the industry. Therefore cost leadership strategy seeks to supply a high volume of goods and services at the lowest price in the market to attract the most number of customers (Li & Li, 2008). It can therefore be concluded that cost leadership focuses more on the customer as opposed to the customer (Frambach, Ruud, Prabhu, & Verhallen, 2003). To achieve low cost strategy the whole organization has to adapt low cost policy in which case the whole organization including the staff are committed to the strategy (Malburg, 2000). In his argument Malburg (2000) states that to achieve this, the organization has to cut on activities that does not cut on cost and hence not creating a cost advantage on the part of the company. In their research on an airline in US, Peteraf & Reed (2008) found that technology was a one of the most important factors that reduce on production costs of an organization.

Low cost can also be achieved through adapting new innovations, new designs and reengineering activities based on economies of scale (Richard & Marilyn, 2004). An argument by Helms *et al* (1997) states that high income is achieved by having a large market share, in order to achieve a large market share the firm can lower its prices and attract a higher percentage of buyers and therefore higher income. However this strategy has been known to reduce on customer loyalty and it may lead to loss of revenue if the company lowers its cost more (Cross, 1999).To avoid loss of customer loyalty the organization can use cost leadership strategy by being more efficient than their competitors in their production process for both goods and services (Richard *et al* 2004).

In his research, Enz (2011) argued that there were different ways of creating low cost leadership; this were High capacity utilization, economies of scale, benefits from learning curve effects, technological advances and outsourcing. High capacity utilization is important since fixed cost represent a high percentage of total cost. Goes ahead to argue that high capacity utilization is be able to maintain a lower cost structure as opposed to the competitors. On economies of scale, Enz (2011) argues that through scale leadership in an industry an organization is able to position itself effectively. Economies of scale can be achieved through lowering the cost operating cost through the purchasing economies. The principle of economies of scale operates on the ability of the company expanding its scale of operation both at the chain level and at the property level (Enz, 2011). In the learning curve effect Enz (2011) argued that by creating a simple system did not require as much repletion in the learning process and hence the organization is able to cut on costs. Technological advancement is also a key player in low cost leadership. According to Enz (2011) cost saving technologies is a tradeoff between increasing fixed costs and reduction of variable costs. Through improving of technology the organization is able to lower the production cost per (Enz, 2011). Unit Examples of the hotel industry major lodging companies have invested on technology to reduce on the total unit cost per lodging. Outsourcing is also key cost reduction activity. By purchasing activities such as labour and security increases the organizations flexibility and at the same time reduce the risks and costs that are associated with producing and buying the activity from within the organization (Enz, 2011). Finally the organization should consider taking the cost leadership strategy to another level such as e-business, (Kim & Kim, 2000). According to Kim *et al* (2000) first time shoppers price is the important factor that and therefore a customer appealing price would be important. According to Porter (2001) internet technology is important to reduce variable cost and therefore just remaining with the fixed cost. Porter (2001) also goes on to argue that through internet technologies the organization is able to access outside vendors and therefore the company is able to outsource expensive activities that are not the core business of the organization.

2.2.3 To Determine the Effects of Market Segmentation Strategy on Changes in Rice Demand Patterns

Ulrich & Michaela (2006) defined market segmentation as offering products and services tailored to specific customers based on their needs. Dolnicar (2008) argued that in segmenting a market group of individuals with similar personal characteristics are developed. Dolnicar (2008) goes ahead to state that advantages of segmentation include the ability to specialize with a certain group, an organization can put more efforts to improve a product to fit a certain group instead of a whole population, marketing efforts can be focused to a specific group only and finally and most important segmentation aid in strategic positioning of the organization. The process of market segmentation involves steps. According to Charles, Lamb &McDaniel (2003) the first step towards market segmentation include the selection of a product or service for study. McDaniel *et al.* (2003) continue to state that the second step of market

segmentation is making a choice on the basis of segmenting the market. The organization should then select a market descriptor and then analyze the segments identified (Sun, 2009). According to Sun (2009), the steps mentioned above create a basis for segmentation which can be done demographically, geographically, psychologically and behavioral wise.

Segmentation done on the basis of demography includes demographic values such as age, income, occupation, religion, race, family, nationality and social class (Armstrong & Kotler, 2005). According to Sun (2009) individual members in each group have the same experiences to the organizations products and therefore advertisement is done using images and icons that appeal to the specific target group (Fair, 2003). Ferrell & Hartline (2008) also argued that demographic segmentation makes it easy to measure and vary between closely related customer needs and usage rates. Although demographic segmentation enables the organization to achieve strategic position stages in life defined an individual's major concerns and therefore changes in this stages may change the needs and focus of an individual (Kotler,2003). Cahill (2006) also goes ahead to argue that as a much as demographic segmentation is important for the organization to meet individual group needs there some members of the group that may not fit in the sub-set an example of elders who behave like youngsters. The second basis of segmentation is geographical segmentation, the organization divides the market based on their geographical locations such as countries, regions or counties (Sun, 2009). The organization can then choose to operate in one or more segments and pay special attention to each segment (Chandrasekar, 2010). This kind of strategy is mostly used by multinational companies and high capital businesses that are able to alter their product mix based on the consumers in each segment (Kotler, 2003). This strategy can be profitable to an organization however people in one region may differ in their tastes and preference based on other factors that are mostly demographic (Boone, Louis, Mackenzie, David & Kurtz, 2009).

Segmentation based on the behavior concentrates on how the customers behave in the market and the times when the behavior seems to change and this gives the organization a better understanding of the market (Reid & Bojanic, 2009). This is possible when customers develop a need and purchase a product which happens in different occasions (Kotler, 2003). This argument is based on the argument that the company provides exactly what the customers want and not based on their production line (Hamka, 2012). He goes on to argue that the company may segment the market based on how often the customers purchase a specific product. Kotler (2003) on his side argues that customers' attitudes can be used to determine the behavior of the market. He went ahead to determine the behaviors' as enthusiastic, positive, indifferent, negative and hostile (Kotler, 2003). According to Hamka, (2012) also noted that behavioral segmentation is possible using a combination of both the geographical and demographic segmentation. Finally, it's the psychographic segmentation whose main purpose is to understand as a person by measuring the psychological dimensions of the customer (Hamka, 2012). According to Larsen (2010) psychological segmentation is derived from customer personality and lifestyle. This can be concluded that psychological segmentation is divided based on the customer's attitudes, values, lifestyle opinions and interest (Pickton & Broderick, 2005).

2.4 Critique Review

The generic strategy may when properly implemented can be able to ensure strategic competitive positioning of the organization, however it has it shortfalls. One of the major shortfalls is on the cost leadership technique in which Porter (1998) suggests that the organization should invest on machinery as a way of cost cutting. As much as this suggestion can appealing to the management, investing heavily on equipments does not for sure lead to profitability of the organization (Datta, 2009). Differentiation on its part has the advantage of enabling the organization to concentrate on one or more products and therefore producing high quality products. This however poses the danger of an organization over differentiating itself hence losing its legitimacy (Porac, Thomas & Baden-Fuller, 1989). It has also been established that if a firm differentiates itself too much to the point of losing its legitimacy it consequently loses its ability to make rational decisions (Porac et al., 1989).

Finally, market segmentation enables the organization to meet individual need of customers by being able to design a specific product for a particular market segment. However, it has proven to be difficult to design products that satisfy each customer's individual needs and therefore organizations have found themselves spending money on constant innovation (Kotler & Armstrong 2001).

2.5 Summary

From the literature it has been established that generic strategies are important for an organization that seeks strategic positioning. The generic strategies enable the organization to manage its supply chain. By achieving the supply chain management the organization is able to competitively position itself Paulraj (2007). The review of literature has also been able to establish that by achieving a high profit margin between the organization and the competitors the organization is able to achieve and maintain its competitive position (Bech-larsen, *et al* 2007).

Further the review has also been established that the organization should capitalize on low cost production process (Davidson, 2008). Offering differentiated products to the market has also been found to create a unique niche for the organization in the market. Finally the review has been able to by concentrating on a group of customers and having products tailored to their needs, tastes and preferences has an effect of competitively positioning the organization in the market as compared to the competitors.

2.6 Research Gap

From the review it has been established that there is a scarcity of studies that investigate on the timing for application of the generic strategies and the organization structures that ought to be in place to ensure a successful implementation of the strategies. Majority of the existing studies have concentrated on explaining the individual generic strategies, their advantages and disadvantages. This study will seek to cover the gap by establishing the time that is best to apply the strategies and the structures needed to ensure that there is a successful implementation.

III. RESEARCH METHODOLOGY

3.1 Introduction

This chapter covered research methodology that was adopted to carry to carry out the study. The methodology included research design; it will show the target population, sample size, sample design and techniques, data collection instruments, research instruments, data collection procedure and finally data analysis and processing tools.

3.2 Research Design

Research design was defined as a blue print of carrying out a study, in which case the researcher has maximum control over the factors that may influence or otherwise interfere with the validity of the study finding. The study sought to establish the causes of the positioning problem in MRM and therefore adopted descriptive research design. Descriptive research design was used since it seeks to answer the questions concerning the causes of the problem (Coopers and Schindler, 2011). The study also sought the opinion of the people by use of questionnaires. The study employed qualitative approach to gather information as to why the organization is experiencing difficulties in strategic positioning while quantitative approach was used to investigate the ideas and opinions of people in regard to strategic positioning of the organization.

3.3 Target Population

The study targeted 57 permanent employees of Mwea Rice mills. The population was comprised of the senior management employees, supervisors and General staff. Mwea Rice Mills was made up of 50 general workers, 2 supervisors and 5 managers.

Table 3.1: Target Population

GROUP	NUMBER	PERCENTAGE
MANAGERS	5	9%
SUPERVISORS	2	3%
GENERAL WORKERS	50	88%
TOTAL	**57**	**100%**

3.4 Sample Size

Mugenda & Mugenda (2003) considered a sample size of not less than 30% of the population sufficient enough for a study, however to collect a sufficient sample for the study, the study will adapt a formula by (Coopers and Schindler, 2000).

$$n = \frac{N}{1+N(e)^2} \qquad n = \frac{57}{1+57(0.05)2}$$

= **50**

Where **n** is the sample size, **N** is the population of the size, and **e** is the error. The study assumed a confidence interval of 95% making the allowed error to be 5%.

Table 3.2: Sample

GROUP	NUMBER	PERCENTAGE	SAMPLE SIZE
MANAGERS	5	8.77%	4
SUPERVISORS	2	3.51%	1
GENERAL WORKERS	50	87.72%	45
TOTAL	**57**	**100%**	**50**

3.5 Sample Design and Technique

A stratified sampling design was employed to ensure that there were representatives from each department. Stratification is the process of diving members of a population into subgroups that are homogeneous and mutually exclusive (Hunt and Tyrrell, 2001). The study adapted a stratified research design since it allowed the researcher to apply different research methods in the different strata (Cooper and Schindler, 2003). The study employed stratification to ensure that there is representation of individuals from the different groups in the company.

3.6 Data Collection Instruments

The study collected both primary and secondary data in order to achieve the objectives of the study. The secondary data contributed to the formation of the background information necessary to guide the collection of primary data. Primary data was collected using questionnaires to identify the opinions and ideas of people in the organization, observation was also applied to identify the structure in place in Mwea Rice Mills that aid to achieve strategic positioning of the company.

3.7 Data Collection Procedure

Two instruments were used in the data collection process; Questionnaires and observation. The questionnaires were used to collect specific information from the respondent while observation was used to identify certain structures in place.

3.7.1 Questionnaires

In order to get the answers from the answers from different employees, the research used both open ended and closed ended questionnaires to collect relevant data. The closed ended questions were used to collect specific information from the respondent while the closed ended questions were used to get the respondent to give more information through personal opinion.

3.7.2 Observation

The researcher used observation in order to assess the different structures in place at Mwea Rice Mills that would aid to the company achieving the strategic competitive positioning over its competitors.

3.8 Data Analysis and Processing

After the questionnaires have been collected from the field they were adequately checked for reliability, completeness and verification. The data was then be coded and keyed to the Statistical Package of Social Sciences. Content analysis was used to analyze the qualitative data while descriptive statistics was used to analyze quantitative data. Measures of dependency which are correlation and covariance were also used.

The study will also adopt regression technique in the form of $\mathbf{Y = \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \varepsilon}$.

Where;

Y = Changes in Rice Demand

α = Constant,

$\beta_1, \beta_2, \beta_3, \beta_4$ = Partial regression coefficients,
X_1 = product differentiation
X_2 = cost leadership,
X_3 = market segmentation,
ε = Error term
The data will then be presented inform of tables and figures.

IV. RESEARCH FINDINGS AND DISCUSSIONS

4.1 Introduction

The general objective of the study was to establish competitive positioning strategies in response to changing rice demand pattern in Kenya. The chapter is divided into various sections. The initial section covers the background information with respect to the respondents; the second section covers effects of product differentiation in response to changes in rice demand pattern in Kenya. The third section will deal with cost leadership in response to changes in rice demand patterns in Kenya, finally the section will deal with market segmentation strategy in response to changes in rice demand patterns in Kenya.

The target population of this study was the employees of Mwea Rice Mills. A total sample size of (50) respondents were drawn from the population; sample was made up of the (4) members of the management, (1) supervisor and (45) members of the genera general staff. The study employed random sampling.

4.2 General Information

4.2.1 Response Rate

A total of 50 questionnaires were issued to the respondents and out of the 50 all were received back translating to 100% response rate.

Table 4.1: Response Rate based on Department

Positions Held	Frequency	Percent
GENERAL STAFF	45	90.0
MANAGEMENT	4	8.0
SUPERVISOR	1	2.0
Total	50	100.0

4.2.2 Gender of the Respondent

Table 4.2 shows the category of the respondents based on the gender. Majority of the respondents in MRM were men 63% and the minority of the respondents were female at 37%.

Table 4.2 Classification of the respondents on Gender

Gender	Frequency	Percent
MALE	32	62.7
FEMALE	18	35.3
Total	50	100.0

4.2.3 Age category of the respondents

The majority of the respondents as shown in table 4.3 are between the age of 31-40years at 50% of the total respondents, those who are between the age of 41-50 years follow closely at 26%, while those who are between the age of 20-30 years formed 16% of the population. The minority of the respondents based on age where those who were above the age of 51years who 8% of the respondents.

Table 4.3: Age Categories

Age	Frequency	Valid Percent
20-30 years	8	16.0
31-40years	25	50.0
41-50years	13	26.0
Above 51years	4	8.0
Total	50	100.0

4.2.4 Respondents Level of Education

As showed in table 4.4, majority of the respondents 30% are certificate holders and the diploma holders and the secondary school certificate holders followed closely at 26%. Those who studied to the primary school level were the minority at 8% while the degree holders formed 10% of the population. It was however established that none of the respondents had post graduate qualifications.

Table 4.4: Education Level

Education Level	Frequency	Valid Percent
PRIMARY	4	8.0
SECONDARY	13	26.0
CERTIFICATE	15	30.0
DIPLOMA	13	26.0
DEGREE	5	10.0
Total	50	100.0

4.2.5 Classification Based on the Years of Service

According to the results shown in figure 4.5 majority of the employees have worked in MRM over a period of 1-5 years at 46% while the minorities have worked in MRM for a period of above 10 years.

Table 4.5: Years of Service

Experience	Frequency	Valid Percent
BETWEEN 1-5	23	46.0
BETWEEN 6-10	17	34.0
ABOVE 10	10	20.0
Total	50	100.0

4.3 Competitive Positioning Strategies in response to changing demand

The researcher used a scale of 1 to 5. According to the study 5 which was value the highest represented the opinion that the respondents strongly agreed and 1 which was the least represented the opinion that the respondents strongly disagreed. The other value were 4 which indicate agree, 3 indicated that the respondent was neutral and 2 showed that the respondent strongly disagreed.

4.3.1 Product Differentiation

The first objective sought to find how product differentiation affected changes in demand for rice in MRM. The respondents were required to give their opinion on the quality of rice which showed that respondents agreed to the statement that the quality of rice from MRM was of higher quality than of the competitors. This was due to the mean of 3.84 which showed that more people more people agreed to the statement and a coefficient of variation of 28%. On the uniqueness of packaging the coefficient of variation was at 36.7% which indicated that the packaging method used was not unique. It was also evident that MRM had not changed it packaging method in the last five year due to the high dispersion rate of 49.5%, this led to MRM not being above the competitors with a dispersion of 44.8% finally product innovative ideas were important to maintain a competitive edge this was due to the dispersion of 45.1% which showed that MRM was not product innovative.

Table 4.6 Elements of Product differentiation that Affect changes in Demand

	Statements	Mean	Standard Deviation	Coefficient of Variation
D1	Rice from MRM is of higher quality than that of the competitors	**3.84**	**1.075**	**0.280**
D2	MRM is able to package its products in a unique way as compared to the competitors	**3.22**	**1.182**	**0.367**
D3	There has been a change in the packaging design in the last five years	**3.42**	**1.692**	**0.495**
D4	MRM's performance has been above the competitors due to the unique product and packaging design	**3.94**	**1.765**	**0.448**
D5	MRM encourages constant innovation and new ideas towards improving their products	**3.64**	**1.642**	**0.451**

4.3.2 Cost Leadership

In the second objective the respondents were required to give their opinion on whether MRM was able to gain competitiveness on the area of cost leadership. Majority of the respondents disagreed to the statement that MRM had priced its rice lower than the competitors. This was evidenced by the mean of 2.92 and a coefficient of variation of 42%. It was however noted that MRM had reduced the cost of production due to the mean of 3.4 and the coefficient of 33.6%, this might have been because of the new technology that had been adapted which showed a mean of 3.98 and a dispersion of 19.9%. However the technology was not utilized to capacity due to the coefficient of variation of 39.4% and a mean of 3.2 on the statement of capacity utilization. Finally the respondents indicated that MRM has been able to make use of economies of scale with a mean of 3.46 and a coefficient of variation of 32.1%.

Table 4.7 Elements of Cost Leadership that Affect changes in Demand

	Statements	Mean	Standard Deviation	Coefficient of Variation
CL1	Rice price in MRM are lower than those of the competitors	**2.92**	**1.226**	**0.42**
CL2	MRM has been able to reduce on the cost of production in the last five years	**3.40**	**1.143**	**0.336**
CL3	M RM has adopted new production technology	**3.98**	**0.795**	**0.199**
CL4	There is proper utilization of capacity in MRM	**3.20**	**1.262**	**0.394**
CL5	MRM is able to make use of economies of scale	**3.46**	**1.110**	**0.321**

4.3.3 Market Segmentation

The last objective was on market segmentation, the researcher sought to establish whether MRM had segmented its market. The results of the study showed that MRM had not segmented its market this was due to the low mean below 3 that agreed to the statement that MRM had divided it market according to the characteristics of different customers, the dispersion was also high at 37.9%. On the area of specialty which was tested using three statements; MRM has been able to identify specific groups and their needs, MRM and specialized its services on certain group of customers and finally products suit its customers, it was established that MRM did not have a specific group and this was all the variable having a mean of 3.26 and a coefficient of variation of 30.9%. Finally on the area of specific form of advertisement it was established that MRM did not advertise this was due to the mean of 1.88 and a coefficient of variation of 49.3%.

Table 4.8 Elements of Market Segmentation that Affect changes in Demand

	Statements	Mean	Standard Deviation	Coefficient of Variation
S1	MRM has been able to divide its market according to different characteristics of the customers	**2.78**	**1.055**	**0.379**
S2	MRM has been able to identify specific groups and what they need	**3.26**	**1.006**	**0.309**
S3	MRM has specialized its services to a certain group of customers	**3.26**	**1.006**	**0.309**
S4	Products from MRM suit its customers	**3.26**	**1.006**	**0.309**
S5	MRM adverts are targeted towards a specific group	**1.88**	**0.927**	**0.493**

4.4 Analysis

4.4.1 Summary of Mean and Standard Deviation

The table 4.9 shows the average mean and standard deviations of the 50 variables as compared to the effect of each on the response to changes in demand. The study showed a collective mean of 3.003 which shows that the respondents were in agreement with some of the variables in use for the study while they disagreed with others.

Table 4.9 Report Summary

	Mean	Standard Deviation	N
Response Strategies to changing demand	**3.003**	**1.084**	**50**
Product Differentiation	3.03	1.162	50
Cost Leadership	3.092	1.107	50
Market Segmentation	2.888	1.000	50

4.4.1 Correlation

Table 4.10 shows that have a significant positive correlation of 31.5% with response to changing demand. Cost leadership had a lower correlation of 27.1 to response to changing demand while market segmentation had the lowest correlation of 23.4% to response to changing demand.

Table 4.10: Correlation between Elements that Influence Change and Response to Change.

	Response to changing demand	**Product Differentiation**	**Cost Leadership**	**Market Segmentation**
Response to Changing Demand	**1**	**0.315**	**0.271**	**0.234**
Product Differentiation	**0.315**	**1**	**0.086**	**0.196**
Cost Leadership	**0.271**	**0.086**	**1**	**0.065**
Market Segmentation	**0.234**	**0.196**	**0.065**	**1**

4.4.2 Regression Analysis

Table 4.11 shows the regression summary of four independent variables which are; innovation, quality of rice, uniqueness of packaging and changes in the packaging design. From the table the R squared value is 0.65 which means that 65% of the changes in demand are affected by innovation, quality of rice, uniqueness in packaging and changes in the packaging design. The remaining, 35% is determined by other factors in the environment. Therefore MRM has not fully utilized factors of product differentiation.

Table 4.11: Regression analysis Model Summary for Product Differentiation

			Change Statistics			
Model	R	R Square				
			Adjusted R Square	df1	df2	Sig. F Change
1	.806[a]	.650	.619	4	45	.000

a. Predictors: (Constant), INNOVATION, QUALITY of RICE, UNIQUENESS OF PACKAGING, CHANGES IN THE PACKAGING DESIGN

From table 4.12 the R square value is 0.139 which means that only 13.9% of the changes in demand in MRM are affected by use of economies of scale, reduction in cost of production, utilization of capacity and use of new technology while remaining 86.1% is determined by other factors in place at MRM.

Table 4.12: Regression Analysis Model Summary for Cost Leadership

			Change Statistics			
Model	R	R Square				
			Adjusted R Square	df1	df2	Sig. F Change
1	.373[a]	.139	.062	4	45	.000

A. Predictors: (Constant), Use of Economies of Scale, Reduction of Cost of Production in MRM, Utilization of Capacity, New Production Technology

From table 4.13 the R-squared value of 1 which means that market segmentation agreed with the line of best fit. It therefore means in regard to segmentation the environment determined 100% of the rice demand and MRM had no influence.

Table 4.13: Regression Analysis Model Summary for Market Segmentation

Model	R	R Square	Adjusted Square	R Change Statistics df1	df2	Sig. F Change
1	1.000[a]	1.000	1.000	3	45	.

a. Predictors: (Constant), MRM ADVERS TARGETS SPECIFIC GROUPS, DIVISION IS THROUGH THE CHARACTERISTICS OF CUSTOMERS, SPECIALIZATION OF SERVICES TO GROUPS

4.4.3 Relationship between Elements that Influence Changes in Demand

Finally the study compares the different elements that influence changes in demand. Product differentiation showed a significant positive relationship with strategic response to changes in demand in MRM with a beta value of 0.083 and a t-value value of 1.549 while cost leadership showed a positive relationship with a beta value of 0.49 and a t-value of 1.326 and finally market segmentation had the least relationship with a beta value of 0.20 and a t-value of 0.380.

Table 4.14: Comparison of How Different Elements Influence Changes in Demand

Coefficients[a]

Model		Un-standardized Coefficients B	Std. Error	Standardized Coefficients Beta	t	Sig.
1	(Constant)	1.705	.922		1.850	.000
	Product Differentiation	.101	.184	.083	1.549	.000
	Cost Leadership	.053	.162	.049	1.326	.000
	Market Segmentation	-.249	.181	.020	0.380	.000

a. Dependent Variable: Strategic Response to changing demand

Final Regression Equation

$Y = \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \varepsilon.$

$Y=1.705+0.101\ X_1 +0.053X_2 - 0.249X_3$

4.5 Chapter Summary

The finds of the study were presented in this chapter. Descriptive statistics were used to provide further insight. Using the questionnaire that had both closed ended and open ended questions data was collected from 50 respondents and using SPSS it was collated and analyzed using the research questions. Tables were widely used in the chapter to present the data. The next chapter will critically discuss the analysis of the result as presented in this chapter with the view of coming up with recommendations and conclusions.

V. SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

The previous chapter was chapter four that dealt with the analysis and the presentation of data. This chapter will deal with summary of data in the first section, conclusions will then be drawn from the data, and recommendations will then be made to MRM and finally more recommendations for further studies will be made.

5.2 Summary

From the background of this study it shows that there was a 100% response rate from the respondents. The response rate was gotten from the different departments that participated in the study. It was also established that the number of male employees were more than the female employees who worked with MRM. This was gotten from the difference of the male and female respondents which stood at 62.7% and 35.3% respectively. MRM was also found to take advantage of the middle aged personnel who were between the age of 31-40 years and they were the majority of the respondents who formed 50% of the respondents. However those between the age of 20-30 years formed 16% of the respondents and those above the age of 41 years formed 34% of the respondents. On the levels of education it was found that the majority of the respondents were certificate holders who formed 30% of the respondents followed by those who studied up to the secondary level and diploma at 26% each. However those who achieved the professional level of education formed a low percentage of 10% in the organization. Majority 46% of the respondents had worked with MRM over a period of 1-5 years, 34% of the respondents had worked with MRM for over a period between 6 years and 10 years. Those who had worked for over 10 years formed 20% of the respondents.

The second part was on competitive strategies in response to changing demand. In this part the quantitative analysis were carried using the mean, standard deviation and coefficient of variation. Study showed that the average mean for product differentiation to be 3.03. This meant that more than half of the respondents agreed that product differentiation was important for strategic response to changing demand. The cost leadership had a mean of 3.092 while market segmentation had a mean of 2.888. On correlation the researcher established that product differentiation correlated positively with strategic response to changing demand of 31.5% while cost leadership correlated with strategic response to changes in demand at 27.1% finally market segmentation showed a positive correlation of 23.4%. On linear regression the study showed an R-square of 65% which showed that product differentiation contributed to 65% of the changes in demand in favor of MRM, the remaining 35% was controlled by other factors in the business environment. The study also revealed that cost leadership contributed to only 13.9% of the changed in demand that were in favor of MRM while 86.1% was determined by other factors in place in the environment. It was clear that market segmentation had an insignificant contribution to changes in demand. Finally it was clear that Product differentiation was the most applied strategy that affected change in demand in favor to MRM with a coefficient of beta of 0.083, followed by cost leadership of with a beta of 0.049 and the last being market segmentation of 0.02.

5.3 Conclusion

From the study a conclusion was drawn that factors that affected strategic response of MRM to changes in rice demand patterns in Kenya included product differentiation, cost leadership and market segmentation. Of the three it was also found product differentiation strategy contributed to 65% of the strategies that MRM had employed in the market due to the changing patterns of demand. This was followed closely by cost leadership strategy which contributed 13.9% while segmentation contributed to 2% of the strategies that MRM had applied to deal with the changing rice demand.

5.4 Recommendations

The study established that MRM was unable to achieve a competitive edge against the competitors because it applied one of the strategies more than other strategies and that was product differentiation. While it used more of product differentiation the organization did not apply it wholly and concentrated more on packaging that has not been changed regularly over the last five years. The study therefore recommended that MRM should use more of product differentiation. This was in agreement with Kotler et al (2011) who argued that well differentiated product offered both aesthetic benefit and functional benefits to the customer and therefore constant innovation is important to ensure introduction of new or similar things in the organization. Secondly it was recommended that total quality management was important for the MRM to achieve competitiveness based on differentiation. Prajogo eta al (2006) in their study found that there was a significant relationship between differentiation strategy and performance.

Cost leadership was found to be key for MRM to remain competitive. It is recommended that MRM would reduce costs that the organization experienced during production and this was possible through innovation and utilization of the production technology to capacity. Through this the organization is able to cut on unnecessary costs during the production process and therefore this would be translated to the final cost to the customer (Malburg 2000). Finally the study recommended that MRM should concentrate more on segmentation. It was found that MRM did not have any form of segmentation in place. MRM needed to study its market and divide it according to the tastes and abilities of different customers. By segmenting the market MRM would be able to attract a bigger pull of customers. The organization should then choose the segments in which to operate in comfortably. According to Dolnicar (2008) segmentation had the advantage of allowing the company to concentrate on the segment that they had the ability to offer specialized services as opposed to concentrating on the whole group.

5.5 Areas for Further Research

The researcher highlights the following areas that would require further study;

1. Affordable ways of production with little or no wastage in government managed organizations in Kenya today.
2. Ways of remaining competitive in turbulent business environment.

REFERENCES

[1] Abu A., K., M. (2012). Differentiation and Organizational Performance: Empirical Evidence from Jordanian Companies. Journal of Economics. Vol. 3, Issue No.1

[2] Acquaah, M & Yasai-Ardekani, M. (2008). Does the implementation of a combination competitive strategy yield incremental performance benefits? A new perspective from a transition economy in Sub-Saharan Africa. Journal of Business Research. Vol.61 Issue 4, Pp.346–54

[3] Allen, R., S. & Helms, M., M. (2002). Employee perceptions of the relationship between strategy, rewards and organizational performance. Journal of Business Strategies. Vol. 19, Issue 1

[4] Amoako-Gyampah, K. & Acquaah, M. (2008). Manufacturing strategy, competitive strategy and firm performance: An empirical study in a developing economy environment. International Journal of Production Economics. Vol.111, Issue 1

[5] Baregheh, A., Rowley, J., & Sambrool, S. (2009). Towards a multidisciplinary definition of innovation. Journal of Management Decision. Vol. 47, Issue 8. Pp, 1323-1339

[6] Barney, J. B. (1995). Looking inside for competitive advantage. Academy of Management Executive. Vol 9, Issue 4, Pp49-61.

[7] Bauer, C. & Colgan, J. (2001). Planning for electronic commerce strategy: an explanatory study from the financial services sector. Logistics Information Management. Vol. 14, Issue No.1/2, Pp.24-32.

[8] Bech-Larsen, T., Esbjerg, L Grunert, K. G., Juhl, H. J., & Brunso, K. (2007). The Supermalt identity: how Brixton-based Afro-Caribbean consumers construct.

[9] Bech-Larsen, T., Esbjerg, L. Grunert, K. G., Juhl, H. J., and Brunsø, K. (2007). The Supermalt identity: how Brixton-based Afro-Caribbean consumers construct.

[10] Cahill Dennis J. 2006. Lifestyle Market Segmentation. The Haworth Press

[11] Campbell, R., Schiff, H., Snodgrass, D., Neven, D., Downing, J. & Sturza, D. (2009). Global Food Security Response: West Africa Rice Value Chain Analysis.

[12] Cockburn, I. M., Henderson, R. M., & Stern, S. (2000). Untagling the Origins of Competitive Advantage. Strategic Management Journal. Vol. 21, Issue No. 10/11, Pp. 1123-1145.

[13] Cooper, D. R., & Schindler, P. S. (2011). Business Research Methods (11th ed.). New York: McGraw-Hill/Irwin.

[14] Coopers D. R. & Schindler, P. (2000). Business Research Methods. New York, NY: Mcgraw-Hill.

[15] Datta A.K (2009). Materials Management Procedures, Text and cases (2nd edition) PHI learning private Limited New Delhi.

[16] Davidson, S. (2008). Seizing the competitive advantage. Community Banker. Vol. 10, Issue. No.8, Pp.32-4.

[17] Dirisu, O., Iyiola, J. & Ibidunni, O. (2013). Product differentiation: a tool of competitive advantage and optimal organizational performance (a study of unlevel Nigeria plc). European Scientific Journal Vol 9 Issue 34, Pp258-281

[18] Donicar, S. (2008). Market Segmentation in Tourism. University of Wollongong.

[19] Eichengreen, B. & Wyplogsz, C. (2001). "When Does Capital account Liberalization Help More" Central Planning and Monitoring Unit. Ministry of Agriculture Economic Review of Agriculture 2010. Issue 48

[20] FAO (2004). Strengthening Farm-Agribusiness Linkages in Africa. Food and Agriculture Organization of The Unite states (FAO), (2004). United States Http://Www.Fao.Org/Docrep/008/Y5785e/Y5785e00.Htm

[21] Farrell, O.C. & Hartline, Michael D. (2008) Marketing Strategy (4th ed). USA \ South-Western

[22] Frambach, R. T., Prabhu, J. C., & Verhallen, T. M. M. (2003). The influence of business strategy on new product activity: The role of market orientation. International Journal of Research in Marketing. Vol. 20, Issue 4, Pp. 377-397.

[23] Garbelli, M. E. (2005). Product Differentiation Costs and Global Competition. Emerging issues in Management. Vol n., Issue 1 Pp. 66-89.

[24] Grant, A. M. (2008). The significance of task significance: Job performance effects, relational mechanisms, and boundary conditions. Journal of Applied Psychology, Vol. 93, Issue 1, Pp. 108 –124

[25] Grant, R. M. (2005). Contemporary Strategy Analysis. (5th ed.). Malden: Blackwell Publishing,

[26] Hyatt, L. (2008), A simple guide to strategy, Nursing Homes. Nursing Journal. Vol. 50 No.1, pp.12-13

[27] Keller, K., L. (2008). Strategic Brand Management: Building, Measuring and Managing Brand Equity (3rd ed.). Upper Saddle River, New Jersey: Pearson Prentice Hall

[28] Koter, P. & Keller, K. (2011). A Framework for Marketing Management, 4th edition, Pearson Education, Inc. Publishing as Prentice Hall

[29] Kotler, Philip. Marketing Management. New Jersey: Pearson Education, 2003.

[30] Lançon, F. & Benz, H. D. (2007). Rice imports in West Africa: Trade regimes and food policy formulation. Poster prepared for the 106th seminar of the European Association of Agricultural Economists.

[31] Malburg, C. (2007). Competing on costs. Industry Week, Vol. 249, Issue No.17, Pp.31-35.

[32] Matsa, D., A. (2009). Competition and Product Quality in the Supermarket Industry

[33] Mintzberg, H. (1994). The Rice and Fall of Strategic Planning. Prentice Hall, Englewood Cliffs, NJ.

[34] Morgan, N. A., Kaleka, A. & Katsikeas, C. S. (2004). Antecedents of export venture performance: A theoretical model and empirical assessment. Journal of Marketing. Vol. 68

[35] Mugenda, M. O. & Mugenda, A. G. (2003). Research Methods, Quantitative & Qualitative Approaches. Nairobi, KE: Acts Press,

[36] Mwai, E., M. (2010). Assessment of the Marketing Constraints Affecting Small Scale Rice Farmers in Kenya: The Case Study of Mwea Irrigation Scheme. Nairobi University Thesis Collection.

[37] Paulraj, A. & Chen, I. J. (2007). Strategic Buyer- supplier Relationships, Information Technology and External Logistics Integration. Journal of Supply Chain Management. Vol. 43, No. 2, Pp 2-5

[38] Paulraj, A., & Chen, I.J. (2007). Strategic buyer-supplier relationships, information technology and external logistics integration. The Journal of Supply Chain Management, Vol 43 Issue2, Pp2-14.

[39] Peteraf, M., & Reed, R. (2007). Managerial discretion and internal alignment under regulatory constraints and change. Strategic Management Journal. Vol 28 Issue 11, Pp. 1089–1112.

[40] Pickton, D., & Broderick, A. (2005). Integrated Marketing Communication. Harlow: FT Prentice Hall.

[41] Porac, J. F., H. Thomas and C. Baden-Fuller (1989). 'Competitive groups as cognitive communities: The case of Scottish knitwear manufacturers', Journal of Management Studies, Vol 26, Pp. 397–416

[42] Porter, M. (1980). Techniques for analyzing industries and competitors, Competitive Strategy. New York: Free Press.

[43] Porter, M. (1985). Creating and sustaining superior performance. Competitive Advantage. New York: Free Press.

[44] Porter, M. E. (2001, March). Strategy and the Internet. Harvard Business review .

[45] Porter, M.E. 1998a. Competitive Advantage: Creating and Sustaining Superior Performance, with a new introduction. New York: Free Press

[46] Prajogo, D. I. & Sohal, A. S. (2006). The relationship between organization strategy, total quality management (TQM), and organization performance the mediating role of TQM. European Journal of Operational Research. Vol.168

[47] Prajogo, D. I. (2007). The relationship between competitive strategies and product. Quality Industrial Management and Data Systems. Vol. 107

[48] Raduan, C .R. Jegak, U., Haslinda, A. & Alimin, I. I. (2009). A Conceptual Framework of the Relationship between Organizational Resources, Capabilities, Systems, Competitive Advantage and Performance. Journal of International Studies. Issue No. 12

[49] Reid, R. and D. Bojanic (2009), Hospitality Marketing Management, 5th edition, New York: John Wiley & Sons

[50] Reilly, T. (2002). Be a champion of the solution. Industrial Distribution. Vol. 91, Issue No.5, Pp.62.

[51] Shammot, M. M. (2011). Quality Management Practices and Their Impact on Organizational Performance, and Customer Behavior. European Journal of Economics, Finance and Administrative Sciences. Vol. 1, Issue 34

[52] Sharp, B., & Dawes, J. (2001). What is Differentiation and How Does it work? Journal of Marketing Management. Vol. 1, Issue 17, Pp.739-759

[53] Spencer, X. S., Joiner, A. T., & Salmon, S. (2009). Differentiation Strategy, Performance Measurement Systems and Organizational Performance: Evidence from Australia. International Journal of Business. Vol. 14, Issue 1

[54] Strandholm, K. & Kumar, K. (2003). Differences in Environmental Scanning Activities between large and small organizations: The advantage of size. Journal of American Academy of Business, Vol. 1 Issue No.1

[55] Sumutka, A. & Neve, B. (2011). Quality as a Competitive Advantage

[56] Sun, S. (2009). An analysis on the Conditions and Methods of Market Segmentation. International Journal of Business and Management. Vol 4, Issue No. 2 Pp. 63-70

[57] Thongrattana, P. T. (2012). An analysis of the uncertainty factors affecting the sustainable supply of rice production in Thailand. University of Wollongong Thesis Collection.

[58] Ulrich, D. & Michaela, D. (2006) Market segmentation strategies of Multiproduct Firms. The Journal of Industrial economics. Vol. LIV. Issue No. 1

[59] Wang, Y. & Lo, H. (2003). Customer-focused performance and the dynamic model for competence building and leveraging: A resource-based view. Journal of Management Development. Vol. 22. Issue 1 Pp. 483–526

[60] West Africa Rice Center (WARDA. (2007). "Africa Rice Trends: Overview of Recent Developments in the Sub-Saharan Africa Rice Sector. Africa Rice Center Brief. Cotonou. Benin

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The Role of Organizational Experiences in the Formation and Acceptance of a Leader Identity: A Phenomenological Study of Leaders Working Within the Context of a Religious Not-for-Profit Organization

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The Academy of Organization, Management & Leadership

Abstract- This study examined the leadership identity development of a sample of leaders in order to better understand leaders' perceptions about what contributed to the development of their leadership identities. Using in- depth interview questions, the lived experiences of organizational leaders were explored so as to build on the limited existing research on leadership identity and offer further insight into the phenomenon of leadership identity formation. The results of this study revealed that the study participants had each experienced leadership within multiple social and organizational contexts. Based on the responses of study participants, the acceptance of their leadership identities was influenced, in part, by the leaders to whom they had been exposed and by the social contexts in which their leadership experiences took place. The participants in this study began to identify themselves as leaders while working within the context of organizations that provided opportunities for leadership, collaboration, and mentorship from experienced leaders.

Index Terms- Leadership, Leadership Identity, Identity Development, Organizational Context.

I. INTRODUCTION

How one forms a leadership self-identity is a phenomenon that has yet to be fully understood (Johnson, Venus, Lanaj, Mao, & Chang, 2012; Komives, 2011). There has been growing curiosity surrounding this issue, and some researchers have speculated on the possibility that certain social–contextual factors may contribute to leadership identity development (Campbell, 2011; Komives, Owen, Longerbeam, Mainella, & Osteen, 2005; Wagner, 2011). As leadership has been identified as a construct that is often shaped by the social context in which it is experienced (Fielding & Hogg, 1997; Onorato, 2010), an examination of the social contexts in which leadership is identified provides a deeper understanding of the process of leadership identity formation. This study examines how organizations, as social contexts, affect one's leadership identity formation by answering the question: What are leaders' perceptions concerning the role of their organizations in their leadership identity formation?

This study examines leaders' perceptions concerning how their experiences in the social context of organizations influenced the development of their leadership identities. Recognizing organizations as social contexts provides an atmosphere for continued study of the organizational experiences that shape one's leadership identity. As individuals spend a significant portion of their waking lives in the context of organizations, it has been suggested that this life domain may influence one's self-identity (Dutton, Roberts, & Bednar, 2010; Rus, van Knippenberg, & Wisse, 2010; Wagner, 2011). This identity can be influenced by differing contextual aspects and can even affect one's overall professional development (Brook, Garcia, & Flemming, 2008). With this in mind, it was necessary to not only examine how an individual's leadership identity had been formed but also how this identity development may have been influenced by the organizational context in which leadership experiences took place (DeRue & Ashford, 2010).

The apparent scarcity of published information about leadership identity development, particularly the lack of research focusing on organizational context and leadership identity, supports the need for further study (DeRue & Ashford, 2010; DeRue, Ashford, & Cotton, 2009; Komives, Owen, Longerbeam, Mainella, & Osteen, 2006). Adding to the existing knowledge base by exploring the organizational experiences that contributed to the development of one's leadership identity is of interest to anyone working within any modern organization, because it has been suggested that leadership identity development is an antecedent of leadership effectiveness (Day & Harrison, 2007; DeRue, Ashford, et al., 2009; Johnson et al., 2012). By examining how leadership identity is formed and how this identity formation was influenced by organizational experiences, this study serves to provide further insight into the phenomena of leadership.

II. RESEARCH BACKGROUND

Leadership identity formation is a phenomenon that has received limited attention (DeRue & Ashford, 2010; Johnson et al., 2012; Wagner, 2011). Curiosity surrounding this issue has led to an increased awareness of the role self-identity plays in the overall development of leaders and prospective leaders (Komives, Owen, et al., 2006). This study helps to gain a greater understanding of how leaders choose to identify themselves as leaders and how organizational experiences have influenced their understanding of their leadership identities. This was accomplished by first identifying the existing theories that have a bearing on this study.

Identity Theory

As one of the two most commonly held views concerning self-identity, identity theory is built upon the understanding that one's identity develops as a response to the situational need for a particular formalized role (Stets & Burke, 2000). Individuals understand who they are based on their understanding of the world in which they live and the roles they play in their world. In this view, one understands one's self as the occupant of a particular role (Burke & Tully, 1977). Identity theory appears to be much more situational in nature, as it builds upon the assumption that one's identity develops as a result of the need to perform a particular task or to fill a particular role (Hogg, Terry, & White, 1995).

Identity theory's emphasis on role performance has somewhat limited the overall understanding of identity in that identity theory does not fully account for individuals' understanding of how they fit into a particular group but rather places emphasis on what an individual does (Stets & Burke, 2000). As Hogg, Terry, et al. (1995) pointed out, identity theory does not place as much emphasis on the socio-cognitive variables related to identity development and may ignore the importance of contextual cues. This theory does not provide for a complete understanding of how an individual develops his or her identity.

Social Identity Theory

Unlike identity theory, social identity theory holds that identity is the result of an individual's involvement in various social constructs and that one's identity develops as a response to observed similarities between one's self and the other members of a social group (Hogg & Abrams, 1988; Tajfel & Turner 1979). Tajfel (1972) introduced social identity theory and explained that the process involved an individual comparing oneself to members of other groups; this involves self-categorizing and social comparison. As people label or categorize themselves, they begin to identify with groups based on their perceived similarities with those other group members (Hogg & Abrams, 1988). If people believe that they exhibit the prototypical behaviors of the members of a particular group, they will identify themselves as also being a part of the group (Hogg, van Knippenberg, & Rast, 2012).

Though useful in studying the dynamics of some social groups, social identity theory does present some challenges (Stets & Burke, 2000). Through social comparison, one's identity depends upon one's ability to accurately assess how he or she compares with the members of a group. This also involves understanding how one may differ from the group members. An individual may only understand that he or she is dissimilar to other individuals and may not be able to truly understand his or her own unique identity.

Identity Development

Though both views do provide insight into the nature of self, neither identity theory nor social identity theory appear to fully explain how one develops his or her personal identity—let alone explain how one develops a leadership identity (DeRue & Ashford, 2010; DeRue, Ashford, et al., 2009). Identity theory places more emphasis on the individual's behaviors, while social identity theory focuses on the individual's perceptions of social categorization and group fit. When addressing a leader's identity development, identity theory appears to define a leader based on how he or she does leadership, while social identity theory supports this definition based on how individuals categorize themselves as leaders. In other words, identity theory focuses on doing, while social identity theory focuses on being, but neither fully explain how individuals self-identify as leaders (Stets & Burke, 2000).

Leadership Identity Development

Komives, Owen, et al. (2005) examined the identity development of leaders by exploring the issues that influence the development of an individual's identity as a leader. The grounded theory study conducted by Komives, Owen, et al. resulted in the identification of a six-stage LID model. The six stages in the model were awareness, exploration/engagement, leader identified, leadership differentiated, generativity, and integration/synthesis (Komives, Own, et al., 2005).

Awareness is identified as the period of time during which an individual first becomes aware of leadership. During this stage, leadership is understood as something that does exist and leaders such as teachers, parents, and politicians exist outside of ones' self. Leadership, in this stage, is merely a concept that exists externally (Kimoves, Owen, et al., 2005). One's understanding of leadership within this stage is limited to an external concept and is not understood as a state that can be achieved by one's self; rather, it is understood as something that is for others (Komives, Owen, et al., 2006).

The second stage is exploration or engagement. This stage is characterized by one's exposure to groups and to group experiences (Komives, Owen, et al., 2005). During this stage, individuals begin to build friendships within their groups and begin to learn how to work together (Komives, Longerbeam, et al., 2009). In this stage, individual group members may be given some responsibilities in their group, but these do not necessarily include any leadership responsibilities (Komives, Owen, et al., 2005).

During the third stage, one identifies leadership as a hierarchical system that allows for positional leaders (Komives, Owen, et al., 2005). Leadership, in this stage, is understood as a position that some group members hold. Leadership exists in the actions or activities of the group's positional leaders. In this stage, leadership is not understood as being achievable by all group members but is reserved for those who are already recognized as leaders (Komives, Owen, et al., 2006).

During the fourth stage, leadership is understood as a process shared within a group. The understanding of leadership moves beyond recognizing leaders as those holding positions to the recognition that leadership happens in all aspects of the group (Komives, Owen, et al., 2005). The leader, in this stage, is understood as "a facilitator, community builder, and shaper of the group's culture" (Komives, Owen, et al., 2005, p. 606). During this fourth stage, individuals still do not recognize that leadership is a role that they can take on within the group.

The fifth stage is characterized by the understanding that leadership can be developed, but this is still understood as a process that takes place in the other group members (Komives, Owen, et al., 2005). During this stage, one does not necessarily self-identify as a leader but does understand the importance of developing other group members. Individuals who reach the

stage of generativity may feel a sense of responsibility for developing and even mentoring others in the group (Komives, Owen, et al., 2005).

The sixth and final stage is integration or synthesis. It is during this stage that one truly recognizes that he or she can also be a leader (Komives, Owen, et al., 2005). The capacity for leadership within the individual is understood as being a part of the process of personal development, and one begins to understand that he or she is also a potential leader (Komives, Owen, et al., 2006). This is the point when a leader first identifies himself or herself as a leader. This is when one actually accepts a leadership identity.

Social Learning

To better understand the social contexts in which leaders developed their leadership identities, and the social influences that may have contributed to leaders' leadership identity, this study used Bandura's (1976) social learning theory to examine what study participants learned about leadership within the social context of organizations. Social learning theory has been built upon the understanding that individuals learn how to behave in various social situations based on their observations of others (Bandura, 1976). As an individual observes the actions and outcomes of certain behaviors, he or she in turn learns how to act within similar situations (Bandura & Walters, 1963). This observational learning involves modeling the behaviors of others and applying this knowledge within a given social context.

Bandura (1977) noted that individuals are more likely to imitate the behaviors of others whom they perceive to be similar to them. These observed similarities help to determine the learned behaviors and contribute to the cognitive understanding of ones role within the social context (Bandura, 1977). Additionally, social learning is also understood as a reciprocal process during which a social environment determines one's behavior and one's behavior determines his or her environment (Bandura, 1977). Because social context and social learning have been recognized as possible elements within the various stages of LID (Komives, Owen, et al., 2006) the role of social learning was addressed in this study.

III. Research Method

This study used a qualitative phenomenological approach. A phenomenological research approach was appropriate for this research study because the purpose of this study was to better understand the experiences among individuals who had experienced similar phenomena and also to focus on what may have influenced these common experiences (Creswell, 2007; Moustakas, 1994). All of the participants in this study have shared experiences, as all of the participants had experienced the phenomena of LID and all had had past leadership experiences within the social context of organizations.

Study Participants

When considering the use of a particular research method, Hycner (1999) explained, "The phenomenon dictates the method . . . including even the type of participants" (p. 156). As leadership identity formation was the phenomena examined in this study, a phenomenological approach was utilized to select study participants. With this in mind, participants for this study were selected after determining that they held a recognized leadership position within an organization and determining that they identified themselves as leaders.

The participants in this study, or co-researchers, all worked within the context of a religious not-for-profit organization and each had a leadership position within the organization. Though all worked with the same organization, some participants also worked with other organizations and had other employers. Three of the study participants were female, and the remaining seven were male. Their ages ranged from 25 to 69 years old. The participants' demographic information is provided in Table 1.

Table 1: Study Participant Demographic Information

Number	Pseudonym	Gender	Age	Location
1	Adam	M	66	Northeast US
2	Barbara	F	69	Northeast US
3	Chris	M	39	Northeast US
4	Megan	F	38	Northeast US
5	Peter	M	42	Northeast US
6	Patrick	M	25	Northeast US
7	Bryan	M	34	Southern US
8	Tom	M	47	Northeast US
9	Bernie	M	37	Northeast US
10	Donna	F	47	Northeast US

Note. Participant numbers were assigned based on the order of recruitment, not order of interview.

Analysis

This study used Moustakas's (1994) modified Stevic–Colaizzi–Keen method in order to provide textural–structural descriptions of experiences. The analysis began with the identification of, what Creswell (2007) described as, "significant statements, sentences, or quotes that provide an understanding of how the participant experiences the phenomenon" (p. 61). These statements were organized into clusters of meaning to identify common themes within the participants' interview responses. This information was organized using a coding method involving the categorization of interview responses. The interview transcripts were coded and organized in order to identify common themes within the study participants' interview responses (Saldana, 2009). These themes were used to construct descriptions of the experiences of each of the study participants. The individual participant textural and structural descriptions of their experience with the phenomenon of leadership identity formation were used to create a composite textural–structural

description of participants' experiences. This information provided the opportunity to present a unified account of the phenomenon being examined and further insight into leadership identity. The codes and themes that were present in the participant interviews are provided in Table 2.

IV. Results

From the interview transcripts of each of the study participants, or coresearchers, horizons emerged. These horizons provided the content needed to uncover the meaning of each of the participant interviews. Through the use of structural coding, the horizons revealed meaning units, which were analyzed and clustered into six common themes. Though presented as a composite, the themes were found in each of the participant interviews. These six themes along with the meaning units that were used to develop each theme are presented in Table 2.

Table 2: Themes Present in Participant Interviews

Codes/Meaning units	Theme
Church, college, family, military, school, sports teams, youth organization, workplace	Leaders experienced leadership in multiple contexts
Acknowledgement, assigned roles, calling, group-granted ID	Leaders need to be recognized as leaders
Inspiration/motivation, mentoring, personal growth, prayer	Leaders need to be invested in and developed
Authoritarian positions, modeling, natural/authentic, nonauthoritarian, reluctance	Leaders identify who they are through social comparison
Communication, hands on, team work	Leaders recognize the need to work with others
Accomplishing goals, fulfillment, responsibility for others	Leaders feel a sense of purpose

Note. Codes, meaning units, and themes are based on a composite of all 10 study participants.

The composite themes were used to develop textural descriptions and structural descriptions of the experiences of each of the coresearchers. These individual descriptions were used to create a composite textural-structural-description of the participants' experiences.

Composite Textural–Structural Description

The 10 leaders who participated in this study each experienced leadership within multiple social contexts. Leaders recognized the advantages of having a variety of organizational experiences and pointed out the value of working within environments that allowed for observation and interaction with different styles of leadership. Through social comparison, leaders were able to, at an early age, determine the types of leaders that they did not want to be as well as the types of leaders they wanted to follow. From this knowledge, leaders were able to construct a concept or model of leadership that they wanted to emulate.

The identification of others as leaders was not enough to initiate study participants' acceptance of a leadership identity. The participants needed to not only observe leadership but also to be active participants in social groups. They recognized the importance of working within groups and developed a sense of teamwork. Their interactions in their respective social groups positioned them to prepare for their future group leadership roles. Though some participants may have had an innate sense of their future leadership role, their group involvement further contributed to their understanding of leadership.

The study participants' involvement in groups allowed them to be recognized as leaders. Through acknowledgement, assigned roles, or a group-granted leadership identity, the participants began to recognize that others identified them as leaders. This recognition came from either their peers or from one of their mentors or leaders. The participants were recognized as leaders by being appointed to leadership positions or by being identified as role models by their peers. Through this recognition, they were eventually able to identify themselves as leaders and accept their leadership identities.

Each study participant was invested in and developed. In some cases, this process was closely related to their recognition. Study participants continued to learn about leadership and were able to develop as leaders. Through the mentorship and motivation by their leaders and peers, the study participants were able to accept their leadership identities. Though they recognized themselves as leaders, the participants in this study acknowledged that they understood that leaders need developed. They each described their own personal growth and explained that, as leaders, they felt a sense of purpose.

Essence of the Experience

The final phase of a phenomenological investigation is the development of "a unified statement of the essences of the experience of the phenomenon as a whole" (Moustakas, 1994, p. 100). Through the composite textural–structural description of all 10 of the study participants, the researcher captured the essences of the experience of leadership identity formation. The development of a leadership identity is initiated by observing leaders and through one's involvement in multiple social groups. The acceptance of this identity is aided by encouragement and recognition from others. Following acceptance, one's leadership identity continues to develop over time.

V. Discussion

The results of this study show that the study participants experienced leadership within multiple social and organizational contexts. The acceptance of their leadership identities was influenced, in part, by the leaders to whom they had been exposed and by the social contexts in which their leadership experiences took place. The participants in this study were identified as leaders by others and eventually accepted leadership identities.

Leadership Identity Development

Each of the 10 participants in this study described the development of his or her leadership identities as a process. Even though some of the participants, such as Bernie and Tom, explained that they felt that they had a natural ability to lead, they made a point of emphasizing that their understanding of themselves, as leaders, developed over time. The 10 participants' descriptions of the processes involved in their identity formation appear to be consistent with the research conducted by Komives, Owen, et al. (2005). Each participant described a process that resembled the six stages presented by Komives, Owen et al.

The participants in this study described that they first became aware of leadership by observing leaders. This took place in the home as they observed parents and other family members. Participants also observed public figures and recognized these individuals as leaders. They became aware that there were people who were in charge of things. Bernie became aware of this when he observed his father. Donna and Patrick recognized that their mothers were leaders. Megan was aware of public officials and political leaders. As each participant became aware of the existence of leadership, he or she had a structural context for understanding leadership.

The study participants explained that when they became aware of the existence of leadership, they began to interact with leaders. These early interactions took place within the context of their families, churches, and schools. Megan and Peter both described interactions with their parents and explained that their early interactions with leaders were somewhat one-sided. This was similar to the descriptions offered by all but two of the remaining participants. Chris explained that his early interactions with leaders were more collaborative and positive experiences. Bernie also described his early interactions with leaders as being positive experiences. Through these early social interactions, the participants were able to learn about leadership from their own personal experiences and recognized leadership as more than just a vague concept.

As participants observed and interacted with leaders, they were able to identify leaders. Leaders were initially identified as those individuals who held positions of authority. This concept was described in all 10 participant interviews. The participants explained that they had developed an understanding of leadership that was based on leaders who held authoritarian positions or served in assigned roles. This seemed consistent with the third stage of leadership identity development presented by Komives, Owen, et al. (2005).

The study participants each shared that after identifying leaders, they had compared and contrasted the leaders that they observed with their own understanding of leadership. Tom did not see that the leaders he observed embodied his understanding of leadership as a group process. He identified leaders who only held positions of leadership but did not, in his opinion, act in the best interest of the group. This was similar to the descriptions shared by Peter, Megan, and Patrick. Chris and Donna recognized leadership as a group process and saw this style of leadership in the leaders that they observed. The descriptions offered by each participant showed that the participants developed an understanding of leadership within the context of groups and recognized leadership as a group process prior to accepting a leadership identity. This, too, is consistent with the research findings of Komives, Owen, et al. (2005).

After becoming involved with organizations, the participants in this study recognized that they could be leaders and recognized the need to develop others who were in their social groups. The descriptions offered by Megan, Peter, and Adam suggests that they had identified themselves as leaders before recognizing the need to develop others. This seemed to deviate slightly from the research of Komives, Owen, et al. (2005), which suggested that leaders first felt a sense of responsibility for developing and even mentoring others in the group before leaders accepted a leadership identity. The remaining participants had identified the need to develop others prior to the acceptance of their leadership identities.

Identity and Social Identity

The organizational leaders who participated in this study developed a leadership identity after having experiences that required them to perform roles within their groups or organizations. Their descriptions fit within Stryker's (1968) view of self-identity as an individual's desire to perform a specific role within a social structure. This role-focused view of identity was illustrated in the descriptions offered by the participants in this study. Adam, Barbara, Peter, and Patrick each described the leadership roles that they had within their groups and explained that they developed a sense of leadership while performing the tasks associated with their roles.

The participants in this study also described that they had developed a leadership identity while taking part in the activities of social groups. This appeared to be consistent with Tajfel's (1972) social identity theory, which focused on how individuals identify themselves within social groups. This theory explains that an individual compares himself or herself to the members of his or her group, as well as members of other groups (Tajfel &Turner, 1979). The description of Tom's experiences highlight this perspective. He decided that he did not share in the values of his youth group and left the group.

Social Comparison and Self-Categorization

Through social comparison and self-categorization, the participants in this study were able to understand who they were as leaders. All the participants in this study shared that they had compared themselves to other leaders and that, as a result, they had developed an understanding of themselves as leaders. This appears consistent with the ideas presented by Tajfel and Turner (1979) who explained that as people compare themselves to others, they begin to develop an understanding of where they fit within the social structures that exist in their world. The participants' descriptions of their experiences suggested that, by observing leaders, they were able to create some standard for a leadership self-definition or self-categorization. The descriptions of these experiences support the social identity theorists' position that an individual's understanding of self requires that he or she compare himself or herself to others (Hogg, Terry, et al., 1995; Stryker & Burke, 2000; Tajfel & Turner, 1979).

The leaders who participated in this study offered descriptions of their leadership experiences that were also consistent with Tajfel and Turner's (1979) presentation of self-categorization as the process by which an individual identifies

himself or herself as being included in a particular group. Barbara Peter, Patrick, and Donna shared that they did not feel that they fit within the same categories as the leaders that they observed. Their initial understanding of leadership did not seem consistent with the views that they had of themselves. The descriptions of these experiences were similar to Hogg's (2001) observation that because of the subjective self-evaluative nature of this concept, individuals might not have a completely accurate perspective of other people or of themselves.

Group-Granted Identity

The leaders who participated in this study shared descriptions of their experiences that also supported Hogg's (2001) argument that followers create or promote group leaders who typify leadership behaviors. Barbara, Megan, Chris, Bernie, and Donna began to identify themselves as leaders after their peers granted them leadership identities. These participants had other members of their social groups who encouraged them to take on leadership roles and appointed them as their group leaders. Though the study participants may not have initially identified themselves as leaders, their peers identified each of them as leaders. This, as Hogg explained, gives the power of leader identification to group members who proclaim that selected members are, in fact, leaders. Though the participants' peers granted them leadership identities, all of the 10 participants still had to accept their leadership identities.

Identity Acceptance

It has been suggested that the process of self-identifying as a leader may actually take place after one assumes a leadership position (Kramer, 2003; Lord & Hall, 2005). This position appears to be supported by the descriptions offered by the participants in this study. Adam, Peter, Patrick, Bryan, and Tom accepted their leadership identities after being appointed to or assuming leadership roles within a group. Barbara, Megan, Bernie, Chris, and Donna finally accepted their leadership identities after their peers acknowledged them as leaders. Whether appointed, assigned, or granted the role of a leader, all the leaders who participated in this study eventually accepted their roles and, as a result, identified themselves as leaders. This appears to support Kramer's (2003) study, which found that those in positions of leadership who have been identified as leaders by other members of their social constructs eventually self-identify as leaders.

The Role of Social Learning

The study participants explained that they had initially learned about leadership by observing others in their social groups. This is consistent with Bandura's (1976) understanding that individuals learn how to behave in various social situations based on their observations of others. As the participants in this study observed the actions and outcomes of certain behaviors, they learned how to behave in similar situations. Bandura explained that this form of observational learning involved modeling the behaviors of others and applying this knowledge within a given social context.

Some participants offered descriptions that included modeling the behaviors of their leaders. Bernie and Chris, for example, modeled the behaviors they saw their older family members exhibit after determining that these behaviors had positive outcomes. Donna observed leaders who she saw as effective and eventually decided to emulate their behaviors. Tom observed what he identified as negative leadership behaviors and learned that such behaviors hindered the effectiveness of a group. Patrick observed leaders who were authoritarian and a leader who took a collaborative approach toward leadership. He eventually chose to model the collaborative leadership behaviors that were exhibited by his youth group leader. The participants' descriptions of their leadership experiences suggest that opportunities to observe various leaders allowed them to learn about both effective and ineffective approaches toward leadership.

Organizational Context

The leaders who participated in this study described the characteristics of the organizational settings in which they experienced leadership. Adam, Barbara, Chris, Megan, Peter, Patrick, Brian, Bernie, and Donna identified themselves as leaders through their involvement in educational organizations. They described the opportunities for leadership as well as the support and mentorship that were offered in these organizations. This seems to coincide with Campbell's (2011) research of college administrators, which suggested that the availability of mentors and the abundance of student leadership opportunities contributed to the development of her study participants' leadership identities.

The study participants also described the role that the church played in their leadership identity formation. Tom shared that he had identified himself as a leader while participating in his church youth group. He described this group as being dysfunctional and did not initially identify it as an environment that would allow him to grow, but within this context, he began to understand that he had a responsibility to be a role model to the other members of the group. Barbara also identified herself as a leader while working with her church. Though she also worked within the context of an educational institution, she described her church as a safe environment that seemed like a family. In this environment, she learned about leadership and began to take on leadership roles.

Limitations and Recommendations

Adhering to a phenomenological methodology, this study offered a description—not an explanation—of the participants' leadership experiences. This research has offered descriptions of the experiences of a specific group of organizational leaders but cannot be generalized to describe the experiences of all leaders. With this in mind, the researcher encourages future investigation of the concepts described in this study using other sample populations and other research methods. Using an equal sample of men and women may provide additional opportunities to examine any differences between the way in which males and females experience leadership identity.

Research on specific leadership styles may also provide opportunities for future research on the topic of leadership identity. A study of leaders who self-identify as servant leaders, for example, might provide opportunities for insight into the process involved in one taking on a servant leadership identity. Bryan and Donna explained that they viewed themselves as

servant leaders but did not fully describe how they accepted that specific leadership identity. This study did not fully examine the leadership styles that each participant had observed. Bernie and Donna described early experiences with leaders that were only positive. Tom described leadership experiences that he viewed as negative. The remaining participants described both positive and negative leadership experiences. The role of the style of leadership and the impact that this has on the process of a leader's identity development may be worth investigating.

This study did not account for people who did not self-identify as leaders, despite having leadership positions. Though Peter and Patrick both identified themselves as leaders prior to their participation in this study, they each, during his respective interview, admitted to sometimes struggle with accepting this identity. The salience that they attached to this identity and the reasons for their reluctance to accept the identity may be worthy of future study. Research using a sample of people in leadership positions who do not self-identify as leaders may provide further insight into the nature of leadership identity formation.

As an emerging area of study within the field of organizational leadership, there are numerous opportunities for future research related to leadership identity. This study examined leaders' perceptions concerning how their experiences in the social context of organizations affected their individual leadership identity formation and provides a foundation for future research focusing on the role of contextual factors. Recognizing organizations as social contexts provides an atmosphere for continued study of the organizational experiences that shape one's leadership identity. Future research will provide opportunities for insight and allow for a deeper understanding of the process involved in the formation of one's leadership identity.

REFERENCES

[1] Bandura, A. (1976). Social learning perspective on behavior change. In A. Burton (Ed.), *What makes behavior change possible?* (pp. 34-57). New York, NY: Brunner/Mazel.

[2] Bandura, A. (1977). *Social learning theory*. Englewood Cliffs, NJ: Prentice Hall.

[3] Brook, A. T., Garcia, J., & Fleming, M. (2008). The effects of multiple identities on psychological well-being. *Personality and Social Psychology Bulletin, 34*, 1588-1600.

[4] Burke, P. J., & Tully, J. (1977). The measurement of role/identity. *Social Forces, 55*, 81-97.

[5] Campbell, H. M. (2011). *The leadership identity development of college administrators who attended women's colleges* (Doctoral dissertation). Retrievedfromhttp://repository.lib.ncsu.edu/ir/bitstream/ 1840.16/6996/1/etd.pdf

[6] Creswell, J. W. (2007). *Qualitative inquiry and research design: Choosing among five approaches*. Thousand Oaks, CA: Sage

[7] Day, D. V., & Harrison, M. M. (2007). A multilevel, identity-based approach to leadership development. *Human Resource Management Review, 17*, 360-373.

[8] DeRue, D. S., & Ashford, S. J. (2010). Who will lead and who will follow? A social process of leadership identity construction in organizations. *Academy of Management Review, 35*, 627-647.

[9] DeRue, D. S., Ashford, S. J., & Cotton, N. C. (2009). Assuming the mantle: Unpacking the process by which individuals internalize a leader identity. In L. M. Roberts & J. E. Dutton (Eds.), *Exploring positive identities and organizations: Building a theoretical and research foundation* (pp. 217-236. New York, NY: Routledge.

[10] Dutton, J. E., Roberts, L. M., & Bednar, J. S. (2010). Pathways for positive identity construction at work: Four types of positive identity and the building of social resources. *Academy of Management Review, 35*(2), 265-293.

[11] Fielding, K. S., & Hogg, M. A. (1997). Social identity, self-categorization, and leadership: A field study of small interactive groups. *Group Dymanics: Theory, Research, and Practice, 1*(1) 39-51.

[12] Hogg, M. A. (2001). Social identity and the sovereignty of the group. In C. Sedikides & M. B. Brewer (Eds.), *Individual self, relational self, collective self* (pp. 123-143). Philadelphia, PA: Psychology Press.

[13] Hogg, M. A., & Abrams, D. (1988). *Social identifications: A social psychology of intergroup relations and group processes*. London, England: Routledge

[14] Hogg, M. A., Terry, D. J., & White, K. M. (1995). A tale of two theories: A critical comparison of identity theory with social identity theory. *Social Psychology Quarterly*, 58, 255-569.

[15] Hogg, M. A., van Knippenberg, D., & Rast, D. E. (2012). The social identity theory of leadership: Theoretical origins, research findings, and conceptual developments. *European Review of Social Psychology, 23*(1), 258-304.

[16] Hycner, R. H. (1999). Some guidelines for the phenomenological analysis of interview data. In A. Bryman & R. G. Burgess (Eds.), *Qualitative research* (Vol. 3, pp. 143-164). London, England: Sage.

[17] Johnson, R. E., Venus, M., Lanaj, K., Mao, C., & Chang, C. (2012). Leader identity as an antecedent of the frequency and consistency of transformational, consideration, and abusive leadership behaviors. *Journal of Applied Psychology, 97*(6), 1262-1272.

[18] Komives, S. R. (2011). College student leadership identity development. In S. E. Murphy & R. J. Reichard (Eds.), *Early development and leadership: Building the next generation of leaders*. New York, NY: Routledge.

[19] Komives, S. R., Longerbeam, S. D., Mainella, F., Osteen, L., Owen, J. E., & Wagner, W. (2009). Leadership identity development: Challenges in applying a developmental model. *Journal of Leadership Education, 8*(1), 11-47.

[20] Komives, S. R., Owen, J. E., Longerbeam, S. D., Mainella, F. C., & Osteen, L. (2005). Developing a leadership identity: A grounded theory. *Journal of College Student Development, 46*(6), 593-611.

[21] Komives, S. R., Owen, J. E., Longerbeam, S. D., Mainella, F. C., & Osteen, L. (2006). A leadership identity development model: Applications from a grounded theory. *Journal of College Student Development, 47*(4), 401-418.

[22] Kramer, R. M. (2003). The imperative of identity: The role of identity in leader judgment and decision making. In D. van Knippenberg & M. A. Hogg (Eds.), *Leadership and power: Identity processes in groups and organizations* (pp. 184-197). London, England: Sage.

[23] Lord, R. G., & Hall, R. J. (2005). Identity, deep structure, and the development of leadership skill. *Leadership Quarterly, 16*, 591-615.

[24] Moustakas, C. (1994). *Phenomenological research methods*. Thousand Oaks, CA: Sage.

[25] Onorato, S. M. (2010). *Developing a leadership identity: A case study exploring a select group of Hispanic women at a Hispanic serving institution* (Doctoral dissertation). FIU Electronic Theses and Dissertations. Paper 253.

[26] Rus, D., van Knippenberg, D., & Wisse, B. (2010). Leader self-definition and leader self-serving behavior, *The Leadership Quarterly, 21*, 509-529.

[27] Saldana, J. (2009). *The coding manual for qualitative researchers*. Thousand Oaks, CA: Sage.

[28] Stets, J. E., & Burke, P. J. (2000). Identity theory and social identity theory, *Social Psychology Quarterly, 63*(3), 224-237.

[29] Stryker, S. (1968). Identity salience and role performance: The importance of symbolic interaction theory for family research, *Journal of Marriage and Family, 33*, 558-564.

[30] Stryker, S., & Burke, P. J. (2000). The past, present, and future of an identity theory. *Social Psychology Quarterly, 63*, 284-297.

[31] Tajfel, H. (1972). Social categorization. English manuscript of 'La catégorisation sociale.' In S. Moscovici (Ed.), *Introduction à la Psychologie Sociale* (Vol. 1, pp. 272-302). Paris, France: Larousse.

[32] Tajfel, H., & Turner, J. C. (1979). An integrative theory of intergroup conflict. In W. G. Austin & S. Worchel (Eds.), *The social psychology of intergroup relations* (pp. 33-47). London, England: Academic Press.

[33] Wagner, W. (2011). *Examining developmental stages of leadership for college students: A validation study of the leadership identity development model*.Retrieved from http://hdl.handle.net/1903/12087

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Border Community Social Solidarity in Maintaining an Area through Local Wisdom in Bengkayang Regency

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Abstract- The boundary between West Kalimantan and region of Sarawak (Malaysia) is along 866 Km traversed by 50 footpaths (rat paths) in 55 villages (http://kalimantan.menlh.go.id , 2012). The length of the border region makes both societies are able to across borders more freely. Historically, social relations between Jagoy Babang (Indonesia) with Sarawak (Malaysia) is a cognate bound by very close socio-cultural relations through the bound of marriage and blood ties. Along the border community issues there is a duality of perception boundaries between government regulation with peoples' customary law under the auspices of the board of the Dayak. On one side, the boundary regions are bounded by the legislation between the two countries, but on the other hand, it has had indigenous customary law in determiningboundaries. Wisdom of local communities border could be seen from customary law governing boundaries.

This study used a qualitative method helped by the descriptive research to illustrate the actual phenomena that occur in the field.This study was assisted data collection techniques of observation, interviews and documentary studies. The technique was`supported by a data collection tool such as observation, interview and documentation tool. Informants in this study were community leaders in the border Jagoi Babang Jagoi Tribal Council, the village and sub-district chief. The results illustrate that it can not be denied that boundary violations were committed by certain persons such as illegal stakes made by unscrupulous Malaysians.The boundaries are often missing so that boundaries become blurred. Do not let the bonds of solidarity in border communities disappear due to irresponsible persons because it regards each other in order to maintain kinship and shared causes in the border region for generations of children and grandchildren. Social solidarity bond is formed comes from local wisdom in keeping the border region originated from rules of customary law which are adhered to by the local community. In addition to the customary law, social solidarity bonds also formed the spirit of mutual cooperation and a sense of kinship based on shared causes.

Index Terms- Solidarity Association, Local Wisdom, Border Region.

I. Introduction

The reality of the border between the two countries peoples of Indonesia and Malaysia are closely intertwined due to kinship ties and geographical proximity; hence their relationship are bound by ties of family which is not barred by the citizenship problem to interact. They live side by side which then form a bond of social solidarity. The formation of social relationships due to social norms adhered to by the people of different nationalities border. They have the social capital in the form of customs and customary law, especially under the auspices of the Dayak Bidayuh " Traditional Council of Binua Jagoy" inherited from generation to generation resulting in the establishment of social solidarity. Society has had a legacy of communal land border crossing that has been recognized and agreed upon customary law. Borders of the two Community of different countries are made according to state regulations restricted by boundary markers making it easier for them to inhabit even work on communal land belonging to their ancestors. The relationship is a relationship based on mutual trust and mutual symbiosis; the relationship that is not considering bilateral relations based on international law, but the primordial ties of relations.This condition can be exploited by unscrupulous people who exploit the situation for personal gain.

Border peoples' customary law, on one hand,glue communities of both countries, but on the other hand can cause problems concerning bilateral relations between the two countries including the presence of vulnerable security boundaries which often shift and unable to protect the border between the two countries. The pattern of public relations in the border between the two countries is limited to social issues, customs and customary law which have not been fully set up for border protection issues between the two countries. Formal juridical regulations concerning international law as the basis for the settlement of border issues between the two countries have not been working properly. Allegedly, there are some areas of the two countries claimed as each country's boundaries; sometimes it is shifted. Furthermore,in the disputed boundaries, unscrupulous Malaysians move the boundary markers illegally to expand their territory. Based on these indications, the purpose of this study is to make a pattern of border security through customary law in order to protect the border region using the approach of social solidarity. Forms of social solidarity border with all its limitations in keeping the area is in the form of mutual cooperation and sense of common fate for shared causes.

II. Literature Review

2.1. Concept of Social Solidarity and Social Networking

Here are the concept of social solidarity by Emille Durkheim in her book *The Division Of Labor in Society* (1933: 111) which reveals about the division of labor in modern industrial society, the specialization for appropriate expertise at work. Durkheim also explains that natural community groups formed a good bond of social solidarity that occur naturally. The concept of social solidarity emphasizes on the state of relations between individuals and groups and underlying engagement with the social life. Emille Durkheim (Johnson, 1986) says that social solidarity is a state of the relationship between individuals or groups based on moral feelings and beliefs held together and

strengthened by shared emotional experience. Real form will bear a relationship with an emotional experience that strengthens the relationship between them. Furthermore, Durkheim said that social solidarity can be positive due; (1), to the dependence of the individual to society that bind to each other, (2), to the existence of a system of different functions and special and unite relationship remains and is a symbiotic mutualists. As explained by Garna (1996) social solidarity is a relationship or bond of groups of people who have social relations based on family ties or friendship bound by meeting the emotional feelings and the feeling of togetherness. The emotional connection is caused by a sense of morality together bound by the norms prevailing in the society. According to the writer, social solidarity bonds emerge because of the intensive relationship and social contact between members of the community;they meet each other, know each other, work together and help each other, and eventually form an emotional bond with each other resulting to the sense of belonging bound by the sense of family.

In this study, social solidarity in the boundaries is constructed because of the kinship ties and emotional attachment in shared causes. They are united in the bonds of mutual solidarity to help secure the border region from the violations and seek after the actors who wants the expansion for their own personal gain.

Existence of social solidarity ties for border residents from sub-ethnic Bidayuh is due to the social network of fellow citizens. Referring to the concept of social networks according to the Suharto (2000. http://www.policy.hu/suharto/modul) is an established social structure of individuals and organizations bound by a relationship between individuals and groups. According to the writers, the social networks of social ties in the social system include social norms, social institutions and commitments, so that social networks create a sense of social solidarity in the community.

2.2. Regulations regarding the border region Jagoi Babang

Boundary is the line in the border region that gives the rights of sovereignty as a state based on law of the State border of the Unity Republic of Indonesia (NKRI) and borders of the neighboring country of Malaysia. Regulations regarding the boundaries of the Territory is intended to provide legal certainty regarding the scope of the territory, the territory of the management authority, and sovereign rights.

State boundaries are state jurisdiction to protect the public and the state and the region as a boundary for economic activities as well as the boundary of state's sovereignty on national defense in anticipation of the threat of a country's integrity. Thus the boundaries show the integrity of the nation with respect to the politic, economic, defense and security of a country, as well as addressing the administrative boundaries of the state government in implementing the policy and legislation of a country.

The state's boundary regionsare described in accordance with Law No. 43 2008 on the territory of the state in Chapter III which describes the scope of the country in Article 4;the territory of the state includes the land, territorial waters, seabed, the ground beneath and the air space above it, as well as all sources of wealth contained therein. Further described in chapter 5 the State Borders on land, waters, seabed and the subsoil thereof and the air space above it is set on the basis of bilateral agreements and / or trilateral regarding land borders, sea borders and airspace as well as by legislation and international law.

The task of securing the border region lies not only in government; the public is also responsible for protecting the border area.Community participation in the management of border areas is established under the Law No. 43 2008 on the territory of the State.Society who plays a role in the management of Border Area community is governed by Article 19 of Law No. 43 of 2008 in the form of: (a) fostering development in border area; and (b) protecting and defending the Border Regions. Public participation is carried out in accordance with the provisions of the legislation.

Looking at the security area, there is a territorial border controlled by a particular ethnic group and therefore the other parties could not claim it. The region is called the communal land. More specifically concept of communal land (http://id.wikipedia.org/wiki/Tanah_ulayat) is that the parcels of land on which there is a communal right of a particular customary law community. Customary rights, according to customary law, is the authorityowned by customary law community over certain areas of the environment, which allows the community to take advantage of natural resources, including land, in the region for their survival. Community and the resources mentioned above have a relation outwardly and inwardly hereditary and are uninterrupted between the customary law community with the area concerned.

III. Research Method.

The focus of this research is the ties of solidarity among the border community in maintaining boundaries derived from local knowledge in the form of customs and customary law of the Dayak Bidayuh sub-ethnic. Data collection activities were carried out in the border region indicating a shift in the border boundary and local wisdom of the communities. Data collection was done through observation to observe the border region boundary conditions. Data collection was amplified using the technique of in-depth interviews of informants among other Dayak Bidayuh sub-ethnic communities directly domicile adjacent to the Sarawak and supported by the Jagoi Babang village authorities with consideration that they were more aware of their origins and activities of the people in the border region. Stages of data analysis were done by deepening the analysis of qualitative data from the initial crawl data until the completion of the preparation of research data. The stages of qualitative data analysis (Alwasilah, 2003: Muhajir, 2000) were done by compiling data based on themes and categories.The next stepwas making data interpretation to provide the depth of meaning in association with the concept, and the final stage was to determine the validity of the data through triangulation techniques, by verifying the data through resource persons, informants and relevant theories.

IV. Discussion of Social Solidarity of Border Communities in Protecting the Border Area by Local Wisdom

Solidarity bond among border communities in maintaining boundaries through local wisdom is believed to maintain the area.Solidarity bond is formed due to the geographic boundary conditions of West Kalimantan for along the 866 Km which is very large and heavy. Heavy region which is bounded by forests, hills, canyons and rivers forces them to be able to survive due to a lot of insecurity around the border region. In regard to the role of the community in keeping the area borders the following described bonds form of social solidarity based on local wisdom border communities through customary law, the spirit of mutual cooperation and sense of common fate for shared causes.

4.1. Customary law regulating the border region

The following described territory border of a State according to its norms function and customary laws relating to the protection of the borders without colliding with boundaries according to the regulations of both countries, Indonesia and Malaysia. Regulations regarding the protection of the border region is not only derived from state law regulations, but also accompanied by social norms prevailing in a society called the customs and customary law. The existence of a law of social capital in Jagoi Babang reflects the existence of a regularity and adherence to traditional values and norms that have been preserved for generations.

Land area owned by the community is designated as a source of livelihood that mainly rely on natural sources of the surrounding land as well as communal and sacred sites maintained by the community. Border region is decided using the values of local wisdom believed and agreed by communities of both countries. Division of community management using customary law become a living space for indigenous peoples, and at the same time also maintain the integrity of indigenous territories from outside interference or interference from within the community itself. Boundaries of indigenous peoples as described by the Secretary Council of Dayak Bidayuh Kasminto [1] describedthat during the management activity to maintain indigenous territories, there are always "custom officers" that serve as a guard territory and a law enforcement of customary law based on customary justice exist in society of Dayak Bidayuh.

Protection system for the frontier area is bound by solidarity among the Dayak Bidayuh community. This is due to the vast area to be protected which consists of hilly areas, forest areas, canyons and rivers as a source of livelihood for border residents. In keeping with the extent of the boundary of the region,the community work together.

4.2 Community's Mutual Aid System in maintaining the border region.

Economic life of the Dayak people reliesheavily on agriculture and plantations. Swidden agriculture is a livelihood closely related to the Dayak community (see, for example, Dove, 1998; Anyang 1998).

[1] The results of the interview with the secretary of the Dewan Adat Dayak Bidayuh, dated May 13, 2014

[2] The results of interviews with village heads Jagoi Mr. Nogian, dated May 11, 2014.

Traditional farming pattern in of Dayaksis in form of dryland farming which relies on local knowledge practiced by generations and has lasted hundreds of years. Diverse plants are also planted, such as rice, vegetables and medicinal plants, to meet their own needs and to keep the plant in order to remain sustainable. Post-harvest, they will grow the former field with productive crops such as fruits, rubber, ironwood trees, palm and other crops of economic value.

Community awareness of social solidarity that is built within the selflessness of Dayak people is inseparable in their daily life that each individual can not survive as a stand-aloneindividual; each individual is part of other individuals so that they complement each other and meet each other. Dayak people tend to do something together, mutually aid. When building a house,they would ask the help of neighbors and vice versa; when working their fields, they share the work cutting the fields, planting rice, harvesting rice, helping one another without any compensation together.This happens due to the heightened awareness of the importance of the togetherness value in building a balanced community life.

Agriculture and plantation cultivation pattern is done together. This sense of community is done because of the very extensive arable land which can not be done alone, so it requires the help of other persons; without the collaboration they could not do it. A natural boundary marker in their agricultural area by plantingbamboo, planting certain trees, such as fruit becomes a "marker" which means that there is ownership of a person or family on a particular indigenous territories that should be respected and not be disturbed by other parties.

Basically the boundariesbetween Indonesia and Malaysia are legally jurisdicted by using the coordinates via satellite and forever will not change because it is imaginary, but empirically the problem occurs when these boundaries are markedby small sized concretes that easily lost which is unrepresentative. Therefore, the problem of determining the border communities requires local wisdom involving indigenous experts to determine the boundaries.

Although role of community to keep the border region has been governed by state law and the international community has had its own rules, *thefacto* they do not have administrative evidence passed by the State administration. They use rules in accordance with customary law.This rule is very effective to keep their own territory. It is conceivable that extensive hundreds of acres of land without fenced and guarded. No one would dare to claim or annex the border of each other. Natural boundary is

one of the local wisdom used by border citizens of both countries.

Natural boundaries such as hills, canyons, rivers and trees, and fields that have economic value peranian also serve as "marker" for border boundaries. According to Mr. Nogian [2], the natural boundary as a form of permanent and strong local wisdom is not easily shifted by the others and no one dares to take over the ownership. Border community more precisely determines the boundaries of their land and others'; in other words, they have better knowledge regarding borders of Indonesia and Malaysia.

4 3. Shared fate andcauses to protect the border region

Awakening awareness of border communities can not be separated from how they build a philosophy of better community life if they cooperate with each other well. Associated with arable and communal land that belong to the community, everything is governed by customary law for both citizens of each country. According to Mr. Kasminto [3], Local Wisdom is derived from the regulation of local Dayak Bidayuh very adhered by local residents. If ones violate the rules, they will be punished according to the level of the violation.Adherence to customary law means maintaining communal rights passed from generation to generation in order not to let it fall onto the hands of irresponsible people.

Sense of common fate and shared causes is outlined by the Dayaks view of nature as part of their life. Nature is not only where they hunt, search for wood or farm. Nature is their own life; if nature is destroyed, the continuity of their lives will also be threatened. Solidarity bond is formed due to its duty to maintain the balance of nature, this means maintaining the continuity of their lives. Ecosystems and habitats are invaluable "treasure". Maintaining things as theirs is part of their self-sustain and natural existence as a whole.

Based on observations and interviews with various informants. It can be explained that maintaining natural ecosystems means preserving nat[1]ure. There is a philosophy of values in ways they solve problems that arise among them, such as issues related to territory management area. In shortusing the mechanism and management of border security will be more effective if it is approached through the cultural framework (customary law).

If we look at the border communities, they seem like two different sides of the coin. On one hand they are Indonesian, but on the other hand they make a living in the neighboring countries, Malaysia. Based on interviews with resource persons Mr. Dedeng [4], without question they are Indonesians, yet they have to struggle to make a living for his family on the other side and are obliged to secure its territory from 'barons' who want to control their territory. Reinforced by Mr. Nogian [5], he explained that they have similar feeling of kinship in retaining the territory. Nevertheless,these citizens in the border must be realistic and pragmatic to address the situation. Through strong ties of solidarity, border residents must be aware that their dependence with Malaysia sometimes is susceptible to a variety of trickery, not to mention the dangers of those eyeing Indonesia's natural wealth and their annexation threat.

They realized that sense of togetherness among border communities will let them face the threats for area annexation;if this is done well, they will automatically go hand in hand to help each other. Collective consciousness built makes them protecting each other and helping each other on the threat of state neighbors. Border residents formed a bond of solidarity based on the existence of consciousness and communal ties up in community with a sense of belonging and mutual aid.

Community togetherness in the face of various threats is backed by the Council of Dayak Bidayuh who provides assistance for members facing problems regarding land border's right. In addition, Council of Dayak also facilitates and provides assistance for issues of indigenous land rights, the issue of land lease, the transfer of customary land rights, the purchase, and so on. This is necessary because they are aware of the deceit by unscrupulous who coveted their wealth of natural and agricultural land.

V. Conclusion

Based on the theoretical framework and field studiesanalysis, the conclusions of the study are:

1. Border communities form bonds of social solidarity as they are prone to problems. They realize that the natural resources in the border region become the target of certain elements to exploit and annextheir land borders. Sub-ethnic of Dayak Bidayuhis bound by ties of solidarity that comes from their local wisdom. Customary law has a role in maintaining the border region because it has judicial function that can bind its citizens to comply with applicable regulations. One of the local wisdoms that has been inherited for generations is using natural boundaries such as trees, bamboo plants, hills, ravines and rivers, as well as the huma plant (field), the graves and sacred sites. Boundaries made by using local knowledge is proved to be more effective; each citizen knows where their boundaries.
2. Forms of social solidarity border communities because of the emotional ties of kinship. They feel the kinship and shared causes, assist each other in maintaining the boundaries from the various external threats. The form of the power of collective consciousness is in the form of the power network as the embodiment of community's desire to defend the border region without changing the ownership and being passed on from generation to generation.

[3] The results of interviews with the Secretary of the Board D custom sieve Bidayuh father Kasminto dated May 12, 2014.

[4] The results of interviews with Village Secretary Jagoi dated May 10, 2014.

[5] Results of interviews with village heads Jagoi Date May 11, 2014

REFERENCES

[1] Alwasilah, A. Chaedar. 2003. Pokoknya Kualitatif. Dasar-dasar Merancangdan Melakukan Penelitian Kualitatif. Bandung: Pustaka Jaya.

[2] Anyang, V.C. Thambun, 1998. Kebudayaan dan Perubahan Daya Taman Kalimantan Dalam Arus Modernisasi, Studi Etnografis Organisasi Sosial Dan Kekerabatan dengan Pendekatan Antropologi Hukum, Jakarta: PT. Gramedia.

[3] Dove, Michael.R, 1988. Sistem Perladangan di Indonesia, Suatu Studi Kasus Dari Kalimantan Barat, Yogyakarta: Gajah Mada University Press. Eriksen, Thomas Hylland. 1993. Ethnicity & Nationalism, Antrhropological Perspektives. London: Pluto Press.

[4] Johnson, Doyle Paul. 1986. Teori Sosiologi Klasik dan Modern (terj.) Jilid.1 dan Jilid.2, Jakarta: PT Gramedia.

[5] Durkheim, Emile. 1933. The Division of Labor in Society. Terjemahan George Simpson. New York: The Pree Press.

[6] Garna, Yudistira K. 1996. Ilmu-IlmuSosial, Dasar-Konsep-Posisil. Bandung: Program Pascasarjana Universitas Padjadjaran Bandung.

[7] Muhadjir, Neong. 2000. Metodologi penelitian Kualitatif. edisi ketiga. Yogyakarta: Rake Sarasin.

Internet

[8] Pusat Pengelolaan Ekoregion Kalimantan, 2012. Kawasan Perbatasan Kalimantan. http://kalimantan.menlh.go.id. Diunduh 1 Juni 2014.

[9] Suharto. 2000. Modul. http://www.policy.hu/suharto/modul. Diunduh 12 Mei 2013.

[10] Tanah Ulayat (http://id.wikipedia.org/wiki/Tanah_ulayat) . Diunduh 1 Juni 2014

[11] Igapurwanti. http://igapurwanti-unair-artikel_-hukumadat-Persekutuan.html. Diunduh 1 Juni 2014.

[12] Act:

Law No. 43 of 2008 about the state's territory, Chapter III:

Article 4; State territory covers land, territorial waters, seabed, and the ground beneath and the air space above it, including all sources of wealth contained therein.

Article 5; State Boundary in the land, waters, seabed and the subsoil thereof and the air space above it is set on the basis of bilateral agreements and / or trilateral regarding land borders, sea borders and airspace as well as based on legislation and international law.

Article 19 in the form of border management;

Developing Border Areadevelopment;

Keeping and maintaining the Border Regions. Public participation is carried out in accordance with the provisions of the legislation.

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The Influence of Loan to Value Policy and Macroeconomic Factors Against The Stock Return of Real Estate and Property Subsector in The Indonesia Stock Exchange

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Abstract- The global financial crisis in 2008 brought impact to the superpower country, the United States, starting from the fall of property sales; in fact, the decrease in property sales also hit Asian region (business Indonesia, 2010). The granting of mortgage loan plays a role in the declining demand in the property sector due to the crisis, which eventually affected the stock return of property and real estate, in addition to the macroeconomic factors in Indonesia. This study aims to verify the impact of macroeconomic factors that is interest rate, the exchange rate, world oil price, money supply, and loan to value policy on the stock return of real estate and property subsector by using Vector Error Correction Model (VECM) for 2010-2014: 55 period. This study applied historical research and uses periodical data and sample determination considers purposive sampling while research data analysis utilizes. Samples of this research are divided into three groups based on market capitalization that is big cap, med cap and small cap. The result of cointegration test shows that there is a long-term or equilibrium relationship between interest rate, the exchange rate, world oil price, money supply, kurs, loan to value and return of the real estate and property subsector. IRF analysis shows that the shock on macroeconomic factors and loan to value policy gives different response to the return fluctuation. The return model is the most vulnerable when the presence of the shocks in macroeconomic variables are the return property and real estate. The results show several finding, that some variables have significance determinant to return of the property and real estate. The result shows the new loan to value policy does not have a significant impact, so that policy makers need to make some revisions to deal with changes of contents and provisions therein.

Index Terms- Loan to Value, Macroeconomics, Market Capitalization, Stock Return, Vector Error Correction Model (VECM)

I. INTRODUCTION

Indonesia also was exposed to global financial crash in 2008, causing some firms in real estate and property in Indonesia stock exchange to file for bankruptcy. The crisis occurred because of the granting of loan to borrowers who are not credible (subprime mortgage) leading to the bubble in the property sector. The property bubble is the situation where the property price increases unreasonably. Bank Indonesia anticipated the possibility of similar crises to occur by setting the limits of loan by publishing a loan to value policy. Terms of loan to value also aim to provide greater opportunities for the people with lower-middle income to acquire a proper home and to enhance consumer protection in the property sector. Information on the loan to value policy also exerts influence to the decision-makers, that is, investors in the property sector.

The loan to value policy determines the amount of loan that can be granted by the Bank against the value of the collateral at the time of granting, with a maximum of 70%. The establishment of the loan to value policy also affects the property sector especially contractors or developers. The policy influences the company's performance in terms of housing unit sales volume that would affect the profitability of the company (Bei 2015). The performance is affected by a decline in the demand of property that also leads to changes of stock price in the property sector. The rising trend of stock price in property and real estate subsector has emerged even before the stipulation of loan to value policy, and then continues to experience a declining trend from 2012 (Figure 1).

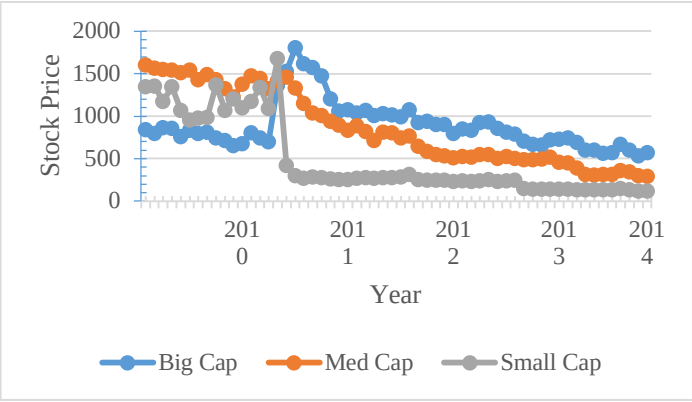

Figure 1: The movement of stock prices in real estate and property subsector in the period of 2010-2014

Gunanta (2013) in his research identified a decrease in the stock price of property and real estate during the loan-to-value restriction than before the restriction effectively applies. Changes in stock prices would affect the stock return value. Stock return is the degree of profits gained on investment taken. To measure the stock return can use market capitalization as the indicator. The market capitalization value is gained by multiplying the stock price with the outstanding shares. Market capitalisation is the value of the company's outstanding shares in the market that shows a good company growth potential with low risk (Thobarry 2009). Investment selection is also based on information, that the stock return is also affected by macroeconomic factors outside the company and causes ups and downs in company performance, either directly or not (Rakasetya et al., 1995).

Housing stock price in Indonesia experiences a decreasing trend. Shares in the property field in majority decline sharply, exchange rate weakens up to Rp12000 per dollar, followed with the increase in the interest rate (BI rate); these eventually outweigh the risk of failure in credit payment. Bank Indonesia raises minimum down payment required for home loan since July 2012 because the institution has noted a slowdown in the rate of property-related credits. The real estate performance declines along with weakening commercial property sales as the impact of the loan to value policy application. The degradation in issuer's performance will affect the total shareholder return in Indonesia stock exchange. This condition raises fears of bubble outbreak in property sector in the United States, besides some fluctuative macroeconomic variables. Macroeconomic variables such as interest rates, inflation, money supply, the exchange rate, and world oil price are some of the variables that are experiencing fluctuations in each period, triggering to the ups and downs in investment activity. The macroeconomic variables change, either decrease or increase, will reflect the condition of stock return to either a positive or negative result. Based on the description, the problem formulated in this study is to what extent the influence of macroeconomic factors and loan to value policy against the stock return of real estate and property subsector in the Indonesia stock exchange. The purpose of this study is to analyze the effect of macroeconomic factors and loan to value policy against the stock return of real estate and property subsector in the Indonesia stock exchange.

II. METHODOLOGY

The type of data is displayed in Table 1 with a research period of 2010-2014. As many as 54 issuers included in the property and real estate subsector and listed on the Indonesia stock exchange were included in this study.

Table 1: Types, sources and data unit

No	Types	Sources	Data Unit
1	*Closing price*	The Indonesia Stock Exchange	Poin
2	Inflation	Central Statictic Institution	Percent (%)
3	Interest Rate	Bank Indonesia	Percent (%)
4	The Exchange Rate	Bank Indonesia	IDR/USD
5	The Money Supply	Central Statictic Institution	Sheet
6	Oil Price	Energy Information Administration	US$/Barrel

The number of issuers who met the requirements in this research is 24 issuers. Issuers were then grouped to: 8 issuers with a large market capitalization value, 8 issuers with a middle market capitalization value, and 8 issuers with a small market capitalization value. The selection of the issuers is based on:

1. Issuers of property and real estate subsector that are listed and still active in Indonesia stock exchange during the year of 2010 to 2014.
2. Issuers have data or a market capitalization value, monthly stock price, and net income (> 50% comes from housing and or apartment) for the year of 2010 to 2014.

Vector Error Correction Models model was selected in this study because there is co-integration between variables. In-level VAR model could not be used for analysis based on testing at pre-estimation. Pre-estimation testing is namely: (1) Stationary test; (2) Stability test of the VECM model; (3) determination of the optimal lag; (4) Cointegration test.

The VECM Research Model.

VECM estimation modeling is aimed to know the influence of loan to value policy and macroeconomic factors, as follows:

$$D(Return) = \alpha_{10} + \alpha_1 LD(Return) + \alpha_2 LD(INF) + \alpha_3 D(SBI) + \alpha_4 LD(KURS) + \alpha_5 LD(M2) + \alpha_6 LD(Oil\ Price) + \alpha_7 LD(Dummy) + \alpha_7 LEC + e_1$$

$$D(INF) = b_{10} + b_1 LD(Return) + b_2 LD(INF) + b_3 D(SBI) + b_4 LD(KURS) + b_5 LD(M2) + b_6 LD(Oil\ Price) + b_7 LD(Dummy) + b_7 LEC + e_2$$

$$D(M2) = c_{10} + c_1 LD(Return) + c_2 LD(INF) + c_3 D(SBI) + c_4 LD(KURS) + c_5 LD(M2) + c_6 LD(Oil\ Price) + c_7 LD(Dummy) + c_7 LEC + e_3$$

$$D(KURS) = d_{10} + d_1 LD(Return) + d_2 LD(INF) + d_3 D(SBI) + d_4 LD(KURS) + d_5 LD(M2) + d_6 LD(Oil\ Price) + d_7 LD(Dummy) + d_7 LEC + e_4$$

$$D(M2) = e_{10} + e_1 LD(Return) + e_2 LD(INE) + e_3 D(SBI) + e_4 LD(KURS) + e_5 LD(M2) + e_6 LD(Oil\ Price) + e_7 LD(Dummy) + e_7 LEC + e_5$$

$$D(Oil\ Price) = f_{10} + f_1 LD(Return) + f_2 LD(INF) + f_3 D(SBI) + f_4 LD(KURS) + f_5 LD(M2) + f_6 LD(Oil\ Price) + f_7 LD(Dummy) + f_7 LEC + e_6$$

$$D(Dummy) = g_{10} + g_1 LD(Return) + g_2 LD(INF) + g_3 D(SBI) + g_4 LD(KURS) + g_5 LD(M2) + g_6 LD(Oil\ Price) + g_7 LD(Dummy) + g_7 LEC + e_7$$

Description:
L = operation of lag (LZ = Zt-1); EC is the error correction term; e is the disturbance term; D is the first difference order which is used to reduce the stationer of variables. INF = inflation; SBI = Indonesian interest rate; KURS = Indonesian rupiah exchange rate to US dollar; M2 = the amount of money supply; Oil Price = world oil price; Dummy = loan to value policy.

Impuls Respone Function (IRF). Impulse response function was performed to test the dynamic structure of the variable system in the model investigated, namely by innovation variable. Moreover, IRF also denoted the response of each endogenous variable all the time against shocks from the variable itself and other endogenous variables.

Forecast Error Decomposition of Variance (FEVD). FEVD could be used to see a change in one macro variable, indicated by changes in variance error. This method can also characterize the dynamic structures of VAR model, as well as see the strengths and weaknesses of each variable in affecting the other variables for quite a long time.

III. RESULT AND DISCUSSION

The stationary test using the ADF (Augmented Dickey Fuller) was done to find out the model with constant, either with or without including the current trend constant. The result of ADF test shows that the strock return, dummy variable, and macroeconomic variables were not stationary at the level. The six variables used were stationary at first difference with the ADF value smaller than the Mac Kinnon critical value. The rest of the variables used were multiplied by the amount of lag from each VAR. Then, the result of stability test shows that the variables were stable at lag 1. The range of modulus value obtained was between 0.24-0.97. This suggests that the estimation model has been stable (< 1). Determination of the optimal lag was done by considering the optimal VAR lag method of endogenous variables is an independent variable used in the model. The test for optimal lag undertaken in the study was lag 1 based on SC criteria. Gupta et al. (2012) put forward the VAR model, which generally uses the same length of lag for all variables in the model.

The next stage is cointegration test. The result of cointegration test with multi variables using Johansen maximum likelihood with the optimum lag length of 1 shows that the number of long-term relations in the system is mostly one (r = 1) for the 5% significance level. Thus, this study employed the VECM model because all models were cointegrated. The emergence of cointegration in equation system depicts the short-term dynamics, which is consistent with the long-term relation. All models were cointegrated, so that the dummy variable as well as macroeconomic variables in stock return of property and real estate subsector were analyzed using vector error correction model. The result of VECM estimation can be seen in Table 2.

Table 2: The result of estimation of VECM model regarding stock return in real estate and property subsector based on the market capitalisation

Variabel	**Short Term**		
	Big cap	*Med cap*	*Small cap*
CointEq1	-0.354944*	-0.074886*	-0.178741*
D(*RETURN*(-1))	-0.409588*	-0.675431*	-0.703178*
D(INF(-1))	0.031739	0.057600	0.047175*
D(SBI(-1))	0.083788	0.265290	-0.138492*
D(LN_KURS(-1))	-0.298550	-0.392755	-0.127260
D(LN_M2(-1))	1.074760	-1.173096	-1.355311*
D(LN_OIL PRICE(-1))	0.008945	0.002515	-0.224774
D(DUMMY(-1))	0.111693*	0.091583	-0.067830
Long Term			
RETURN(-1)	1.000000*	1.000000*	1.000000*
INF(-1)	0.030638*	0.048540*	0.021884
SBI(-1)	0.027288	0.094409*	0.044901
LN_KURS(-1)	0.330688	0.330688*	1.244805
LN_M2(-1)	0.795951*	0.795951*	1.778309
LN_ OIL PRICE (-1)	0.577659*	0.640812*	1.102463
DUMMY(-1)	0.213156*	0.301468*	0.482834

Description: an asterisk (*) indicates the variable is significantly influential

A. The influence of loan to value policy against stock return of real estate and property subsector

Allegedly, the application of the loan to value policy will influence the property value and the volume of property sales because of reduced consumer buying power. This condition also gives considerable impact to the performance of companies which lower the stock prices and volume of properties stock sale. For the short term, the loan to value policy positively affects the small cap stock return model (Table 2). As well as in the long term, the loan to value policy has a positive effect on the big cap and med cap return model (Table 2). Investors trust the credibility of the property firms by persistently soaking their capital in the property and real estate stock (Bei 2015). In other words, the market is not reactive to the application of loan to value policy due to the investor's confidence to the business performance in property subsector. In the long term, the application of the policy no longer contains strong information, so it does not have a positive effect on the stock return.

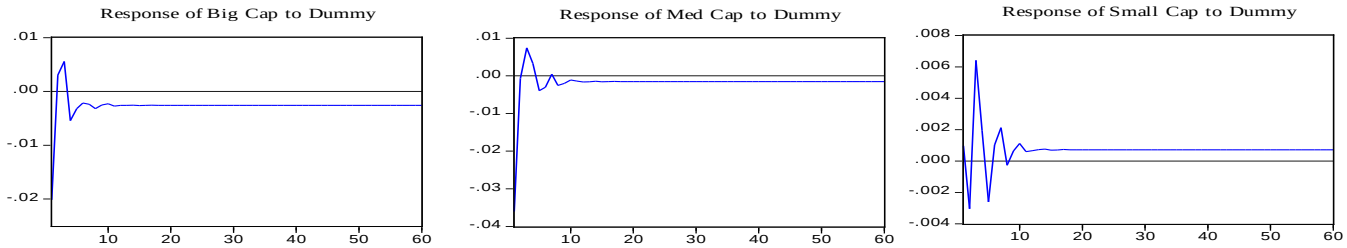

Figure 2: The results of the impulse response test with loan to value policy to stock return real estate and property subsector with big, medium, and small capitalization

B. The influence of inflation against stock return of real estate and property subsector

In the short term, the inflation affects negatively to small capitalization stock return model (Table 2). Inflation can increase revenues, but push up the production costs of the company at the same time. If the increase in the cost of production is higher than the increase in the price as set by the company, the company's profitability will decline. The research of Ito (2013) also found the negative influence of inflation against the stock return. Rising inflation would lead to a decrease in the stock demand. Thobarry (2009) added that inflation indicates a decrease in the purchasing power of individuals or companies. Rising inflation would lead to a decrease in the stock demand and also make the investors expect the highest demand on the risk premium and rate of return that will result in the decline in stock return. Long-term inflation positively influences big capitalization and medium capitalization return model (Table 2). Regarding the long-term effect, this research is in line with a study by Yulianto (2015) that inflation can occur not only because of the rising cost but also the demand-pull. The rising inflation due to the demand-pull will increase revenue for the company that ultimately improves the earning gained by shareholders. Investors treat the rising inflation as a positive signal, and then they will respond it by raising the stock price on the capital market.

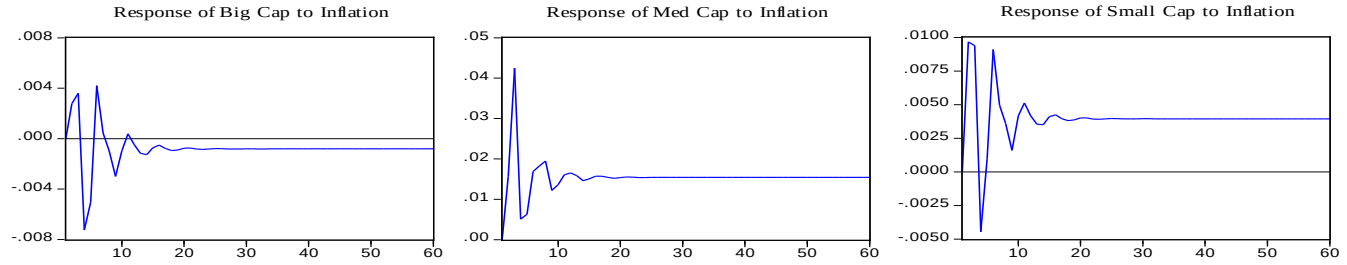

Figure 3: The results of the impulse response test with inflation to stock return real estate and property subsector with big, medium, and small capitalization

C. The influence of the money supply against stock return of real estate and property subsector

In the short run, the money supply has a negative effect on the small cap stock return model (Table 2). This is different from the finding of research done by Octafia (2013) that the increasing money supply in the society will cause the investors to invest in property stock to gain more advantage. In the short term, people prefer to invest in the investment portfolio which is easy to liquidate and has a small risk. They tend to meet their daily needs first, so as not to invest in stock. For the long term, the money supply brings a positive effect on the big cap and med cap return model (Table 2).

The amount of supply money circulating in the community causes the interest rate to fall, so that the property becomes an alternative stock investment compared to banking products. Investors will likely choose to soak their money on stock compared to the savings and deposits in the long term, so that the demand for shares has increased. Meanwhile, in the short term, they will choose to invest with in the investment form with small risks, such as valuables, or prefer to meet their personal needs first, so that investments in stock with a large risk are undesirable.

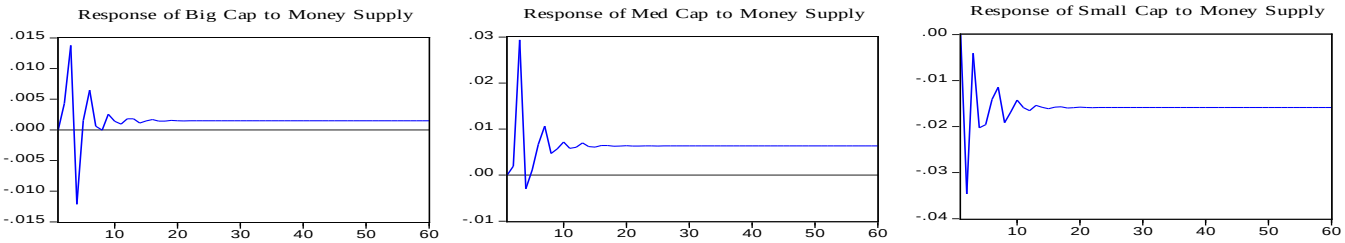

Figure 4: The The results of the impulse response test with the money supply to stock return real estate and property subsector with big, medium, and small capitalization

D. The influence of the interest rate against stock return of real estate and property subsector

In the short term, the interest rate affects negatively to small cap stock return model (Table 2). The result is similar to the finding of Octafia (2013) that high interest rate causes investors to withdraw their stock investments and move it to savings or deposits. In the long-term, interest rate positively influences the med cap return model (Table 2). In the long run, when interest rate declines, the demand in property and real estate subsector such as apartments and housing will increase. Although in the beginning the profitability acquired by companies initially decrease, soon they will get increasing demand which allows them to make a profit. This will increase the stock price and attract investors to invest. Purnama (2013) suggested there is a positive influence between interest rates and the stock return of the company, because of the different characteristics of companies. In addition, the interest rate affects stock return in the long term through the fundamental condition of the company.

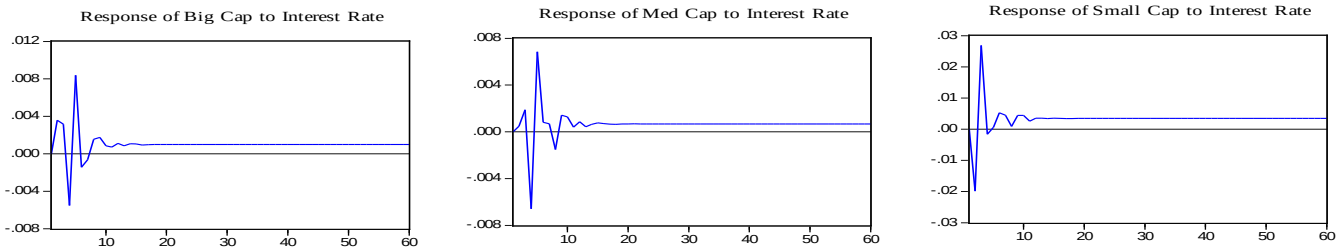

Figure 5: The The results of the impulse response test with the interest rate to stock return real estate and property subsector with big, medium, and small capitalization

E. The influence of the exchange rate against stock return of real estate and property subsector

In the long term, the exchange rate positively influences the med cap return model (Table 2). The finding is similar to the research result of Pratikno (2009), that when rupiah currency is stronger than other foreign currencies (appreciation), it will lower the cost of imports for production. Lower import costs will lead to lower production costs and improved profitability of the company so that the dividend distribution increases. The research of Suyanto (2007) identified a negative relationship between the exchange rate of dollar/USD and the return of shares. The rise in the exchange rate of USD shows the weakening rupiah, so investors in the stock market will tend to hold or sell the stock. If the exchange rate of rupiah declines, it will eventually lead to a declining profit of the company. Conversely, if the exchange rate of dollar against rupiah declines, the investors will invest in the form of shares due to the fair economic condition.

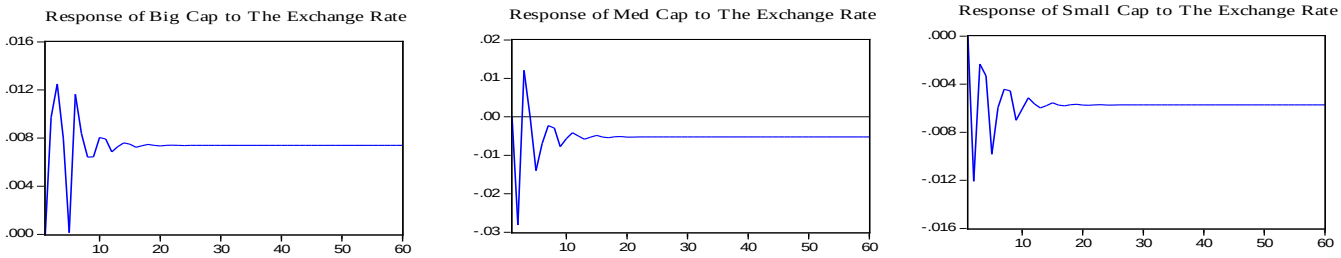

Figure 6: The The results of the impulse response test with the exchange rate to stock return real estate and property subsector with big, medium, and small capitalization

F. The influence of world oil price against stock return of real estate and property subsector

In the long-term, world oil price would positively affect the big cap and med cap return model (Table 2). This is in accordance with the research by Movahedizadeh et al. (2001)

that suggested the world oil price has a positive influence on stock return. The rising world oil price impacts on the increasing fuel price. Since every economic activity requires transportation in its efforts, the rise in fuel price affects all econominic sectors which depend their business on fuel as an energy source. Dornbusch (2004) puts forward that world oil price is also affecting state budget, given the change in fuel price will affect the the selling price within the country, and the price of other goods including stock price traded on the Indonesia Stock Exchange.

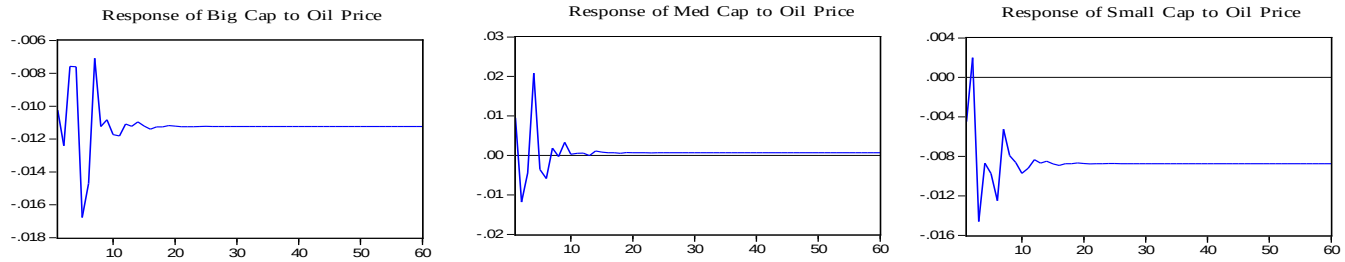

Figure 7: The The results of the impulse response test with world oil price to stock return real estate and property subsector with big, medium, and small capitalization

Forecast Error Decomposition of Variance (FEVD) Analysis. The variable that contributes a big percentage in property and real estate subsector is indeed the stock return, both on the big cap, med cap, and small cap, as seen in Figure 8. Other factors also play a pivotal role over time, due to the influence of macroeconomic changes, which take time to affect other variables.

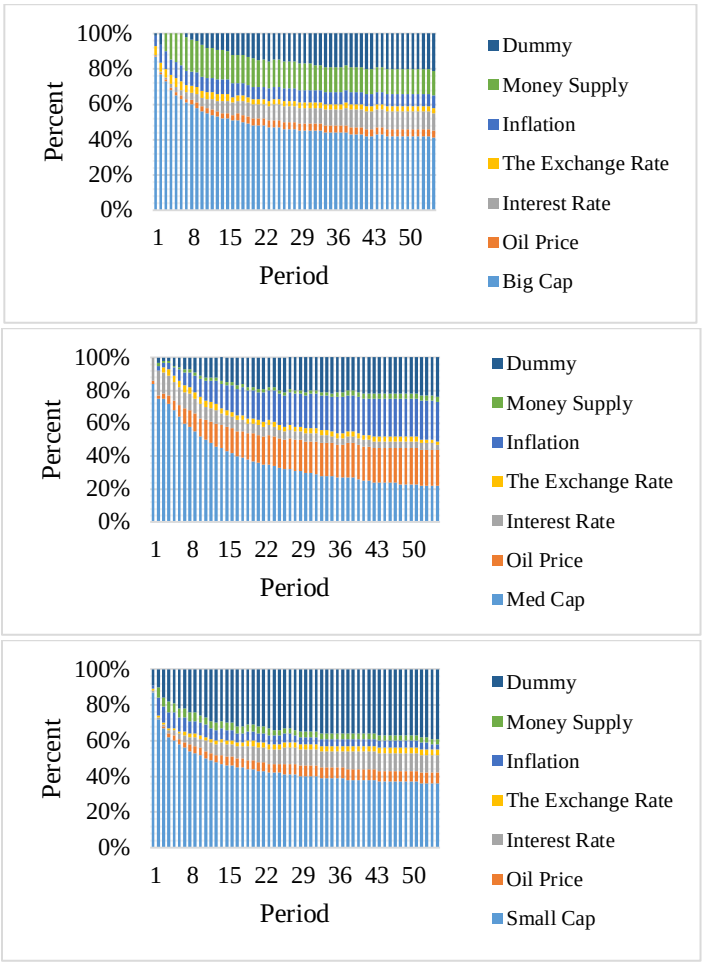

Figure 8: The result *forecasting error variance decomposition* test on stock return model of real estate and property subsector with a large, medium and small market capitalisation

The loan to value policy which is described through dummy variable provides the biggest contribution on the stock return, because the stipulation of the policy provides influences to consumer demand on subprime mortgages, that will signficantly bring both positive and negative effects to the company's profit. Information regarding the loan to value policy that is conveyed to public will affect the investors' decision. It requires 55 months to observe the long-term effects. The longer the period of observation will give more precise result, which at the end describes the stock return of property and real estate subsector experiences a decline.

Following loan to value policy, inflation also demonstrates a big contribution. If there is a rise in the inflation value, there is a trend for decreased investment allocation by the public because the money for daily consumption also increases. Inflation is in the range between 3%-9% during 2010-2014. This is based on the research of Vanya (2014) that inflation brings a great contribution and is steadily increasing until the end of the period. World oil price variable also plays a major role. The rising of oil price is based on increasing demand rather than the reduced supply, thus the increasing price either directly or indirectly encourages the increase of the stock return.

Investors can decide to invest in a stock with large market capitalization, small and medium enterprises, in which each has different degrees of return. The smaller the market capitalization is, the more the variables which can affect the return of the shares. Stocks with large capitalization have the same potential of risk, but also generate higher return. Small-capitalization issuers can set up strategies to improve their performance after identifying the variables that could affect their total shareholder return. The observation will help in anticipating and reducing the losses that can be borne due shocks on a variable. The existence of a loan to value policy affects the return of issuers with a big market capitalization in the short-term and the return of issuers with a large and middle market capitalization in the long term. Investors' interest toward stock in real estate and property subsector is still high due to the confidence level of profit they will gain in the future.

IV. CONCLUSION

In the short term, the big cap stock return is affected by the stock return and loan to value policy. Med cap stock return is influenced by the stock return itself. Small cap stock return is influenced by the stock return, inflation, interest rates, and the money supply. For the long-term, big-cap stock return is influenced by inflation, money supply, world oil price, and loan to value policy. The med cap stock return is affected by inflation, interest rates, the exchange rate of rupiah against USD, the amount of money supply, world oil price and loan to value policy. The loan to value policy does not meet the goals to be achieved by Bank Indonesia, so the institution needs a new policy or other supporting factors. Investors who are risk takers can benefit from stocks with a large market capitalization to earn capital gains. For further research, it is recommended to add other macroeconomic variables, such as GDP, money supply, and other factors.

REFERENCES

[1] V.N.R Bei, Shofwan., The influence of loan to value policy to stock market reaction in The Indonesia Stock Exchange. *Brawijaya of Journal Science*, 2015, pp. 1-12.

[2] R. Gupta, M. Jurgilas, A. Kabundi, S.M. Miller, Monetary policy and housing sector dynamics in a large-scale bayesian vector autoregressice model. *International Journal of Strategic Property Management* vol. 16 no. 1, 2012, pp. 1-20.

[3] T. Ito, The impact of stock price and interest rate on REIT market in Japan. *International Journal of Business* vol. 18 no. 4, 2013, pp. 1-12.

[4] U. Mardiyati, A. Rosalina, The influence of the exchange rate, the interest rate, and inflation against stock return index in the Indonesia Stock Exchange. Journal of Indonesia Science and Management Research vol. 4 no. 1, 2013, pp. 1-15.

[5] R.S. Meta, The Difference between inflation, the interest rate, and the exchange rate. [Thesis]. 2005. Semarang (ID): Diponegoro University.

[6] H. Movahedizaeh, A.M.D. Nassir, M.A. Kouchaksaraei, M. Karimimalayer, N.S. Sedeh, Bagherpour, The impact of macroeconomic factors on Tehran Stock Exhange Index during unjust economic and oil sanctions from January 2006 to December 2012, *Advanced in Economics, Management and Marketing*, 2014, pp. 112-121.

[7] Muchlis and Harton, The influence of rupiah to usd exchange rate, (SBI) rates, and inflation of customer index on the stock price of property sectors companies in indonesian stock exchange. *Discussion paper of monash university*, 2009.

[8] S.M. Octafia, The influence of the exchange rate, the interest rate and the money supply with *error correction model* method. *e.journal.unp.ac.id*. 2015.

[9] A.K.S. Purnama, Wiksuana, Mustanda, The influence macroeconomics to finance performance and company stock return of banking, *Journal of Management, Business Strategy and Enterpreneurship* vol. 7, 2013, pp. 9-18.

[10] G.G. Rakasetya, Darminto, A.R. Dzulkirom, The influence of micro and macroeconomic to stock price of mining and mining services company in the Indonesia Stock Exchange 2008-2011, *Journal Business Administration* vol. 6, 2013, pp. 1-12.

[11] Suyanto, The influence of the exchange rate, the interest rate, and inflation in the Indonesia Stock Exchange 2001-2005. [Thesis]. 2007. Semarang (ID): Diponegoro University.

[12] A.A. Thobarry, The influence of the exchange rate, the interest rate, inflation and GDP growth to stock price index of property sector. [Thesis]. Semarang (ID): 2009. Diponegoro University.

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Risk Factors Associated with *Plasmodium Falciparum* Infection in Zaria, Kaduna State.

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Abstract- A study of the risk factors associated with *Plasmodium falciparum* infection in patients attending selected hospitals in Zaria Kaduna State was carried out. Four hundred blood samples were collected by venipuncture from consenting patients. The blood samples were examine microscopically for *Plasmodium falciparum* on thin and thick blood smears prepared for each sample. The results were analysed statistically using the Chi square test at 95% confidence interval. Only the ring trophozoites of *Plasmodium falciparum* were observed in the infected samples. Those who were always sleeping under insecticide treated mosquito nets at home had the least prevalence (5.5%) which was lower than the 6.7% prevalence of those who were not sleeping under insecticide treated nets always. The highest prevalence was found among those who were not sleeping under insecticide treated mosquito nets at home with 94.1% (χ^2=293.088, p<0.05). Respondents who were using insecticides at home always had the least prevalence with 5.9% the highest prevalence (88.8%) however was found in those not using insecticide at home (p<0.05). Alcohol consumption and smoking were significantly associated with *Plasmodium falciparum* infection. Smokers had a prevalence of 62.5% which was higher than the 27.6% found in non-smokers. Alcohol users also had a higher prevalence (83.3%) than non-alcohol users with 27% (χ^2=9.118, p<0.05). We concluded that consistent use of insecticide and insecticidal nets at home reduced malaria prevalence, while smoking and alcohol consumption increased malaria prevalence due to *Plasmodium falciparum* infection. In conclusion, alcohol consumption, smoking, use of insecticidal net and insecticides at home were the risk factors found to be significantly associated with malaria infection in this study

Index Terms- Plasmodium falciparum, Insecticide-treated-net, trophozoites, insecticide

I. Introduction

Malaria is caused by intracellular parasites belonging to the genus *Plasmodium*; 5 species are recognized as pathogens of humans, namely, *P. falciparum, P. vivax, P. ovale, P. malariae, and P. knowlesi*. Depending on the intensity of transmission and the parasite species involved, the clinical and public health impact of malaria is geographically variable. Most serious illness and mortality from malaria in the world is caused by *P. falciparum*. Complications of severe anaemia and cerebral malaria are thought to be the major cause of morbidity and mortality (Malaguarnera and Musumec, 2002). It has been estimated that half of the world's population (3.5 billion people) will live in malaria transmission areas in 2010 (Hay *et al*., 2004). Half of the world's population (3.3 billion) is at risk of malaria (WHO, 2010). The profound effect of malaria on much of sub-Saharan Africa, in particular, is well known, and most of the estimated 1 million deaths caused annually by malaria occur in Africa (Breman *et al*., 2004). Insecticides-Treated Nets (ITNs) offer a form of personal protection and have repeatedly been shown to reduce severe diseases and mortality due to malaria for both the pregnant women and children in endemic regions. Community- wide trials in several African settings, ITNs have been shown to reduce all-cause mortality by about 20% (Carol *et al.,* 2007). The insecticides used for treating the nets kill mosquitoes and other insects. These insecticides also have repellent properties that reduce the number of mosquitoes that enter the house and attempt to feed thereby offering protection not only for the person under the net but also for those in the same room with the net owner (Carol *et al.,* 2007).

II. Materials and Methods

2.1 Study design

The study was a cross sectional study which lasted for six months. Data was collected from consenting individuals who attended the hospitals during the period of the research.

2.2 Study area and study population

The study was carried out in four selected hospitals in Zaria, Kaduna State. Major Ibrahim B. Abdullahi memorial hospital Zaria- former Limi, Hajiya Gambo Suwaba Hospital Kofan Gaya Zaria, Salama Hospital and St. Luke's Hospital Wusasa Zaria. Zaria is situated at Latitude 11° 25″ North and Longitude 4° 27″ East of Nigeria (The World Gazetteer, 2007). Zaria is located in the North Western part of Nigeria. The inclusion criteria of the studied population were patients who came to carryout blood related test in the laboratories of the hospitals where the research was conducted.

2.3 Sample collection and processing

A well-structured questionnaire was used to obtain samples and bio-data from consenting individuals. The sample size was determined using the equation $n= Z^2p(1-p)/d^2$ as described by Naing *et al*. (2006). A total of 400 blood samples were collected from the four hospitals; 100 samples from each hospital. Venipuncture technique was used for blood sample collection. A soft tubing tourniquet was fastened to the upper arm of the patients to enable the index finger to feel a suitable vein. The puncture site was then cleansed with methylated spirit (methanol) and venipuncture was made with the aid of a needle attached to a 5 ml syringe. When sufficient blood was collected, the tourniquet was then released and the needle removed immediately while the blood was transferred into an EDTA bottle (Epidi *et al*.,

2008).Thick and thin blood films were prepared immediately after the blood samples were collected according to the technique outlined by Cheesbrough (2009). A drop of each blood sample was placed in the center of a grease-free clean glass slide, and immediately it was spread using a smooth edged slide spreader to make a thin film. The thin film was allowed to air dry before it was fixed with methanol. The thick film was made by transferring a drop of blood to another clean slide and spread in such a way that it was possible to see (but not read) newsprint, it was then allowed to dry properly. The blood films were stained using 10% Giemsa working solution for 30 minutes. After staining the blood films, they were allowed to air-dry (Cheesbrough, 2009).

2.4 Microscopic examination of the stained blood films

The stained blood films were examined under the microscope using 100X objective lens after focusing. Presence of ring forms of *Plasmodium* and Trophozoites of *Plasmodium* indicated positive results. A blood smear was considered negative after examining at least 100 high power (100X objective) microscopic fields for parasites (Cheesbrough, 2009).The prevalence rate of malaria was determined by the number of positive over the number of specimens collected.

Prevalence rate = $\frac{No.\ positive}{Total} x100$

2.5 Ethical Clearance

Ethical approval and consent was sought and obtained from the ethical committee of Kaduna State Ministry of Health and the ethical committees of the various hospitals included in the study.

2.6 Data analysis

Data generated from the research were analysed using SPSS version 20 from SPSS Inc., USA. Chi square analysis was used to check the level of significance in the occurrence of malaria parasite in relation to different variables at 95% confidence level.

III. Results

Table 1 shows the relationship between malaria and the use of insecticide treated nets. Those who were always sleeping under insecticide treated nets at home had a prevalence of 5.5% which was lower than the 6.7% prevalence of those who were not sleeping under insecticide treated nets always. The highest prevalence was found among those who were not sleeping under insecticide treated nets at home with 94.1% (χ^2=293.088, p=0.000).

Table 2 Shows malaria prevalence in relation to the use of insecticides at home. The highest prevalence (88.8%) was found among those who were not using insecticides at home, followed by those who were not using insecticide at home always with 7.1%. The least prevalence was found in those who were using insecticides always with 5.9% (χ^2=264.123, p=0.000).

Parasitaemia in relation to presence of bush and gutters around the house of respondents is shown in table 3.Those who had bushes/gutters around their houses had 32.0% while those without bushes/gutters around their houses had 27.4% (χ^2=0.640, p=0.424) .

Table 4 shows malaria prevalence in relation to alcohol usage and smoking. Those who used alcohol and those who were smokers had 83.3 and 62.5% prevalence respectively, which were higher than the 27.4% and 27.6% in those who were not drinking alcohol and non-smokers respectively (χ^2=4.724, p=0.030).

Table 1: Use of insecticide treated nets (ITN)

Use of ITN	N screened	N positive	% Prevalence	χ^2	P value
Always	238	13	5.5	293.088	0.000*
Not always	60	4	6.7		
Never	102	96	94.1		

Key: ITN=Insecticide treated nets, N=number, χ^2=chi square,%= percentage

Table 2: Malaria prevalence in relation to use of insecticides at home

Use of Insecticide	N screened	N positive	% Prevalence	χ^2	P value
Always	237	14	5.9	264.123	0.000*
Not always	56	4	7.1		
Never	107	95	88.8		

Key: N=number, χ^2=chi square, %=percentage, *=significant at p≤0.05

Table 3: Parasitaemia in relation to presence of bush and gutters around the house

Bushes/gutter	N screened	N positive	% Prevalence	χ^2	P value
Yes	75	24	32.0	0.640	0.424
No	325	89	27.4		

N=number, χ^2=chi square, %=percentage

Table 4: Malaria prevalence in relation to alcohol usage and smoking

Use of alcohol	N screened	N positive	% Prevalence	χ^2	P value
Yes	6	5	83.3	9.118	0.003*
No	394	108	27.4		
Smoking					
Yes	8	5	62.5	4.724	0.030*
No	392	108	27.6		

N=number, χ^2=chi square, %=percentage,*=significant at $p \leq 0.05$

IV. Discussion

This study shows a significant ($p<0.05$) relationship between malaria prevalence and the use of insecticide treated mosquito nets (ITN) at home. Those who were always using ITN, had a lower prevalence (5.5%) as compared to those who were not always using ITN, with a prevalence of (6.7%). Those who were not using ITN had a very high prevalence (94.1%). This suggests that the constant and appropriate use of insecticidal net decreases the prevalence of malaria. The protective effect of insecticide-treated mosquito net use shown in this study adds to the vast body of evidence supporting the efficacy and effectiveness of insecticide-treated mosquito nets for protection against malaria and other vector-borne diseases in this setting. Long Lasting Insecticidal Nets (LLINs) have been successful in reducing malaria incidences by either reducing or not allowing human exposure to the vector mosquitoes (Sunil and Vijay, 2014). A reduction in malaria prevalence was also observed among those who used insecticides to control mosquitoes at home. Those who used insecticides always, had a lower prevalence (5.9%) compared to those who were not using insecticides always, with a prevalence of (7.1%). Those who were not using insecticides at all had significantly high prevalence (88.8%).The number of people protected as a result of insecticide usage increased from 13 million in 2005 to 75 million in 2009 (WHO, 2010).

The presence of bush/gutter at home was not significantly associated with malaria, even though those who had bush/gutter around their houses had a higher prevalence (32.0%) than those without bush/gutter around their houses (27.4%). This is in agreement with the findings of Nkuo-Akenji *et al.* (2006) who reported that malaria parasite prevalence and parasite density was higher in children living in houses surrounded by bushes/garbage and swamps/stagnant pools of water when compared with those inhabiting cleaner environments. This could be justified by the fact that bushes, swamps/stagnant pools and gutters serve as breeding grounds for mosquito (the vector that transmits malaria parasites).

In this study, respondents who consumed alcohol had a higher prevalence (83.3%) than those who were non-alcohol users with 27.4%. This may be because the body odour of alcohol consumers increases their attractiveness to mosquitoes. Thierry *et al.* (2010) reported that beer consumption consistently increased volunteer's attractiveness to mosquitoes by increasing mosquito's activation (proportion of mosquitoes engaging in take-off and up-wind flight) and orientation (proportion of mosquitoes flying towards volunteers' odours). According to their report, beer consumption is a risk factor for malaria and needs to be integrated into public health policies for the design of control measures. Smokers also had a higher prevalence than non-smokers. This implies that smoking increased their susceptibility to malaria.

V. Conclusion

Alcohol consumption, smoking, use of insecticidal net and insecticide at home were the risk factors found to be significantly associated with malaria infection in this study. Consistent use of insecticides and insecticide treated mosquito nets at home reduced malaria prevalence significantly.

References

[1] Breman, J.G., Alilio, M.S., Mills, A. Conquering the intolerable burden of malaria: what's new, what's needed: a summary. American Journal of Tropical Medicine and Hygiene; 71 (2): 2004, pp1-15.

[2] Carol, G., Paul, G. and Feiko, O. Insecticide-Treated Nets (ITNs) for the prevention of malaria in pregnancy: A Systematic Review of Randomised Controlled Trials. PLoS Med 4(3), 2007, pp107.

[3] Cheesebrough, M. District laboratory practice in tropical countries. Part 1.Second edition updated, 2009, pp. 245-249.

[4] Hay, S,I., Guerra, C.A., Tatem, A.J., Noor, A.M., Snow, R.W. The global distribution and population at risk of malaria: past, present, and future. Lancet Infectious Diseases; 4, 2004, pp327-336.

[5] Malaguarnera, L and Musumec, S. The immune response to Plasmodium falciparum malaria. Lancet Infect Dis; 2, 2002, pp472–78

[6] Idoko, M.O., Ado, S. and Umoh, V. Prevalence of Dangue virus and Malaria in patients with febrile complaints in Kaduna metropolis, Nigeria. British Research Journal 8(1), 2015, pp343-347.

[7] Naing, L., Winn, T., Rusli, B.N. Practical issues in calculating the sample size for prevalence studies. Archives of Orofacial Sciences; 1, 2006, pp9-14.

[8] Nkuo-Akenji T., Nelson N. N., Maze, B.N., Helen, K. K., Edith, L. A., Armand, N., Damain, N. A., Michael, S., Michael, G. B., Kenneth, N. N. and Vincent, P.K. T. (2006). Environmental factors affecting malaria parasite prevalence in rural Bolifamba, South- West Cameroon. Afr J Health Sci.; 13, 2006, pp40-46.

[9] Sunil, D., Vijay V. Culminating anti-malaria efforts at long lasting insecticidal net? The Journal of Infection and Public Health,7 (6), 2014, pp457–464. DOI: http://dx.doi.org/10.1016/j.jiph.2014.06.002

[10] Thierry, L., Louis-Clément, G., Kounbobr, R.D., Eric E., Didier, F., François, R., Carlo, C., and Frédéric, T. Beer Consumption Increases Human Attractiveness to Malaria Mosquitoes. PLoS One.; 5(3),2010. doi: 10.1371/journal.pone.0009546

[11] W.H.O. Guidelines for the treatment of malaria, second edition, 2010.

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Local stability properties of a delayed SIR model with relapse effect

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***Abstract*:** This paper investigates a time-delayed SIR model with a non-linear Beddington-DeAngelis type incidence rate function and relapse. Immunity of some diseases is temporary, that is, the recovered individuals may return to the infected class after a certain period of time. The local stability properties of the disease-free equilibrium and the endemic equilibrium were completely analyzed by utilizing the characteristic equations at particular equilibrium. It can be seen that local stability properties of the model is totally based on the basic reproduction number which depend on the latent time delay. It was obtained that the disease dies out when the basic reproduction number less than unity, and the disease remains endemic when greater than one.

***Index Terms*-** Characteristic equation; Equilibrium; Epidemic model; Local stability.

I. INTRODUCTION

Recently, considerable attention on the dynamics analysis of various models such as SIR, SEI, SEIR, SIRS and epidemiological disease transmission models transmitted by vectors have been paid by the researchers [9,11,16,18,17]. Most of the models in literature have been considered without taking into account the exposed class which has individuals who are infected but not infective (see, for example, [6]). The authors of the research articles [3,4] have explicitly included exposed class into their models. Further, large numbers of models found from literature have considered only the dynamics of disease using ordinary differential equations, that is, without time delay. However, dynamical behaviors of models that of utilizing past information of the model reflects more realistic dynamical behaviors. Hence, it is more reasonable to incorporate time delays into the models though it has complicated mathematical analysis. In epidemiological models, the bilinear incidence rate, that is, βSI and the standard incidence rate, that is, $\beta SI / N$ are frequently used, which are based on the mass action law. Where $\beta > 0$ is the contact rate, N is the total human population, S is the number of susceptible individuals who are subjected to the disease and I is the number of infective individuals who can transmit the disease. To place the epidemic models in biologically more sensible ground Capasso and Serio [1] introduced the saturation incidence rate instead of standard and bilinear incidence rate. Furthermore, some authors (see, for example, [2,10,13,14] and the references therein) used Beddington-DeAngelis type incidence rate function. A more general incidence rate function of the form $f(S,I)$ has been used by the authors in [5] in epidemiology and have obtained stability results.

Relapse effect of the diseases of humans such as tuberculosis, bovine and herpes are common in epidemiology, and its mathematical behavior have been studied by several authors van den Driessche[12] and Xu[15]. Motivated by the article of Xu[15] and Hattaf et. al [5], in this study we used Beddington-DeAngelis type incidence rate function in the following model with relapse effect and investigated the stability behavior, and the results obtained are presented in this article.

$$\begin{cases} \dot{S}(t) = \Lambda - \dfrac{\beta S(t) I(t)}{1 + aS(t) + bI(t)} - \mu_1 S(t), \\ \dot{E}(t) = \dfrac{\beta S(t) I(t)}{1 + aS(t) + bI(t)} - \dfrac{\beta e^{-\mu_2 \tau} S(t-\tau) I(t-\tau)}{1 + aS(t-\tau) + bI(t-\tau)} - \mu_2 E(t), \\ \dot{I}(t) = \dfrac{\beta e^{-\mu_2 \tau} S(t-\tau) I(t-\tau)}{1 + aS(t-\tau) + bI(t-\tau)} + \delta R(t) - (\mu_3 + \gamma + \alpha) I(t), \\ \dot{R}(t) = \gamma I(t) - (\mu_4 + \delta) R(t). \end{cases} \tag{1.1}$$

In model (1.1), the number of individuals at time t in the susceptible, exposed, infectious and recovered classes is denoted by $S(t)$, $E(t)$, $I(t)$ and $R(t)$, respectively. The death rates related to above classes are respectively denoted by positive real number μ_1, μ_2, μ_3 and μ_4. The removal rate and disease induced death rate are respectively denoted by the parameters γ and α which are

non-negative constants. We also assume that the influx of susceptible comes from a constant recruitment is given by Λ. Moreover, the non-negative parameter δ represents the rate at which an individual in the recovered class reverts to the infective class. The term $\beta e^{-\mu_2\tau}S(t-\tau)I(t-\tau)/(1+aS(t-\tau)+bI(t-\tau))$ represents the individuals surviving in the latent period τ and becoming infective at time t, where $\tau \geq 0$ represents the time delay describing the latent period of the disease. Further, $a, b \geq 0$.

As usual, the initial conditions for model (1.1) is chosen as below

$$S(\theta)=\phi_1(\theta), \quad E(\theta)=\phi_2(\theta), \quad I(\theta)=\phi_3(\theta) \quad R(\theta)=\phi_4(\theta), \quad (\tau \leq \theta \leq 0) \tag{1.2}$$

For the continuity of the initial conditions, it is assumed that

$$E(0)=\int_{-\tau}^{0} \beta e^{\mu_2\theta} \frac{\phi_1(\theta)\phi_2(\theta)}{1+a\phi_1(\theta)+b\phi_2(\theta)}\,d\theta,$$

where $\phi=(\phi_1(\theta),\phi_2(\theta),\phi_3(\theta),\phi_4(\theta))^T \in C,$ and C denotes the Banach space $C([-\tau,0],R_+^4)$ of continuous functions mapping the interval $[-\tau,0]$ into R_+^4. To place the initial conditions in biologically more sensible we use $\phi_i(0)>0$ for $i=1,2,3,4.$

We can consider the dynamics of the following model instead of model (1.1), as $E(t)$ is not appeared explicitly in the first, third and fourth equations.

$$\begin{cases} \dot{S}(t)=\Lambda-\dfrac{\beta S(t)I(t)}{1+aS(t)+bI(t)}-\mu_1 S(t), \\ \dot{I}(t)=\dfrac{\beta e^{-\mu_2\tau}S(t-\tau)I(t-\tau)}{1+aS(t-\tau)+bI(t-\tau)}+\delta R(t)-(\mu_3+\gamma+\alpha)I(t), \\ \dot{R}(t)=\gamma I(t)-(\mu_4+\delta)R(t). \end{cases} \tag{1.3}$$

Non-negativity and boundedness results of model (1.1) are shown in the following theorem.

Theorem 1. Under the initial condition (1.2), the solution $(S(t),\ E(t),\ I(t),\ R(t))^T$ of model (1.1) is existent, unique and non-negative and bounded on $[0,+\infty)$.

Proof. The existence and uniqueness of the solution $(S(t),\ E(t),\ I(t),\ R(t))^T$ of model (1.1) can be easily proved by using the well-known theorems in [7]. Let us show that the solution $(S(t),\ E(t),\ I(t),R(t))^T$ of model (1.1) is non-negativity and ultimately bounded.

First let us show the non-negativeness of solutions on $[0,T)$ where $0<T<\tau$. For $t\in[0,\tau]\cap(0,T)$, from the first equation of model (1.1), we have that

$$\begin{aligned} \dot{S}(t) &= \Lambda-\frac{\beta S(t)I(t)}{1+aS(t)+bI(t)}-\mu_1 S(t) \\ &\geq -\left[\frac{\beta I(t)}{1+aS(t)+bI(t)}+\mu_1\right]S(t). \end{aligned}$$

Hence, one has that

$$S(t)\geq \phi_1(0)e^{-\int_0^t\left(\frac{\beta I(s)}{1+aS(s)+bI(s)}+\mu_1\right)ds}.$$

For $t\in[0,\tau]\cap(0,T)$, from the third equation of model (1.1), one has that

$$\begin{aligned} \dot{I}(t) &= \frac{\beta e^{-\mu_2\tau}S(-\tau)I(-\tau)}{1+aS(-\tau)+bI(-\tau)}+1\delta\phi_4(0)-(\mu_3+\gamma+\alpha)I(t), \\ &\geq -(\mu_3+\gamma+\alpha)I(t). \end{aligned}$$

Hence, one has that

$$I(t) \geq \phi_3(0)e^{-(\mu_3+\gamma+\alpha)t}.$$

For $t \in [0,\tau] \cap (0,T)$, again from the fourth equation of model (1.1), one has that

$$\begin{aligned}\dot{R}(t) &= \gamma I(t) - (\mu_4+\delta)R(t),\\ &\geq -(\mu_4+\delta)R(t).\end{aligned}$$

Hence, one has that

$$R(t) \geq \phi_4(0)e^{-(\mu_4+\delta)t}.$$

From the second equations

$$E(t) = \beta\int_{t-\tau}^{t} \frac{e^{-\mu_2(t-\theta)}S(\theta)I(\theta)}{1+aS(\theta)+bI(\theta)}\,d\theta.$$

Therefore , by step by step method, one can show that the solutions $(S(t), E(t), I(t), R(t))^T$ of model (1.1) are existence, unique and nonnegative in $[0,+\infty)$.

For $t \geq 0,$ define $N(t)$,

$$N(t) = S(t)+E(t)+I(t)+R(t).$$

Taking the derivation along the solution of model (1.1), for $t \geq 0,$ we have that

$$\begin{aligned}\dot{N}(t) &= \Lambda - \mu_1 S(t) - \mu_2 E(t) - (\mu_3+\alpha)I(t) - \mu_4 R(t),\\ &\leq \Lambda - MN(t).\end{aligned}$$

It follows that $\limsup_{t\to+\infty} \leq \frac{\Lambda}{M}$. □

II. EQUILIBRIA AND STABILITY

Model (1.3) has always a disease-free equilibrium $E_0(S_0 = \Lambda/\mu_1, 0)^T$. The characteristic equation of the linearization of model (1.3) near the disease-free equilibrium $E_0(S_0, 0)^T$ is

$$\begin{vmatrix} \lambda+\mu_1 & \dfrac{\beta S_0}{1+aS_0} & 0 \\ 0 & \lambda+(\mu_3+\gamma+\alpha)-\dfrac{\beta S_0 e^{-(\mu_2+\lambda)\tau}}{1+aS_0} & -\delta \\ 0 & -\gamma & \lambda+\mu_4+\delta \end{vmatrix} = 0. \tag{2.4}$$

Define the basic reproduction number

$$R_0 = \frac{\Lambda\beta e^{-\mu_2\tau}}{(a\Lambda+\mu_1)B},$$

where $B = \mu_3+\gamma+\alpha-\gamma\delta/(\mu_4+\delta)$. Hence, one can obtain the following theorem for local stability of the disease-free equilibrium E_0. Therefore, the eigenvalues satisfy $\lambda = -\mu_1 - \frac{1}{(1+aS_0)^2} = 0,$ which is always negative and others are given by

$$f(\lambda,\tau) = \lambda^2 + P_1(\tau)\lambda + P_0(\tau) + (Q_1(\tau)\lambda + Q_0(\tau))e^{-\lambda\tau} = 0. \tag{2.5}$$

where

$$\begin{aligned} &P_0(\tau) = (\mu_4+\delta)(\mu_3+\gamma+\alpha) - \delta\gamma, \quad P_1(\tau) = \mu_4+\delta+\mu_3+\gamma+\alpha,\\ &Q_0(\tau) = -\frac{\Lambda\beta(\mu_4+\delta)e^{-\mu_2\tau}}{a\Lambda+\mu_1}, \qquad Q_1(\tau) = -\frac{\Lambda\beta e^{-\mu_2\tau}}{a\Lambda+\mu_1}.\end{aligned}$$

Theorem 2. The disease-free equilibrium E_0 is locally asymptotically stable provided that $R_0 < 1,$ and unstable provided that $R_0 > 1.$

Proof. Let us first consider the case $\tau = 0.$ Hence, we have that

$$P_0(0) + Q_0(0) = (\mu_4 + \delta)(\mu_3 + \gamma + \alpha) - \delta\gamma - \frac{\Lambda\beta(\mu_4 + \delta)}{a\Lambda + \mu_1}$$
$$= (\mu_4 + \delta)B(1 - R_0), \tag{2.6}$$

$$P_1(0) + Q_1(0) = (\mu_4 + \delta) + (\mu_3 + \gamma + \alpha) - \frac{\Lambda\beta}{a\Lambda + \mu_1}$$
$$= (\mu_4 + \delta) + \frac{\delta\gamma}{(\mu_4 + \delta)} + B(1 - R_0), \tag{2.7}$$

From equations (2.7) and (2.6), one can see that $P_0(0) + Q_0(0) > 0$ and $P_1(0) + Q_1(0) > 0$ if $R_0 < 1.$ Then, by Ruth Hurwitz criterion, it has that equation (2.5) has roots with negative real parts if $R_0 < 1.$ Hence, if $R_0 < 1,$ the disease-free equilibrium E_0 is locally asymptotically stable.

Next, we consider case $\tau > 0.$ Then, let us take $\lambda = \omega i$ is a root of equation (2.5) where $\omega \geq 0.$ It has by separating real and imaginary parts that

$$\omega^2 - P_0(\tau) = Q_1(\tau)\omega \sin\omega\tau + Q_0 \cos\omega\tau,$$
$$P_1(\tau)\omega = Q_0(\tau)\sin\omega\tau - Q_1\omega\cos\omega\tau.$$

By squaring and taking addition, we have that

$$\omega^4 + [(P_1(\tau))^2 - 2P_0(\tau) - (Q_1(\tau))^2]\omega^2 + (P_0(\tau))^2 - (Q_0(\tau))^2 = 0. \tag{2.8}$$

$$(P_0(\tau))^2 - (Q_0(\tau))^2 = [(\mu_4 + \delta)(\mu_3 + \gamma + \alpha) - \delta\gamma]^2 - \left[\frac{\Lambda\beta(\mu_4 + \delta)e^{-\mu_2\tau}}{a\Lambda + \mu_1}\right]^2$$
$$= B(1 - R_0)(\mu_4 + \delta)^2\left[B + \frac{\Lambda\beta e^{-\mu_2\tau}}{a\Lambda + \mu_1}\right],$$

$$(P_1(\tau))^2 - 2P_0(\tau) - (Q_1(\tau))^2 = \left[(\mu_4 + \delta) + (\mu_3 + \gamma + \alpha)\right]^2 - 2\left[(\mu_4 + \delta)(\mu_3 + \gamma + \alpha) - \delta\gamma\right]$$
$$-\left[\frac{\Lambda\beta e^{-\mu_2\tau}}{a\Lambda + \mu_1}\right]^2$$
$$= (\mu_4 + \delta)^2 + \delta\gamma\left[2 + \frac{\mu_3 + \gamma + \alpha}{\mu_4 + \delta} + \frac{B}{\mu_4 + \delta}\right] + B^2(1 - R_0^2),$$

Equation (2.8) does not have positive real roots, if $R_0 < 1.$ In case $R_0 < 1,$ the disease-free equilibrium E_0 is locally asymptotically stable from Theorem 3.4.1 in [7].

If $R_0 > 1,$ we have that

$$f(0, \tau) = (\mu_4 + \delta)B(1 - R_0) < 0, \quad \lim_{\lambda \to +\infty} f(\lambda, \tau) = +\infty.$$

Therefore, $f(\lambda, \tau) = 0$ has at least one positive root. □

When $R_0 > 1,$ model (1.3) has a unique endemic equilibrium $E^*(S^*, I^*, R^*)^T$ other than the disease-free equilibrium $E_0,$ where

$$I^* = \frac{B(a\Lambda + \mu_1)(R_0 - 1)e^{-\mu_2\tau}}{\mathrm{B}((\beta + \mu_1 b)e^{-\mu_2\tau} - aB)}, \quad S^* = \frac{(1+bI^*)B}{\beta e^{-\mu_2\tau} - aB}, \quad R^* = \frac{\gamma I^*}{\mu_4 + \delta}.$$

The characteristic equation of the linearization of model (1.3) near the endemic equilibrium E^* is

$$\begin{vmatrix} (\lambda + \mu_1 + \frac{(1+bI^*)\beta I^*}{(1+aS^*+bI^*)^2}) & \frac{(1+aS^*)\beta S^*}{(1+aS^*+bI^*)^2} & 0 \\ -\frac{(1+bI^*)\beta I^* e^{-(\lambda+\mu_2)\tau}}{(1+aS^*+bI^*)^2} & \lambda + \mu_3 + \gamma + \alpha - \frac{(1+aS^*)\beta S^* e^{-(\lambda+\mu_2)\tau}}{(1+aS^*+bI^*)^2} & -\delta \\ 0 & -\gamma & \lambda + \mu_4 + \delta \end{vmatrix} = 0.$$

By introducing the following notations,

$$a_2(\tau) = \mu_1 + \frac{(1+bI^*)\beta I^*}{L} + \mu_3 + \gamma + \alpha + \mu_4 + \delta,$$

$$a_1(\tau) = \left[\mu_1 + \frac{(1+bI^*)\beta I^*}{L}\right]\left[\mu_3 + \gamma + \alpha + \mu_4 + \delta\right] + (\mu_4 + \delta)B,$$

$$a_0(\tau) = \left[\mu_1 + \frac{(1+bI^*)\beta I^*}{L}\right](\mu_4 + \delta)B,$$

$$b_2(\tau) = -\frac{B(1+aS^*)}{1+aS^*+bI^*},$$

$$b_1(\tau) = -\frac{B(1+aS^*)}{1+aS^*+bI^*}(\mu_1 + \mu_4 + \delta),$$

$$b_0(\tau) = -\frac{B(1+aS^*)}{1+aS^*+bI^*}\mu_1(\mu_4 + \delta),$$

$$L = (1+aS^*+bI^*)^2.$$

The characteristic equation becomes,

$$\lambda^3 + a_2(\tau)\lambda^2 + a_1(\tau)\lambda + a_0(\tau) + [b_2(\tau)\lambda^2 + b_1(\tau)\lambda + b_0(\tau)]e^{-\lambda\tau} = 0. \tag{2.9}$$

Theorem 3. The endemic equilibrium E^* is locally asymptotically stable, if it existence.

Proof. Let us consider case $\tau = 0$,

$$a_0(0) + b_0(0) = (\mu_4 + \delta)B\left\{\frac{\mu_1 bI^*}{1+aS^*+bI^*} + \frac{(1+bI^*)\beta I^*}{L}\right\}, \tag{2.10}$$

$$a_1(0) + b_1(0) = \frac{(1+bI^*)\beta I^*}{L}(\mu_3 + \gamma + \alpha + \mu_4 + \delta) + \mu_1(\mu_4 + \delta) + \frac{(\mu_4 + \delta)BbI^*}{1+aS^*+bI^*}$$
$$+ \frac{\mu_1\gamma\delta(1+aS^*)}{(1+aS^*+bI^*)(\mu_4 + \delta)} + \mu_1\frac{bI^*}{(1+aS^*+bI^*)}(\mu_3 + \gamma + \alpha), \tag{2.11}$$

$$a_2(0)+b_2(0)=\mu_1+\mu_4+\delta+\frac{(1+bI^*)\beta I^*}{L}+\frac{\delta\gamma}{\mu_4+\delta}+\frac{BbI^*}{1+aS^*+bI^*}, \tag{2.12}$$

$$\begin{aligned}(a_2(0)+b_2(0))(a_1(0)+b_1(0))-(a_0(0)+b_0(0))\\ =\frac{\mu_1(1+bI^*)\beta I^*}{L}(\mu_3+\gamma+\alpha)+\frac{(\mu_4+\delta)^2BbI^*}{1+aS^*+bI^*}\\ +(\mu_1+\mu_4+\delta)\left\{\frac{(1+bI^*)\beta I^*}{L}(\mu_4+\delta)+\mu_1(\mu_4+\delta)\right.\\ \left.+\frac{\mu_1}{1+aS^*+bI^*}\left[\frac{\gamma\delta(1+aS^*)}{(\mu_4+\delta)}+(\mu_3+\gamma+\alpha)bI^*\right]\right\}.\end{aligned} \tag{2.13}$$

By equations (2.10), (2.11), (2.12) and (2.13) and by Ruth Hurwitz criterion, one can see that equation (2.9) has roots with negative real parts. Hence, the endemic equilibrium E^* is locally asymptotically stable when $\tau=0.$

Next, we consider case $\tau>0$. Then, let us take $\lambda=\nu i$ be a root of equation (2.9) where $\nu\geq 0.$ It has by separating real and imaginary parts that

$$-\nu^3+a_1(\tau)\nu=(b_0(\tau)-b_2(\tau)\nu^2)\sin\nu\tau-b_1(\tau)\cos\nu\tau,$$
$$a_2(\tau)\nu^2-a_0(\tau)=b_1(\tau)\nu\sin\nu\tau+(b_0(\tau)-b_2(\tau)\nu^2)\cos\nu\tau.$$

By squaring both sides and taking the addition, we have that

$$\nu^6+(a_2^2(\tau)-2a_1(\tau)-b_2^2(\tau))\nu^4+(a_1^2(\tau)-2a_0(\tau)a_2(\tau)+2b_0(\tau)b_2(\tau)-b_1^2(\tau))\nu^2+a_0^2(\tau)-b_0^2(\tau)=0. \tag{2.14}$$

$a_0^2(\tau)-b_0^2(\tau)=(a_0(\tau)-b_0(\tau))(a_0(\tau)+b_0(\tau))$. We have already proven that $a_0(\tau)+b_0(\tau)>0.$ Further, from the expressions of $a_0(\tau)$ and $b_0(\tau)$, we can easily see that $a_0(\tau)-b_0(\tau)>0.$ It shows that $a_0^2(\tau)-b_0^2(\tau)>0$.

$$\begin{aligned}a_2^2(\tau)-2a_1(\tau)-b_0^2(\tau)=(\mu_4+\delta)^2+\left[\mu_1+\frac{(1+bI^*)\beta I^*}{L}\right]^2+\frac{\gamma\delta}{\mu_4+\delta}\frac{B(1+aS^*)^2}{L}\\ +\gamma\delta\left[2+\frac{(\mu_3+\gamma+\alpha)}{(\mu_4+\delta)}\frac{(1+aS^*)^2}{L}\right]\\ +\frac{(\mu_3+\gamma+\alpha)bI^*}{L}(bI^*+2(1+aS^*))>0,\end{aligned}$$

$$
\begin{aligned}
&a_1^2(\tau) - 2a_0(\tau)a_2(\tau) + 2b_0(\tau)b_2(\tau) - b_1^2(\tau) \\
&= \frac{bI^*(bI^* + 2(1+aS^*))}{L}(\mu_1^2 + (\mu_4+\delta)^2 B^2) \\
&+ \left[\mu_1 + \frac{(1+bI^*)\beta I^*}{L}\right]^2 \left((\mu_4+\delta)^2 + 2\gamma\delta\right) \\
&+ \left[2\mu_1 + \frac{(1+bI^*)\beta I^*}{\mu_4+\delta}\right]\frac{(1+bI^*)\beta I^*}{\mu_4+\delta}(\mu_3+\gamma+\alpha)^2 \\
&+ \frac{\mu_1^2\gamma\delta}{\mu_4+\delta}\frac{(1+aS^*)^2}{L}\left(\mu_3+\gamma+\alpha+B\right) > 0.
\end{aligned}
$$

It can be seen that from above calculation that equation (2.14) does not have positive real roots for ν^2. Hence, the endemic equilibrium E^* is locally asymptotically stable from Theorem 3.4.1 in [7]. □

III. Discussion

Now In this study, we have developed a SEIR epidemic model with relapse and time delay. We have established that existence of endemic equilibrium and stability properties to completely depend on the basic reproduction number. It is necessary to mention here that the author in the research article [15] has considered a SEIR epidemic model with saturation incidence rate function and time delay, and in which the author have given complete local and global stability properties. However, in this paper, we have used non-separable incidence rate function of variables S and I. Therefore, it is complicated to define a Liapunov function to show the global dynamics for the endemic equilibrium. Instead of global dynamics, we have given complete local dynamic properties for both disease free equilibrium and endemic equilibrium. It is worthy to note that the basic reproduction number in this paper is less than that of in the paper [15], by which we can see that use of Beddington-DeAngelis incidence rateis better to avoid disease becoming endemic. We left studying of global stability properties of both equilibria as future work.

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REFERENCES

[1] V. Capasso, G. Serio, A generalization of the Kermack–Mckendrick deterministic epidemic model, Math. Biosci., 42 (1978) 41–61.
[2] A. Elaiw, I. Hassanien and S. Azoz, Global stability of HIV infection models with intracellular delays. J. Korean. Math. Soc., 49 (2012) 779–794.
[3] S. Gao, L. Chen, Z. Teng, Pulse vaccination of an SEIR epidemic model with time delay, Nonl. Anal. (RWA).,9(2008) 599–607.
[4] S. Gao, Z. Teng, D. Xie, The effects of pulse vaccination on SEIR model with two time delays, Appl. Math. Comput., 201 (2008) 282–292.
[5] K. Hattaf, A. A. Lashari, Y. Louartassi, N. Yousfi, A delayed SIR epidemic model with general incidence Rate, Electron. J. Qual. The. Diff. Eq., 3 (2013) 1-9.
[6] H. W. Hethcote, P. van den Driessche, Two SIS epidemiologic models with delays, J. Math. Biol., 40 (200) 3– 26.
[7] Y. Kuang, Delay Differential Equations with Applications in Population Dynamics, Academic Press, New York, 1993.
[8] Y. Kyrychko, K. Nlyuss, Global properties of a delayed SIR model with temporary immunity and nonlinear incidence rate, Nonl. Anal.(RWA)., 6 (2005) 495–507.
[9] A. A. Lashari, G. Zaman, Global dynamics of vector-borne diseases with horizontal transmission in host population, Comput. Math. Appl., 61 (2011) 745–754.
[10] C. Lv, L. Huang and Z. Yuan, Global stability for an HIV-1 infection model with Beddington-DeAngelis incidence rate and CTL immune response, Commun. Nonl.Sci. Numer. Simulat., 19 (2014) 121–127.
[11] Y. Nakata, Y. Enatsu, Y. Muroya, On the global stability of an SIRS epidemic model with distributed delays, Discrete Contin. Dyn. Syst. Supplement., (2011) 1119–1128.
[12] P. van den Driessche, L. Wang, X. Zou, Modeling diseases with latency and relapse, Math. Biosci. Eng., 4 (2007) 205–219.
[13] X. Wang, Y. Tao and X. Song, A delayed HIV-1 infection model with Beddington- DeAngelis functional response. Nonl. Dyn., 62 (2010) 67–72.
[14] X. Wang, Y. Tao and X. Song, Global stability of a virus dynamics model with Beddington-DeAngelis incidence rate and CTL immune response. Nonl. Dyn., 66 (2011) 825–830.

[15] R. Xu, Global dynamics of a delayed epidemic model with latency and relapse, Nonl. Anal. Mod.& Cont., 18 (2) (2013) 250–263.
[16] G. Zeng, L. Chen, L. Sun, Complexity of an SIR epidemic dynamics model with impulsive vaccination control. Chaos, Solitons &Fractals., 26 (2005) 495–505.
[17] X. Zhao, X. Zou, Threshold dynamics in a delayed SIS epidemic model, J. Math. Anal. Appl., 257 (2001) 282–291.
[18] J. Zhen, Z. Ma, M. Han, Global stability of an SIRS epidemic model with delays, Acta Math. Sci., 26B (2006) 291–306.

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Fabrication and investigation of the deformation behaviour of Al-10Si-TiB2 composites

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Abstract- Light weight metal matrix composites based on aluminum alloy and TiB_2 particulates has emerged as an important class of materials and finding increasing applications in automobile, aero-space and space industries, in their quest for achieving better fuel economy. In order to fabricate a kind of high strength particulate reinforced aluminum alloy matrix composites, a high strength aluminum-10silicon alloy was selected as a matrix and composites reinforced with varying amounts of TiB_2 particles from 2 to 10% were synthesized using stir casting method. The deformation behaviour was analyzed. Stress of base Al -10Si alloy and its TiB_2 composites in the as cast condition has increased with increase in deformation in both samples of aspect ratio 1 and 1.5. Load required to deform of base Al -10Si alloy and its TiB_2 composites in the as cast condition increased with increase in reinforcement content as well as with aspect ratio. The increase in the properties could be attributed to be good bonding of TiB_2 particles and aluminum matrix. Stress of base Al -10Si alloy and its TiB_2 composites in the as cast condition has increased with increase in deformation in both samples of aspect ratio 1 and 1.5. But hardness has decreased with with increased aspect ratio. Strength coefficient (K) and strain hardening exponent (n) of Al-10Si-10TiB_2 considered in the present investigation was found to be 386.1 and 0.493 shows that the material has good flow stress per unit strain, good formability and can be work hardened at higher rate compared to its base Al -10Si alloy and its composites. Bulge diameter for base Al-10Si alloy and its composites increased with increasing degree of deformation, due to friction at contact surfaces, where as radius of curvature of bulge decreased with increasing degree of deformation.

Index Terms- Al -10Si alloy,TiB2, MMC, Stir casting, Deformation, Radius of curvature of bulge.

I. INTRODUCTION

Many operations in manufacturing processes such as forging, rolling, extrusion etc are performed with the work piece, subjected to compressive forces. Specimen subjected to a compressive load gives information useful for these processes [1-2]. Uni-axial compression of cylinders is a standard test, determines the ability of material to be forged either in cold or warm conditions without cracking. This test is important and gives a representative behaviour during metal forming at room temperature.

In uni-axial compression testing, the presence of frictional constraints between the dies and the work-piece has a direct effect on the plastic deformation of the later. When a solid cylinder undergoes axial compression between the top and bottom platen, the work-piece undergoes heterogeneous deformation, resulting in the "barrelling" of the cylinder. Friction at the faces of contact causes a retarding effect on the plastic flow of metal on the surface and in its vicinity. As a result, a conical wedge of a relatively undeformed metal is formed next to platens, while the rest of the cylinder suffers high strains and bulges out in the form of a barrel. This demonstrates that the metal goes easily towards the nearest free surface which is said as the point of least resistance, a well-known principle of plastic deformation [2].

II. LITERATURE REVIEW

Many investigators have carried out a series of investigations on uniaxial compression testing/cold forging of solid cylinders. Because of its relevance in many metal forming applications, comprehensive review of literature has been published by Johnson and Mellor [3]. Another major aspect of uniaxial compression from the standpoint of testing the mechanical properties of metals is its estimation of their forming limits up to plastic instability and subsequently fractures. *Narayanasamy R*, et al. [4-5] studied the cold upset forming for different materials and different shapes. A new geometrical shape factor (GSF) has been established based on the dimensions of the deformed specimens. It was reported that the measured barrel radius of curvature follows a straight line relationship with the GSF. Narayanasamy R and Pandey K S et al. [6] studied the effect of barrelling in aluminium solid cylinders during cold upset forming and found that the measured radius of curvature of the barrel exhibited a straight-line relationship with the new geometrical shape-factor, irrespective of the aspect ratios of the cylinders. Sowerby R, Banerjee J.K et al. [7, 8] showed theoretically that the barrel radius can also be expressed as a function of axial strain and subsequently confirmed the same through experimental verification. Kulkarni and Kalpakjian et al. [9] conducted experiments on 7075 aluminium specimens with three aspect ratios to examine the arc of barrel and lead to conclusion that it may be a circular or parabolic. Schey A, Narayanasamy R et al. [10-11] presented a comprehensive report on the different geometrical factors that affect the shape of the barrel and concluded that the expansion of the original end face was highly sensitive to friction and the material's strain hardening

characteristics. Yang *D et al.* [12] developed an upper bound solution for the determination of forging load and also deformed bulged profile during upset forging of cylindrical billets under the dissimilar frictional conditions at flat die surfaces. Male A T and Cockcroft M G et al. [13] developed ring compression test, which is most commonly, employed method for determining friction characteristics. The test involves the compression of a hollow thick walled cylinder, or ring, and the determination of the variation of the internal bore diameter with the height reduction. Shaw M C et al. [14] studied the significance of axi symmetric compression from the stand point of mechanical/manufacturing properties of materials and estimated the forming limits up to plastic instability and fracture. Malayappan S et al. [15] also made analysis on effect of friction and concluded that the final shape of the work-piece after the upsetting process can be divided into two geometries namely a barrelled portion and a truncated cone portion and the new hoop strain slope is found to increase accordingly with increasing aspect ratio. Sljapic V [16] studied fracture in axi-symmetric and three dimensional cold upsetting of brass and concluded that the material exhibit a transition from ductile to brittle behaviour under the room temperature quasi-static test conditions. Kobayashi S [17] studied the deformation characteristics and ductile fracture of 1040 steel in simple upsetting of solid cylinders, and also calculated the ring compression tests to evaluate the friction factor.

Extensive studies have been reported by various authors on the compression of solid cylinders where the initial height/diameter (H_0/D_0) ratio equals or exceeds unity. Though there are many works on friction studies, little attention has been given to the compression of taller cylinders, due to the height of the specimen and ductility of the material. To be comprehensive and practical, a model of the forging process should permit the determination of the platen forces, the friction between the platens and work piece, pressure distributions affecting tool life, the internal flow of the forging influencing die-design, forging sequence and the properties of final product dictating in-service performance.

Banerjee and Narayanasamy et al. showed theoretically that the barrel radius can also be expressed as a function of axial strain and subsequently confirmed the same through experimental verification [18,19,20]. Narayanaswamy et al, have done experimental work on workability behaviour of aluminium, Al-Al_2O_3 [20], Al-Fe [21,], Fe [22] and Fe-TiC [23,] during cold upsetting. S Dikshit et al. [24] carried out cold upsetting experiments under unlubricated condition on cast and homogenized AA 2014/SiC composites to study the effect of homogenization on deformation behavior.

Present work attempts to discuss the deformation behaviour of Al-10Si alloy and Al-10Si -TiB_2 composites under uni axial compression, which had a direct relevance to the experimental results.

III. EXPERIMENTAL METHODS

A. Fabrication of composites

Al-10Si alloy was melted at 775^0C under the protection argon atmosphere. The reaction slag was skimmed from the surface of melt. TiB_2 particles were added in to the vortex formed during stirring. Al-10Si alloy basedcomposites were produced by varying the TiB_2 content from 2% to 10% in the form of 8inch long x 25mm dia. and 8inch long x 22mm dia. castings. The composites were quenched in water at room temperature.

The cylindrical test specimens of size 25mm length x 25mm diameter with aspect ratio 1 and 37.5mm length x25mm diameter for aspect ratio 1.5 were machined from the castings for deformation studies. Hardness studies were carried out on Vickers micro hardness tester (micro vickers hardness tester, Model: LV 700) hardness testing machine.

B. Compression Test

The upset tests were performed at room temperature between two flat platens on a UTM of 100 KN capacity universal testing machine (Model: UTM/E100). The compression dies of EN-31 grade are used for compression and the sample was placed axi-symmetrically in between the dies. The tests were conducted at 10%, 20%, 30%, 40% and 50% deformations on the top surface of the Al-10Si alloy and its TiB_2 composites with a constant cross head speed to assess the deformation behaviour for two limiting values of aspect ratio 1.5 (to avoid buckling) and 1.0 (which is used in most of the forging applications).

Fig.1.(a): Al-10Si alloy specimens showing bulge profiles at various deformation stages under compression testing at aspect ratio 1.0.

Fig.1(b): Al-10Si-2%TiB_2 composite specimens showing bulge profiles at various deformation stages under compression testing at aspect ratio 1.0.

Fig.1.(c): Al-10Si-4%TiB_2 composite specimens showing bulge profiles at various deformation stages under compression testing at aspect ratio 1.

Fig.1.(d): Al-10Si-6%TiB_2 composite specimens showing bulge profiles at various deformation stages under compression testing at aspect ratio 1.

Fig.1. (e): Al-10Si-8%TiB_2 composite specimens showing bulge profiles at various deformation stages under compression testing at aspect ratio 1.

Fig.1.f: Al-10Si-10%TiB_2 composite specimens showing bulge profiles at various deformation stages under compression testing at aspect ratio 1.0

Fig.2. (a): Al-10Si alloy specimens showing bulge profiles at various deformation stages under compression testing at aspect ratio 1.5.

Fig.2. (b):Al-10Si-2%TiB_2 composite alloy specimens showing bulge profiles at various deformation stages under compression testing at aspect ratio 1.5.

Fig.2.(c):Al-10Si-4%TiB_2 composite specimens showing bulge profiles at various deformation stages under compression testing at aspect ratio 1.5.

Fig.2.(d):Al-10Si-6%TiB_2 composite specimens showing bulge profiles at various deformation stages under compression testing at aspect ratio 1.5.

Fig.2.(e): Al-10Si-8%TiB_2 composite specimens showing bulge profiles at various deformation stages under compression testing at aspect ratio 1.5.

Fig.2.(f): Al-10Si-10%TiB_2 composite specimens showing bulge profiles at various deformation stages under compression testing at aspect ratio1.5.

IV. RESULTS AND DISCUSSION

A. Compressive behaviour

Compressive properties of the alloy and composites have been studied from the load-displacement curves.

Figure 3 and 4 shows the true stress–true strain curves of alloy and composites with aspect ratios of 1.0 and 1.5 respectively.

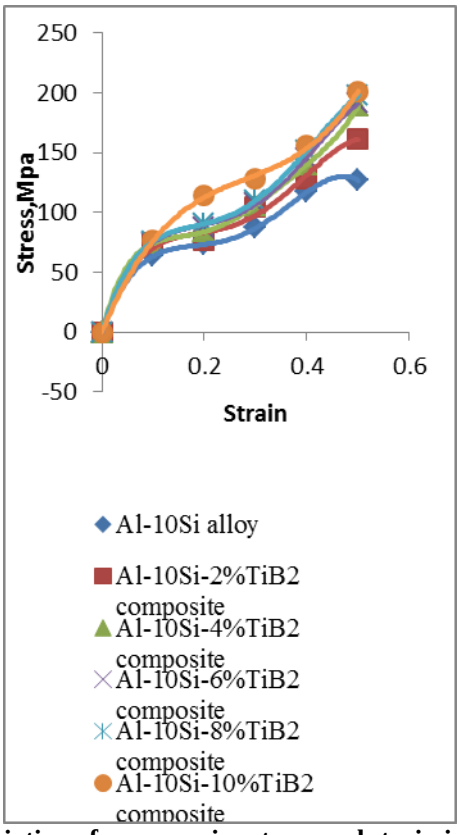

Fig.3.variation of compressive stress and strain in Al-10Si alloy and composites (aspect ratio 1)

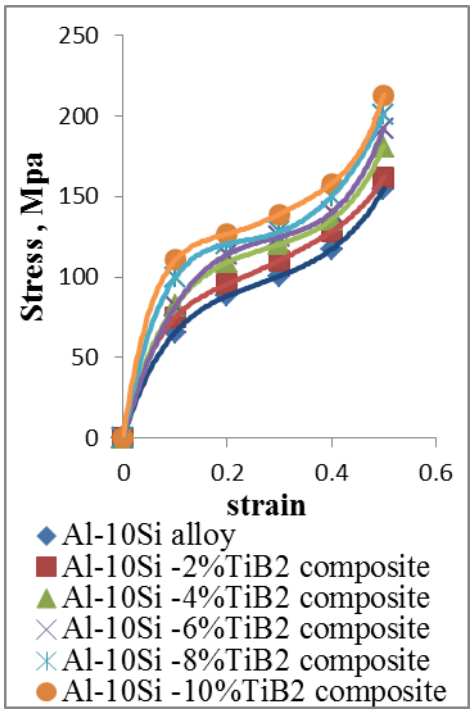

Fig.4: variation of compressive stress and strain in Al-10Si alloy and its composites (aspect ratio 1.5)

Both alloy and composites exhibit strain hardening behaviour showing increase in load with increasing displacement. The composites show higher loads than the alloy and the increase in load increases with the increasing reinforcement contents, indicating increased work hardening due to the presence of reinforcements and its corresponding weight fractions.

Erik Parteder [25], Khlaghi F [26] and Valdez S [27], reported, the strength of the MMC is expected to increase by addition of solid particles due to the strengthening effects occurred in particulate reinforced composites. These effects include the transfer of stress from the matrix to the particulate, the interaction between individual dislocations and particulates, grain size strengthening mechanism due to reduction in composite matrix grain size, and generation of a high dislocation density in the matrix of the composite as a result of the difference in thermal expansion between the metal matrix and particulates.

Figure 5 and figure 6 shows the effect of aspect ratio1 and 1.5 on load taken by the specimen up to 50% deformation. The increase in aspect ratio decreases the load required for the same amount of deformation. For a fixed diameter, a shorter specimen will require a greater axial force to produce the same percentage of reduction in height, because of the relatively larger undeformed region [28].

From the above observations it is evideint that stress of Al-10Si alloy and its composites in the as cast condition increased with increase in degree of deformation in both samples of aspect ratio 1 and 1.5. Further it was also observed that the load required to deform Al-10Si alloy & composites in the as cast condition increased with increase in reinforcement content as well as with aspect ratio.

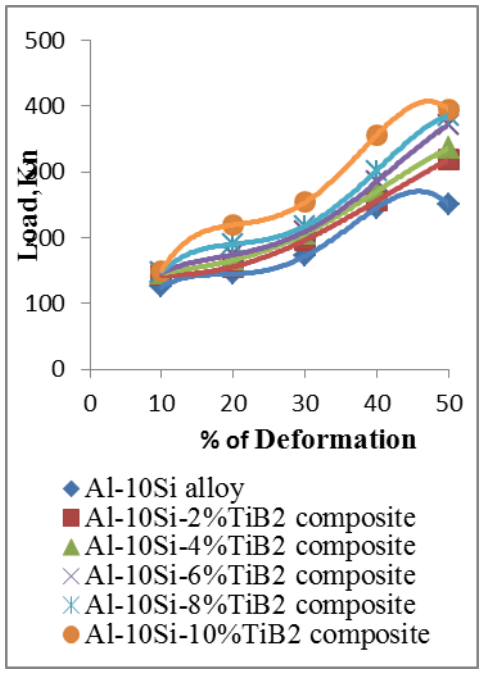

Fig.5:Effect of load on deformation of samples with aspect ratio1.

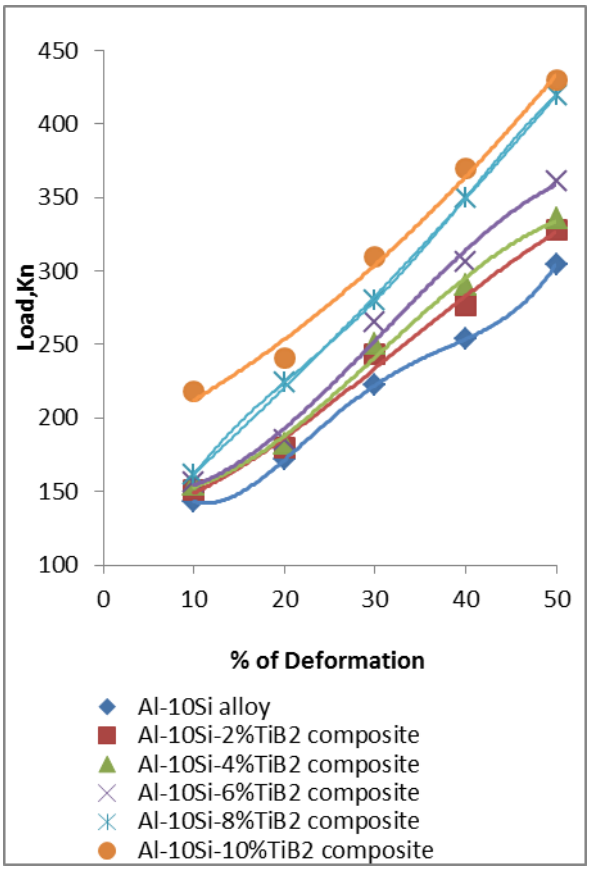

Fig.6: Effect of load on deformation of samples with aspect ratio 1.5.

From the above observations it is evideint that load required to deform the alloy and its composites in the as cast condition

has increased with increase in deformation, in the both samples of aspect ratio 1and 1.5. Further it is also observed that the load required to deform the alloy & composites in the as cast condition is reduced with increased aspect ratio

A. Hollomon power law parameters

In the absence of thermal action, such as recrystalization or recovery, during the deformation process, the exponent 'n' was a measure of the work hardening. This represents the increase of flow stress $\bar{\sigma}$ with increase in natural strain $\bar{\varepsilon}$. Based on this phenomenon, the work hardening coefficient 'n' was a measure of achievable maximum formability for different materials during forming with the same external restraints. A higher work hardening coefficient means a higher uniform elongation value, thereby reducing the tendency for local straining in the material. Although slip planes occasionally cross grain boundaries, especially if the crystals have twin orientation or close to it as a rule deformation stops whenever a change of orientation is present not only grain boundaries but also sub boundaries acts as barriers for movement, and a pile-up of dislocations with distortion of the crystal results (29-31)

The calculated true stress vs. true strain was fit into the equation of Holloman power law [28-33] given by:

$\bar{\sigma} = K \bar{\varepsilon}^{n}$ ---------- (1) Where $\bar{\sigma}$ = true stress, $\bar{\varepsilon}$ = true plastic strain, K= strength coefficient, and
n = strain hardening exponent

Hollomon parameters 'K' and 'n' are used widely to assess the behaviour of metals in both uni axial tension and compression at room temperature [34-36]. These constants have also been used to relate properties in metal forming [37-43]. The strength coefficient (K) gives the flow stress at unit strain and it is the measure of elastic spring-back. The strain hardening exponent 'n' is an important parameter in metal forming. It signifies the strain hardening or work hardening characteristic of a material, that is, the higher the value of 'n', higher is the rate at which the material work hardens. A material with high value of 'n' is preferred for process which involves plastic deformation. The larger the 'n' value, the more the material can deform before instability [43]. To validate the calculations, the plastic region of the curve.

In order to study the effect of reinforcement content on strength coefficient (K) and strain hardening exponent (n), calculations have been made taking base alloy value as zero. Figure.7. and figure.8. shows the effect of reinforcement content on strength coefficient (K) and strain hardening exponent (n). As the reinforcement content increases, a continuous increase in K values have been observed. Increased fabrication time of composites may be one of the reasons for the formation of thick interface between the matrix and the reinforcement, inhibiting effective transfer of load from matrix to the reinforcement.

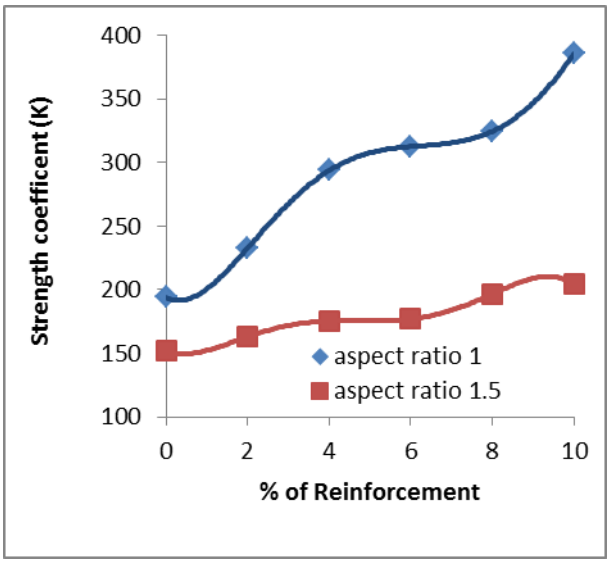

Fig.7: variation of strength coefficient (K) with respect to content.

It is evideint that strength coefficient (K) and strain hardening exponent(n) of the Al-10Si alloy and its TiB_2 composites in the as cast condition as well as after deformation has increased with increased reinforecement content in the both samples of aspect ratio 1 and 1.5. But it was observed that the samples with aspect ratio 1 are found to have higher values of strength coefficient (K) and strain hardening exponent (n) than that of the samples with aspect ratio 1.5.

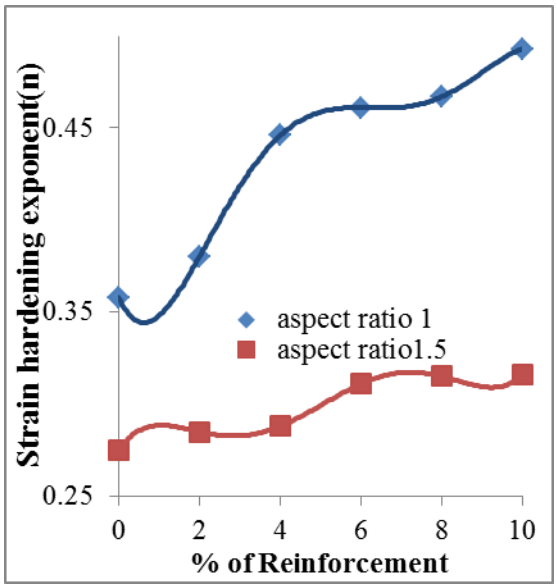

Fig.8: Variation of strain hardening exponent (n) with reinforcement content.

Venugopal et al [44] reported that, decrease in strength coefficient (K) value is due to occurance of bulk forming & mass constancy. Composites with higher reinforcements offer higher resistance towards deformation. Narayanaswamy R [23] reported that composites with smaller particles, offer higher value of strength coefficient. Samuel K G et al [45] reported that, the larger the strain hardening exponent (n) value, the more the

material can deform before instability. A material with high vaue of n was preferred for process, which involve plastic deformation. The strain hardening exponent found to be increasing with increase in aspect ratio. The increase in strain hardening exponent (n) with increasing aspect ratio shows the material can take more plastic deformation before instability.
An effective interface is one which transfers quickly from the matrix to the reinforcement in the smooth way, and this effectiveness holds good only when a uniform interface is formed between the matrix and reinforcement. Formation of thicker interfaces not only impedes load transfer (diminishing 'K') but also minimizes the dislocation mobility (diminishing 'n').

Hollomon parameters 'K' and 'n' are used widely to assess the behavior of metals in both uniaxial tension and compression at room temperature [33-35]. These constants have also been used to relate properties in metal forming [36-42]. The strength coefficient (K) gives the flow stress at unit strain and it is the measure of elastic spring-back. The strain hardening exponent 'n' is an important in metal forming. It signifies the strain hardening or work hardening characteristic of a material, that is, the higher the value of 'n', higher is the rate at which the material work hardens. A material with high value of 'n' is preferred for process, which involves plastic deformation. The larger the 'n' value, the more the material can deform before instability [43].

It is evident that strain hardening exponent (n) of the Al-10Si -TiB2 composites in the as cast condition has increased with increased reinforecement content in the both samples of aspect ratio 1and 1.5. Further it is also observed that the strength coefficient (K) and strain hardening exponent (n) of the Al-10Si alloy TiB_2 composites decreased with increased aspect ratio.

B. Hardness behaviour during work hardening

Hardness was found to be increasing with increasing deformations and also with increasing reinforcement content. Work hardening of material due to increased dislocation density during deformation is the reason for the increase in hardness. As the dislocation density increases, resistance to the mobility of dislocations increases, resulting in a continuous increment in hardness values.

In order to substantiate the compressive behaviour with the aspect ratio (H/D), hardness testing was conducted. Figure.9. shows the effect of deformation on hardness, for the Al-10Si alloy and its TiB_2 composites. The hardness values were found to be low for samples with aspect ratio 1 when compared to that of 1.5. This behavior indicated was in tune with that of compressive behavior, as discussed in the earlier paragraphs.

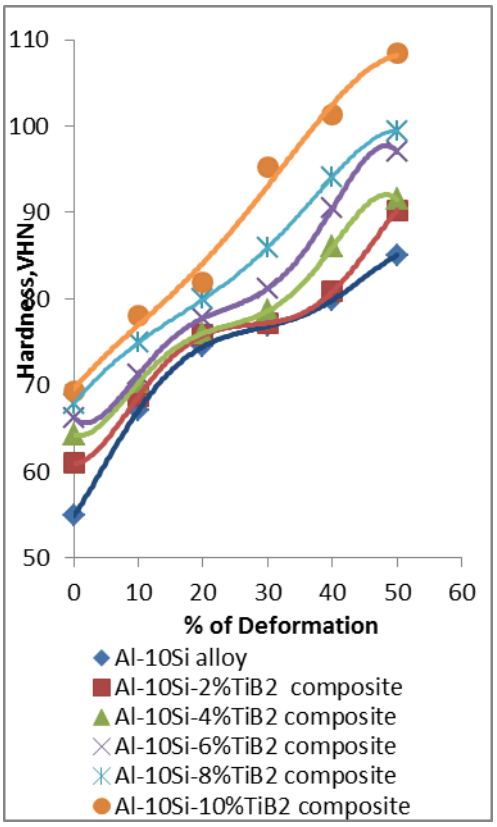

Fig.9:Effect of deformation on hardness of samples with aspect ratio1.

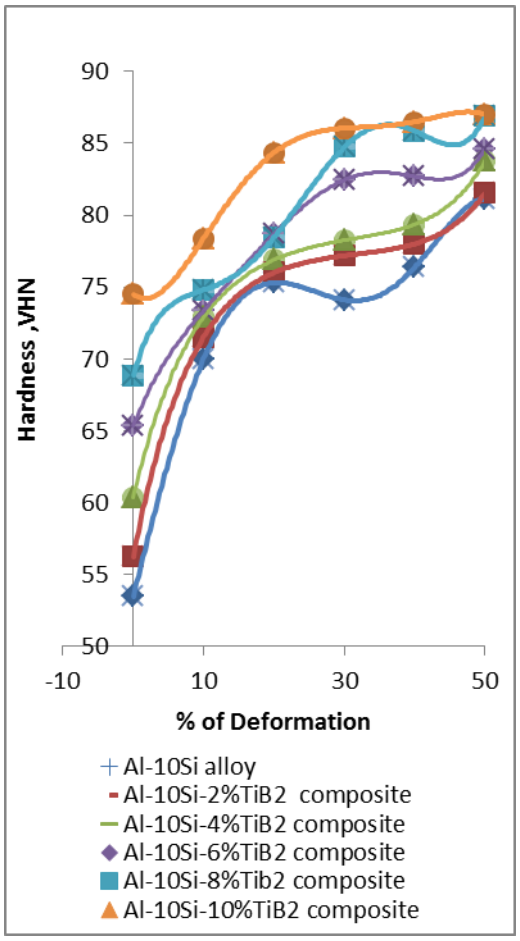

Fig.10: Effect of deformation on hardness of samples with aspect ratio1.5.

From the above observations it is evideint that hardness of alloy and its composites in the as cast condition has increased with increase in deformation, in both samples of aspect ratio 1 and 1.5, and the same decreased with with increased aspect ratio.

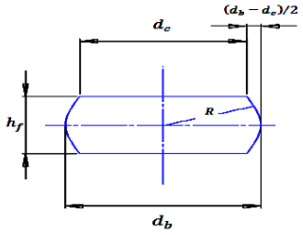

Fig.11: Effect of deformation on bulge diameter

Bulging is the phenomenon when the faces under uni-axial compression get deformed to result in a bulge shaped profile with bulge diameter attaining a maximum in the middle of the height of the deformed specimen. The bulge profile observed in this particular case of Al-10Si alloy subjected to uni axial compression at room temperature bears a close resemblance to that one shown in figure 11.

Fig.12. shows the effect of deformation at the centre of the samples. The diameter at the centre increases more compared to the ends of the cylinder (sample) due to friction free volume that is available at the centre compared to the restricted deformation at the contacts. The bulge diameter is found to be increasing with increasing deformation

Radius of curvature of Bulge = $R = h_f^2 / 4(d_b - d_c)$ ---------2

Where h_f = height of the sample after deformation
d_b = bulge diameter of the sample after deformation
d_c = top diameter of the sample after deformation

Fig.12:specimens under different deformations with their bulge profiles.

C. Radius of curvature of bulge

Fig.13. Shows the effect of reinforcement content on radius of curvature of bulge. Radius of curvature of bulge decreases with increase in reinforcement content. This effect is much more pronounced with decreasing aspect ratio.

Height of the specimen after deformation, the bulge diameter and the top diameter of the specimen after each and every deformation are measured in each case. Kulkarni et al [9] reported that the profile of the bulged surface is approximately by an arc of a circle, figure.12.The radius of curvature of bulge is calculated basing on the formula given below as equation 1..The radius of curvature of bulge plotted as a function of percentage of deformation is shown in the figure 13.The radius of curvature of bulge found to be decreasing with increasing deformation. As the deformation proceeds, the flow of the metal at the top and bottom platens will increase with respect to the middle and hence the radius of curvature seems to be decreased.

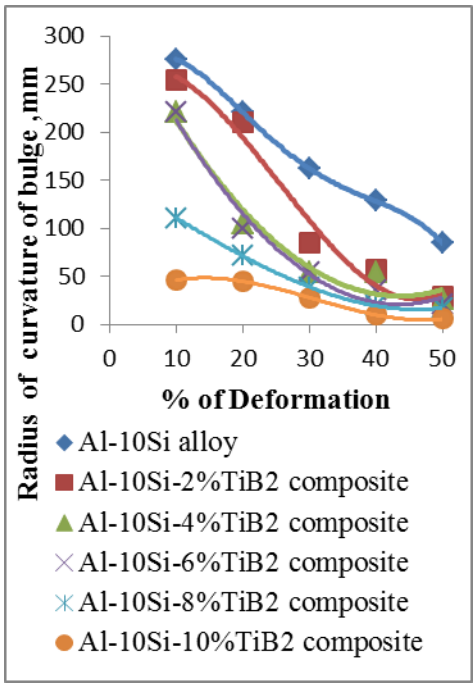

Figure.13: Effect of deformation on radius of curvature of bulge (aspect ratio 1).

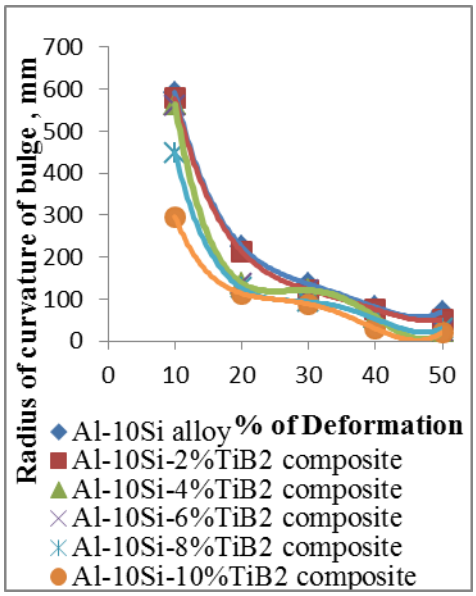

Figure.14: Effect of deformation on radius of curvature of bulge (aspect ratio 1.5).

From the above observations it is evideint that radius of curvature of bulge of Al-10Si alloy and its TiB_2 composites in the as cast condition decreased with increase in deformation in the both samples of aspect ratio 1and 1.5 and the same is reduced with increased aspect ratio.

V. CONCLUSIONS

1. Stress of base Al -10Si alloy and its TiB_2 composites in the as cast condition has increased with increase in deformation in both samples of aspect ratio 1 and 1.5.
2. Load required to deform of base Al -10Si alloy and its TiB_2 composites in the as cast condition increased with increase in reinforcement content as well as with aspect ratio.
3. Hardness of base Al -10Si alloy and its TiB_2 composites in the as cast condition has increased with increase in deformation, in both samples of aspect ratio 1 and 1.5, and the same decreased with with increased aspect ratio.
4. Strength coefficient (K) of Al -10Si-10%TiB_2 considered in the present investigation is found to be 386.1 shows that the material has good flow stress per unit strain compared to its base Al -10Si alloy and its composites.
5. Strain hardening exponent (n) of Al-10Si-10%TiB_2, considered in the present investigation, is found to be 0.493, shows that the material has good formability and can be work hardened at higher rate compared to base Al -10Si alloy and its composites.
6. Bulge diameter for base Al -10Si alloy and its composites is increasing with increasing degree of deformation, due to friction at contact surfaces.
7. Radius of curvature of bulge for base Al -10Si alloy and its composites is decreasing with increasing degree of deformation.

REFERENCES

[1] Matruprasad R "Flow stress and Barreling Behavior of Aluminum Alloy Solid Cylinders during Upset Forging at Elevated Temperature" NIT Rourkela, 2011.

[2] Kobayashi S, "Deformation characteristics and ductile fracture of 1040 steel in simple upsetting of solid cylinder and rings", Journal of Engineering for Industry, Transactions of ASME, Series B, pp.391-399, 1970.

[3] Johnson W, Mellor P B "Engineering plasticity", Van Nostrand, London, ch 6, pp.110–114, 1975

[4] Narayansamy R, Sathiyanarayanan S, Ponalagusamy R,"A study on barreling in magnesium alloy solid cylinders during cold upset forming", Journal of Materials Processing Technology, Vol.101, pp.64-69, 2000

[5] Manisekar K, Narayansamy R, "Phenomenon of barreling in square billets of aluminum alloy during cold upset forming", International Journal of Advance Manufacturing Technology, Vol.21, pp.84-49, 2003

[6] Narayansamy R, Pandey K S, "A Study on barreling in aluminum solid cylinders during cold upset forming", Journal of Materials Processing Technology, Vol.70, pp.17-21, 1997.

[7] Sowerby R, O'Reilly I, Chandrasekaran N, Dung N L, "Materials testing for cold forging", ASME Journal of Engineering Materials and Technology, Vol.106, pp.101–106, 1984.

[8] Banerjee J K, "Barreling of solid cylinders under axial compression", ASME Journal of Engineering Materials and Technology, Vol.107 (2), pp.138–144, 1985.

[9] Kulkarni K M, Kalpakjian S, "A study of barreling as an example of free deformation in plastic working", ASME Journal of Engineering Materials and Technology, Vol. 91, PP.743-754,1969.

[10] Schey A, Venner T R, Takomana S L; "Shape changes in the upsetting of slender cylinders", ASME Journal of Manufacturing Science and Engineering,Vol.104, pp.79-83,1982.

[11] Narayanasamy R, Murthy R S N, Viswanatham K, Chary G R, "Prediction of the barreling of solid cylinders under axial compressive load", Journal of Mechanical Working Technology, Vol.16, pp.21-30, 1988.

[12] Yang D Y, Choi Y, Kim J H, "Analysis of upset forging of cylindrical billets considering the dissimilar frictional conditions at two flat die surfaces", International Journal of Machine Tools and Manufacture,Vol.31, pp.397-404,1991.

[13] Male A T and Cockroft M G "A method for the determination of the coefficient of friction of metals under conditions of bulk plastic deformation", Journal of Institute of Metals, Vol.93, pp.489-494, 1964.

[14] Shaw M C and Avery J P, "Forming limits - Reliability, Stress Analysis and failure prevention methods in mechanical design", ASME Centennial bound Volume, A century publication, Chicago, USA, pp. 297-303, 1980.

[15] Malayappan S, Narayanasamy R, "Some aspects on barreling in aluminum solidcylinders during cold upset forging using a die with constraints", Journal of Materials processing technology, Vol.135 pp.18-29, 2003.

[16] Sljapic V et al "Observations on fracture in axi-symmetric and three dimensional cold upsetting of brass", Journal of Materials Processing Technology, Vol.125-126 pp.267-274, 2002.

[17] Kobayashi S, "Deformation characteristics andductile fracture of 1040 steel in simple upsetting of solid cylinder and rings", Journal of Engineering for Industry, Transactions of ASME, Series B, pp.391-399, 1970

[18] Banerjee, "Barreling of solid cylinders under axial compression", ASME J Eng. Mater. 138–144.

[19] . R Narayanaswamy, T Ramesh and K S Pandey, Mater. Des. Vol. 27, 2006, pp 566.

[20] R Narayanaswamy, T Ramesh and K S Pandey, Mater. Sci. Eng. A vol. 391 2005, pp 418-426.

[21] R Narayanaswamy, T Ramesh and K S Pandey, Mater. Sci. Eng. A vol. 391 2005, pp 418-426.

[22] N Selvakumar and R. Narayanaswamy, J. Eng Mater. Techol., vol. 127, 2005 pp251-256.

[23] R Narayanaswamy, V Senthilkumar and K S Pandey, Int. J. Mech. Mater. Des vol.3vol 3, 2006, pp 75-184..

[24] S Dikshit, V Gurjar, R Dasgupta and S Chaturvedi "Studies on cold upsetting behaviour of AA 2014-based metal matrix composites, fem simulation and comparison with experimental results" J. Mater. Dci. 2010, vol. 45, pp 4174-4179

[25] Erik Parteder, Rolf Bunten. "Determination of flow curves by means of a compressive test under sticking friction conditions using on iterative finite-element procedure." Journal of materials processing Technology, Vol. 74; 1998: pp: 227- 233

[26] Khlaghi F and Zare-Bidaki A "Influence of graphite content on the dry sliding and oil impregnated sliding wear behavior of Al 2024–graphite composites produced by in situ powder metallurgy method", Wear, Vol. 266, 2009, pp 37-45.

[27] Valdez S, Campillo B, Perez R, Martinez L and Garcia A "Synthesis and microstructural characterization of Al-Mg alloy-SiC particle composite", Mater Lett., Vol. 62, 2008, pp 2623–2625.

[28] George E. Dieter "Mechanical Metallurgy" 1928 McGraw-Hill, Book Company London

[29] Malygin G A, "Dislocation density evolution equation and strain hardening of f.c.c. crystals", physica status solidi (A), Vol.119, pp.423- 436, 1990

[30] Kubin L P, Y.Estrin, "Evolution of dislocation densities and the critical conditions for the portevin-le chatelier effect", Acta metal. mater, Vol.38, pp.697-708,1990.

[31] Sidney H Avner, "Introduction to Physical Metallurgy", 2nd edition, Mc Graw - Hill Book Company, pp.472-476, 1974, ISBN10: 0074630067, ISBN 13: 9780074630068 .

[32] Hollomon J H, "Tensile deformation", Transactions of American Institute of Mechanical Engineering, Vol. 162, pp. 268–277, 1945.

[33] Tong W, "Strain characterization of propagative deformation bands", Journal of the Mechanics and Physics of Solids, Vol.46 (10), pp.2087-2102, 1998.

[34] Buhler H and Wagner H W, Mewtallk Z. Vol.55, pp.136-144, 1967.

[35] Datsko J, "Material properties and manufacturing processes", wiley, New York, 1966.

[36] Fitzpatrick, "J.M J.Matter," Vol.3, pp.977-982, 1968.

[37] Dillamore I L, "The relevance of tensile properties to sheet formability", Journal of Physics D: Applied physics, Vol.7, pp.979-991, 1974.

[38] Green S J, Langan J J, Leasia J D, Yand W H, Metallurgical. Transactions, Vol.2, pp.1813, 1971

[39] Huges, I F, Page E W, Metallurgical. Transactions, Vol.2, pp.2067-2075, 1971.

[40] Kashar L J, Transactions of. Metallurgical Society. AIME, Vol.239, pp.1461-1468, 1967.

[41] Levy, B S, Sheet Metal, Vol.47, pp.527-530, 1970.

[42] Painter M J, Pearce R, "Instability and fracture in sheet metal", Journal of Physics D: Applied Physics, Vol. 7, pp. 992-1002, 1974.

[43] Rowe G W, Wolstencrosft F, "A mechanical approach to the metallurgy of machining", Journal of the Institution of Metals, Vol.98, pp.33-41, 1970.

[44] P Venugopal, S Annamali, Vijay Jagannathan and VVenkatramani, "On the apparent strength coefficient, strain hardening exponent and boundary friction coefficient of sintered p/m copper compacts", Journal of Mechanical Working Technology, vol. 20, pp. 137-147.

[45] Samuel K G, "Limitations of Hollomon and Ludwigson stress-strain relations in assessing the strain hardening parameters" J. Phys. D: Appl. Phys, vol. 39, 2006, pp 203-212.

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Formulation and Characterization of Herbal cream containing Fenugreek seed extracts.

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Abstract- The aim of present study was formulation of a stable W/O emulsion containing fenugreek seeds extract using olive oil as a base. Extract of Fenugreek seeds was obtained by using methanol as a solvent and the extract of fenugreek seeds, was entrapped in the inner aqueous phase of W/O emulsion. The formulation was prepared in internal aqueous phase (W/O emulsion) containing the extract of fenugreek seeds. The herbal formulation showed good spreadibilty, good consistency, homogeneity, pH, non greasy and no evidence of phase separation. The formulation, was stable at all the accelerated conditions regarding color, liquifaction and phase separation. The extract-containing cream substantially increased skin elasticity, hydration and decreased the skin melanin.

Index Terms- Fenugreek seed extract, cream, emulsion, formulation.

I. INTRODUCTION

Emulsions are a class of disperse systems consisting of two immiscible liquids. The liquid droplets (the disperse phase) are dispersed in a liquid medium (the continuous phase). To disperse two immiscible liquids, one needs a third component, namely, the emulsifier which is a surface active agent. Emulsifiers reduce interfacial tension between two immiscible liquids. The choice of the emulsifier is crucial in the formation of the emulsion and its long-term stability. In cosmetics, emulsions are the delivery vehicle for many hair and skin conditioning agents. Oil in Water (O/W) emulsions are the most commonly used cosmetic delivery systems which supply moisture to skin and improve the skin condition by forming the occlusive barrier on the skin. Anionic and non-ionic emulsions are used to deliver various oils and waxes which provide miniaturization, smoothness and softness to hair and skin. Emulsions formed with cationic emulsifiers are themselves effective conditioning agents since their positive charge is attracted to the negative sites on the hair, thus allowing them to resist rinse off.

In recent years, scientists are looking towards the cosmetic products utilizing natural resources. Fenugreek (Trigonella foenum graecum) is an annual herb that belongs to the family Leguminosae widely grown in Pakistan, India, Egypt, and Middle Eastern countries. Due to its strong flavor and aroma, the leaves and seeds of fenugreek are widely consumed in Indo-Pak subcontinent as well as in other oriental countries as a spice in food preparations, and as an ingredient in traditional medicine. It is rich source of calcium, iron, β-carotene and other vitamins. Fenugreek seeds extract is usually used to treat severe skin inflammation, chapped lips and skin aging. The seeds are used as a traditional remedy for the treatment of diabetes and hypercholesterolemia in Indian and Chinese medicines.

Olive oil is obtained from the olive (the fruit of *Olea europaea*; family Oleaceae), a traditional tree crop of the Mediterranean Basin. The oil is commonly used in cooking, cosmetics, pharmaceuticals, and soaps, and as a fuel for traditional oil lamps. Olive oil has a long history of being used as a home remedy for skincare. Egyptians used it alongside beeswax as a cleanser, moisturizer, and antibacterial agent. It can be used to relief of seborrheic dermatitis, acne, psoriasis or atopic dermatitis. The aim of our study is to prepare the emulsion of olive oil and aqueous fenugreek extract and compare the efficacy of this formulation with base i.e. olive oil emulsion in water and marketed product.

II. MATERIALS AND METHODS

Material: Fenugreek seeds and Olive oil were purchased from local market of Matunga, Mumbai. Span 80, Tween 80, Guar gum (additive) were ordered from TCI Chemicals(India)Pvt. Ltd.

Methods:

Preparation of plant extracts:

Dried and fresh batches of fenugreek seeds were purchased from local market, Matunga, Mumbai. Seeds were washed with distilled water to get rid of extraneous matter. Fenugreek seeds (10 g) were dried in oven at 50^{o}C. After drying, they were ground into a fine powder in a mixer. Methanol (250 ml) was used for extraction by Soxhlet extraction method for six hours. The extracts were filtered. The residue was re-extracted twice under the same condition to ensure complete extraction. The extracts were combined, filtered and evaporated to dryness under reduced pressure at 65^{o}C by a rotary evaporator. Extract was stored at dry place. 10 ml of the extract was measured into a pre-weighed aluminum dish and kept in an oven at 85°C for 24 hours then followed by placing in desiccator for 14 hours. The weight difference was calculated and percentage yield as well as weight expressed in mg/10 ml was determined.

Emulsion preparation

Oil phase that consisted of olive oil and calculated quantity of Span 80 (HLB No. 4.5) and Tween 80 (HLB No. 15) was prepared. At the same time, aqueous phase was prepared by adding the fenugreek seeds extract and natural polymer in water. After that, oil phase was added to the aqueous phase drop by

drop at 2500 rpm stirring to get the O/W emulsion based emulsion and further stirred for 30 minutes.

Preparation of base: The procedure was continued exactly as described above for preparation of cream without using the fenugreek seeds extract. This is the emulsion of olive oil and water.

Standardization of cream parameters:

The effect of various parameters like surfactant content, oil content, fenugreek seeds extract, HLB number of surfactant blend and additive content on emulsion stability was studied by trial and error method. A series of surfactant blends of different HLB numbers were prepared by the proper mixing of individual emulsifiers. Initially the surfactant concentration was kept at 0.5% (w/w) level and oil content was varied from 5 to 20% (w/w) level. As these emulsions were found physically unstable, procedure was repeated by increasing emulsifier concentration from 0.5 to 5% (w/w).

Characterization of emulsions and stability tests:

Rheological properties of an emulsion are important. These properties decide the physical stability, skin feel, ease of application on skin and its overall performance. The factors like oil content, amount of additive are the controlling factors of viscosity of an emulsion. The viscosity of emulsion and base was measured at 20±0.1ºC over a shear rate-range of 0 to 600 s^{-1}, using a rotational viscometer RV-2.

Stability tests were performed under different conditions for the emulsion and base. These tests were performed on samples kept at 8 ± 0.1^{O}C (in refrigerator), 25± 0.1^{O}C (in incubator), 40 ± 0.1^{O}C (in incubator) and 40 ± 0.1^{O}C (in incubator with 75% relative humidity).

Dermatological tests and product evaluation on skin:

Evaluation Test:

pH: 10% w/v suspension of the cream was prepared with water and the pH was measured using pH meter.

Homogeneity: The formulations were tested for the homogeneity by visual appearance and by touch.

Appearance: The appearance of the cream was judged by its color, pearlscence and roughness and graded.

Dilution method: Fixed amount of cream was diluted with water and mineral oil separately

Filter paper method: A streak of the cream was applied on the filter paper

Ash: Product was taken in a flat –bottom platinum dish and ashing was done at 600 ˚C in muffle furnace

feel: Emolliency, slipperiness and amount of residue left after the application of fixed amount of cream was checked.

Type of smear: After application of cream, the type of film or smear formed on the skin were checked.

Sixteen human volunteers having ages between 25 and 35 years were selected. Prior to the tests, a cosmetic expert examined the volunteers for any serious skin disease or damage especially on cheeks and forearms. The volunteers were instructed to apply the emulsion for 12 weeks and to come after every week for the dermatological tests.

Skin Irritation Tests were carried out by applying 0.5 g of emulsion and the base daily for seven days on 4cm^2 area of forearms and cheek. The skin was observed for any visual change such as redness *(erythema)* and swelling *(oedema)* after every 24 hours for seven days. Evaluations were done by using the "Primary Skin Irritation Index" which is the composite score obtained by summing individual scores of erythema and oedema which can range from 0 to 8 representing the degree of skin irritation.

The study of moisturizing property of formulated emulsions was carried out using a CM-825PC Corneometer against an aqueous marketed cream. The base line values were taken on 2 cm × 2 cm area on forearms. Test area was then treated with 0.1 g of formulated emulsion and control. Humidity conditions were set at 25 ±0.1°C and 48.5±0.1°C.

III. RESULTS AND DISCUSSION

The pH of human skin typically ranges from4.5 to 6.0 and 5.5 is considered to be average

pH of the skin. Therefore, the formulations intended for application to skin should have pH close to this range The pH values of the formulation remained constant with slight decrease in values.

Days	Temperature	Parameters					
		pH	Homogenity	Spreadability	After feel	Colour	Type of smear
0	RT	5.92	**	**	E	NC	NG
	40^{0}C	5.91	**	**	E	NC	NG
5	RT	5.91	**	**	E	NC	NG
	40^{0}C	5.90	**	**	E	NC	NG
10	RT	5.89	**	**	E	NC	NG
	40^{0}C	5.86	**	**	E	NC	NG
15	RT	5.87	**	**	E	NC	NG
	40^{0}C	5.83	**	**	E	NC	NG
20	RT	5.82	**	**	E	NC	NG
	40^{0}C	5.80	**	**	E	NC	NG
25	RT	5.76	**	**	E	NC	NG
	40^{0}C	5.77	**	**	E	NC	NG
30	RT	5.69	**	**	E	NC	NG

	40^0C	5.66	**	**	E	NC	NG
45	RT	5.61	**	**	E	NC	NG
	40^0C	5.62	**	**	E	NC	NG
60	RT	5.55	**	*	E	NC	NG
	40^0C	5.52	**	**	E	NC	NG

Table no. 01:Stability Testing

**: Good, *: Satisfactory, E: Emollient, NC: No Change, NG: Non greasy.

These formulations had almost constant pH, homogeneous, pearlescent, emollient, non-greasy after the application. There was no significant colour change observed in the formulation at the end of 3 months indicating the good stability of the emulsion. The stable formulations were safe in respect to skin irritation and allergic sensitization. The prepared herbal face cream is intended for cosmeceutical use rather than as mere cosmetic. It contains fenugreek seed extract which act as an anti-oxidant agent.

The yields of the extracts obtained by the soxhelt method were calculated as percent by weight of the fenugreek seed. According to the chemical composition and polar nature of phenolic compounds, fenugreek contains a relatively high percentage yield in polar solvents like water, methanol etc. while lower in nonpolar solvents. The yield was found to be 55.6 in mg/10 ml and in 23.5% yield.

The optimized parameters of the cosmetic creams showing six months storage stability at 28±2°C are shown in below:

	Oil (w/w)	Surfactant blend (w/w)	Additive (w/w)	Aqueous phase (w/w)	Surfactant blend ratio Span 80 : tween 80	HLB no. of Surfactant blend
Formulation	24%	4%	0.8%	71.2%	71.43:28.57	7.5
Base	24%	4%	0.8%	71.2%	76.19:23.81	7

Table no.02 : optimized parameters of the cosmetic cream and base

The surfactant molecules from oil phase and water phase get associated in a particular way at the O/W interface. Sufficient emulsifier concentration is necessary to produce the tightly packed monolayer of surfactant molecules at the interface which acts as a mechanical barrier to flocculation and coalescence of oil droplets thereby stabilizing the emulsion. All stable creams obtained were having close matching of HLB no. of surfactant blend and oil phase. Thus, preparation of surfactant blend with identical HLB no. that with oil phase is found to be one of the most important criteria for obtaining stable creams. The use of natural polymers as additives has enhanced texture, viscosity of external phase, rheological behavior and storage stability of creams against various phenomena such as coalescence, flocculation, layer separation, etc.

The formulated cream was found to be stable for 60 days without separation of layers at different temperatures. No phase separation was observed for the emulsion indicating the formation of tightly packed monolayer of surfactant molecules at the interface which acts as a mechanical barrier to flocculation and coalescence of oil droplets thereby stabilizing the emulsion. No phase separation even on centrifugation was seen in any of the samples kept under different storage conditions, i.e. 8^OC, 25^OC, 40^OC and 40^OC (75% RH) up to 60^{th} day of observation. This indicated that the emulsions were stable at all the storage conditions for 60 days.

Spreadability denotes the extent of area to which the gel readily spreads on application to skin or the affected part. The bioavailability efficiency of a cream also depends on its spreading value.

Formulation	**Ingredients**	**Concentrations**	**Spreadability**
1	Aqueous phase	71.2	10.3
	Oil phase	24	
	Surfactant	4	
	Span 80:tween 80	76.19:23.81	
	additive	0.8	

2	Aqueous phase	72.2	9.35
	Oil phase	23	
	Surfactant	4	
	Span 80:tween 80	72.44:27.56	
	additive	0.8	
3	Aqueous phase	73.2	8.29
	Oil phase	22	
	Surfactant	4	
	Span 80:tween 80	71:29	
	additive	0.8	

Table No. 03 Spredability in different formulations

The application of base resulted in slight increase in water content of skin at the end of three hours while the application of formulation showed significant increase in water content of skin at the end of three hours. The significant increase in moisture after application of formulation may be due to the fact that fenugreek extract contains mucilaginous polysaccharide that is a natural effective ingredient for improving skin hydration, possibly through a humectant mechanism. The results shows that the emulsion of olive oil and fenugreek extract can be used as effective moisturizer. On the other hand, marketed products give short term relief to dry skin.

IV. CONCLUSION

The emulsion of aqueous extract of fenugreek seeds and olive oil can be prepared. The rheological parameters and storage stability of each formulated cream were found to be identical with marketed product. The formulation was found to be superior to the marketed product for long term effect and spreadability. Due to no adverse effect of the formulation on skin and good moisturizing properties, the formulation can be used as a skin care product and an effective moisturizer.

REFERENCES

[1] Myers D. Surfactant Science and Technology, 2005, 5-14

[2] Vladisavljevic, G.T.; Shimizu, M.; Nakashima,T. J. Memb. Sci. 2006, 284, 373.

[3] Magdy, I. M. AAPS. J. 2004, 6, 1

[4] Magdassi, S.,Delivery Systems in Cosmetics, Colloids Surf. A Physicochem. Eng. Aspects, 1997, 123-124, 671-679

[5] F. J. Alarcon-Aguilara, R. Roman-Ramos, S. Perez-Gutierrez, A. Aguilar-Contreras, C. C. Contreras-Weber and J. L. Flores-Saenz, J. Ethnopharmacol.,1998, 61, 101.

[6] Sharma, R. D.; Sarkar, A.; Hazra, D. K. Phytother. Res., 1996, 10, 332.

[7] Ody, P.; New York: Dorling Kindersley., 1993, 47, 164.

[8] Ulbricht, C.; Kuo, G.; Szapary, P.; Smith, M.; Altern Med Rev., 2003, 8, 20.

[9] Aburjai T., Natsheh F.M.: Phytother. Res., 2003, 17, 987.

[10] Lucas, C.; Poirier, F.; Laperdix, C. 2006, US Patent: 20060182824

[11] Miraldi, E.; Ferri, S.; Mostaghimi, V. J. Ethnopharmacol., 2001, 75, 77.

[12] Wołosik, K.; Knaś, M.; Zalewska, A.; Niczyporuk, M.; Przystupa, A. W. Journal of cosmetic science 2013, 64, 59–66.

[13] Verncer, B.J. 1991, 15, 261-265

[14] Vijayalakshmi, A.; Tripura, A.; Ravichandiran V. International Journal of ChemTech Research, 2011, 3, 320-327

[15] Bhatia SC. Perfumes, Soaps, Detergents and Cosmetics. New Delhi: CBS Publishers and Distributors; 1998. Vol. 2.

[16] .Tirtha SS. The Ayureveda Encyclopedia. Delhi: Srisatguru Publication; 1998. 3. Sadasivam S, Manickam A. Biochemical Methods. New Delhi,New: Age International (P) Ltd; 2004.

[17] Jellinek JS. Formulation and Function of Cosmetics. Wiley – Interscience; 1970. 5. Lieberman HA, Rieger MM, Banker GS. Pharmaceutical Dosage Forms – Disperse Systems. New York:,Marcel Dekker, Inc.;1996. Vol. 2.

[18] 6. Forster T, Rybinski WV, Wadle A. Influence Of Microemulsion Phases on The Preparation Of Fine Disperse Emulsions. Adv. In Colloid & Interface Sci. 1995; 58:119-149.

[19] Carstensen TJ. Drug Stability Principles and Practices. New York: Marcel Dekker, Inc.; 1995.

[20] Grimm W. Extension of The International Conference on Harmonization Tripartite Guideline for Stability Testing of New Drug Substances and Products to Countries Of Climatic Zones III and IV. Drug Development and Industrial Pharmacy. 1998; 24(4): 313- 325

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Vegetation Analysis in the Riparian Zones of Angono Rizal, Philippines

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Abstract

Saving the life of the Angono River system is the ultimate vision of this research. Specifically, it analyses the vegetation along the riparian zones of the river's headwater as important benchmark information for future environmental actions of government agencies. Transect walk and satellite imagery revealed that the land cover, based on Standard Land Cover Classification System of the Department of Environment and Natural Resources (DENR) of the Philippines, is a non-forest other land cultivated annual. It was also found out that the tree vegetation is already weak and in critical condition and the very few remaining tree species are threatened by the fact that the study site is privately owned by a realty developer and a mining company and occupied by informal settlers. Thus, rehabilitation, conservation, protection and other important research endeavors, within the whole length of the river system are deeply calling for an immediate and active priority and concern from its various private and public stakeholders.

Index Terms- headwater, inventory, riparian, vegetation

INTRODUCTION

Sitio Labahan is a small portion of the large Barangay of San Isidro which can be found at the upper section of the river and mountainous north-eastern side of Barangay Angono, Rizal.

In 2007, the University of Rizal System Angono Campus identified the Barangay San Isidro, Angono Rizal as its adopted place in support to the mission of the institution of extending service to the community. And in 2008, the adopted community continues their cooperation with the projects given to them. Small as it is, the area, where the community lives, is very significant for it forms part of the headwater of the river system.

The natural characteristics of the area is already profoundly affected by the unprecedented human activities such as mining, land conversion and overharvesting of the remaining few natural resources available. In addition, the area had been seriously damaged by the tropical cyclone Ondoy in September 2009 which destroyed the large area along the riparian zone.

The area needs high priority due to several reasons namely, the amount of water flowing on the river portion traversing the barangay is very little; the residential wastes can be found anywhere in the river; some portion of the riparian zones are already occupied by the informal settlers; very few tree species are to be found and the number is apparently small; soil erosion is very common; very little concern of the community residents towards their natural environment is observable; and overharvesting of the remaining few second growth plant resources is common. All these are threatening the death of the headwater of the river system.

Vegetation as the primary component that will sustain the life of the headwater certainly needs evaluation and rehabilitation. Hence, this research offered significant benefits including but not limited to scientific basis for future rehabilitation, significant information for the community and the Local Government Unit of the current status of the vegetation at the riparian zones, and attracting more active participation of the community and LGU towards its rehabilitation. Likewise, the result of the study provided scientific evidence to convince funding agencies to offer support toward the riverbank and headwater rehabilitation.

OBJECTIVES

This research was conducted to analyze the vegetation in the riparian zones of Angono River. Specifically, it sought to:

- determine the type of vegetation or land cover along the riverbanks of Sitio Labahan;
- assess the vegetation by identifying the remaining tree species and families in the area including its average height and diameter, know the diversity index of the remaining tree species in the area.
- analyze the result and identify other important research endeavors to be done in the area which shall lead to the development or crafting of a comprehensive rehabilitation plan.

REVIEW OF LITERATURE

The Reality

In the Philippines, there are 421 principal river basins in 119 proclaimed watersheds, 19 of which are identified as major river basins. There are a total of 99 lakes, 16 of which have areas more than 400 hectares. Laguna de Bay in Luzon, with an area of

922 sq. km, and Lake Lanao in Mindanao are the largest lakes. (Kho et al., no. date).

The micro-watershed system traversing along the political boundaries of Antipolo City, Municipality of Taytay and Angono Rizal is one of the twenty two (22) supporting channels to the Laguna Lake. Likewise, the system is a critical watershed and a major water supply support system for the agricultural and residential areas located along the river system.

At present, there were no recorded formal researches similar to the present work that have been done in the area which aims at evaluating and rehabilitating the headwater, the riverbank and the Angono River system as a whole.

The Service that is threatened to its Extinction

Japan International Cooperation Agency (JICA) mentioned that water demand in the Philippines was 29,944 mm/yr. in 1996 and is expected to dramatically increase up to 86,500 mm/yr. in 2025 (Kho et al., no date).

Water supply support system has always been the compelling force to put these watersheds under appropriate management. The river system under study, as it contributes primarily in the sustenance of the micro-watershed system demands high priority on protection, conservation and rehabilitation considering its current observable conditions.

Watershed management requires various forms of resources or capital to support the activities and the task is made more challenging by the fact that most of the watersheds have already been turned into settlement areas *(which is also observed along the Angono micro-watershed system- both the upstream and downstream areas).* The support should come from the political units closest to the watershed. These usually consist of the municipalities and Barangays that are found within the watershed, and those people living in the upstream and the downstream areas (Francisco and Rola, 2004).

Riverbanks perform an important role in the lives of the people and the communities around it. A well-protected and stable riverbank protects the nearby agricultural land and crops from damage during flood. Due to the wanton destruction of forests and improper land use practices, most riverbanks become unstable and are now in critical condition. Hence, there is a need to rehabilitate these riverbanks to address the problem of stream bank erosion and instability (PCARRD, 2006).

What could possibly be done?

Fajanil et al. (DENR 6) conducted a study from 2002 to 2005 to find out the suitability of bamboo (*Gigantochloa levis*-Botong & *Bambusa blumeana* var. Luzonensis -Bayog) and vetiver grass in rehabilitating critical riverbanks in Cuartero, Capiz Philippines. These two species have great potential to control soil erosion and can be used to stabilize riverbanks as mentioned in other reports. Fajanil et al. found that *Bayog* + vetiver grass performed best in terms of growth performance, number of vetiver tillers, and soil build-up.

In addition, in 2004, *Botong* had an average of 8.5 poles/clump with an average of 5.3 shoots/clump while *Bayog* had an average of 7.85 poles and 4.42 shoots, and it had an average of 30.3 poles and 6.2 shoots in 2005. These indicated that inter-planting of bamboos with vetiver enhances bamboo pole and shoot production. Hence, *Bayog* in combination with vetiver should be planted along riverbanks to control soil erosion. (PCARRD, 2007)

During the field reconnaissance in the study area, many bamboos were also observed. With the study of Fajanil et al. and the observation in Sitio Labahan, bamboo seems to be a species of interest in rehabilitating the riverbank while maintaining the existing tree species found in the study area.

CONCEPTUAL FRAMEWORK

The current study is a salient factor, together with the remaining research endeavors, required prior to the crafting of the rehabilitation plan for the riverbanks. It is also important that participation of prime stakeholders *(LGUs, Landowners, Neighborhood Associations and residents, national and local laws, policies and regulations on watershed and environment)* are present towards the success of the development of the riverbank rehabilitation plan.

The current research results and the future research endeavors to be conducted plus the whole rehabilitation plan will directly support the riverbank recovery. It will also indirectly benefit the residents, the whole river system, and the agriculture and industries and ultimately the Laguna Lake water support system.

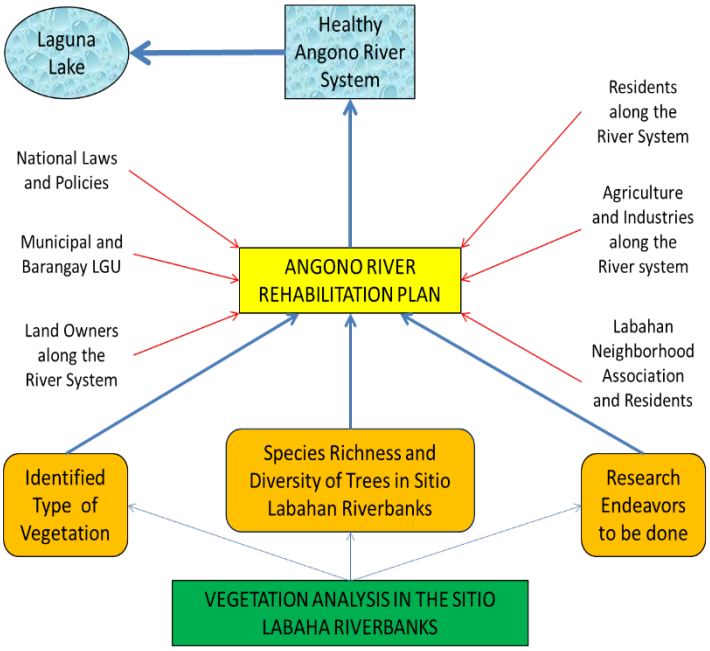


Figure 1. Framework of the study

METHODOLOGY

The following implementing strategies were used in the study.

Request of unwarranted permits

The Local Government Unit and the Neighborhood Association were formally informed to suit the requirements of the Executive Order 247 *(Bioprospecting)* and the Republic Act 9147 *(Wildlife Resources Conservation and Protection Act of the Philippines).*

Determination of the type of vegetation or land cover

Transect walk and field reconnaissance were conducted. The land cover classification made by Philippine's National Mapping and Resource Information Authority (NAMRIA) and the DENR's Standard Land Cover Classification System and the existing site state were considered in the land cover identification.

Assessing the vegetation

Field reconnaissance and establishment of sampling plots were done with the assistance of the officers of the *Sitio Labahan Neighborhood Association.* GPS unit was used during the survey. A total of eight 10x10m sampling plots were established where the species were identified. Average height and diameter, classification as to diameter and height at maturity and population density were also measured. Shannon-Weiner Diversity Index (1n) was used to compute the diversity values.

Classification and identification of collected specimens

Collected specimens were identified using taxonomic keys, books from Forest Products Research and Development Institute (FPRDI) and verified by dendrologists from College of Forestry, University of the Philippines in Los Banos, Laguna.

To determine the necessary research endeavors to be conducted in the area

The work of Contreras (2004) on the *"Realities of a Watershed Management Approach in the Philippines"* published in the Philippine Institute for Development Studies, Discussion Paper Series No. 2004-19 was analyzed and salient information were considered. PCARRD's *"Vegetation Analysis Manual"* was also utilized. Kho and Agsaoay-Saño's work on *"Customary water laws and practices in the Philippines"* were also utilized.

RESULTS

The type of vegetation or land cover

The transect walk and field reconnaissance conducted along the riparian areas revealed that the vegetation or the land cover occurring in the site is a non-forest other land cultivated annual based on the Standard Land Cover Classification System of DENR (DAO 2008-24 –Annex F1).

Assessment of vegetation or land cover

On Species Richness

Inventory of the vegetation in the sampling plot revealed a total of 150 combined trees and seedlings counted from the different sections of riparian zones of the study area. Of this total, 96 are seedlings and 54 are trees. Further, the combined data revealed a total of 20 families, 29 genera and 43 species (Table I). This number of species is comparatively lower than those observed in Mt. Hamiguitan (Amoroso et al., 2006) and Mt. Malindang (Arances & Amoroso et al., 2004).

Table I. Number of families, genera, species and counts

Plant Group	Families	Genera	Species	Count
Seedlings	10	12	23	96
Trees	10	17	20	54
Total	20	29	43	150

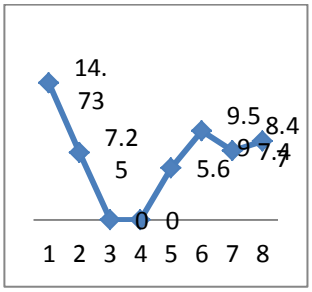
Of the two plant groups, the count of the seedling species is a bit higher than the trees which are maybe due to excessive or overharvesting by the informal settlers in the area. Likewise, the low species count of plants in the area can be attributed to the sandy and gravelly soil type plus its susceptibility to erosion, landslide and continual quarrying. The area covered in the study is so small with 7.7 hectares as compared to about 6,834 hectares of Mt. Hamiguitan (Amoroso et al., 2006).

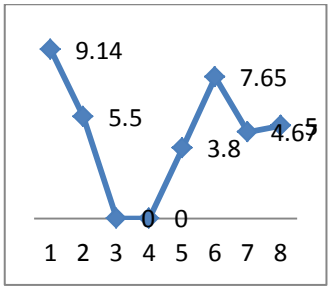
Diameter and Height of Trees

The sampling inventory revealed that the average diameter of trees is 8. 84 cm, while the average height is 5.96 meters. It was also noted that the highest diameter and height average can be found in Plot 1 because it is located at the highest point in the transect and the farthest from the bulk of the informal settlers. However, when Plot 1 was compared to other plots, still these averages are quite alarming because this only implies that the trees in the area are no longer reaching ideal diameters before being harvested.

Table II. Mean Diameter (a*) and Mean Height (b*) of Trees

Average Diameter	Average Height
8.84 cm	5.96 m

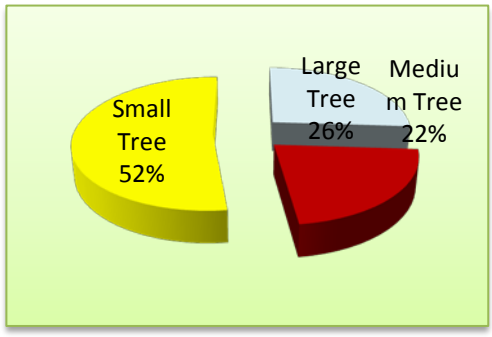




(a) Mean Diameter per Plot (cm) (b*) Mean Height per plot (m)*

Classification as to diameter and height at maturity (Tree Size)

In the analysis of the inventory data, it can be noted that more than half (52%) of the total plants identified are classified as small trees, 22% are medium and 26% are large with regards to their diameter and height at maturity as classified in the *Lexicon of Philippine Trees* (Salvosa, 1963). This higher percentage of small trees can be attributed to the fact that large trees are usually the preferred subject of harvesting, thereby reducing its chance to multiply as times pass by.



**Large (>40cm dm/>15m ht), Medium (30-40cm dm/5-15m ht), Small (3-30cm dm/2-5m ht)*

Figure 2**.** Percentage distribution of identified plant species as to Tree size, diameter and height at maturity

Population density

The average population density of the species identified is 0.007 (Table 4).

Table III. Population Density of Tree and Seedlings

Common Name	Relative Density	Common Name	Relative Density
Acacia auriculiformis	0.005	*Pithecellobium dulce* Roxb.	0.001
Persea gratissima Mill.	0.001	*Semecarpus cuneiformis* Blanco	0.004
Voacanga globosa Blanco	0.001	*Mangifera indica* L.	0.006
Pterospermum diversifolium Blume	0.001	*Artocarpus heterophyllus* Lam.	0.006
Antidesma ghaesembilla Gaertn.	0.003	*Ficus pseudopalma* Blanco	0.005
Muntigia calabura L.	0.011	*Ficus odorata* Blanco	0.001
Gmelina arborea Roxb.	0.001	*Tebernaemontana pandacaqui* Poir.	0.003
Anona muricata L.	0.003	*Sandoricum koetjape* Burm.	0.004
Endospermum peltatum Merr.	0.001	*Spondias purpurea* L.	0.001
Macaranga bicolour Muell.-Arg.	0.001	*Macaranga grandifolia* Blanco	0.004
Ficus septica Burm.	0.005	*Terminalia catappa* L.	0.001
Leucaena leucocephala Lam.	0.095	*Sterculia crassiramea* Merr.	0.001
Ficus ulmifolia Lam.	0.014	*Ficus nota* Blanco	0.001
Gliricidia sepium Jacq.	0.009		

The table indicates that the number of individuals of a population per unit of living space in the study area is very small. The data also reveals that the vegetation is composed of twenty (20) fruit bearing species and out of twenty, nine (9) of which are edible. Out of the nine edibles, six (6) can give marketable produce when given proper care and management. Further, this fact suggests that planting strategies have to be devised to increase the population of the remaining species in the area and to increase the economic use or profitability of the possible produce of the edible and fruit bearing species.

Species diversity

Species are distinct units of diversity and each playing a specific role in the ecosystem. Species diversity refers to the variety of species within a region. In nature, the number and kind of species, as well as the number of individuals per species vary, leading to greater diversity (Tutorvista, 2010).

Table IV. Shannon-Weiner Diversity Index per Plot

Name	Plot 1	Plot 2	Plot 3	Plot 4	Plot 5	Plot 6	Plot 7	Plot 8
Trees	0.759	0.872	n/a	n/a	0.759	0.639	0.276	0.26
	Very low	Low			Very Low	Very Low	Very Low	Very Low
Seedlings	0.265	0.759	0.171	0.276	0.439	0.171	0.615	0.301
	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low
Trees & Seedlings	0.532	1.004	0.171	0.276	0.71	0.469	0.677	0.499
	Very Low	Low	Very Low	Very Low	Very Low	Very Low	Very Low	Very Low

The inventory data showed a very low diversity index as revealed by the Shannon-Weiner Index. The diversity indices in all sampling plots are comparatively lower than the diversity indices in the analysis made in the different vegetation types in Mt Hamiguitan (Amoroso et al., 2006).

Other important research endeavours to be done in the area before crafting the comprehensive rehabilitation plan

To meet the basic requirements in the rehabilitation of the riparian zones in Sitio Labahan, the following steps have to be undertaken prior to the crafting of comprehensive riparian zone rehabilitation plan.

1. Basic Scoping
2. Mapping
3. Floral diversity assessment
4. Soil and Climate Characterization
5. Species-Site Compatibility Assessment
6. Identification of suitable land cover development strategy or technique (Assisted Natural Regeneration, Reforestation or Enrichment Planting)
7. Assessment of institutional and social capital (Contreras, 2004)
8. Assessment of political capital (Contreras, 2004)

CONCLUSIONS

Therefore, the current land cover (trees in particular) in the riparian zone of Sitio Labahan showed low species richness and diversity on a per unit area basis. And the physical features revealed an area that is highly disturbed and eroded by natural and man-made forces such as tropical cyclones, mining and quarrying activities. Hence, both biological and physical components of Sitio Labahan riparian zones need high priority for protection, conservation and rehabilitation.

IMPLICATIONS AND RECOMMENDATIONS

The national policies and guidelines regarding the mining, quarrying and settlement along the buffer zones of bodies of water are not implemented well in the study area. The floral component is basically limited and needs attention. The headwater of the river is in the brink of its extinction and the riverbanks are unhealthy and physically dangerous to the residents occupying the area. Hence, the Local Government Unit should implement policies religiously. Likewise, a local ordinance or Memorandum of Agreement regarding the management, rehabilitation, protection and conservation of the riparian zones and its biological components should be established to ascertain the protection of the headwater and river system as a whole.

Local Government Units adjacent to the river system should also make their priority because the headwater of this micro-watershed is within their political boundaries and their constituents also benefit from it.

Realty developer and resort owner along the headwater should take part in maintaining the buffer zones to sustain the life of the current micro-watershed system as a whole.

Lastly, all the necessary research activities be conducted the soonest possible time to be able to craft the rehabilitation plan.

ACKNOWLEDGMENT

Special appreciation is extended to the Commission on Higher Education (CHED) of the Philippines for funding the study and to the University of Rizal System for giving the full support towards the completion of the study.

REFERENCES

1. Amoroso, VB and Aspiras, RA and Polizon, JJA (2006). Participatory Inventory and Distribution of Endangered, Endemic and Economically Important Plants inHamiguitan Range Wildlife Sanctuary, Davao Oriental, Central Mindanao University, Musuan Bukidnon, Philippines

2. Arances, J., Amoroso, V., Ridsdale, C., Rufila, L., Comilap, R., Pacut, N., Visser, L., Galvezo, J., Lumaray, C., Montimar, B., Grueco, W., Tan, B., Opiso, G., Comilap, C., Sacal, S. (2004). Development of a Participatory Methodology for Inventory and Assessment of Floral Resources and their Characterization in the Montane Forests of Mt. Malindang. The Biodiversity research Program for Development in Mindanao: Focus on Mt. Malindang and Environs, SEAMEO, SEARCA, College Laguna. PDM Press, Inc. Quezon City Philippines.

3. Contreras, Antonio. (2004). Realities of a Watershed Management Approach in the Philippines: A Framework for Case Analysis, Philippine Institute for Development Studies, Discussion Paper Series No. 2004-19

4. Ella, Arsenio B., Tongacan, Arsenio L., Escobin, Ramiro P., and Pitargue Jr, Fernando C.(2008). Philippine Woods: Principal Uses, Distribution and Equivalent Woods in Asia Pacific, Forest Products Research and Development Institute, DOST Laguna Philippines.

5. Francisco, Herminia A. and Rola, Agnes C. (2004). Realities of a Watershed Management Approach in the Philippines: Synthesis of Case Studies, Philippine Institute for Development Studies, Discussion Paper Series No. 2004-24

6. Kho, James and Agsaoay-Saño, Eunice. (no date). Customary water laws and practices in the Philippines. Kho Agsaoay Benavidez Law Offices, 2204-B West Tower, Philippine Stock Exchange Centre, Exchange Road, Pasig City1605 Philippines.

7. PCARRD (2007). Philippine Council for Agriculture, Forestry and Natural Resources Research and Development Highlights 2006. Los Baños, Laguna: 204p.

8. Rojo, Justo P (1999). Revised Lexicon of Philippines Trees, Forest Products Research and Development Institute, DOST Laguna Philippines.

9. World Bank Philippine Environment Monitor (2003). JICA Master Plan Study on Water Resources Management in the Philippines (1998)

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Instructor-Related Problems of Junior Teacher Education Students of University of Rizal System Angono, Philippines

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Abstract

The research established a baseline data of the instructor-related problems of junior teacher education students to call the attention of the administration to study and design plan on how to address the issues. Descriptive survey method through researcher-made instrument was applied. Total enumeration of subjects was observed.

The problems were *favoritism, not teaching, giving exam/quiz beyond what he has taught, more on self-study than actual teaching, absenteeism and tardiness, poor knowledge on the subject, majority of the time is reporting, giving many activities in place of teaching the lesson, no clear records of grade, projects outside the scope of the subject, and collecting money in place of a project/grade.*

Problems vary from subject to subject although some subjects appear to have more problems than the others. Likewise, some problems were unique to certain course and specialization
The result implies that instructor-related problems exist which require attention and solution. And certain subjects that seemed to have many problems need immediate attention to prevent recurrence.

As a whole, the result implies that indeed there were instructor-related problems to be solved to uplift the quality of education being served to its clientele.

Hence, independent analysis of the identified problems should be conducted considering real root cause to avoid superficial solutions.

Index Terms- education students, instructor problem, teacher education, teaching problem

INTRODUCTION

Academic institution is always considered a place where awareness, talents and skills are honed. Congruent with the academic institution's ultimate function is the obligation or responsibility of instructors to teach the students well.

As these responsibilities are performed by the institution and by the mentors, students' feedbacks or opinions are very critical and important. These opinions of learners are almost always true and instrumental to further planning, modification, adjustments or formulation of new programs gearing towards resolution of encountered difficulties or problems in the past.

According to Loriz Malaguzzi (1920-1994), learning and teaching should not stand on opposite banks and just watch the river flow by; instead, they should embark together on a journey.
In the act of classical conditioning, the learner comes to respond to stimuli other than the one originally calling for the response (as when dogs are taught to salivate at the sound of a bell). One says in such a situation that a new stimulus is learned. In the human situation, learning to recognize the name of an object or a foreign word constitutes a simple instance of stimulus learning (Encyclopedia Britannica Online, 2009)

Hence, in doing such role, feedback is always a must.

With this research, the university sees, from the students' perspectives, important issues or problems that exist and can be addressed either immediately or in the near future.

OBJECTIVES

The research was made to meet the following objectives:

General:

To establish a baseline data of the instructor-related problems of junior teacher education students to get the attention of the administration to study and design strategy on how to address such problems.

Specific:

To determine the instructor-related problems of the junior teacher education students per subject, by program and by specialization.

To know which subjects have the most number of teacher-related problems observed.

FRAMEWORK OF THE STUDY

This research is anchored to the pedagogical view of human behavior in education theory under conditioning and behaviorist theories that in the act of classical conditioning, the learner comes to respond to stimuli other than the one originally calling for the response. One says in such a situation that a new stimulus is learned. In the human situation, learning to recognize the name of an object or a foreign word constitutes a simple instance of stimulus learning. (Encyclopedia Britannica, 2009)

Hence, over and above the lessons being given by the teachers, the students learned to respond to other stimulus that exist during their classes and one of which is the stimulus known as problem. And as they encounter such kind of stimulus the students either give their feedback or response to the stimulus openly or secretly.

In this study, such responses will be documented to be used as baseline data for any possible design or strategy to solve the problem. Balanced teaching-learning process can be attained if feedbacks or opinions about the educative process are solicited directly from the subjects or the students.

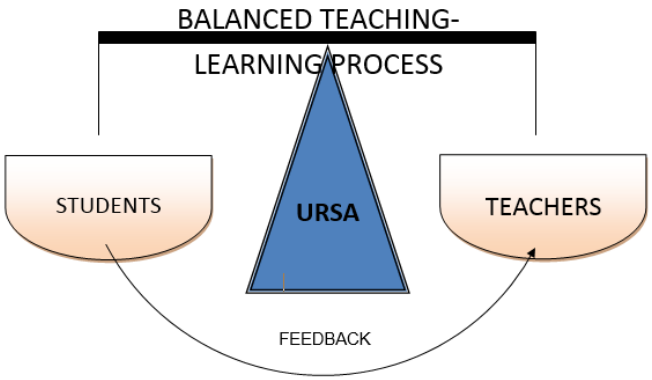

Figure I: Framework of the study

METHODOLOGY

The research utilized a survey instrument to identify the common problems encountered by junior teacher education students with their subject teachers in the past two years of stay in the university.

All the Junior Secondary and Elementary Education students were the respondents.

Table I
Distribution of respondents by program

Program	Frequency	Percentage
Secondary Education	49	83.1
Elementary Education	10	16.9
Total	**59**	**100**

Table II
Distribution of respondents as to specialization

Specialization	Frequency	Percent
English	29	49.2
Filipino	20	33.9
Special Education	10	16.9
Total	59	100

Descriptive statistics were applied in the analysis of data.

Copies of the program curricula were used as guide during the analysis of the data to assure the accuracy of the subjects included in the evaluation. Anonymity of the respondents and the teachers evaluated were assured to maintain professionalism and objectivity of the research.

RESULTS

The following results were derived in the study.

Instructor-related problems of the junior teacher education students.

Table III
Instructor-related problems based on the number of subject/s where the problem was observed

OBSERVED PROBLEMS	No of Subjects where the problem was observed (Out of 26 Subjects specified)	Percentage	Rank
Favoritism	11	42	1.5
Not teaching	11	42	1.5
Giving exam/quiz beyond what he has taught	10	38	3
More on self-study than actual teaching	9	35	4
Absenteeism & Tardiness	8	31	5.5
Poor knowledge about the subject	8	31	5.5
Majority of the time is reporting	7	27	7

Giving many activities in place of teaching the lesson	6	23	8
No clear records of Grade	5	19	9
Projects outside the scope of the subject	2	8	10
Collecting money in place of a project/grade	1	4	11

The data showed that among the problems observed by the junior teacher education students, *favoritism* and *not teaching* were mostly observed in a number of subjects. In addition, *giving exam/quiz beyond what he has taught, more on self-study than actual teaching, absenteeism & tardiness*, and *poor knowledge about the subject* among others were also observed in a number of subjects. And *collecting money* is only observed in one subject.

These observations are quite interesting to look into. In fact, all these can be corrected using appropriate strategies but what made these problems more interesting are its likely causes.

Academic and human resource management strategies are very critical on these matters. *Favoritism* is very personal in nature, and solving this problem depends on the conviction of individual faculty members. To cite another problem is *not teaching*. This problem could have been rooted from many reasons such as: (a) The teacher is really not knowledgeable about the subject he handles; (b)The teacher sees that others are not also teaching; (c) The faculty is dismayed to some administrative concerns (d) The teacher has this behavior even in the past; (e) others.

Therefore, this study gives hint to planners and academic managers to look into the root cause of any particular problem and address it intelligently. Because teacher-related problems when drastically addressed without clear plans to have a win-win solution could result to another problem instead of having only the teacher-student problem it may give rise to teacher-administrator gaps and conflicts.

Instructor-related problems of the junior teacher education students per subject.

Table IV
Teacher related problems encountered per subject

SUBJECTS TO WHICH PROBLEMS WERE EXPERIENCED	Absenteeism & Tardiness	Favoritism	Projects outside the scope of the subject	Not teaching	Poor knowledge about the subject	Majority of the time is reporting	Giving exam/quiz beyond what he has taught	No clear records of Grade	More on self-study than actual teaching	Giving many activities in place of teaching	Collecting money in place of a project/grade
Child & Adolescent Development	•			•	•	•	•		•	•	
Facilitating Learning									•		
Principles of Teaching 1		•									
Developmental Reading	•	•		•		•	•	•	•	•	
Assessment of learning 1				•						•	
Principles and Techniques of Educational Technology	•	•		•					•		
Selection, Production and Utilization				•						•	
Study and Thinking Skills		•	•	•	•	•					
Writing in the Discipline		•		•		•	•		•		
Pagbasa at Pagsulat sa Ibat-ibang Disiplina Tungo sa Pananaliksik	•	•		•							
Teaching Aids		•					•	•		•	
Philippine History						•	•				
World History	•				•	•			•		
Comp. Concepts with Word Processing				•							
Philippine Literature						•					
World Literature		•									
Foundation of MAPEH1					•						
College Algebra	•	•	•				•	•			
Plane & solid Geometry							•				
Plane and Spherical Trigonometry	•	•						•			
Intro to Statistics	•	•		•	•		•	•	•	•	•

Physical Science							•		•		
General Psychology							•		•		
Observational Child Study 1				•	•						
Observational Study 2					•						
Assessment of Children with Special Needs					•						

Apparently, the instructor-related problems of junior teacher education students vary from subject to subject. This only shows that a problem which may be observed in any subject really depends on individual faculty member.

Subjects which appear to have more problems have to be given higher concern or attention. The university has the responsibility to select quality teachers and establish a continuous monitoring and evaluation of the performance of the faculty members. As such, instead of looking at the issue negatively, it should be used as a very salient input in planning and policy formulation that would make the workforce even better without igniting quarrels and conflicts between and among the rank and file and those in the positions.

Subjects which have the most number of instructor-related problems observed.

Table V
Order of subjects as to the number of problems encountered

SUBJECTS TO WHICH PROBLEMS WERE EXPERIENCED	No of Problems Encountered in the Subject (Out of 11 problems observed)	Percentage	Rank
Intro to Statistics	9	82	1
Developmental Reading	8	73	2
Child & Adolescent Development	7	64	3
Study and Thinking Skills	5	45	5
Writing in the Discipline	5	45	5
College Algebra	5	45	5
Principles and Techniques of Educational Technology	4	36	8
Teaching Aids	4	36	8
World History	4	36	8
Pagbasa at Pagsulat sa Ibat-ibang Disiplina Tungo sa Pananaliksik	3	27	10.5
Plane and Spherical Trigonometry	3	27	10.5
Assessment of learning 1	2	18	14.5
Selection, Production and Utilization	2	18	14.5
Philippine History	2	18	14.5
Physical Science	2	18	14.5
General Psychology	2	18	14.5
Observational Child Study 1	2	18	14.5
Facilitating Learning	1	9	22
Principles of Teaching 1	1	9	22
Comp. Concepts with Word Processing	1	9	22
Philippine Literature	1	9	22
World Literature	1	9	22
Foundation of MAPEH 1	1	9	22
Plane & solid Geometry	1	9	22
Observational Study 2	1	9	22
Assessment of Children with Special Needs	1	9	22

The data expressed that *Intro to Statistics*, *Developmental Reading*, and *Child & Adolescent Development* were the top 3 subjects with the most number of instructor-related problems with nine (9), eight (8) and seven (7) respectively and the rest have problems varying from five (5) and below.

Solution to these problems should be carefully implemented to avoid further problems afterwards. To cite some strategies, if the teacher handling the subject is on a part time basis then the HR officer should think twice of rehiring him again. As for the academic dean, he should rather give the subject to a more capable faculty member.

However, those subjects with less observed problems should not be taken for granted since each of these is as important as others to be addressed.

Instructor-related problems by program

Table VIa
Instructor-Related Problems per Course
(Secondary Education)

SUBJECTS TO WHICH PROBLEMS WERE EXPERIENCED	Absenteeism & Tardiness	Favoritism	Projects outside the scope of the subject	Not teaching	Poor knowledge about the subject	Majority of the time is reporting	Giving exam/quiz beyond what he has taught	No clear records of Grade	More on self-study than actual teaching	Giving many activities in place of teaching the lesson

SUBJECTS TO WHICH PROBLEMS WERE EXPERIENCED	Absenteeism & Tardiness	Favoritism	Not teaching	Poor knowledge about the subject	Majority of the time is reporting	Giving exam/quiz beyond what he has taught	No clear records of Grade	More on self-study than actual teaching	Collecting money in place of a project/grade
Child & Adolescent Development	•		•	•	•			•	
Developmental Reading	•		•		•			•	
Principles and Techniques of Educational Technology	•		•						
Writing in the Discipline		•							
Philippine History					•				
Philippine Literature					•				
Foundation of MAPEH 1				•					
Plane & solid Geometry						•			
Plane and Spherical Trigonometry							•		
Intro to Statistics	•								•
Physical Science								•	
Observational Child Study 1			•	•					
Observational Study 2			•	•					
Assessment of Children with Special Needs			•	•					

Child & Adolescent Development				•			•		•	•
Facilitating Learning									•	
Principles of Teaching 1		•								
Developmental Reading		•					•	•		•
Assessment of learning 1				•						•
Principles and Techniques of Educational Technology		•		•					•	
Selection, Production and Utilization				•						•
Study and Thinking Skills		•	•			•				
Writing in the Discipline				•	•		•		•	
Pagbasa at Pagsulat sa Ibat-ibang Disiplina Tungo sa Pananaliksik	•	•		•						
Teaching Aids		•					•	•		•
Philippine History						•	•			
World History	•				•	•			•	
Comp. Concepts with Word Processing				•						
World Literature		•								
College Algebra	•	•	•				•	•		
Plane and Spherical Trigonometry	•	•						•		
Intro to Statistics	•	•		•	•		•	•	•	•
Physical Science							•			
General Psychology							•		•	

Table IVb
Instructor-Related Problems per Course
(Elementary Education)

The preceding two tables (VIa and VIb) present the instructor-related problems by program.

In Table VIa, it can be observed that *projects outside the scope of the subject* and *giving many activities in place of teaching the lesson* were encountered by Secondary Education students which are obviously not encountered by Elementary Education students.

On the other hand, *collecting money in place of a project/grade* is apparently present in Table VIb (Elementary Education students) and absent in Table VIa (Secondary Education students). And the rest of the problems are common to both programs.

These observations imply that problems encountered by course have commonalities and differences. Therefore, academic planners and policy makers should analyze very clearly as to what particular strategy is to be imposed to a specific program due to observed differences.

This goes with the idea in education which says that no particular teaching approach is perfect to all types of learners. This practically and equally means that no specific solution for varied problems.

Instructor-related problems by specialization

Table VIIa
Instructor-related problems by specialization
(Secondary Education: Filipino)

SUBJECTS TO WHICH PROBLEMS WERE EXPERIENCED	Absenteeism & Tardiness	Favoritism	Projects outside the scope of the subject	Not teaching	Poor knowledge about the subject	Majority of the time is reporting	Giving exam/quiz beyond what he has taught	No clear records of Grade	More on self-study than actual teaching	Giving many activities in place of teaching the lesson	Collecting money in place of a project/grade
Child & Adolescent Development				•			•		•	•	
Principles of Teaching 1		•									
Assessment of learning 1				•						•	
Principles and Techniques of Educational Technology		•		•					•		
Selection, Production and Utilization				•						•	
Study and Thinking Skills		•	•								
Writing in the Discipline				•		•	•				
Pagbasa at Pagsulat sa Ibat-ibang Disiplina Tungo sa Pananaliksik	•	•		•							
Philippine History						•	•				
World History	•				•	•			•		
Comp. Concepts with Word Processing				•							
World Literature		•				•					
College Algebra	•	•	•				•	•			
Plane and Spherical Trigonometry	•	•									
Intro to Statistics	•	•		•	•		•	•	•	•	•
General Psychology							•		•		

Table VIIb
Instructor-related problems by specialization
(Secondary Education: English)

SUBJECTS TO WHICH PROBLEMS WERE EXPERIENCED	Absenteeism & Tardiness	Favoritism	Not teaching	Poor knowledge about the subject	Majority of the time is reporting	Giving exam/quiz beyond what he has taught	No clear records of Grade	More on self-study than actual teaching	Giving many activities in place of teaching the lesson
Child & Adolescent Development						•		•	
Facilitating Learning									
Developmental Reading		•				•	•		•
Principles and Techniques of Educational Technology			•					•	
Writing in the Discipline			•	•	•			•	
Teaching Aids		•				•			•
World History	•			•	•				
Intro to Statistics	•		•	•		•	•		
Physical Science						•			

Table VIIc
Instructor-Related Problems by Specialization
(Elementary Education: Special Education)

SUBJECTS TO WHICH PROBLEMS WERE EXPERIENCED	Absenteeism & Tardiness	Favoritism	Not teaching	Poor knowledge about the subject	Majority of the time is reporting	Giving exam/quiz beyond what he has taught	No clear records of Grade	More on self-study than actual teaching	Collecting money in place of a project/grade
Child & Adolescent Development	•		•	•	•			•	

Developmental Reading	•		•		•			•	
Principles and Techniques of Educational Technology	•		•						
Writing in the Discipline		•							
Philippine History					•				
Philippine Literature					•				
Foundation of MAPEH 1				•					
Plane & solid Geometry						•			
Plane and Spherical Trigonometry							•		
Intro to Statistics	•								•
Physical Science								•	
Observational Child Study 1			•	•					
Observational Study 2			•	•					
Assessment of Children with Special Needs			•	•					

The preceding tables presenting the instructor-related problems by specialization have disclosed similar problems except on the following: (a) Both Secondary Education: Filipino and Secondary Education: English students encountered problem on *giving many activities in place of teaching the lesson* while Elementary Education: Special Education students do not encounter such problem. (b) Both Secondary Education: Filipino and Elementary Education: Special Education students encountered problem on *collecting money in place of project or a grade* while Secondary Education English students have not experienced such kind of a problem.

These observations show once more that even students of the same program but of different specialization encountered different problems.

On a different perspective, these differences and similarities of encountered problems may be due to one of the following: (a)they have different teacher on the same subject; (b)they have the same teacher on the same subject on the same time or even in different time or class schedule; (c) different teachers handling the same subjects manifest the same behavior; (d)different teachers handling the same subjects manifest different behavior; (e) different teachers handling different subjects manifest the same behavior; and (f) different teachers handling different subjects manifest different behavior

CONCLUSIONS

The result of the study only implies that categorically there were instructor-related problems exist which require attention and solution. And certain problems were apparently unique to certain group of students or specific major/specialization. In addition, there were subjects that seemed to have many problems and need immediate attention to prevent recurrence. As a whole, indeed, there are problems to be solved to uplift the quality of education being served to its clientele.

REFERENCES

1. Stimulus-Response Theory**.** (2009). In *Encyclopædia Britannica.* Retrieved July 27, 2009, from Encyclopædia Britannica Online: *http://www.britannica.com/EBchecked/topic/566450/stimulus-response*

2. Relationship between Teaching & Learning. (2009). In Blog at Word Press.com, Theme: Cutline by Chris Pearson. Retrieved July 28, 2009, from Blog at WordPress.com: *http://jamminsoul.wordpress.com/2008/08/14/relationship-between-teaching-and-learning/*

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Why Children Leave their Homes for the Streets? The Case of Harare

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Abstract- This study is part of a broad research that sought to establish the counseling needs of adolescent street kids and in Harare Central Business District. This paper looks at the major causes that lead to children leaving their homes for the streets. A representative sample was drawn which comprised of 40 street kids who were receiving some assistance from four non-governmental organizations and 8 officials from the organizations. A qualitative descriptive survey was used to guide the methodology. Data was collected using questionnaires and structured interviews for officials and the street kids respectively. Qualitative data with descriptive statistics was used in the presentation and analysis of data. The results showed that children were forced into the streets by factors that included social factors connected with the breakdown of the family structure, economic factors that included poverty and unemployment. The study recommended that non-governmental organizations must get to the root cause of the problem instead of just treating the symptoms of the problem as what is currently happening. It was also recommended that there was need for the organizations to involve the street children in finding solutions to their problems.

Index Terms- street kids, non- governmental organisations, counselling, counselling needs

I. Introduction

Children who live in the streets survive outside the confines of the home where there are parents who provide nurturing and guidance. It is unusual and out of the norm for a child below the age of majority to be found living alone fending for himself or herself. The phenomenon of children living in the streets is a recent one in Zimbabwe. It surfaced only after the advent of independence. According to Muchini and Nyandiya-Bundy(1991) municipal by-laws were so ruthlessly applied that they would not tolerate the slightest signs of loitering which is characteristic of street kids. In support Grier (1996) states that in Zimbabwe during the colonial era, it was impossible for children to work in the streets as the municipal by-laws restricted this and were strictly and brutally enforced. This was a time when there was a lot of repression and suppression of the indigenous people such that they were forbade to be found at certain places like the city centre unless they were on duty. The City of Harare has witnessed a rapid increase in the number of adolescent street children in the last few years. This paper explores the major causes of this phenomenon.

1.2 The Research Question

What are the major causes that make children leave their homes for the streets?

II. Literature Review

Definition of street kids

Research distinguishes between two different groups of street children. The classification is basically based on the degree of contact between the child and his or her family. The two categories comprise of children "of" the streets who have completely lost contact with their families and relatives. These ones sleep and depend entirely on the streets. Children "on" the streets are those who are still maintaining contact with their families. Children "on" the streets can be divided further into those who come into the streets daily to beg and do odd jobs going back to their families at the end of their day and those who work in the streets and periodically visit their families (Rurevo and Bourdillon, 2003).

The Child Protection and Adoption Act (1996) of Zimbabwe considers children less than eighteen years in two categories: a child and a young person. A child is considered to be any person under the age of sixteen years and includes an infant. A young person is considered to be any person who has attained the age of sixteen but has not attained the age of eighteen years. In this study the term child is going to be considered as any person who has not attained the age eighteen, it will therefore include a young person.

The concept 'street children' and/or 'street kid' according to Michaleon (2006) encompasses any child or adolescent under the age of eighteen who works and/or lives in the street alone or with his or her family or asylum seekers who are technically homeless and without support. In Zimbabwe the phenomenon of asylum seekers who come in large numbers was last experienced during the times when there was instability in Mozambique in the 1980s. This group of children is not included in the present study.

However, in the present study the concepts of 'street children' or 'street kids' are used to mean the same as was adopted by Rialp (1991) at The Inter-Non Governmental Organisation Conference in Switzerland which regarded them as,

"…boys and girls who have not yet reached adulthood for whom the street has become their habitual abode and/or source of livelihood and who are inadequately protected, supervised or directed by responsible adults."

The concept and the definition will apply to both categories of children discussed above. In the context of this study "boys and girls who have not yet reached adulthood" mean those children who have not yet attained the age of eighteen, which is the legal age of majority in Zimbabwe. When under the age of eighteen children are therefore legally considered to be minors and should be dependent on adults for most of their needs. These adults could be parents, relatives or other people who can legally be responsible for the needs of these children.

2.1. Why do children leave their homes?

The phenomenon of children living in the streets implies neglect on the part of parents or guardians of these children who are found in the streets. The following sections discuss the major reasons why children migrate from their homes into urban streets.

2.1.1. The issue of neglect according to Zimbabwean law

The Zimbabwe's Children's Protection and Adoption Act (1996) identifies the following as acts of neglect or ill-treatment of children;

(a) Fail to provide or pay for adequate food, clothing and/or lodging.
(b) Fail to provide or pay for dental, medical or surgical aid or other effective remedial care necessary for his/her health.
(c) Left the child in the care of another person and thereafter shown inadequate interest in the wellbeing of that child
(d) Failed to provide adequate supervision of that child.

The Children's Protection and Adoption Act under subsection 10 also stipulates that causing any child to beg or accompany an adult while that person begs is an offence and act of negligence.

There are a number of factors that lead children to leave their homes to make the streets their places of abode. The factors can be put into three classes which are economic, social and psychological.

2.1.2. Economic factors.

In a study of children living in the streets in Kenya, Gichuru (1993) concluded that the children in the streets of Nairobi and any other city in Kenya had their origin basically from poverty. Michaleon (2006) in a study on street children in Greece, Germany and United Kingdom found that children in the streets were mostly those who were from socially and disadvantaged families, neighbor-hoods and societies marked by unemployment, poverty, crime and violence. It was when parents and/or guardians failed to provide for the children under their charge that forced the children to go and work in the streets. If the parents had the means to provide for their children there would be very few reasons that led children to go to live in the streets. Gichuru (1993) in Kenya, further said that some children came to the city as refugees to escape from poverty in rural areas in search of means to supplement family incomes with but often without the consent of their parents. When they came into the city usually these children expected to find work easily but the situation in most times did not turn up to be like that as they failed to find the work.

Kanjii (1996) studied of children living in the streets and found out that children in the South and Eastern African region engaged in economic activities and faced the consequence disadvantage in terms of school attendance and performance. The children engaged in diverse activities like petty commerce (often working long hours for adults), begging, washing cars, scavenging and shoe-shinning. Kanjii (1996) went on to say that these were the children who were visible in the streets and that there was another group of children who were invisible but who were in the same category. These were children who worked as domestic servants in the case of girls and boys who worked in garages as car washers and in sweatshops.

In many countries especially in developing countries it had been difficult to get employment when one had limited skills which were characteristic of street children. Black (1993) agreed when he said that the recent history of recession and structural adjustment in many countries was making a combination of economic and social factors which had recently tended to precipitate and drive children out of school and into the world of work. These structural adjustment programmes had had a tendency in most instances of reducing the labour force in organizations thereby making many people redundant. When people were made redundant the ones who suffered most were children. In order to supplement the family income after being made redundant Myers and Boyden (1998) found that in Ethiopia almost without exception the children were on the streets to make money for their own and for the family. The study reported that 67% of the street kids reported that they had both parents who were alive and were living with them. This was what this study considered as children on the streets. The study also found out that 76% reported that they were in the streets to make money.

2.1.3. Social factors

The changing structure of our society was making it hard for families to keep on providing for their families in the manner they were used to. Black (1993) noted that high fertility, extremely rapid urbanization followed by a lowered Gross Domestic Product and the effects of adjustments had combined to create a new poverty characterized by family fragmentation, lawlessness and squalor. The rapid urbanization was a result of adoption by most traditional economies of the western production models. The western production models required that labour be near the production plants. Asiachi (1986) in support of the movement of labour to central places where production would be occurring said that urban migration, which was an almost inevitable consequence of industrialization and development, tended to result in what has been called the 'industrialisation' of the family. This was the response that the family to adapt to the phenomena of industrialization. In some cases the father who in some cases provided labour to industry had to be away from home for a considerable period of time. This had led to the breaking down of families which in turn placed the burden of raising the family on the shoulders of the mother. Asiachi (1986) in a study found that 75% of the street kids in Kenya came from single mothers and broken families.

When families have broken it is the child who suffers most. In some instances children were left in the care and custody of step-mothers who in most cases seriously ill-treated children who were not theirs. Among the children who were in the streets of Harare more than 60% had fled from the ill-treatment by their step-mothers (Dhemba 2005). In Zimbabwe Raviro and Bourdillon (2003) concured and said when families were sucked into poverty the income from children becomes more important for their livelihood of such families. This in a way was promoting child labour.

The breaking down of traditional way of life giving way to western type has meant the abandoning of the communal way of life where the extended family would chip in when there were problems. Gichuru (1993) reiterated that individualism had taken over from the traditional communal way of life where the community as a whole was responsible for the upbringing of the young in a collective way. In the case now where the emphasis was on individual prosperity where people do not care much about the welfare of other people not directly related to them. Supporting this assertion Chatterjee (1992) stated that industrialization had brought with it 'nuclearisation' of the family where one was only concerned with those who are directly related to him. This meant in cases where there were broken families and orphans they had no-one to look after them and they ended up in the streets. Swart-Kruger (1996) was concerned about this moral erosion of values and care which had to a great extend, been the cause of the neglect of children who ended up in the streets.

When the husband died in most African societies the wife did not have rights to continue occupying land she used with her husband. Kanjii (1996) alluded to this when he said customary law in most parts of Africa excluded women from owning land in their own right and the city offered a means of independent survival after becoming a widow or marital separation. However due to the generally lower education and skills level and high dependency ratios, female headed households tended to have fewer income earning opportunities and to be overrepresented among the poorest although there are exceptions.

In a study of street children in Tanzania, Munyacho (1992) found that nearly one third of the households were headed by women. The phenomenon of single mothers was a result of a combination of social and economic factors, including the increasing employment of women outside the home. It was also connected to the impact of rapid urbanization and unfamiliarity lifestyle on family ties and conjugal life.

2.1.4. Psychological factors

There are individual characteristics in the children that lead some children to leave their homes to come to the streets while other siblings stayed in the home. Munyacho (1992) noted that some children in the streets had fled from problems at their homes to come to the streets where they made their own rules. These were children who generally hated following rules. When they were on their own, away from the discipline of their parents they fought and snatched things from each other. For many street children, that jungle discipline was preferable to the harshness of the homes from where they came from (Baker, 1998).

Some children lacked the resilience to follow rules and regulations at home and school. Raviro and Bourdillon (2003) found that among the street kids in their study sample some came from homes where they had failed to cope with the discipline required from them. One child in a family of six children for instance took to the streets while the other five remained at home. Thus issues of tolerance to stress and personal disposition of each individual child are said to be important in determining which among the siblings took to the streets. It is a matter as much as character and personality as it is of fate and environment (Vittachi, 1989.)

The present study looked at the factors that forced children to leave their homes to make the streets as their homes or a platform to earn a living as identifying factors for counseling. While previous studies mainly focused on finding out why street kids came to the streets in other countries like Kenya, Ethiopia and Nigeria no study had been conducted in Zimbabwe. this study focused on exploring the key drivers that forced the street kids to leave their homes where they had grown up to come and make the streets of Harare their places of abode.

III. METHODOLOGY

This study employed a descriptive research design. This method was used as the researchers felt it was the most ideal for the study. The descriptive survey research designs are defined by their methodical collection of standardized information from any representative sample of the population (Christensen, 1994). In addition, this research design suits the context under which the present study was taken as the survey represents a probe into a given state of affairs that exists at a given time. The sample comprised of ten randomly selected children from each of the four purposively selected organizations that deal with street children. The organizations were selected due to their visibility in dealing with street children. The children were selected by dividing the children who were present on the day the researchers visited into two groups of boys and girls and then randomly picking five children from each group who would participate in the research. The sample of those who work with children was purposively selected so that at each of the four organizations one participant came from the administration and the other came from field workers. These deal directly with the street children. Questionnaires were administered to the officials while the street children were interviewed. In order to ensure obtaining reliable and valid results a pilot study of the questionnaire and the interview guide was conducted at SOS Children's Home in Waterfall, Harare. SOS Children's Home keeps children who will have been identified by the Ministry of Social Services in the streets to be too young and are then kept in a family like setting. Qualitative data analysis with descriptive statistics was used to present and analyse the data.

IV. RESULTS

4.1 Demographic data

Table 1. Response Rate

Group	Proposed	Actual Number

	Number	
Organisation Officials	8	8
Street Children	40	40
Total	**48**	**48**

All the questionnaires given to officials were completed and collected on the day interviews with street children were being carried out. All the street children identified to participate in the interview responded to all questions asked by the researchers.

Table 2. Children's Reasons for Leaving Home

Reasons For Leaving Home	Male	Female	Total
Ill-treatment by stepmother	6	16	22
Both parents deceased	5	3	8
Came to look for work in Harare	11	5	16
Parents could not afford rent	8	4	12
Came to look for relatives and failed to locate them	6	3	9
Grandparents were failing to support	7	2	9
There was no food at home	8	6	14
Chased away by parents	1	7	8
Parents were too strict	3	1	4

Most of the children left their homes due to the ill-treatment by step-mothers which show the reasons of maintaining families intact. The other reasons that were cited by most children were mostly economic as they was need to come and look for work, that there was no food at home and failure to pay rent by their parents thus leading the children to take to the streets. Very few reported that they were in the streets because their parents were too strict or that they had been chased away by their parents. These were mostly children who were being taken care of at Shelter Trust.

Table 3. Organisation Officials' Perceptions on why Children leave their Homes

Reason	Number
Lack of food at home	3
Having no money to pay rent	1
Having no one to stay with after death of parents	6
Ill treatment by guardians	6
Coming to look for work	3
Disliking rules at home	1

Most of the officials were of the opinion that children are driven into the streets mostly by death of parents. When the parents die at times the guardians are not able to treat the orphans well as a result they run away to areas they are safer. Only one thought the harsh rules at home would lead a child to leave his/her home to come and live in the streets.

Table 4. Whether Parents are still alive

Parents existence status	Male	Female	Total
All are alive	3	1	4
Mother died	6	18	24
Father died	1	3	4
Both Parents died	5	3	8
Total	**15**	**25**	**40**

The results showed when a mother passed away the chances of children being ill-treated and then resorting to the streets were quite high. The death of a father did not play a very significant part as the least number of children among the groups were in that category. Girls were the ones who were affected by the death of a mother.

V. Discussion

Research results showed that social factors were crucial drivers of children from their homes into the streets. 22 out of 40 (55%) reported that they fled their homes due to ill treatment by their step-mothers. The research results concurred with those of Asiachi (1986) who found that 75% of the street children in Kenya came from single or broken families. In the study only 4 out of 40 (10%) of the children said they had both parents alive. These had been driven into the streets by lack of proper accommodation or failure to raise rent. Broken families are the ones that usually created step mothers who ill-treated children from the previous marriage of the husband. Organisation officials 8 out of 8 (100%) also reported that guardians ill-treated children leading the children to resort to the streets to find refuge. The research results point out that the loss of a mother was the major determinant of whether a child would find him or herself in the streets or not. Girls were the ones who were most affected by the loss of a mother as in this study 18 out of 25 (72%) of the girl street children had mothers who had died. In comparison only 4 out of 40 (10%) had fathers who had died and also the same percentage had both parents alive. This confirmed Asiachi's (1986) findings which had indicated that most of the street children were from broken families. Economic hardships were the main drivers of children into the streets. 16 out of 40 (35%) said they had come to the city to look for work, 14 out of 40 (35%) gave the reason of lack of food at home while 12 out of 40 (30%) gave the reason of the problem of rent. 50% of officials also were of the opinion that the children were in the streets due to economic reasons as they had come to look for work and that there was no food at home. This was in line with the findings of Michaleon (2006) in Greece who found that that most of the

children in the streets were from disadvantaged families marked by poverty and unemployment. Very few children 4 out of 40 had run away from their homes due to the strict rules at their homes. Even organization officials one cited strict rules as possible reasons why children could leave their homes to come to the streets showing that this was not a major reason that forced children. This contradicted Baker (1998) who found out that some children detested the strict discipline at home and preferred the rules of the jungle that operated in the streets. In this research this group comprised of a very small percentage though it was significant.

The results show that there was a need for a combined effort by the whole community in order to address the issues that led children to leave their homes for the streets. The economic factors called for the central government and the corporate sector to revamp the economy so that more jobs are created and unemployment is reduced. The social factors called for the community to focus on the treatment of orphans especially when there were girls under the care of step mothers as they were at higher risks of being ill-treated ending up in the streets. Advocacy and community conscientisation has to be vigorously undertaken so that every member in community played a role in identifying at risk children.

VI. Recommendations

(i) There is need for the communities to be conscientised on the type of people who are at high risk of being maltreated and leading them to resort to living in the streets.

(ii) Children from broken families especially those who do not have mothers needed to be put under social surveillance to detect early signs of ill-treatment.

(iii) There is need for advocacy campaigns to be conducted so as to enlighten the communities on the plight of street children.

References

[1] Agnelli, S. (1986). Street Children: A Growing Urban Tragedy. London.Weidenfeld and Nicholson.

[2] Asiachi, J. (1986). A Model Alternative System in Education: Undugu Basic Education in Kenya. Kenya Educational Journal. 1986.

[3] Attwood A (2009). Street Kids Join Forces. Zimbabwe Streetkid News. Harare.

[4] Baker, R. (1998). Runaway Street Children in Nepal: Social Competence Away from Home. London. Falmer Press.

[5] Black M. (1993). Street and Working Children. Florence. Unicef.

[6] Cambell, A. (1991). The Girls in the Gang. Blackwell. Oxford.

[7] Chatterjee, A. (1992). India: The forgotten Children in the Cities. Innocent Studies.UNICEF.

[8] Ennew, J. (1994). Street and Working Children:A Guide to Planning. London. Save the Children.

[9] Felsman, J.K. (1984). Abandoned Children: A Reconsideration. Children Today. May-June 1984.

[10] Gichuru, F.X. (1993). Street Children in Nairobi: The Undugu Experience. Nairobi. UNICEF.

[11] Kanjii N. (1996). Review of Urbanisation Issues Affecting Children and Women in the Eastern and Southern African Region. Nairobi. Unicef.

[12] Karombo, S. (2005). In the Streets of Zimbabwe. Harare. UNICEF.

[13] Kokota, A. (2010). Its better to die of AIDS than to die of Hunger. Harare. UNICEF.

[14] Leedy, P.D. (1985). Practical Research: Planning and Design. New York. McMillan Publishing

[15] Mc Veigh T. (2010) Zimbabwe's Street Children Challenge and Illusion of Change. Harare. UNICEF.

[16] Michaleon J. (2006). The Street Children and Homeless Youth. Thessaloniki. Aristotle University.

[17] Myers, W.E. and Boyden, J. (1998). Child Labour: Promoting the Best Interests of Working Children. Save the Children (UK). London.

[18] Rialp, V. (1991). Street Children. World Health. March-April 1991.

[19] Ritcher, L.M. and Kruger J.S. (1995). AIDS-Risk Among Street Children and Youth: Implications for Interventions. South African Journal of Psychology, 25, 1, 31-35

[20] Rurevo R. and Bourdillon M. (2003). Girls on the Street. Harare. Weaver Press.

[21] Swart, J. (2000). Street Children: Refugees, Drop-outs or Survivors. The Child Care Worker. Vol. 16. 2000.

[22] Swart-Kruger J. (1996). An imperfect fit- street children and state intervention. Africa Insight, 3. 231-35.

[23] Wortman, C.B. (1998). Psychology. New York. Knoff.

[24] Zadzagomo E.(2009). Children Need Everyone's Protection. Zimbabwe Streetkid News. Harare.

[25] Zaman, T. (2000). Community Based Rehabilitation as we Experience it. Basingstoke. Macmillan.

[26] Zimbabwe Government (1996). Children's Protection and Adoption Act.Harare. Government Printers

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The Effectiveness of Support Services available for the Street Adolescent in Harare

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Abstract- This study is part of a broad research that sought to establish the counseling needs of adolescent street kids and in Harare Central Business District. This paper looks at the effectiveness of support services available for the street adolescent in Harare. The representative sample drawn comprised of 40 street kids who were receiving some assistance from four non-governmental organizations and 8 officials from the organizations. A qualitative descriptive survey was used to guide the methodology. Data was collected using questionnaires and structured interviews for officials and the street kids respectively. Qualitative data analysis with descriptive statistics was used in the presentation and analysis of data. The study found out that those organizations that offered support services concentrated on providing food, recreation, education and blankets. The personnel who were involved in counseling the street did not possess the relevant counseling qualifications. The study concluded that the support services were not effective in the long run as the organisations focussed on the symptoms of the problem. There is need for the organisations that deal with street kids to give more emphasis on empowering the children to take charge of their lives instead of making them depend on handouts. In addition the organizations need to be advised to take in employment people who have some counseling qualification to work with these children or encourage the present ones to acquire counseling qualifications.

Index Terms- street kids, support services non- governmental organisations, counselling, counselling needs

I. INTRODUCTION

Children who live in the streets survive outside the confines of the home where there are parents who provide nurturing and guidance. It is unusual and out of the norm for a child below the age of majority to be found living alone fending for himself or herself. The phenomenon of children living in the streets is a recent one in Zimbabwe. It surfaced only after the advent of independence. According to Muchini and Nyandiya-Bundy(1991) municipal by-laws were so ruthlessly applied that they would not tolerate the slightest signs of loitering which is characteristic of street kids. In support Grier (1996) states that in Zimbabwe during the colonial era, it was impossible for children to work in the streets as the municipal by-laws restricted this and were strictly and brutally enforced. This was a time when there was a lot of repression and suppression of the indigenous people such that they were forbade to be found at certain places like the city centre unless they were on duty. The City of Harare has witnessed a rapid increase in the number of adolescent street children in the last few years. This interrogates the effectiveness of support services given to adolescent street children by non governmental organizations.

1.2 The Research Question

How effective are the support services given to adolescent street children by non-governmental organizations in Harare?

II. LITERATURE REVIEW

Definition of street kids

Research distinguishes between two different groups of street children. The classification is basically based on the degree of contact between the child and his or her family. The two categories comprise of children "of" the streets and completely lost contact with their families and relatives. These ones sleep and depend entirely on the streets. Children "on" the streets are those who are still maintaining contact with their families. Children "on" the streets can be divided further into those who come into the streets daily to beg and do odd jobs going back to their families at the end of their day and those who work in the streets and periodically visit their families (Rurevo and Bourdillon, 2003).

The Child Protection and Adoption Act (1996) of Zimbabwe consider children less than eighteen years in two categories a child and a young person. A child is considered to be any person under the age of sixteen years and includes an infant. A young person is considered to be any person who has attained the age of sixteen but has not attained the age of eighteen years. In this study the term child is going to be considered as any person who has not attained the age eighteen, it will therefore include a young person.

The concept 'street children' and/or 'street kid' according to Michaleon (2006) encompasses any child or adolescent under the age of eighteen who works and/or lives in the street alone or with his or her family or asylum seekers who are technically homeless and without support. In Zimbabwe the phenomenon of asylum seekers who come in large numbers was last experienced during the times when there was instability in Mozambique in the 1980's. This group of children is not included in the present study.

However, in the present study the concepts of 'street children' or 'street kids' are used to mean the same as was adopted by Rialp (1991) at The Inter-Non Governmental Organisation Conference in Switzerland which regarded them as,

"…boys and girls who have not yet reached adulthood for whom the street has become their habitual abode and/or source of livelihood and who are inadequately protected, supervised or directed by responsible adults."

The concept and the definition will apply to both categories of children discussed above. In the context of this study "boys and girls who have not yet reached adulthood" mean those children who have not yet attained the age of eighteen, which is the legal age of majority in Zimbabwe. When under the age of eighteen children are therefore legally considered to be minors and should be dependent on adults for most of their needs. These adults could be parents, relatives or other people who can legally be responsible for the needs of these children.

2.1 Effectiveness of present support initiatives

Numerous initiatives had and were still being implemented in an effort to try and address the problem of street children. The Zimbabwe Government had The Department of Social Welfare that was mandated to oversee the implementation of the Children's Protection and Adoption Act. This Act had provisions that guaranteed proper maintenance of children and set up procedures of what should be done if a child was being neglected. It seemed that despite the law being present there were children who were still being neglected as manifested the increasing number of street kids and no one was prosecuted for breaking that law. It therefore called for vigorous advocacy programme in order to safeguard the children's rights.

The department of social welfare was practically under siege as a result of perennial underfunding and mass exodus of qualified and experienced social workers in the face of growing social problems orphans and vulnerable children. These factors had compromised its capacity to coordinate, supervise and implement child welfare programmes and service delivery in general (Zadzagomo,2009).

There were also non-governmental organizations like Oasis Zimbabwe, Streets Ahead, Girl Child Network, Shelter Trust, Mbuya Nehanda Training Institute and various church organizations that have made initiatives to assist the street children.

Oasis Zimbabwe was an organization that basically looked in the welfare of disadvantaged children. It equipped them with skills in tailoring, carpentry, computers and agriculture as part of their social responsibility and supported the government's efforts to improve the lives of street children and orphans. It also ran the Tanaka project for street girls and imparted to them self-help skills (Dhemba, 2008).

Shelter Trust was a welfare organization that catered for the welfare of pregnant girls. It gave them temporary shelter and prepared them for delivery and tried to reconcile the pregnant girls with their families especially the father of the unborn child. It also provided support for desperate women in their homes. This organization was trying to address the symptoms of street children (Attwood, 2009). There was need to actually empower the child so that when she faced a similar problem in future she would be in a position to make a beneficial decision.

Mbuya Nehanda Training Institute operated as a home for street kids and other destitute children by giving them education and accommodation. Children were encouraged to take part in the farming projects of the institute, which helped to feed the children. The organization had suffered from chronic financial problems and from time from time had been short of food and other necessities for the children.

The Presbyterian Church provided an informal school and a feeding programme for young street children in the city centre and study group for older children in the Mbare suburb. The church urged the street children with incentives for the children to reform by offering scholarships to study at prestigious schools like Prince Edward and Churchill to those who would have performed well at the grade seven examinations. This was a very noble programme especially where they made grade seven street-kids compete for an educational scholarship as this would be an effort to empower the street kid.

Streets Ahead was a non-governmental organization that helped destitute children to become spiritually, physically and financially self-sufficient. It operated as drop in centre providing children with washing facilities, cooking and recreational facilities. It also operated a base for educational and training programmes. It operated an outreach programme where visits were made to the streets and newcomers were identified and efforts made to reunite them with their families. The outreach workers also assisted the street children get access to medical facilities (Rurevo and Bourdillon, 2003). The programme tried to address the problems of the street kids and only fell short in empowering the street kids so that they were in a position to leave the streets and go and live independent lives on their own.

III. METHODOLOGY

This study employed a descriptive research design. This method was used as the researchers felt it was the most ideal for the study. The descriptive survey research designs are defined by their methodical collection of standardized information from any representative sample of the population (Christensen, 1994). In addition, this research design suits the context under which the present study was taken as the survey represents a probe into a given state of affairs that exists at a given time. The sample comprised of ten randomly selected children from each of the four purposively selected organizations that deal with street children. The organizations were selected due to their visibility in dealing with street children. The children were selected by dividing the children who were present on the day the researchers visited into two groups of boys and girls and then randomly picking five children from each group who would participate in the research. The sample of those who work with children was purposively selected so that at each of the four organizations one participant came from the administration and the other came from field workers. These deal directly with the street children. Questionnaires were administered to the officials while the street children were interviewed. In order to ensure obtaining reliable and valid results a pilot study of the questionnaire and the interview guide was conducted at SOS Children's Home in Waterfalls. SOS Children's Home keeps children who will have been identified by the Ministry of Social Services in the streets to be too young and are then kept in a family like setting. Qualitative data analysis with descriptive statistics was used to present and analyse the data.

IV. RESULTS

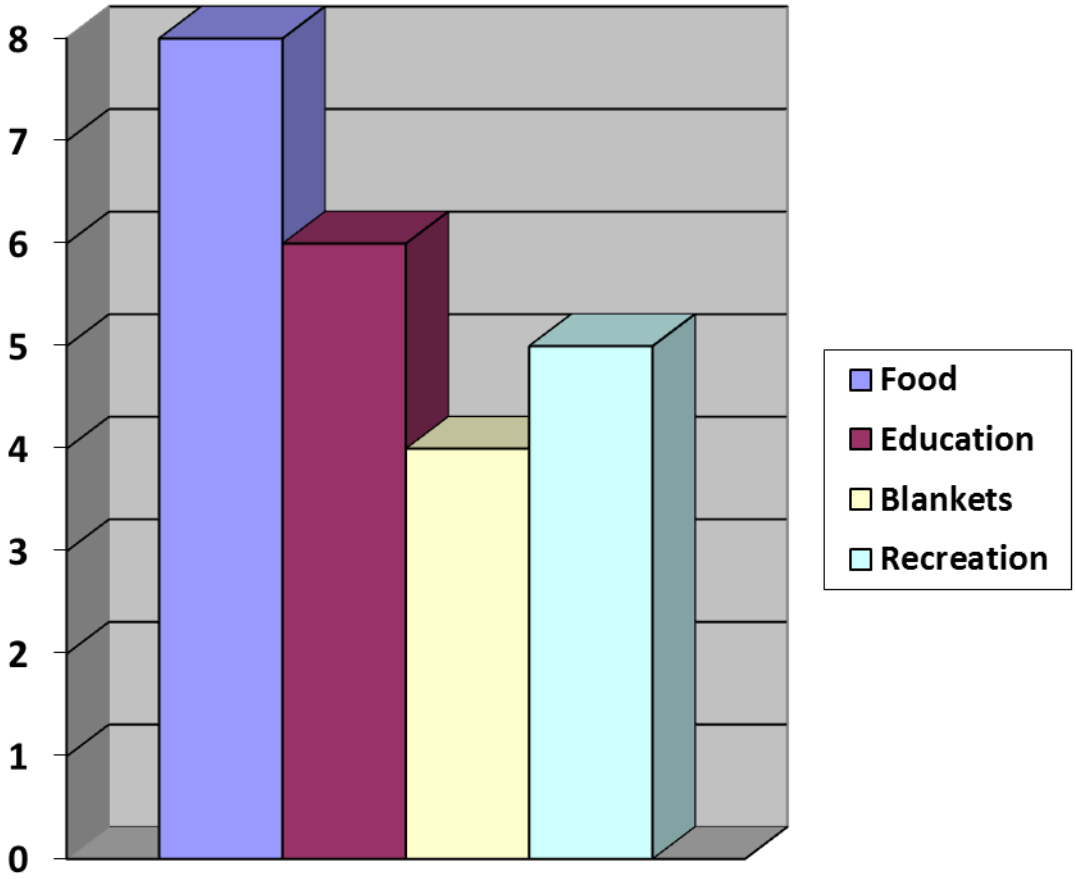
4.1 Demographic data

Table 1. Response Rate

Group	Proposed Number	Actual Number
Organisation Officials	8	8
Street Children	40	40
Total	**48**	**48**

All the questionnaires given to officials were completed and collected on the day interviews with street children were being carried out. All the street children identified to participate in the interview responded to all questions asked by the researchers.

Figure 1. Services Provided by Organisations



The organizations are mostly involved in providing food handouts to the children and providing some education. The education ranges from being given some training in activities like candle making and soap making.

Table 2. What Organisations are unable to do.

Type of Problem	Male	Female	Total
Giving street children pocket money	3	4	7
Securing a safe sleeping place	4	4	8
Protect from arrests from ZRP and Municipal Police	3	2	5
Protecting them from street bullies	2	2	4
Changing public perception on street kids	1	2	3

The results show that it is beyond the mandate of the organizations to give street children pocket money, secure safe sleeping places and stop the Zimbabwe Republic Police from arresting the street kids when found loitering as this required other initiatives for their implementation. Very few felt it was not possible to change public perceptions on the street kids. In addition only 4 thought it was not possible to change the behavior of bullies.

Table 3. Street Kids Hopes for the Future

Future Hope	Males	Females	Total

Start own business	5	6	11
Get a decent job	3	8	11
Successful person	2	3	5
Professional like teacher, lawyer or doctor	1	1	2
Revive their rural home	2	0	2
Grand Total	**15**	**25**	**40**

Most of the street children hoped to start their own businesses maybe this is due to the vending activities they do. They also hoped to get decent jobs and work in town. Very few hoped of becoming professionals may due to the fact that they are aware of their educational limitations. Girls still have hope to raise a decent family though this was expressed by few boys.

Table 4. Assistance Required Achieving the Hopes

Type of assistance	**Males**	**Females**	**Totals**
Go to school	5	8	13
Get seed money	3	3	6
Get professional training	2	3	5
Get a good job	3	8	11
Get premises to conduct business	2	3	5
Grand Total	**15**	**25**	**40**

The results show that most street children left school not out of choice but due to circumstances beyond their control and would like to continue with their education. The children still have hopes of living successful lives expressed by their hopes of getting some professional training and good jobs. Some still think if they get seed money to start businesses they would be able to get out of the streets.

V. Discussion

The organizations were involved in providing the street kids with food (100%), education (75%), recreation (75%) and blankets (50%). The organizations faced limitations that the street kids said they wanted which included being provided with places to sleep, stopping the police from arresting the street kids, giving the street kids some pocket money and protecting the street kids from bullies.

The organizations were focusing on the symptoms of the problem of street children. The tackling of the root of the problem required the involvement of every member of the community which seemed to be beyond the mandate of the organisations. There was need to conduct empowerment programmes so that the street kids would decide on their own how to improve their lives. In the study it was found that 40 out of 40 (100%) of the street kids were never consulted on the type of assistance they required. The organization officials agreed with the street children as 6 out of 8 (75%) said the street children were never consulted on the type of assistance they would want to receive.

The study found out that the street kids had bright expectations about the future. The children hoped to be able to get decent jobs(28%), start own businesses(28%), and become successful(13%). To get to these positions the street kids had some idea on what they should do. 33% of the street children knew that they had to go to school and wanted to be provided with opportunities to learn through going back to school. 28% said they wanted to be given assistance to get jobs. It is clear that when consulted the children were quite clear on what needed to be done so that their problems were solved.

Numerous initiatives had and were still being implemented in an effort to try and address the problem of street children. The Zimbabwe Government had The Department of Social Welfare that was mandated to oversee the implementation of the Children's Protection and Adoption Act. This Act had provisions that guaranteed proper maintenance of children and set up procedures of what should be done if a child was being neglected. It seemed that despite the law being present there were children who were still being neglected as manifested the increasing number of street kids and no one was prosecuted for breaking that law. It therefore called for vigorous advocacy programme in order to safeguard the children's rights.

The department of social welfare was practically under siege as a result of perennial underfunding and mass exodus of qualified and experienced social workers in the face of growing social problems orphans and vulnerable children. These factors had compromised its capacity to coordinate, supervise and implement child welfare programmes and service delivery in general (Zadzagomo,2009).

VI. Recommendations

(i) There is need for the organisations that deal with street kids to give more emphasis on empowering the children to take charge of their lives instead of making them depend on handouts.

(ii) The organizations need to be advised to take in employment people who have some counseling qualification to work with these children or encourage the present ones to acquire counseling qualifications.

(iii) There was need for the organizations to consult the street children on the type of assistance they need so that they provided them with assistance that is relevant to each particular street kid.

References

[1] Agnelli, S. (1986). Street Children: A Growing Urban Tragedy. London.Weidenfeld and Nicholson.

[2] Asiachi, J. (1986). A Model Alternative System in Education: Undugu Basic Education in Kenya. Kenya Educational Journal. 1986.

[3] Attwood A (2009). Street Kids Join Forces. Zimbabwe Streetkid News. Harare.

[4] Baker, R. (1998). Runaway Street Children in Nepal: Social Competence Away from Home. London. Falmer Press.

[5] Black M. (1993). Street and Working Children. Florence. Unicef.

[6] Cambell, A. (1991). The Girls in the Gang. Blackwell. Oxford.

[7] Chatterjee, A. (1992). India: The forgotten Children in the Cities. Innocent Studies.UNICEF.

[8] Ennew, J. (1994). Street and Working Children:A Guide to Planning. London. Save the Children.

[9] Felsman, J.K. (1984). Abandoned Children: A Reconsideration. Children Today. May-June 1984.

[10] Gichuru, F.X. (1993). Street Children in Nairobi: The Undugu Experience. Nairobi. UNICEF.

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Problems Experienced by Adolescent Street Children in Harare

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[**] Senior Lecturer: Disability Studies and Special Needs Education, Zimbabwe Open University

Abstract- This study is part of a broad research that sought to establish the counseling needs of adolescent street kids and in Harare Central Business District. This paper looks at the major problems experienced by adolescent street children in Harare streets. The representative sample drawn comprised of 40 street kids who were receiving some assistance from four non-governmental organizations and 8 officials from the organizations. A qualitative descriptive survey was used to guide the methodology. Data was collected using questionnaires and structured interviews for officials and the street kids respectively. Qualitative data analysis with descriptive statistics was used in the presentation and analysis of data. The study found out that the children faced problems with the Zimbabwe Republic Police and municipal police. There was also rampant bullying that was experienced by street kids. The study recommended the need to establish supervised 'safe houses' near city center that do not seem to relegate street children to areas where they should work for their upkeep. The police need to be conscientised of the need to treat the street children humanly and not treat them as criminals.

Index Terms- street kids, non- governmental organisations, counselling, counselling needs, Harare

I. Introduction

Children who live in the streets survive outside the confines of the home where there are parents who provide nurturing and guidance. It is unusual and out of the norm for a child below the age of majority to be found living alone fending for himself or herself. The phenomenon of children living in the streets is a recent one in Zimbabwe. It surfaced only after the advent of independence. According to Muchini and Nyandiya-Bundy(1991) municipal by-laws were so ruthlessly applied that they would not tolerate the slightest signs of loitering which is characteristic of street kids. In support Grier (1996) states that in Zimbabwe during the colonial era, it was impossible for children to work in the streets as the municipal by-laws restricted this and were strictly and brutally enforced. This was a time when there was a lot of repression and suppression of the indigenous people such that they were forbade to be found at certain places like the city centre unless they were on duty. The City of Harare has witnessed a rapid increase in the number of adolescent street children in the last few years. This paper explores the major problems experienced by these children as they dwell in the streets.

1.2 The Research Question

What are the major problems experienced by adolescent children in the City of Harare?

II. Literature Review

Definition of street kids

Research distinguishes between two different groups of street children. The classification is basically based on the degree of contact between the child and his or her family. The two categories comprise of children "of" the streets and completely lost contact with their families and relatives. These ones sleep and depend entirely on the streets. Children "on" the streets are those who are still maintaining contact with their families. Children "on" the streets can be divided further into those who come into the streets daily to beg and do odd jobs going back to their families at the end of their day and those who work in the streets and periodically visit their families (Rurevo and Bourdillon, 2003).

The Child Protection and Adoption Act (1996) of Zimbabwe consider children less than eighteen years in two categories a child and a young person. A child is considered to be any person under the age of sixteen years and includes an infant. A young person is considered to be any person who has attained the age of sixteen but has not attained the age of eighteen years. In this study the term child is going to be considered as any person who has not attained the age eighteen, it will therefore include a young person.

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"…boys and girls who have not yet reached adulthood for whom the street has become their habitual abode and/or source of livelihood and who are inadequately protected, supervised or directed by responsible adults."

The concept and the definition will apply to both categories of children discussed above. In the context of this study "boys and girls who have not yet reached adulthood" mean those children who have not yet attained the age of eighteen, which is the legal age of majority in Zimbabwe. When under the age of eighteen children are therefore legally considered to be minors and should be dependent on adults for most of their needs. These adults could be parents, relatives or other people who can legally be responsible for the needs of these children.

2.1 Problems experienced by street kids

The problems that street kids have come from the manner in which they stay with other street kids, their relationship with the various authorities, the community perceptions and vagaries of the environment. The subsequent sections discuss the street-kids interrelationships, relationships with authorities and community perceptions on street kids.

2.1.1. Street kids interrelationships

The street kids seemed to face serious relationship problems with each other. The major problems were to do with territoriality. They had divided the city into territories where one should not encroach without the permission of the owner of the territory. The Herald of 12 April 2008 had a story of Tanya who claimed the area near the Africa Unity Square Park in Harare to be hers. She had apparently succeeded in repulsing intrusion into this territory by a group of boys who had wanted to take it from her. From that instance she claimed complete ownership of that area.

Not all street kids might be as strong as Tanya. Karombo (2005) said most of the street children survived frequently by their rapid reflexes and a swift pair of feet that kept the inhabitants of that shadowy world out of really serious trouble. In Brazil the situation was even worse. The police claim that murders of street children by 'death squads' of other street children especially in Rio de Janeiro were quite common since some of the street children were employed to carry out dangerous activities by other street children (Swart, 2000). In one incident a nine year old boy in Ipanema (Brazil) was found killed and when his body was found, there was a note tied to his hand which said, 'I killed you because you had no future.' In the streets they seemed to operate and implement their own code of conduct that had to be followed by everyone in the group. If anyone tried to go against the street laws the individual was given relevant punishment.

In an effort to protect themselves from bullies usually the street kids who would be weaker formed gangs that helped each other repulse the intrusion into their territory. When someone new came into the territory he or she had to become affiliated to at least one of the groups for protection. Girls usually paid for their protection by giving sexual favours to boys from the stronger groups otherwise they would live a life of constant harassment (Karombo, 2005). At times the girls also teamed together and helped each other so that they did not give in to the sexual demands of any member of the street gangs they did not recognise. Some groups had a leader who had to give consent to whatever sexual relationships that would be going on and had the power to even break some of the relationships if there was someone who was taking an unfair advantage over the other (Cambell,1991).

2.1.2. Relationships with authorities

In Zimbabwe the authorities that were in constant touch with the street children were the State Police(The Zimbabwe Republic Police in Zimbabwe), the Municipal Police, The Department of Social Welfare and some non-governmental organizations.

The Zimbabwe Republic Police usually rounded up the street kids accusing them of loitering and prostitution in the case of girls. Kokota (2010) said in the raids made by the police the streets where street children were beaten up with some being left for dead. The ones that were taken to the police station were subjected to numerous acts of brutality with girls being forced to have sex with the police officers in return for freedom. Those who did not comply were eventually sent to Mbuya Nehanda Holding Camp which was meant to be a 'safe home' but the conditions there were even worse as there was no food and the conditions there were so poor that very few children had stayed there for more than three months. Most of the street children who were taken there soon found their way back into the streets.

The police during these raids took away the street children's blankets and all of their belongings that were usually stuck in drainage ways and other hiding places. When their blankets had been taken the street kids were then forced to use drugs in order to shield themselves from the cold nights and the biting mosquitoes at night (Mc Veigh, 2010).

The municipal police according to Karombo(2010) were the most feared by the street children. This was because they were hard to evade since in most cases they came when they were not in uniform. The street kids all the same had devised alarm systems of alerting each other of the presence of the municipal police as when they moved their vehicles had designated points where they parked. When they were around the street kids had to hide to avoid being arrested.

In Tanzania, Kanjii (1996) put that the street kids suffered from the unsympathetic bureaucracies who when they want to regulate their activities did so without understanding the needs of the concerned street kids. The practice of rounding up the children, screening them for criminals and then sending the remainder to ill equipped and poorly funded 'safe houses' was counterproductive. It only resulted in hardening the street kids and making them employ more effective ways of evading the police.

2.1.3. Community perceptions on street kids

The street kids had to continually endure the negative perceptions that the community had towards them. The members of the community detested the sight of the street kids who were in most cases dirt and unkempt on top of that asked for money and scavenged for food in bins.

In Nepal, Baker (1998) found people were not amused by the behavior street kids who would want to be paid for people to park their cars at places that they regarded as theirs. This was especially so when they considered that the street kids had connections with car thieves. Failure of the people to pay the street kids the money they wanted usually resulted in burglary in their cars. This forced the people to put pressure on the authorities to take action on the street kids.

In Zimbabwe large restaurants like Chicken Inn had adopted a practice of keeping their bins clean and empty in an attempt to discourage the street children from visiting. This was because when the street children visited their premises they harassed their clients by their constant begging.

Some unscrupulous people men took advantage of the girls and sexually abused the young girls for very little money. The perceptions of the men towards the street girls was however still negative as they made the street children first take a bath before having sex with them (Kokota, 2010). This indicated that the men already considered negatively the street kids but they just want to get cheap sexual gratification.

The public viewed children to be competent only for playing and learning under the control of adults. When some children did not fit that paradigm, others become uncomfortable and readily judged the children and their situation anti-social. Where children worked for an income, even when it was for the benefit of their families, child labour was condemned. Poor and desperate children appearing on the streets spoiled the image of their city that was well managed and the children were blamed. The street kids were usually referred to as thieves. They thought they were violent and they did not pay attention to their personal circumstances that brought or motives that drove them into the streets. It was quite common to hear people say;

'These children are just lazy and unemployable. They do not want to work. They would rather have easy money. Nothing good comes from these street kids'

Or

'Most children from poor families are working as domestic maids so why should they just come and sit in the streets'

These showed that the community viewed the street kids as children who had lost direction who did not want to live under the confines of acceptable authority (Ennew, 1994). They trivialized the underlying factors that pushed these children in the streets.

It was therefore imperative that this study took a position of exploring possible ways of changing the community's perceptions towards the street children so that whatever initiatives that were taken involved the street children. Previous studies had just identified the problems faced by the street children and imposed solutions to them without consulting them. This study's main thrust was on empowering the street child so that he/she was in a position of ownership to the solution of the problems that they had.

III. Methodology

This study employed a descriptive research design. This method was used as the researcherss felt it was the most ideal for the study. The descriptive survey research designs are defined by their methodical collection of standardized information from any representative sample of the population (Christensen, 1994). In addition, this research design suits the context under which the present study was taken as the survey represents a probe into a given state of affairs that exists at a given time. The sample comprised of ten randomly selected children from each of the four purposively selected organizations that deal with street children. The organizations were selected due to their visibility in dealing with street children. The children were selected by dividing the children who were present on the day the researcherss visited into two groups of boys and girls and then randomly picking five children from each group who would participate in the research. The sample of those who work with children was purposively selected so that at each of the four organizations one participant came from the administration and the other came from field workers. These deal directly with the street children. Questionnaires were administered to the officials while the street children were interviewed. In order to ensure obtaining reliable and valid results a pilot study of the questionnaire and the interview guide was conducted at SOS Children's Home in Waterfalls. Qualitative data analysis with descriptive statistics was used to present and analyse the data.

IV. Results

4.1 Demographic data

Table 1. Response Rate

Group	Proposed Number	Actual Number	Response Rate (%)
Organisation Officials	8	8	17
Street Children	40	40	83
Total	**48**	**48**	**100**

All the questionnaires given to officials were completed and collected on the day interviews with street children were being carried out. All the street children identified to participate in the interview responded to all questions asked by the researcherss.

Table 2: Problems Experienced

Type of Problem	Males	Females	Total
Sleeping	15	20	35
Police	12	18	30
Clothes	10	16	26
Where to keep their belongings	15	20	35
Bullies	8	18	26
Education	10	8	18
Food	8	15	23
Scolded by members of community	8	10	18

The children reported that sleeping and where to keep their belongings presented the biggest challenge to them. This was followed by the harassment by the police.

V. Discussion

In the streets children faced problems centered on territoriality with other street children, continuous harassment by the police and the community perceptions on the presence of street kids. The problems that bothered street children were

where to sleep(100%), where to keep their belongings(100%), police harassment(86%), clothing(75%), bullying(75%) and being scolded by members of the community(51%).

Bullying and territoriality are problems that street children confront everyday. The bullying in Zimbabwe has not reached the levels of Brazil where there are 'death squads'. This may in part due to the heavy presence of the police which the street kids detest which kept bullying under check.

The police were feared because when the police rounded up the street children the conditions the children were subjected to, were very frustrating. They had to undergo a criminal screening process and sent to 'safe houses' at Mbuya Nehanda Centre. The centre was characterized by ill-treatment and hunger such that most children soon after being rounded up found their way back into the streets.

The problems of the street kids with the police call for strong advocacy campaigns to be carried with the police so that the police treated the street kids humanly and not in an accusing manner. These children were only an indication that something was wrong in our society and not that these children were a problem. There was need to find out what caused the children to go into the streets and address those issues instead of just bundling up the children and sending them to 'safe houses'.

VI. Recommendations

(i) There is need to establish supervised 'safe houses' near city center that do not seem to relegating the street children to areas where they should work for their upkeep.

(ii) The police need to be conscientised of the need to treat the street children humanly and not treat them as criminals.

(iii) There is need for the girls to be taught of the dangers of prostitution as it related to HIV and AIDS.

References

[1] Agnelli, S. (1986). Street Children: A Growing Urban Tragedy. London.Weidenfeld and Nicholson.

[2] Asiachi, J. (1986). A Model Alternative System in Education: Undugu Basic Education in Kenya. Kenya Educational Journal. 1986.

[3] Attwood A (2009). Street Kids Join Forces. Zimbabwe Streetkid News. Harare.

[4] Baker, R. (1998). Runaway Street Children in Nepal: Social Competence Away from Home. London. Falmer Press.

[5] Black M. (1993). Street and Working Children. Florence. Unicef.

[6] Cambell, A. (1991). The Girls in the Gang. Blackwell. Oxford.

[7] Chatterjee, A. (1992). India: The forgotten Children in the Cities. Innocent Studies.UNICEF.

[8] Ennew, J. (1994). Street and Working Children:A Guide to Planning. London. Save the Children.

[9] Felsman, J.K. (1984). Abandoned Children: A Reconsideration. Children Today. May-June 1984.

[10] Gichuru, F.X. (1993). Street Children in Nairobi: The Undugu Experience. Nairobi. UNICEF.

[11] Kanjii N. (1996). Review of Urbanisation Issues Affecting Children and Women in the Eastern and Southern African Region. Nairobi. Unicef.

[12] Karombo, S. (2005). In the Streets of Zimbabwe. Harare. UNICEF.

[13] Kokota, A. (2010). Its better to die of AIDS than to die of Hunger. Harare. UNICEF.

[14] Leedy, P.D. (1985). Practical Research: Planning and Design. New York. McMillan Publishing

[15] Mc Veigh T. (2010) Zimbabwe's Street Children Challenge and Illusion of Change. Harare. UNICEF.

[16] Michaleon J. (2006). The Street Children and Homeless Youth. Thessaloniki. Aristotle University.

[17] Myers, W.E. and Boyden, J. (1998). Child Labour: Promoting the Best Interests of Working Children. Save the Children (UK). London.

[18] Rialp, V. (1991). Street Children. World Health. March-April 1991.

[19] Ritcher, L.M. and Kruger J.S. (1995). AIDS-Risk Among Street Children and Youth: Implications for Interventions. South African Journal of Psychology, 25, 1, 31-35

[20] Rurevo R. and Bourdillon M. (2003). Girls on the Street. Harare. Weaver Press.

[21] Swart, J. (2000). Street Children: Refugees, Drop-outs or Survivors. The Child Care Worker. Vol. 16. 2000.

[22] Swart-Kruger J. (1996). An imperfect fit- street children and state intervention. Africa Insight, 3. 231-35.

[23] Wortman, C.B. (1998). Psychology. New York. Knoff.

[24] Zadzagomo E.(2009). Children Need Everyone's Protection. Zimbabwe Streetkid News. Harare.

[25] Zaman, T. (2000). Community Based Rehabilitation as we Experience it. Basingstoke. Macmillan.

[26] Zimbabwe Government (1996). Children's Protection and Adoption Act.Harare. Government Printers

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Erythroblastopenia revealing a parvovirus infection in a sickle cell patient

Erythroblastopénie révélant une infection à parvovirus chez un patient drépanocytaire

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Abstract- Acute infection with parvovirus B19 is responsible for blocking erythroblasts and is usually without consequences on hematopoiesis, except in patients with chronic hemolytic anemia.it causes a potentially serious acute anemia. We report the case of an 18 year-old sickle cell patient with this infection revealed by erythroblastopenia. He was hospitalized for fever and headache. The Laboratory tests showed a non-regenerative anemia and hemolysis. We concluded to the diagnosis of erythroblastopenia secondary to infection with parvovirus B19 because of the presence of IgM and parvovirus DNA on PCR. The evolution was favorable after transfusion. Any erythroblastopenia in a sickle cell patient should alert the clinician to a possible parvovirus B19 infection.

Index Terms- Erythroblastopenia - parvovirus B19 - sickle cell disease

Résumé- L'infection aiguë par le parvovirus B19 est responsable d'un blocage de la lignée érythroblastique de courte durée et habituellement sans conséquence sur l'hématopoïèse, sauf chez les patients porteurs d'anémie hémolytique chronique chez qui elle entraine une anémie aiguë potentiellement grave. Nous rapportons l'observation d'un patient drépanocytaire âgé de 18 ans chez qui cette infection s'est révélée par une érythroblastopénie.Il a été hospitalisé pour fièvre et céphalée. Le bilan biologique a objectivé une anémie arégénérative et une hémolyse. Le bilan infectieux posa le diagnostic d'érythroblastopénie secondaire à l'infection par le parvovirus B19 devant la présence d'IgM et d'ADN du parvovirus à la PCR. L'évolution suite aux transfusions était favorable. Toute érythroblastopénie chez un patient drépanocytaire devrait alerter le clinicien sur une éventuelle infection à parvovirus B19.

Mots clé- Drépanocytose – érythroblastopénie - parvovirus B19

I. INTRODUCTION

La découverte et l'identification du parvovirus B19 revint à Cossart et al en 1975, qui mirent en évidence pour la première fois la présence de particules de parvovirus dans un isolat sérique intitulé (B19). Ceci explique la dénomination de ce virus. En 1981, son rôle pathogène fut mis en évidence [1]. Il a un tropisme particulier pour les cellules souches érythroblastiques qu'il détruit.

Il est responsable de nombreuses maladies, dont les plus fréquentes sont le mégalérythème épidermique, les crises d'érythroblastopénies compliquant les hémolyses chroniques et l'anasarque foetoplacentaire [1,2].

En vue d'illustrer l'association de l'infection à la morbidité et la mortalité observées dans la population drépanocytaire, nous rapportons l'observation d'un patient drépanocytaire chez qui cette infection s'est révélée par une érythroblastopénie.

II. CASE REPORT

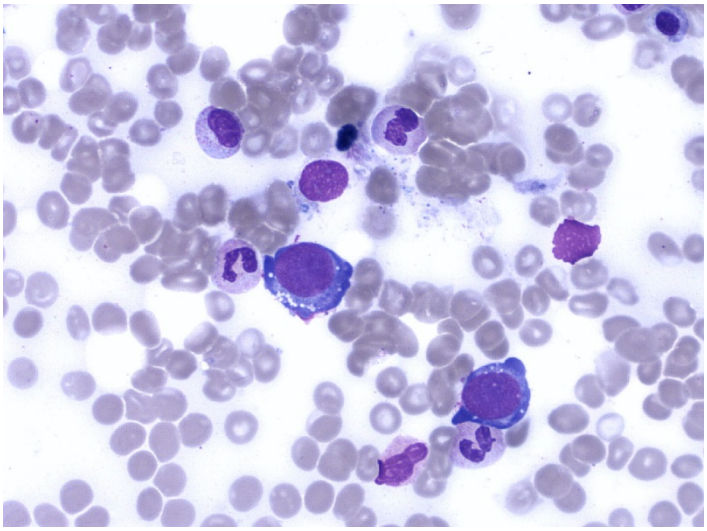
Un jeune patient âgé de 18 ans originaire de côte d'ivoire, suivi pour drépanocytose homozygote S/S a été hospitalisé pour des céphalées, vertiges et asthénie intense sans signes d'appel infectieux (absence de toux, de signes pharyngés, de signes digestifs ni urinaires). L'examen clinique a révélé une fièvre à 40°C, un léger ictère conjonctival habituel, des ganglions axillaires multiples infra-centimétriques à droite, une adénopathie unique centimétrique à gauche.

L'hémogramme a montré une anémie normochrome normocytaire régénérative avec un taux d'hémoglobine à 60 g/l, des réticulocytes à 227G/l, et des leucocytes à 7,2G/l. Le patient présentait également une hémolyse (LDH 876 UI/l, bilirubine totale 131µmol/l). Le bilan infectieux a montré une CRP élevée à 48 mg/l, un ECBU négatif, la recherche de virus respiratoires y compris recherche de grippe A et B négative, des sérologies HIV et EBV négatives, CMV en faveur d'une infection ancienne.

Le patient a bénéficié d'une prise en charge initiale symptomatique par une antibiothérapie probabiliste (amoxicilline) et du paracétamol pendant une semaine.

L'évolution a été marquée par la persistance de la fièvre et une aggravation de l'anémie à 33 g/l devenue arégénérative et un effondrement des réticulocytes jusqu'à 12 G/ l. Le myélogramme réalisé a montré une moelle riche sans arguments pour une nécrose médullaire ni un syndrome d'activation macrophagique avec hypoplasie marquée de la lignée érythroblastique traduisant une érythroblastopénie aigue et faite surtout de proérythroblastes dystrophiques (cellules de grande taille, noyau avec nucléole de

grande taille et présence de vacuoles dans le cytoplasme) (Figure 1et 2). Ceci a conduit à la recherche d'IgM anti parvovirus B19 et à réaliser une PCR qui étaient positives.
Le diagnostic d'une érythroblastopénie secondaire à l'infection à parvovirus B19 a été posé, ce qui a indiqué une transfusion à 2 reprises de culots globulaires phénotypés. Celles-ci se sont compliquées d'un accident hémolytique post transfusionnel suite auquel une supplémentationen folates et en érythropoïétine ont été administrées.
La retransfusion s'est faite sous Rituximab et corticothérapie avec bonne évolution des chiffres d'hémoglobine. Le suivi des réticulocytes a objectivé une augmentation régulière dans le sang témoin d'une reprise d'érythropoïèse efficace.



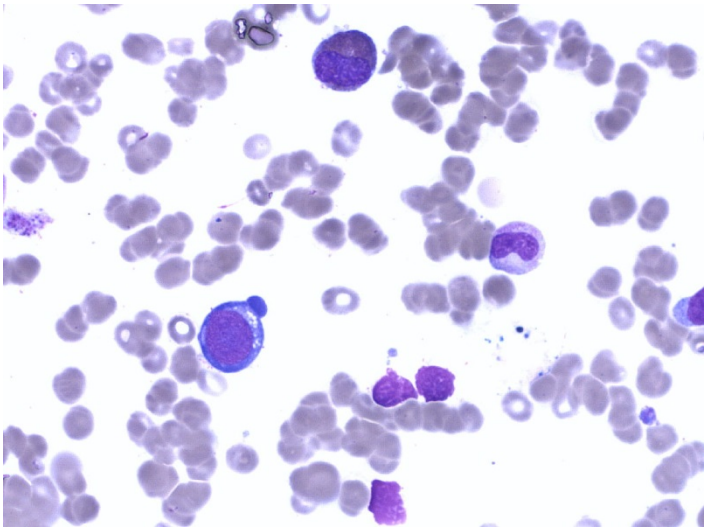


Figure 1 : Myélogramme x500 : Proérythroblaste de grande taille avec gros nucléole et vacuoles cytoplasmiques infectés par le parvovirus B19

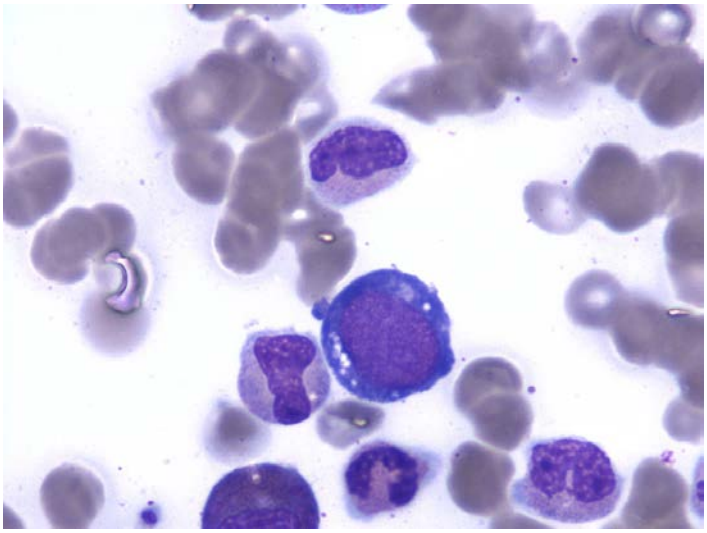


Figure 2 : Myélogramme x1000 : Proérythroblaste de grande taille avec gros nucléole et vacuoles cytoplasmiques

III. DISCUSSION

L'infection par le parvovirus B19 est fréquente dans la population générale puisque 50 % des adolescents et plus de 90 % des sujets adultes ont des anticorps anti-parvovirus B19 d'isotype IgG, témoignant d'un contact ancien [3].
C'est un virus à acide désoxyribonucléique (ADN) simple brin entouré d'une capside icosaédrique. C'est un virus ubiquitaire dont la transmission se fait principalement par voie aérienne (respiratoire) ; l'infection par ce virus survient ainsi de façon sporadique ou sous forme de petites épidémies familiales ou scolaires. Deux autres modes de transmission sont la transmission materno-fœtale et la transfusion des produits sanguins [2].
La période d'incubation est d'environ 1 semaine. La période de contamination est généralement courte chez le sujet immunocompétent, elle peut être plus longue chez les sujets immunodéprimés.
La virémie qui précède les signes cliniques est très brève (2–3 j). La réaction de l'organisme se traduit par une production initiale d'immunoglobulines IgM spécifiques détectables vers le 10ème jour de l'infection, relayée par une production d'IgG dirigées contre la protéine majeure VP2. La coexistence au long terme d'IgG et d'IgM a été rapportée dans certaines formes chroniques observées chez des patients atteints de déficit immunitaire d'origines diverses.
Le risque de l'infection augmente avec l'âge : dans les pays développés, on estime la fréquence de l'infection entre 2 et 10 % des sujets âgés de moins de 5 ans, 40 et 44 % avant l'âge de 70 ans et à 80 % au-delà` de 70 ans [4].
La primo-infection par le parvovirus B 19 est classiquement responsable du mégalérythème épidémique chez l'enfant, de manifestations articulaires chez l'adulte, de crises d'érythroblastopénie aigue chez des sujets atteints d'une anémie hémo1ytique constitutionnelle ou acquise, et d'hydramnios ou de mort fœtale in utero au cours de la grossesse.

Cas particulier du drépanocytaire

L'infection à parvovirus B19 occasionne chez le malade drépanocytaire lors de la virémie une anémie par érythroblastopénie aigue. Celle-ci a été rapportée pour la première fois par Pattison et al. en 1981. Depuis, cette infection a été rapportée au cours de plusieurs complications de la drépanocytose [5].

Le parvovirus B19 est responsable de 70% des crises érythroblastopéniques des patients présentant une drépanocytose [5].

La symptomatologie des infections chez le malade atteint d'hémolyse constitutionnelle est assez caractéristique. L'incubation dure 10 à 13jours, puis la phase prodromique se caractérise par de la fièvre, des douleurs abdominales, une diarrhée, des vomissements tel qu'il a été rapporté par Smith-Whitley et al. dans une cohorte de 633 drépanocytaires à l'hôpital pédiatrique de Philadelphie [4]. On retrouve exceptionnellement un rash cutané et une arthralgie. Notre patient présentait uniquement une fièvre [6, 7].

Ensuite, apparait une anémie profonde (taux d'hémoglobine généralement inférieur à 50 g/l) avec une réticulocytose effondrée comme c'était le cas dans notre observation. Le myélogramme montre une disparition presque totale des précurseurs de la lignée rouge et la présence d'érythroblastes géants qui sont des précurseurs érythrocytaires précoces caractérisés par une vacuolisation cytoplasmique, une chromatine immature et des inclusions nucléaires éosinophiles [8].

Le pronostic demeure excellent, avec ou sans transfusion, la régénération étant très rapide. Cependant, certaines infections à parvovirus peuvent être fébriles et déclencher une crise vaso-occlusive.

Lors des épidémies de mégalérythème, des transmissions intrafamiliales sont possibles, entrainant des aplasies groupées chez des frères et sœurs drépanocytaires homozygotes contaminés au même moment et dépourvus d'anticorps protecteurs. I1 est donc prudent dans les familles de plusieurs drépanocytaires de rechercher systématiquement une anémie lorsque le diagnostic est porté chez l'un d'entre eux [9].

Dans une étude prospective contrôlée, Serjeant et coll. ont suivi 308 enfants drépanocytaires. Dans le groupe d'étude, 91 épisodes de crise aplasique secondaires à l'infection par parvovirus B19ont été documentées par la sérologie. Fait intéressant, 20% du groupe d'étude avait une sérologie positive, mais les anomalies hématologiques étaient minimes ou absentes [9, 10].

Diagnostic et traitement

- L'infection à parvovirus est confirmée par la sérologie [11] :
  - Les anticorps IgM spécifiques détectés par méthode immunologique standardisée (Elisa ou RIA), sont positifs quelques jours après l'éruption cutanée et des taux élevés demeurent décelables 2 à 3 mois après une infection aiguë
  - La séroconversion des titres IgG se fait après celle des IgM avec un délai de minimum 7-10 jours entre les 2 prélèvements et est utile pour les infections antérieures et pour confirmer l'immunité.

- La recherche du génome viral par polymérisation en chaine (PCR) permet de confirmer la présence de ce virus dans un échantillon donné, en particulier médullaire, mais aussi dans le liquide amniotique, le sang fœtal, le sérum, les biopsies tissulaires. L'amplification génique semble plus particulièrement intéressante chez les patients immunodéprimés du fait des difficultés d'interprétation de la sérologie.

Cette méthode permet de quantifier la virémie plasmatique qui est de haut niveau lors des primo-infections et de bas niveau lors des infections chroniques des immunodéprimés [11].

- Le parvovirus B19 n'est pas cultivable en routine.

Rao et AL ont évalué 53 enfants atteints de drépanocytose et qui ont développé une crise aplasique transitoire. 68% avaient des IgM B19 positif et 20% avaient un ADN B19 [12].

Le traitement repose sur l'utilisation de transfusions en cas d'anémie aiguë et sur la perfusion d'immunoglobulines polyvalentes (400 mg/Kg) durant 5 jours en cas d'anémie chronique secondaire à un déficit immunitaire [13].

IV. CONCLUSION

La primo-infection à parvovirus B19 est une complication rare des hémoglobinopathies de l'adulte. Néanmoins toute érythroblastopénie chez un patient drépanocytaire devrait alerter le clinicien sur une éventuelle infection à parvovirus B19. La majoration de l'anémie, peu ou pas régénérative est évocatrice. Le diagnostic repose sur les sérologies et la PCR. L'évolution est rapidement favorable sous traitement symptomatique.

REFERENCES

[1] J.-D. Lelièvre, Parvovirus B19, Encyclopédie Médico-Chirurgicale, 8-050-I-10 (2004)

[2] Antoine Garbarg-Chenon,Virus B19 (parvovirus B19), Biologie clinique, 2002 [90-55-0095]

[3] M Karmochkine, Infection humaine par le parvovirus B19.Rev Med Interne (1995) 16, 905-912

[4] D.-A. Dialloa, A. Guindoa, A. Doriea, L'infection par l'erythrovirus B19 chez le drépanocytaire au Mali, Archives de Pédiatrie 2011;18:962-965

[5] Svetoslav N. Slavov, Simone Kashima, Ana Cristina Silva Pinto,Human parvovirusB19:general considerations and impact on patients with sickle-cell disease and thalassemia and on blood transfusions; Immunol Med Microbiol 62 (2011) 247–262

[6] P. Sève a, T. Ferry a,A. Charhon, Manifestations systémiques des infections à Parvovirus B19 ,La revue de médecine interne 25 (2004) 740–751

[7] T. Kamoun, I. Chabchoub, K. Aissa,Erythroblastopénie aiguë secondaire à une infection par le Parvovirus B19 révèlant une sphérocytose héréditaire chez 2 enfants de la même famille, Archives de Pédiatrie 2011;18:990-992

[8] Morinet et coll. Traité de Virologie Médicale

[9] villanueva,Parvovirus B19 Infection in a Patient with Sickle Cell Crisis, Hospital Physician June 1999

[10] B. Castello-Herbreteau, Infections graves chez l'enfant drépanocytaire, Arch P6diatr 2001 ; 8 Suppl 4 : 732-41

[11] K. E. Brown, N. S. Young, Parvovirus B 19 Infection and Hematopoiesis, BLOOD REVIEWS 177-182

[12] P. CathCbras I, F. Robert, C. Guglielminotti, Primo-infection à parvovirus B19 chez l'adulte immunocompktent ,Rev Med Interne 2000 ; 21 : 324-9

[13] SérgioSetúbal, Adelmo H.D. Gabriel, Jussara P. Nascimento, Aplastic crisis caused by parvovirus B19 in an adult patient with sickle-cell disease,Revista da SociedadeBrasileira de Medicina Tropical 2000.33(5):477-481

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Feedlot performance and carcass characteristics of Sudan desert sheep fed on molasses based diets

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Abstract- Thirty castrated male Sudan desert sheep, *Hamari* ecotype were involved in this study. The animals were kept for a pre-experimental period of two weeks, during which they were fed on groundnut haulm only. The animals were sub- grouped into three groups namely A, B and C.Each animal group received different feed named as the group name (A,B,C) the feed was offered to the animal groups on adlibitum base, while groundnut haulm was offered as a source of roughage daily.

Diet A was comprised of 50% molasses, diet B was composed of 30% molasses, while diet C was composed of 0% molasses.

Feeding period was 56 days during which the daily weight gain was 65.05g, 104.47g and 98.21g for groups A, Band C respectively and the difference was not significant (p>0.05).Total muscle % was highest 56.66% for group C, bone % was highest for groupA 21.40%,and fat was highest in group B 26.22% .The muscle: bone ratio was 2.55,2.53,and 2.84 for groups A,B,and C respectively.

Index Terms- Feed lot molasses, dressing %, carcass%, weight gain, Sudan desert sheep

I. INTRODUCTION

The feeding of high proportions of grains to animals especially ruminants, need to be re-evaluated as it is becoming more and more unjustifiable under the prevailing decreasing world food reserves, which has already resulted in their low availability and high cost.

In Sudan the area grown with sorghum – which is considered as the main grain for Sudanese – in addition its use as animal feed is estimated as 22,018,000 million feddans (1 feddan = 1.038 acres) with total production of about 4,524,000 metric tons (Bank of Sudan annual report 2013).The cost of agricultural production in Sudan tended to be high due to lack of labors and high cost of mechanization. High cost of animal feed production necessitates the search of other alternatives of high nutritional quality and lower cost.

Mcleroy (1961) classified sheep of Sudan into eight distinct ecotypes according to locality, tribe and origin. Of these ecotypes is the Sudan desert sheep which constitute 65% of the sheep population in the country .Jack (1955) stated that Sudan desert sheep is the best type in the country. They are large legged animals carrying a fine hair coat, the color is commonly light brown, often becomes white on the belly and legs.

A good desert sheep may weigh as much as 70 kg live weight. Mcleroy (1961) indicated that Sudan desert sheep included seven tribal breeds namely Watich, Meidob, North riverine wooled, Beja,Butana, Gezira and Kababish which is considered as the prototype to which other types are compared.
In Sudan conventional crops as some sorghum varieties are not used in human food also melon seeds, karkadeh (hibiscus sp.) seeds in addition to agro-industrial by-products such as molasses can help in solving such animal feed deficit.

In Sudan a variety of cash crops are grown, some of their by-products can be used in animal feeding. They include cotton, groundnuts. sesame, millet, sorghum and sugar cane. Barreveld (1982) indicated that crop residues become a useful by-product when a profitable use is made of them, if this is not the case the residue becomes a waste which has to be disposed of.

Now a day the production of sugar is witnessing a considerable increase due to modernization and rehabilitation of sugar industries and establishment of new sugar factories in the latest years. El Fadil (1995) stated that molasses production 0.14 million tons per annum.

Black strap or final molasses is by-product of the cane sugar industry from which the maximum crystalline sugar has been extracted by the normal methods. It is the most used molasses in animal feed. The specific gravity of molasses is 1.39 kg/liter. Undiluted black strap molasses is usually between 80 and 90 Brix (GÖhl 1975).

According to A.O.A.D. (2013) Sudan produces 78% of the total groundnut of the arab world. The total production of groundnut was 1million MT and the area grown was 2.07million Ha with 492 kg/Ha yield.

The history of agricultural by-products as animal feed in Sudan is ancient. Elshafie and Mcleroy (1964) have used a ration composed of 26% cotton seed hulls,20% cotton seed meal, 20% wheat bran, 20% dura grain, 13% molasses and 1% salt/mineral mix I a fattening experiment using 20 heads of Western baggara cattle. They found that the average daily gain was 1.11kg.
Elkhidir et al (1988) fed high molasses, low molasses and high sorghum diets to three groups of Sudan desert lambs from an average 25.40 kg live weight to 40.70 kg average slaughter weight.

II. MATERIALS AND METHODS

Experimental animals:

Thirty castrated male sheep Hamari ecotype were utilized. The age of animals was in the range of two years with two pairs of permanent incisors. The sheep were subgrouped into three groups A,Band C with average induction weights of 41.6 kg, 42.3 kg and 41.3 kg respectively.

All animals were treated for internal parasites by drenching with Albendazole.

Feeds and feeding:

Three iso-caloric feeds A,B and C were used. The feed ingredients (as fed %) and chemical composition are shown on the tables below.

Table 1. Feed ingredients proportions

Ingredients	Concentrate A(as fed %)	Concentrate B(as fed %)	Concentrate C(as fed %)
Sorghum	-	20	40
Molasses	50	30	-
Wheat bran	40	40	40
Groundnut cake	5	5	18
Urea	3	3	-
Salt	1	1	1
Lime stone	1	1	1

Table 2. Feed ingredients chemical compositions

Chemical composition %	Concentrate A	Concentrate B	Concentrate C	Groundnut haulm
Dry matter	80.70	97.60	93.90	93.70
Crude protein	22.80	28.00	21.80	8.13
Crude fiber	5.80	7.20	7.90	31.50
Ether extract	0.30	2.10	3.74	3.05
Ash	6.30	7.40	5.00	15.81
Nitrogen free extract	64.80	55.30	61.56	41.34
Metabolizable energy (Mj/kg) *	12.11	12.19	12.28	7.80

* calculated by the equation
ME = 0.012CP + 0.031EE + 0.05CF + 0.014 NFE
Source : technical Bulletin 33 (1976). Energy Allowences and feeding systems for ruminants . London Her Majesty's stationery office.

Experimental feeding:

Concentrate mixes were offered on ad libitum base, while groundnut haulm was offered at a rate of 1/kg/head/day. Concentrate mixes were offered 3 p:m daily while groundnut haulm was offered 7 a:m daily.

Feed consumption was recorded daily as the difference between feed offered and refusals.

Live weight & growth:

The induction live weight was recorded for each animal at the beginning of the trial, then the animals were weighed individually every week at 8 am after 12 hours deprived from feed.

Total body weight gain was recorded during the whole trial, and the average daily gain was computed.

Feed intake:

The feed intake of each group was recorded daily as difference between amount offered and the refusals, the dry matter values from both roughages and concentrate mixes was used to calculate the dry matter intake.

Slaughter procedure and slaughter data:

At the end of the ffe lot period twelve animals were slaughtered four from each group following the local Muslim practices. The skin, feet as well as the thoracic and visceral organs were individually weighed, gut fill was determined as the difference in weight between the full and empty alimentary tract. The kidneys and kidneys' knob and channel fat were left intact in the carcass. The carcasses were weighed warm and then chilled at 4ºC for 24 hours, thereafter the cold carcasses were reweighed.

The tail was removed from its base and weighed. The kidney knob and channel fat were removed and weighed . the carcass was then halved along the vertebral column into left and right sides, the left side was weighed and broken into whole sale cuts according to M.L.C. procedure (1976), which include head, neck, breast, leg and chump, single short quarter, loin, best end of neck and tail.

Each cut was weighed and dissected into muscle, bone, fat and trim. The weight of each tissue was determined and recorded.

Statistical procedure:

Simple randomized design was used in the experimental procedure. Difference between means (LSD) was computed according to Duncan's multiple rang test (Snedecor and Cochran, 1980)

III. RESULTS AND DISCUSSION

Table 3. Feedlot performance data

Item	Group A	Group A	Group A	S.E.	Level of significance
Number of animals	10	10	10	-	-
Induction weight (kg)	41.60	42.30	41.30	0.57	NS
Final body weight (kg)	43.65 d	48.15 e	45.60 de	0.55	**
Feedlot period (days)	56	56	56	-	-
Total live weight gain (kg)	3.64	5.85	5.50	0.45	NS
Daily live weight gain (g) [1]	65.05	104.47	98.21	8.09	NS
Total concentrate intake (kg) [2]	1.12	1.46	1.07	-	-
Total roughage intake (kg)[2]	0.94	0.94	0.94	-	-
Total D.M. intake[2]	2.06	2.40	2.01	-	-
Feed conversion ratio[3]	16.61	15.75	16.82	1.39	NS
Gut fill (%)	14.57	12.92	11.93	0.79	NS

[1] g/head/day
[2]kg/head/day
[3]feed/kg gain
N.B. in this and subsequent tables means on the same line having similar superscripts are not significantly different.
NS not significant

*p< 0.05 a,b,c
**p<0.01 d,e,f
*** p<0.001 g,h,i

Table 4. Slaughter weight and carcass charactaristics

Item	**Group A**	**Group B**	**Group C**	**SE**	**Level of significance**
Slaughter weight (kg)	**44.00 a**	**47.50ab**	**44.38a**	**0.44**	*
Hot carcass weight (kg)	**22.10a**	**25.00ab**	**23.15b**	**0.34**	*
Cold carcass weight (kg)	**21.13a**	**24.00ab**	**22.55b**	**0.30**	*
Cold side weight (kg)	**10.13a**	**11.63ab**	**10.25a**	**0.21**	*
					Dressing %
Hot carcass wt/live wt base	**50.27g**	**51.85gh**	**59.24h**	**0.61**	***
Hot carcass wt/empty body wt	**58.84a**	**60.09ab**	**59.24b**	**0.96**	*
Cold carcass wt/ live wt	**48.04**	**50.27**	**50.82**	**0.63**	**NS**
Cold carcass wt / empty body wt	**56.25**	**57.70**	**57.79**	**3.46**	**NS**
Total muscle %	**56.12ab**	**50.38a**	**56.66b**	**0.79**	*
Total bone %	**21.40**	**19.95**	**19.96**	**0.37**	**NS**
Total fat %	**20.15**	**26.22**	**25.24**	**1.46**	**NS**
Total trim %	**5.70**	**5.75**	**6.43**	**0.19**	**NS**
Muscle / Bone ratio	**2.55**	**2.53g**	**2.84h**	**0.02**	***
Muscle / Fat ratio	**2.83**	**1.96**	**2.36**	**0.17**	**NS**
Gut fill %	**14.57**	**12.92**	**11.93**	**0.79**	**NS**

Table 5.Yield of whole sale cuts (as % of cold side weight)

Joint	**Group A**	**Group B**	**Group C**	**SE**	**Level of significance**
Leg and chump	33.11	32.93	33.89	0.76	NS
Single short	30.78	30.35	30.39	0.58	NS

forequarter					
Loin	11.81	11.64	11.44	0.34	NS
Best end of neck	9.03	7.82	8.53	0.18	NS
breast	6.40	6.46	6.85	0.21	NS
Neck	6.99	6.53	7.14	0.24	NS
tail	6.64	8.45	7.81	0.69	NS

Table 6.Meat chemical composition

Item	Group A	Group B	Group C	SE	Level of significance
Moisture %	72.84d	67.57de	70.94e	0.4	**
Protein %	22.32e	23.38de	22.10e	0.03	**
Fat %	2.31h	4.80gh	2.99h	0.08	***
Ash %	1.58g	1.04gh	1.12h	0.04	***

It was found that group B which utilized 30% molasses scored the highest feed intake 2.4 kg/ DM / Day than the other groups A and C which consumed 2.06 and 2.01 kg/ DM / Day respectively.

The above findings were higher than those reported by Mansour (1987) who fed diets containing groundnut hulls at a rate of 38-43 % resulted in feed intake values as 1.02,1.13 and 1.40 kg/DM/Day.

The daily live weight gain was not significantly different among treatment groups . Group B (30% molasses) showed the highest daily weight gain 104.47 g/day while Group C (0% molasses) gained 98.21 g/day while group A (50% molasses) had the highest gain 65.05 g/day. The results obtained in this study are lower than those reported by Elkhidir et al (1988) who fed three groups of Sudan desert lambs with high molasses % , low molasses % and high sorghum diets. The mean daliy live weights were 161 g/day, 196 g/day and 179 g/day respectively.

The results obtained are also lower than those obtained by Gaili and Ali (1985) who reported average daily gain of Sudan male sheep as 125 g/day when fed on diet containing sorghum 35%, wheat bran 15%, cotton seed cake 20%, groundnut hulls 29% and salt 1%.

The obtained results are higher than those reported by Elkhidir et al (1984) who reported feed conversion ratios of 8.10 and 9.60 for two groups of ewes fed on molasses-peanut hulls and dura grain based diets

The values for FCR are high which reflects some factors leading to loss of feed. These factors could be the poor design of the feeding troughs which permit the animals to throw away some of the feed while searching their diets. The other factor could be the loss of moisture from the molasses containing feed due to the high summer temperature.

The dressing percentages of hot carcass on slaughter weight basis in this study were 50.27%, 51.85% and 59.24% for groups A, B, and C respectively. The results obtained are comparable with those reported by Gaili et al (1972) who recorded dressing % of 52.25% for mature Sudan desert sheep. Gut fill results are comparable with findings reported by Itidal (1989) .

In this study the whole sale cuts produced no significant differences among the three treatments and the values are comparable to Elkhidir (1989) for Sudan desert sheep fed on high concentrate diet containing groundnut hulls.

IV. Conclusion

The study concluded that feeding diets containing molasses 30% performed good in feedlot and produced better carcass characteristics when compared with others fed diets with 50 % molasses.

References

[1] A.O.A.D. (2013) Arab agricultural Statistics yearbook Vol. No (33), Part (III) page no. (47).

[2] Bank of Sudan 53rd Annual report 2013 web site http://www.cbos.gov.sd

[3] Barreveld W.H. (1982). Alternative and use of agricultural and use of agro-industrial residue in FAO Prod.and Health paper 32:127-138.

[4] Elfadil A.S. Effects of varying protein sources with high Molasses/Urea rations on fattening Zebu calves M.Sc. thesis U.of K. (1995)

[5] El Khidir, O A., Khalafalla, Gumma, A., Y. Osman, O. K. (1984). High level of molasses and peanut hulls in urea supplemented diet for sheep fattening. World Rev. Anim. Prod., 2: 73-77.

[6] El Khidir, O A., Khalafalla, A. M. and Murgos, F.I. (1989). Molasses urea blocks as an emergency diet for sheep in Sudan. The Sudan J. Anim. Prod., 2 (1) : 9-17.

[7] El Khidir, O A., Khalafalla, A. M., Mansour, M. E. and Shadya, A.O. (1988). The effect of feeding diets of variable energy concentration on growth and carcass composition of Sudan desert lambs. Sudan J. Anim. Prod. 1 (2) : 81-88.

[8] Elshafie S. A. and Mcleroy, B. G. (1964) Response of western Baggara cattle to a fattening ration composed of agricultural by-products. Sud. J. Vet. Sc. and Anim. Husb. 5.1.

[9] Gaili, E. S. J., Ghanem, y. S. E. and Mukhtar, A. M. S (1972) . A comparative study of some carcass characteristics of Sudan desert sheep. Edinburgh, London Oliver and Boyd.

[10] GÖhl B.(1975). Tropical feeds. FAO Agricultural studies No. 96. Food and Agricultural organization, Rome, Italy.

[11] Jack, J.D.M. (1955) Food resources of animal origin in Sudan. The proceedings of annual confrernce. The physiological society of Sudan, PP. 10 Mc.coquodate and Co. (Sudan), Ltd.

[12] Mansour, M. E. (1987). Effect of feeding blood meal on performance and carcass characteristics of Sudan desert lambs. M./Sc. thesis U. of K.

[13] Mcleroy, B.G. (1961) sheep of sudan . Sudan J. Vet. Sci. and Anim. Husb. 2 (2) 1935.

[14] MLC,Meat and livestock commission (1976). Cutting and preparing lamb and pork. Technical Bulletin No. 24.

[15] Snedeicor G. W. and Cochran, W.G. (1980). Statistical methods, 7th edition, Iowa state university Press, Ames, Iowa, USA.

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Optimal Design, Analysis and Evaluation of Semi-Adaptive 700-800 KHz Active Band Pass Filter for SAR applications

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***Abstract*-** Technologies have advanced rapidly in the field of digital signal processing due to advances made in high speed, low cost digital integrated chips. These technologies have further stimulated ever increasing use of signal representation in digital form for purposes of transmission, measurement, control and storage. Design of digital filters especially adaptive or semi adaptive is the necessity of the hour for SAR applications. In this research work Butter worth digital FIR semi adaptive band pass filter for 700-800 KHz for 128 order Kaiser window with 0.5 Beta was designed using XILINX and MATLAB soft wares. As part of practical research work 700 -800 KHz Butter worth digital FIR semi adaptive band pass filter for 700-800KHz for 128 order Kaiser window with 0.5 Beta was designed using FPGA kit using SPARTAN-3E. These were optimized, analyzed, compared and evaluated keeping the sampling frequency at 5 GHz. Both these filters were tested by passing a sinusoidal test signal of 781 KHz along with noise and the filtered output signals are presented.

***Index Terms*-** Digital filter, XILINX and MATLAB soft wares, Field Programmable Gate Arrays(FPGA), SPARTAN-3E, DSP Chips

I. INTRODUCTION

The tremendous development in the field of high speed, low cost microelectronic digital IC's over the past few decades has stimulated an ever increasing use of signal representation in digital form for such purposes as transmission, measurement, storage and control. The conversion of a continuous signal to digital form makes possible the numerical manipulation of the data by IC's which is known as digital signal processing which is utmost necessary in the field of synthetic aperture radar applications(SAR). For remote sensing and detection applications digital signal processing concerns the techniques of processing the data to remove, for example, unwanted noise components, before the signal is reconstructed into analogue form, known as digital filtering , which is of interest in this research paper.

SAR data is required to be processed in real time, hence these filters are required to operate in real time. For real time operation, the complexity of the digital signal processing algorithm is limited by the condition that the numerical manipulation to determine each output sample must be performed in less than the sample period. Thus the design of a real-time filter generally involves a compromise between the complex requirements for a complex algorithm and a high sampling frequency.

The possibility of low-cost, real-time digital filtering first emerged in the 1970s when general purpose microcomputers were introduced. The early digital filters, however, had limited speed and precision, which restricted their use to low-frequency applications and simple algorithms. In the 1980s, higher cost special purpose known as DSP chips were introduced, which contained much faster arithmetic units and on-chip memory for storing filter coefficients and data. In some cases, on chip A/D and D/A converters were included and subsequently rapid improvements in speed and complexity were made possible by ICs, thus resulting in design of digital filters of today

II. PROPOSED DESIGN METHODOLOGY

(a) **Simulated Design.** The simulated design methodology is as shown in fig.1. The design process involved the following steps:

(i) MATLAB software tool is used to generate the coefficients required for the operation of the filter.

(ii) Xilinx software tool was used to design the filter.

(iii) In this design methodology Butter worth Finite Interval Response (FIR) semi adaptive digital band pass filter for 700-800 KHz Kaiser window with 0.5 Beat of 128 order TAP was used and designed.

(iv) Filter response was derived for the sampling frequency of 5 GHz.

The (FDA) Filter Design and Analysis tool in MATLAB provides the option to design the digital filter to offer the respective response and coefficients to be implemented within the design using VHDL. Filter design can be carried out often selecting various options available in FDA tool for generation of required coefficients for the respective filter from the target menu using the C header option of the FDA tool.

The generated coefficients in the C header files are then used in the VHDL file for the digital filter designing which is to be convoluted with the sampled data of SAR.

(b) **Practical Design** The simulated design methodology described above was translated on FPGA kit using SPARTA-3E for the practical experimental work. The inputs and outputs were taken on digital storage oscilloscope. In this research work the

following practical circuit design was carried out as per methodology shown in Fig.2. The circuit designed using the SPARTAN Logic IC X-C3S, a seven segment display, DIP switches is as shown in Fig.3.

(i) Butter worth FIR semi adaptive digital band pass filter for frequencies 700 to 800 KHz of 128 order Kaiser window with 0.5 Beta, for a sampling frequency of 5 GHz was carried out.

(ii) The SPARTAN Logic IC contains 4X10-6 logic gates and has 208 pins.

(iii) 8 DIP switches were incorporated for selecting various such as frequency of the filter, sampling rates and input signal.

(iii) 16 bit A/D and D/A converters are used for conversion and reconstruction of samples.

(iv)This filter was integrated into the circuit testing system as shown in fig.4.

In the hardware set up out of 8 DIP switches two are used for input/output, two are for selecting sampling rate and four switches for selecting filter coefficients. These four switches with 16 bit data it is possible to generate 64 sets of filter coefficients.

This technique of using Field Programmable Gate Array with DIP switches as shown in Fig.4 for selecting sampling rate for noise, test signal and various filter coefficients can be termed as a concept of semi-adaptive filter design. With this semi-adaptive technique depending on the test signal and noise condition particular set can be recalled there by increasing the signal to noise ratio for SAR to enable better detection. Here simulated and generated SAR signals accompanied with random noise is sampled at a frequency of 5 GHz.

Here SPARTAN-3E was used, configured in designing the digital filter in this paper. The achieved filter is as shown in figure.3.

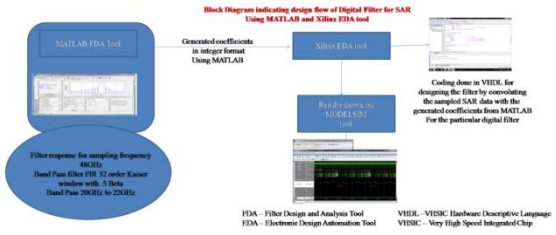

Figure 1. Block diagram of the Design simulation methodology.

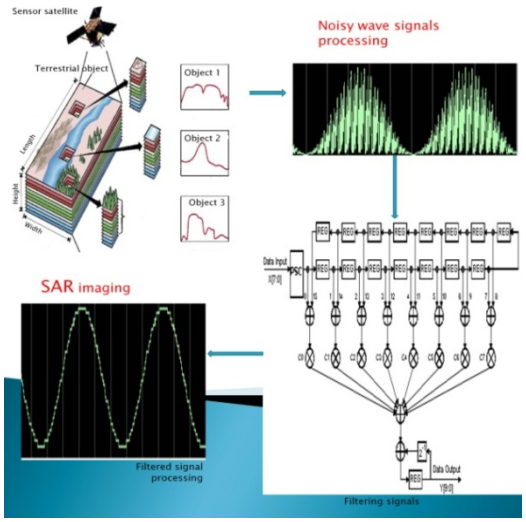

Figure 2. Block Diagram of the Practical Experimentation methodology.

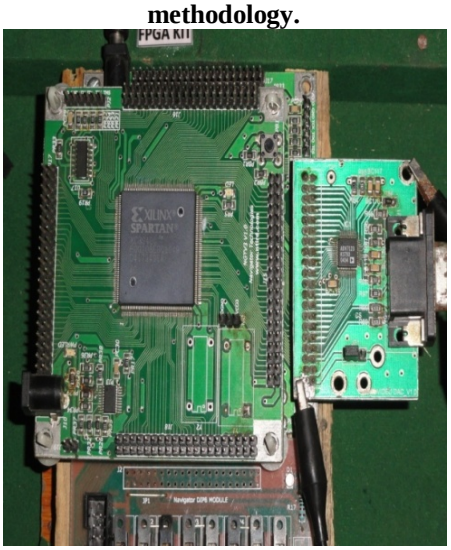

Figure 3. Designed circuit of the proposed methodology.

III. RESULTS AND DISCUSSION

The experimental setup and the designed circuit in this proposed research work are depicted in fig.2 and 3 respectively. The original sinusoidal test signal of 781 KHz was passed through this 700 to 800 KHz digital band pass Butterworth FIR filter of order 128 Kaiser window with .05 Beta which was designed using XILINX and MATLAB soft wares is as shown in Fig.5. From this figure it is clearly seen that noise is suppressed and the test signal has been passed. The figure.6. shows the input test signal and filtered output signal which was passed through the same filter which was designed using SPARTA 3 E kit with logic gates observed in a two channel digital storage oscilloscope. The simulated filter and the practically designed filter have rejected the noise and are comparable with hardly any differences as per expected lines.

The response of the simulated filter for original test signal, noise, test signal mixed with noise and the filterd output signal are clearly shown in fig.5**.** The response of the designed filter

using hardware for input test signal and filtered output signal are shown in figure.6.

It is seen from the fig. 6 that the original signal is completely mixed with noise before it is passed through the filter. The output filtered signal is clearly seen in fig.7 which shows that the designed filter of 7 to 9 GHz is clearly achieving the desired results.

It is seen the fig. 3 and 4 that the band pass filter design using SPARTA 3E Kit was clearly translated and achieved practically using the methodology proposed in this paper. It is seen from the fig. 5 and 6 that the simulated SAR signal clearly passing through the 700 to 800 KHz window in simulated and practically designed band pass filters, by suppressing the noise levels, presenting the reflected echo of the SAR signal.

It is observed from the fig. 5 and 6 that the filters response for the band pass frequency of 700 to 800 KHz, the test signal of 781 KHz, clearly passing through the filter for 128 order Kaiser window with 0.5 Beta for a sampling frequency of 5 GHz. Further it is observed that from the fig. 5 and 6 that the filter output completely suppresses the noise and passes the SAR signal.

Figure 4. Designed circuit of the proposed methodology.

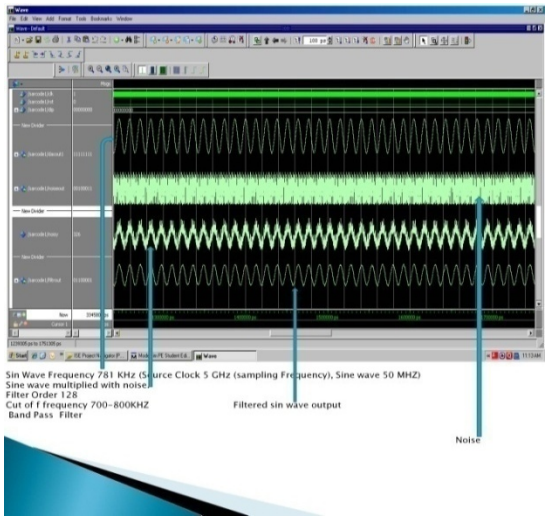

Figure 5. Original, noise, original + noise and output

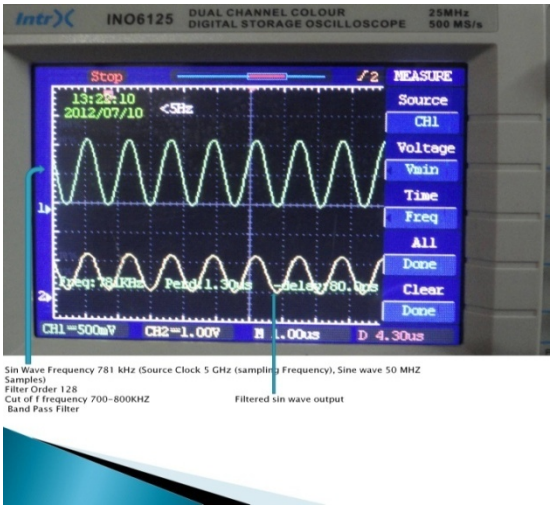

Figure 6. Input and filtered output signals

IV. CONCLUSION

The results obtained from this design clearly demonstrate that a 700 to 800 KHz band pass Butterworth semi-adaptive digital filter was designed successfully by using SPARTA- 3E kit along with A/D, D/A converters and DIP switches and seven segment display for 128 order Keiser window with 0.5 Beta. Same filter was also designed using MATLAB and XILINXK software tools. The response was successfully obtained for the designed frequency of 781 KHz for 128 order Keiser window with 0.5 Beta for a sampling frequency of 5 GHz from both the filters theoretical and practical.. These filters are suitable for low frequency SAR applications to mitigate random noise levels and give the desired target response so that resolution and identification of desired objects are achieved.

The SPARTAN-3E digital signal processing chip was successfully configured, designed and achieved the semi-adaptive butter worth digital FIR filter of 128 order Kaiser window with 0.5 Beta, practically as well as simulated design using XILINX and Mat lab soft wares. Filters designed in this paper analyzed and evaluated which are comparable and matching well in their responses of filtering out unwanted noise and passing the original signal in the designed frequency band.

In this paper a concept of low frequency digital filters for synthetic aperture radar applications for the purpose of deep detection on earth surfaces and deep sea bed are suitably demonstrated. High frequency SAR images are deteriorated by speckle noise, so in this paper an attempt is made to design a practical digital filter using SPARTA 3E kit for low frequency SAR applications. It is well known that lower frequencies have longer wave length and hence can penetrate deeper in to earth and sea bed for detection applications of SAR.

V. FUTURE SCOPE

This experiment on practical circuit design of semi-adaptive digital filters using SPARTAN-3E and simulated design using

XILINX and Mat Lab soft wares for SAR applications shows the possibility to formulate fully adaptive digital filters for Remote Sensing applications such as for Disaster management, mining, Forest management and military applications. These filters will play a crucial role in practical implementation in future SAR noise reduction.

REFERENCES

[1] Tomlinson G, H, "Electrical Networks and Filters (Theory and Design)", Prantice Hall Internationalo (UK) Ltd, 1991.

[2] Rhodes, J.D, "Theory of Electrical Filters", London, John Wiley,1976.

[3] Van Valkenberg, M,E, "Analog Filter Design", London, Holt Rinehart and Winston, 1987.

[4] D.M Pozar and D.H Schaubert "The Analysis and Design Of Microstrip Antenna Array".

[5] K. Ragopal, J. Dinesh Babus, Venkataraman, Generalized adaptive IFIR Filter Bank structures, Science Direct Signal Processing, pp 1-20, 2007.

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Abstract reasoning and Spatial Visualization in Formal Operational Stage

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Abstract- Formal operational stage differs from the previous stages due to the newly acquired ability to think in abstract terms and form hypotheses based on propositions (Inhelder & Piaget, 1958). As the adolescent progresses from early to late stage of development, the knowledge structure becomes more and more integrated in structure. Present study hypothesized that the ability to reason in abstract terms is associated with spatial visualization ability and this association becomes more integrated among late formal reasoners as compared to early formal reasoners. Reasoning of abstraction involves classifying objects or events into problem categories based on their properties. This is followed by making inferences in order to solve the problem which in turn requires visualizing the spatial relations among objects/events. Abstract reasoning thus, requires *conceptual knowledge* and *spatial visualization.* Spatial Visualization is the ability to visualize complex spatial relations among the constituent parts of an object and manipulate them in order to predict a possible outcome. To test this hypothesis, data were collected from 71 high school students (Boys=23; Girls=48; Mean age=14.52 years) by administering paper-pencil tests of abstract reasoning and spatial visualization. Results revealed significant association between abstract reasoning and visualization factor, with the association being stronger among late adolescents as compared to early adolescents. Results were discussed in the light of Piagetian theory of formal operational reasoning among adolescents.

Index Terms- Abstract reasoning, Spatial Visualization, Formal operations, Piaget's theory, Adolescents.

I. Introduction

One most distinguishing feature of formal operational stage is the organization of mental operations which are then performed on 'propositions' themselves and not on classes and relations that characterize the information (Inhelder & Piaget, 1958). Formal operational adolescents are able to construct hypotheses and systematically put it to test. While forming such hypotheses, unlike concrete operational child, formal operational adolescents do not have to limit their consideration to a single aspect at a time. Rather he/she is able to consider a number of variables at a time which might determine the event. The acquired information is the fed into a "combinatorial or structured whole" which further assimilates the information into "propositions" (Inhelder & Piaget, 1958). Such propositions are then arranged in all possible combinations, each offering a potential possibility. The adolescent then takes into account all the possibilities in order to decide which among them explains the real situation most appropriately. Thus the formal operational thinker has the ability to consider only the logical relations among the events while ignoring the concrete contents.

This is made possible by the development of the ability to think and reason in abstract terms, independent of concrete existence. As stated by Breuning (2003) in abstract reasoning "the problem solver examines the problem to determine whether it has certain structural properties and hence belongs to a certain class of problems" (p.232). Thus the reasoning of abstraction involves classifying objects or events into problem categories based on their properties. This is followed by making inferences in order to solve the problem. Such inference making depends on two things: first, *concepts* based on which problems are categorized and second, understanding the spatial relation among abstract representations so that they can be easily categorized and inferences can be drawn.

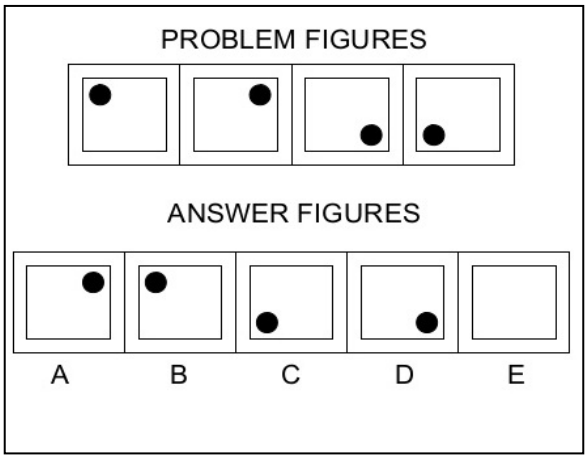

Figure 1. Problem of Abstract Reasoning

This categorization is done based on some rules which are peculiar to a particular category. For example: What comes after 3,5,7,9? The answer is 11. Here one has to have the knowledge of numbers which are again abstract representations. In addition to solve the problem, one needs to know the concept of 'odd numbers'. Now while solving the problem, one need to visualize the number line and has to comprehend the spatial relation among the numbers so as to arrive at the immediate next odd number. Categorization is the process by which concepts (abstract mental representation), based on some rules, determine if a new entity is a representative of a category or not (Rips,

Smith & Medin, 2012). Once an individual develops the concept of an event and is able to categorize a new member based on the rules of the category, he/she can predict if a new entity/event is a member of a particular category. This facilitates not only categorizing but also explains which new course a particular event is going to take. For example in Fig. 1, the question concerns after the first four problem figures. The answer is B. Simply the dot is rotating clockwise and the dot will continue to rotate in a circle and will not rotate in the opposite direction. Thus to solve the problem one needs the knowledge of clockwise rotation. Again, it also requires understanding the spatial relation among the dot and the square box. In the problem figures the dot is always placed at the corners and not in other positions. Thus the next figure would be one where the dot will be placed similarly at the corner. This requires the ability to visualize the box and the dot in the correct order. Thus abstraction requires spatial visualization ability.

Spatial visualization is the ability to deal with complex, multistep manipulations of spatially presented information (Linn & Peterson, 1985). Others however argue that it is the "ability in manipulating visual patterns, as indicated by level of difficulty and complexity in visual stimulus material that can be handled successful, without regard to the speed of task solution" (Lohman, 1979). Spatial visualization is thereby considered as the most extensively studied factor from a cognitive psychological perspective (Carpenter & Just, 1986). As described by Carroll (1993), this factor requires processes for apprehension, encoding and mental manipulation of spatial forms. This factor loads highest on tests like Spatial Relations Test (Bennet, Seashore and Wesman, 1972) items of which require subjects to hold on a visual array of information, comprehend the relations among the information units, apply mental operations to perform transformations of the spatial relations in order to predict an inference and evaluation of predicted outcome.

Development of Conception of Space

As studied by Piaget & Inhelder (1956), the conception of space develops through different stages and comes to a full bloom at the end of formal operational stage. Like all other thought processes, the conception of space is also characterized by different mental operations which enable the adolescents to make sense of spatial relations. For example, the concept that synthesis of the whole is the reverse product of unlimited subdivisions develops through various stages of development. While in the pre-operational stage (upto 6-7 years), the child fails to consider unlimited subdivisions of a whole due to lack of imagination, the concrete operational child (beginning at 7-8 years) can consider a large number of subdivisions but still do not consider it to be infinite. Moreover, they can not generalize the subdivisions beyond vision or tangible size. It is only during the formal operational stage (11-12 years onwards) that the adolescent's thinking processes are finally free of "quasi-perceptual notions" of previous stages. The adolescent can now easily consider the fact that synthesis of the whole is the reverse product of unlimited subdivisions and this conception becomes more and more consolidated as the adolescent progresses towards the end of formal operational stage (16-17 years). As documented by Sorby & Baartmans (2000) development of spatial visualization takes place through three different stages (Bishop, 1978). The first stage involves learning *topological visualization* which enables children to comprehend topological relationships among object. This is followed by the second stage where they acquire *projective representation ability*. This stage facilitates them to visualize an object from a different perspective. Finally in the third stage, they learn to combine their projective representation ability with their concepts of measurement. The projective representation ability appears during adolescence and continues to mature till adulthood is reached. This point to the fact that formal operations appearing during early adolescence also plays an important role in the development of the second and third stage of spatial visualization development.

Development of Abstract reasoning

Formal reasoning is characterized by logical reasoning advancing from concrete to abstract forms (Lister, 2011). How and why such ability to reason is acquired has been so far studied from two different approaches. From the Piagetian point of view, such acquisition is an outcome of brain maturation. Needless to mention, formal operational reasoning is the most abstract form of reasoning in Piaget's view (1952, 1954). Also, since this ability to think in abstract terms is a result of brain maturation, a child exhibiting a certain level of abstract reasoning in a particular domain will also exhibit equally potential abstract reasoning ability in many other domains (Marini & Case, 1994). The neo-piagetian approach however differs from the piagetian viewpoint in that irrespective of age, reasoning in terms of abstraction progresses as one gains expertise in problem-specific domain (Lister, 2011). Thus a person may be novice in a particular type of abstraction-based reasoning task, while might be an expert in solving another type of abstraction based task. According to neo-piagetians (Case, 1985), adolescents can reason out at abstract levels as because the formal stage of development allows them to integrate the results of two different types of lower-order reasoning processes which are typically concrete operational by nature. As observed by Susac, Bubic, Vrlanc & Plaininic (2014), while solving numerical abstract reasoning problems, early adolescents were less accurate and slower in solving equations with symbols than those with numbers while late adolescents could solve both types of problems equally. The researchers concluded that late adolescents could solve the problems as they had already reached a stage of abstract reasoning. Thus a transition occurs at the age of 15-16 years when adolescents learn to use abstract strategies instead of concrete strategies while solving problems.

Present Study

Thus the only thing that differentiates formal operational abstract reasoning is the ability to think in abstract terms. This essentially requires the ability to visualize relations among objects or events, form hypothetical mental models, manipulate the relations by applying mental operations and deduce inferences. Also as the formal operational stage progresses abstract reasoning becomes more and more systematic. Needless to say the ability to visualize spatial relations also develops as this facilitates the ability to think in abstract terms.

Although there are some evidences suggesting the possible connection between spatial visualization and abstract reasoning, there hardly exists any empirical study testifying this hypothesis. The present endeavor is based on the assumption that there exists a substantial association between spatial visualization and abstract reasoning as because theory suggests that spatial visualization underlies abstract reasoning ability. Also there are reasons to believe that this association intensifies as the formal operational child enters into late adolescence from early phase. Thus objective of the present study was to examine the association between abstract reasoning ability and spatial visualization ability in formal operational adolescents and how this association varies among early and late formal thinking.

Objectives of the study

There are two objectives of the present study:

1. To examine the association between abstract reasoning and spatial visualization ability of formal operational adolescents.
2. To examine whether this association differs among early formal operational reasoners and late formal operational reasoners.

II. Method

Participants

Participants were 71 high school students (Boys=23; Girls=48; Mean age=14.52 years). Among them, 52% were of age range 13-14 years while 48% were of age range 15-17 years.

Instruments

Abstract Reasoning: The Abstract Reasoning Test of Differential Aptitude Test (DAT) battery was administered in group testing situation. The test has 50 multiple-choice items, each having five options, out of which only one option is correct. A score of 1 is given on choosing the correct option.

Spatial Visualization: The Space Relation Test of Differential Aptitude Test (DAT) battery was used to measure this ability. This test has 40 multiple-choice items, each having five options out of which there can be more than one correct answer. A score of 1 can be obtained on choosing any one of the correct option.

In both the tests, total score is computed by summating the number of correct responses. The standard formula for calculating the total score as given in the DAT manual has not been followed. This is because here the emphasis is on assessing the ability and not on determining the position of the participant in a given population as can be obtained by comparing his/her score with the given norm.

Procedure

For data collection, permission was sought from local high schools. After obtaining permission, rapport was established with the students. Data were collected in groups. Total time taken for each session was almost 60 minutes. After data collection, participants were provided with small incentives in the form of pens and chocolates. Data were then analyzed and results were discussed.

III. Results

Age wise difference in abstract reasoning and spatial visualization ability

Before looking for association among abstract reasoning and spatial visualization as also the age wise variance in this association, it is important to check if the early adolescents and late adolescents actually differ among themselves with respect to their abstract reasoning ability and spatial visualization ability.

Results suggest that late adolescents (Mean=24.65; *SD*=13.53) performed better than the early adolescents (Mean=14.46; *SD*=7.76) in abstract reasoning ability; this mean difference being statistically significant F (1, 69) = 15.45, $p<0.000$ with effect size being large $\eta^2=0.183$. Again, late adolescents (Mean=22.79; *SD*=6.57) outperformed early adolescents (Mean=18.57; *SD*=5.84) in their ability of spatial visualization. This mean difference is also found to be statistically significant F (1, 69) = 8.23, $p<0.01$ with effect size being moderate, $\eta^2=0.106$. Thus age explains almost 18% variance in the abstract reasoning ability and 11% variance in the spatial visualization ability of the adolescents (Table 1).

Table 1.
Descriptive statistics & Analysis of Variance showing age wise difference in Abstract Reasoning ability and Spatial Visualization ability of the adolescents (*N*=71).

Ability	Age groups	Mean	SD	F value	df	p-value	Eta squared value (η^2)
Abstract Reasoning	Early adolescents (*n*=37)	14.46	7.76	15.45**	1, 69	0.000	0.183
	Late adolescents (*n*=34)	24.65	13.53				
Spatial Visualization	Early adolescents (*n*=37)	18.57	5.84	8.23**	1, 69	0.005	0.106
	Late adolescents (*n*=34)	22.79	6.57				

**p value<0.01

Association among abstract reasoning and spatial visualization

With age significantly affecting the abstract reasoning and spatial visualization abilities of the adolescents, the two age groups can now be separately considered for further analysis of association between the two abilities.

Overall, a moderate association between spatial visualization ability and abstract reasoning ability is obtained r (69) = 0.66, p<0.000. Further this association was checked by taking two age groups into consideration (Table 2). By selecting cases separately for early adolescent group (age 13-14 years) and late adolescent group (age 15-17 years) Pearson correlation was done. Results revealed higher association among late adolescents r (32) = 0.76, p<0.000 as compared to that among early adolescents r (35) = 0.39, p<0.02. Further the two coefficients are found to be significantly differing among each other, as evident from the z value, z = 2.35, p value = 0.02 (two tailed).

Table 2.
Correlation coefficients and z-value showing association among Abstract Reasoning and Spatial Visualization ability (*N*=71).

	Association among Spatial Visualization & Abstract Reasoning			
	r	**df**	**p value**	**z value**
Overall association	0.66**	69	0.000	
• **Early adolescents**	0.39*	35	0.02	2.35*
• **Late adolescents**	0.76**	32	0.000	

*p value<0.05 **p value<0.01

IV. Discussion

As mentioned in the introduction the first question of interest was whether spatial visualization in object-space is associated with abstract reasoning ability among formal operational adolescents. As revealed in results there exists a moderately significant association between spatial visualization and abstract reasoning. Thus spatial visualization is a correlate of abstract reasoning. As a matter of fact often highly developed spatial skills are attributed for better reasoning ability. As proposed by Byrne & Johnson-Laird (1989) "human reasoning relies on the construction and manipulation of mental models". This follows a three step mechanism: constructing a model based on the relations described in the premise, devising a probable conclusion compatible with the model and finally trying to falsify the conclusion by constructing further alternative mental models based on the premises (Johnson-Laird, 1983). Mohring, Newcombe & Frick (2015) investigated the association between spatial skills and propositional reasoning ability among 4- and 5-year olds. Their results indicated that errors made in spatial reasoning task were closely associated with the children's propositional reasoning ability after controlling for age and verbal intelligence. Geary, Saults, Liu & Hoard (2000) found that male advantage in arithmetic reasoning is mediated by male advantage in spatial skills. Thus there is no denying the fact that spatial reasoning underlies ability to think in abstract terms. Present results add to this vast literature by studying the

association among abstract reasoning and spatial visualization ability.

The study further purported to examine how the association between abstract reasoning and spatial visualization ability vary across early and late adolescent groups. Results showed that the association is stronger in case of late adolescents as compared to the early adolescents. In solving abstract reasoning problems, formal operational adolescents form propositions based on the conceptual knowledge and the spatial knowledge they acquire and thereby predict the outcome. With maturity these knowledge structures become more integrated and therefore prediction is more accurate. The high association between abstract reasoning and visuospatial reasoning among late adolescents indicates the existence of a more integrated knowledge structure as compared to the early adolescents. This finding is in line with the Piagetian theory of development of spatial skills wherein late adolescents learn to combine their previously developed projective representations with their newly acquired concepts of measurement in order to solve reasoning based problems (Sorby & Baartman, 2000). As a matter of fact during late formal operational stage, adolescents master to combine previously matured lower-order reasoning processes in order to form complex knowledge structures which enable them to solve reasoning problems more efficiently (Case, 1985; Lister, 2011).

According to Inhelder & Piaget (1958), this integrated structure is an outcome of the various mental operational possibilities implied in the successive stages. This ultimately leads to a state of equilibrium in formal thinking, which exists as a set of possibilities of operations and operational schemata. As the child progresses from one stage to another, this equilibrium widens in its range, with more and more integrated form of understanding. This is not only because the child's abilities grow, but also because as the abilities grow, they also become more and more associated among each other, in order to form a more integrated complex structure. This is evident from the present study findings where the early reasoners and late reasoners not only differed in each of their abilities of abstract reasoning and spatial visualization, but also when the association among the two abilities was considered.

V. Implications of the Study

Previous research have consistently investigated individual differences in spatial visualization factor as also abstract reasoning in relation to their applications in other areas (Breuning, 2003; Miyake et al., 2001; Sorby, 1999; Marini & Case, 1994). However, hardly any attempt has been made before to investigate the role played by spatial visualization in abstract reasoning or as to how this association varies across formal operational stage of development. Present results not only point to the fact that spatial visualization is associated with abstract reasoning but also indicate how this association develops during the formal operational stage. The finding that the association between visualization factor and abstract reasoning is more integrated during late adolescence as compared to early adolescence directly supports piagetian and neo-piagetian theories claiming better developed formal operations appearing later in adolescence. This finding can be further investigated to explore how this integration materializes during late adolescence.

VI. Limitations & Future Research

Before generalizing the results readers must keep in mind the limitations of the present study. First, for assessing abstract reasoning and spatial visualization paper-pencil tests were used. Results would have been much more concrete had reasoning tasks been used instead of paper-pencil tests. That would have allowed studying even the differences in strategies used to solve the problems and resulted in better integration of present results. Inhelder & Piaget had studied spatial skills and abstract reasoning by providing cognitive tasks to solve (1958). Second, number of participants was very small in the present study, representing the early and late adolescents, thus complicating the process of generalization. Further studies should investigate the same problem in a larger population so as to explore the association in more details.

In conclusion it can be said that it would be too much to claim that the present study has a lot to contribute in the field of research in reasoning processes, but this study is definitely a small step in providing empirical evidences for the association between spatial visualization and abstract reasoning as well as how this association develops to form an integrated structure during late adolescence.

References

[1] Bennett, G. K., Seashore, H. G., & Wesman, A. G., Form T, Differential Aptitude Tests, Space Relations, 1972. New York: Psychological Corporation.

[2] Bishop, J. E., Developing Students' Spatial Ability. Science Teacher, 45(8), 1978, 20-23.

[3] Breuning, M., The Role of Analogies and Abstract Reasoning in Decision-Making: Evidence from the Debate over Truman's Proposal for Development Assistance. International Studies Quarterly, 47(2), 2003, 229-245.

[4] Byrne, R. M., & Johnson-Laird, P. N., Spatial reasoning. Journal of memory and language, 28(5), 1989, 564-575.'

[5] Carpenter, P. A., & Just, M. A., Spatial ability: An information processing approach to psychometrics. In R. J. Sternberg (Ed.), Advances in the psychology of human intelligence, Vol. 3, 1986, Hillsdale, NJ: Erlbaum.

[6] Carroll, J. B., Human cognitive abilities: A survey of factor-analytic studies. Cambridge University Press, 1993.

[7] Case, R., Intellectual development. Birth to adulthood, 1985.

[8] Geary, D. C., Saults, S. J., Liu, F., & Hoard, M. K., Sex differences in spatial cognition, computational fluency, and arithmetical reasoning. Journal of Experimental child psychology, 77(4), 2000, 337-353.

[9] Johnson-Laird, P. N., Mental models: Towards a cognitive science of language, inference, and consciousness (No. 6). Harvard University Press, 1983.

[10] Linn, M. C., & Petersen, A. C., Emergence and characterization of sex differences in spatial ability: A meta-analysis. Child development, 1985, 1479-1498.

[11] Lister, R., Concrete and other neo-Piagetian forms of reasoning in the novice programmer. In Proceedings of the Thirteenth Australasian Computing Education Conference-Volume 114 (pp. 9-18), 2011, January. Australian Computer Society, Inc..

[12] Lohman, D., Spatial Ability: A review and reanalysis of the correlational literature (Tech. Rep. No. 8). Stanford, CA: Stanford University, School of Education, 1979.

[13] Marini, Z., & Case, R., The development of abstract reasoning about the physical and social world. Child Development, 1994, 65(1), 147-159.

[14] Miyake, A., Friedman, N. P., Rettinger, D. A., Shah, P., & Hegarty, M., How are visuospatial working memory, executive functioning, and spatial abilities related? A latent-variable analysis. Journal of Experimental Psychology: General, 2001, 130, 621−640.

[15] Möhring, W., Newcombe, N. S., & Frick, A. (2015). The relation between spatial thinking and proportional reasoning in preschoolers. Journal of experimental child psychology, 2015, 132, 213-220.

[16] Piaget, J., The origins of intelligence in children (Vol. 8, No. 5, p. 18). New York: International Universities Press, 1954.

[17] Piaget, J., The construction of reality in the child (M. Cook, trans.). New York: Basic Books, 1954. (Originally published, 1937.)

[18] Piaget, J. & Inhelder, B., "The Child's Conception of Space." Trans. FJ Langdon & JL Lunzer. London: Routledge & Kegan Paul (1956).

[19] Rips, L. J., Smith, E. E., & Medin, D. L., Concepts and categories: memory, meaning, and metaphysics. The Oxford Handbook of Thinking and Reasoning, 2012, 177-209.

[20] Sorby, S. A., Developing 3-D spatial visualization skills. Engineering Design Graphics Journal, 1999, 63(2), 21-32.

[21] Sorby, S. A., & Baartmans, B. J., The Development and Assessment of a Course for Enhancing the 3-D Spatial Visualization Skills of First Year Engineering Students. Journal of Engineering Education, 2000, 89(3), 301-307.

[22] Susac, A, Bubic, A, Vrbanc, A, Planinic, M., Development of abstract mathematical reasoning: the case of algebra. Frontiers in Human Neuroscience. 2014, 8: 679.

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An Experimental Investigation on Axial Strength of Steel Tubular Short Columns Infilled with High Volume GGBS.

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Abstract- Recently the use of composite structures consisting of cold formed steel tubes infilled with concrete has become increasingly popular in civil engineering constructions. This is because of their excellent earthquake resistance properties namely high ductility, high stiffness and large energy absorption capacities. The subject of this work is to investigate the effect of high volume replacement level of cement with GGBS on the strength of concrete filled steel tubular short columns. A theoretical investigation of these experimental results with Euro code is also conducted. GGBS can be used as a replacement for cement or as an additional cementations material in concrete. By conducting cube strength test on 18 specimens with different percentage replacement level of cement, Optimum percentage of GGBS were found out. Infilling the hollow section columns with M30 grade concrete,concrete with GGBS as a replacement for cement were studied. Totally 8 columns were tested and load versus elongation, axial stess- strain behaviour for each type of column was studied. The results show that concrete filled steel tubular columns with optimum percentage of GGBS have the highest compressive strength at age of 28 days than steel tubular column with normal M30 concrete. In the case of ggbs concrete column, the maximum load that can be taken by that specimen is found to be 720 kn, which is 9.3% more compared with normal concrete specimen. The failure mode for column infilled with M30 grade concrete was outward folding failure at bottom of the column and separation of steel and concrete at ultimate load due to bond failure between steel tube and concrete

Index Terms- Infilled steel tubes, GGBS, Optimum percentage

I. INTRODUCTION

In concrete-filled tubes (CFTs) or steel reinforced concrete members, the concrete and the steel forms a composite. A successful composite is one in which the final properties are better than those of the individual components, or the summation of the properties of the individual components. Many studies have proven the superior structural behavior of CFTs when compared to reinforced concrete or steel members. A steel hollow section in-filled with concrete has higher strength and larger stiffness than the conventional structural steel section and reinforced concrete.[1] . Composite column are structural members, which are mainly subjected to forces and end moments. The steel tube serves as a formwork for casting the concrete, which reduces the construction cost. No other reinforcement is needed since the tube itself act as a longitudinal and lateral reinforcements for the concrete core The structural behaviour of a CFT is governed by the member strength, reflecting the fact that the load resistance is dependent not only on the material properties but also on the geometric properties of the entire member[1][2] Also, the use of pozzolans as additives to cement, and more recently to concrete, is well accepted in practice.

Ground granulated blast furnace slag (GGBS) is one such pozzolanic material (termed by a few as a supplementary or complimentary cementitious material) which can be used as a cementitious ingredient in either cement or concrete composites. Granulated blast-furnace slag is a by-product in the manufacture of pig iron and the amounts of iron and slag obtained are of the same order. The slag is

a mixture lime, silica, and alumina, the same oxides that make up Portland cement, but not in the same proportion .The composition of blast-furnace slag is determined by that of the ores, fluxing stone and impurities in the coke charged into the blast furnace[4][5]. Typically, silicon, calcium, aluminum, magnesium, and oxygen constitute 95% or more of the blast-furnace slag. However, it was found that incorporation of ggbs as cementitious materials in concrete can decrease the demand of Portland cement, dry and autogenous shrinkage in early ages, carbonation depth and effect of sulfate corrosion on concrete damage as well as improve the strength in early ages and workability of fresh concrete slurry.[8]To assess the effectiveness of GGBS in Concrete some of the parameters like chemical composition, hydraulic reactivity, and fineness have been carefully examined earlier [9]. It was also seen that among these, the reactive glass content and fineness of GGBS alone will influence the cementitious/pozzolanic efficiency or its reactivity in concrete composites significantly[10][11]. In this paper, an effort is made to investigate the influence of combination of ground granulated blast-furnace slag (GGBS) on the strength development of concrete filled steel tubular columns

II.EXPERIMENTAL INVESTIGATION

Material properties:

In order to study the material properties of the sheets used for making the specimen, tension tests were conducted in standard coupons.The values of yield stress ,ultimate stress, young's modulus are given in table 1.

Table1: Coupon test results

Description	E (N/mm^2)	Fy (N/mm^2)	Fu (N/mm^2)
Steel sheet	$2X10^5$	375	470

Table 2: Properties of sand,cement, aggregates,GGBS

	Coarse aggregate	Sand
Specific gravity	2.85	2.75
Water absorption	0.98	1.23

	Cement	GGBS
Specific gravity	3.15	2.79
Specific surface(m2/kg)	392	599
SiO2	20.6	34.4
Al2O3	4	9
Fe2O3	3.1	2.58
CaO	62.8	32.8

Compressive strength of cubes and optimum percentage of fly ash :

- Normal mix

Concrete of M30 mix was prepared using 10mm size chips and 2 mm size fine aggregates with cement content of 53 grade. The water cement ratio was maintained at 0.42. 3 cubes were cast. After 28 days curing , compression test was conducted. The details of mix and compression test results are given in table3.

Table 3:Compressive load for control concrete

	1	2	3
Compressive Load (kN)	750.3	740.3	704

Average compressive load is calculated as 721.3 kN

- Normal concrete with replacement of cement with different percentages of GGBS

Concrete of M30 mix was prepared using 10mm size chips and 2 mm size fine aggregates with cement content of 53 grade. cement was replaced with GGBS by different percentage . The water cement ratio was maintained at 0.42. 3 cubes were cast. After 28 days curing , compression test was conducted. The details compression test results are given in table 4.

Table 4: Compressive load of fly ash

	GGBS content(percentage wt of cement)		
	30	40	50
Avg compressive load(kn)	874.33	710.13	705.17

Optimum percentage of GGBS is found to be 30%.

a)

b)

c)

Figure1: a) control cubes, b)GGBS cubes c) hollow steel column

Preparation of test specimens:

All columns are of size 100x100x700 mm

Table 5: Specimen details

Specimen number	D(B) m	T Mm	H mm	Fy MPa	Fck MPa
1	100	2	700	375	33
2	100	2	700	375	38.8
3	100	2.5	700	375	38.8
4	100	2.5	700	375	33

Test procedure:

The specimens were placed over the end bearing plates so that the centre of gravity of the column sections coincides with centre of gravity of the end plates.

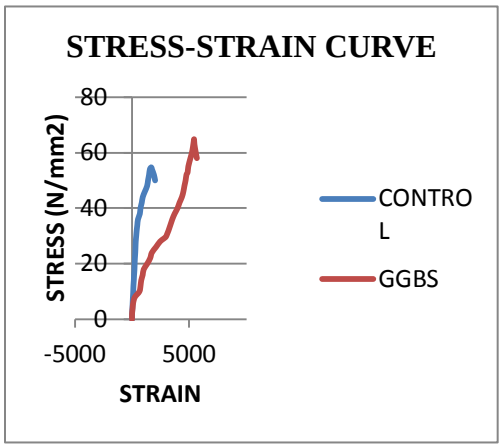
Tests were conducted in a 100 tone universal testing machine. The specimen with end bearing plates was placed on the base of the press and properly centred for loading axially. The strain gauges were tested by applying small loads and after necessary adjustments, initial readings were taken in all the electrical strain gauges. The initial readings on dial gauges were also noted.

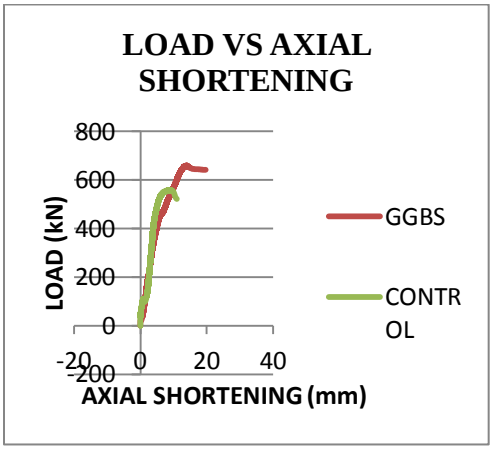
A load interval of 1 kn was used. Each load interval was maintained for about I sec. at each load increment the strain readings were recorded. All the specimens were loaded to failure. All the specimens behaved in a relatively ductile manner and testing proceeded in a smooth and controlled way.

The longitudinal strains on two directions were noted for each load. Near ultimate stage strains were not steady therefore could not be recorded accurately. The ultimate load was observed and recorded for all specimen.

III.RESULTS AND DISCUSSION

- Control concrete columns and GGBS concrete columns with 2 mm thick steel tube





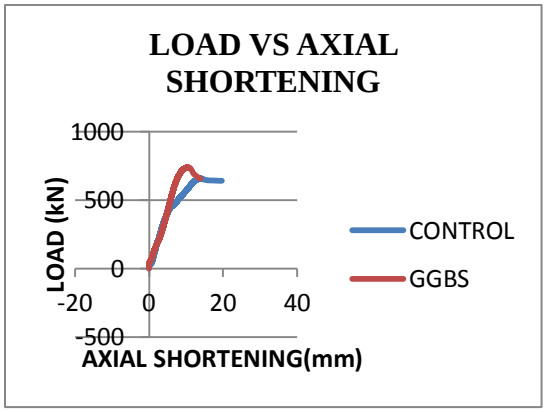
o

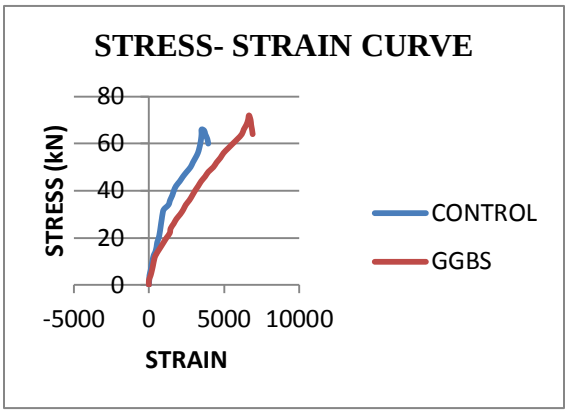
a) b)

Figure2 : a)&b) behaviour of control and GGBS concrete column

On testing control concrete and GGBS concrete specimens the load carrying capacity for ggbs concrete columns are found to be 648.5 kn. So 18.6% increment in ultimate load carrying capacity was obtained while removing 30% cement with ggbs. Strain corresponding to ultimate load is 0 .056.

- comparison between control , GGBS concrete infilled short column with 2.5mm steel tube





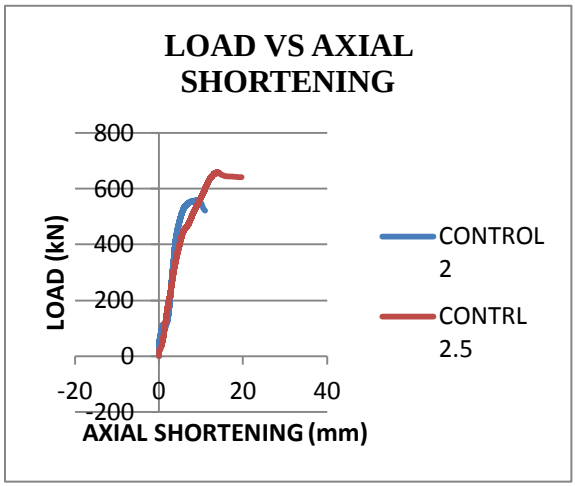
a) b)

Figure3 : a)&b) behaviour of control and GGBS concrete column

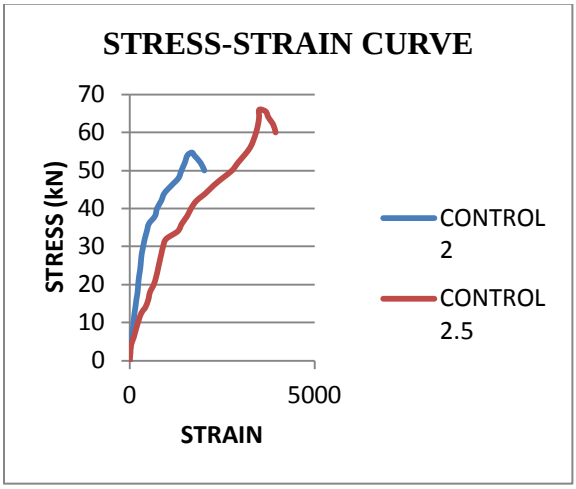
In the case of ggbs the maximum load that can be taken by that specimen is found to be 720 kn, which is 9.3% more compared with normal concrete specimen. 100% increase in strain for ggbs specimen in comparison with control specimen.

Comparison of 2 and 2.5mm steel tubular short column behavior:

1) control concrete columns



a)



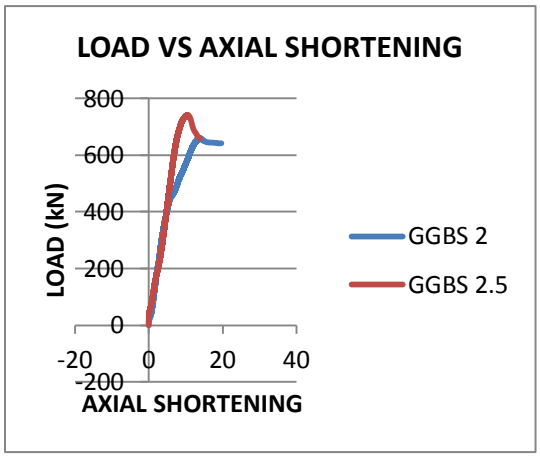
b)

Figure 4:a)&b) behaviour of control concrete column

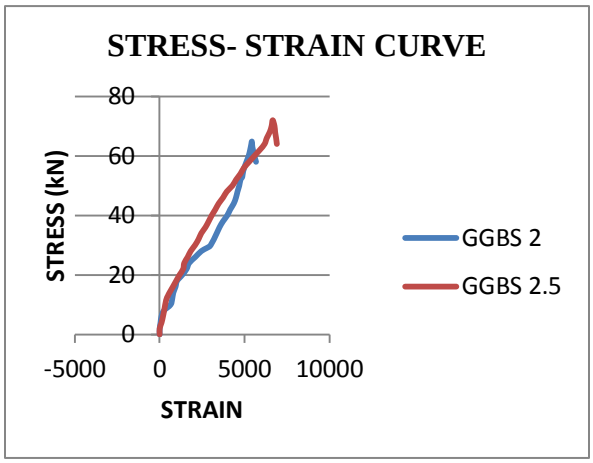
This comparison is to study the confining effect of steel on infilled concrete. Due to increase in thickness the load carrying capacity of control specimen get inceased to about 20.5%. the maximum strain it can take at ultimate load also get increased to 153 %.

In case of M30 grade concrete infilled column ,the curves gradually increases then the sudden drop of curve takes place after the ultimate load is reached. Bulging of the column took place when the ultimate load reached 85% .

- GGBS concrete short columns



a)



b)

Figure 5:a)&b) behaviour of control concrete column

Similar in case of ggbs also. 13% increase in ultimate load and 19% increase in stress level. After the load reaches 90%,the crushing of concrete took place more compared to other cases. Even though the load carrying capacity was more , the crushing was also more. After reaching the ultimate load sudden failure took place.

Almost all columns failed due to local buckling and concrete crushing. Local buckling took place after the elastic range, and after this concrete crushing followed. The failure mode of almost all columns at the bottom or the top was a typical crushing failure mode where the steel wall was pushed out by the concrete core, which in turn was confined by the steel. When the steel was removed from the specimen after failure, the concrete was found to have taken the shape of the deformed steel tube, which illustrates the composite action of the section. In the case of square columns, it is necessary to take into consideration a capacity reduction due to local buckling of the steel tube wall of the column with large B/t ratio rather than the confinement effect of the steel tube.

IV.THEORETICAL INVESTIGATION

- Strength index

A strength index is defined to quantify the section strength

SI = Nue/Nuo

Nuo=As*fy+0.85*Ac*fc ,giving sectional capacity as in ACI

Nue= experimental ultimate strength

- Ductility index

One of the parameter used to quantify section ductility is ductility index. It is expressed as

$DI = €_{85}/€_{ue}$

$€_{85}$ =strain when the load falls to 85% of the ultimate load

$€_{ue}$ = experimental ultimate strain

Table 2: Material properties, section capacities and ductility index

specimen	D(B) Mm	t(mm)	Fy	Fck	Nue	SI	$€_{ue}$	DI
control	100	2	380	33	547000	1.08	1500	0.8
GGBS	100	2	380	38.8	649000	1.185	5500	0.88
control	100	2.5	380	33	659000	1.15	3500	0.914
GGBS	100	2.5	380	38.8	720000	1.2	6800	0.98

Theoretical ultimate load of columns:

Strength Comparison by Design Codes

- Eurocode-4

$$N_{p1,R}=A_a f_y + A_c f_c$$

Where A_a and A_c are the area of steel and concrete, and f_y and f_c are the strength of steel and concrete.

For circular columns, confinement effects have to be incorporated if the relative slenderness λ is less than 0.5

- ACI code

. The squash load for square, rectangular, and circular columns is determined by

$$N_u = 0.85\ A_c f_c + A_s f_y$$

Table 6:strength comparison using different codes

	D or B Mm	Aa Mm^2	Ac Mm^2	EC4 kN	ACI kN	EXPERIMENTAL kN
2 mm	100	784	9216	655	601	540
2.5mm	100	975	9025	725.16	687	650

V.CONCLUSION

Based on the experimental and theoretical investigation done on cold formed steel tubular short columns infilled with high volume pozzolanic materials, the following conclusions were drawn.

- Infilling the hollow section columns with M30 grade concrete, ggbs concrete increases the load carrying capacity, ductility and ultimate strain value.
- The failure mode for column infilled with M30 grade concrete was outward folding failure at the bottom of the column
- For column infilled with ggbs concrete, crushing of the concrete and outward bulging occurs. When the load reached 90% of ultimate load crushing occurred.Due to the higher load carrying capacity compared to M30 grade concrete, the concrete withstood more load, the steel yielded first and then the concrete
- 15-20% increment in ultimate load carrying capacity was obtained while removing 30% cement with ggbs
- Increasing the thickness also increase the ultimate load carrying capacity. 10-20% increment in strength occurs.
- Since, large amount of cement is considerably reduced by the usage of 30% ggbs, it can save economy, reduce environment impact by reducing the heat of hydration.
- And can also reduce size of the structural elements to carry high loads because of the usage of composite members.

REFERENCES

[1] Y.-K. Yeh, G.-Y. Liu, M.-S. Han And C.-M. Chen, "Seismic Behaviour Of Square Concrete-Filled Steel Tubular Beam-Columns Stiffened By Interior Tie Bars", *13th World Conference on Earthquake Engineering* Vancouver, B.C., Canada, August 1-6, 2004, Paper No. 358

[2] S. B. Beheshti-Aval, "Strength evaluation of concrete-filled steel tubes subjected to axial-flexural loading by ACI and AISC-LRFD codes along with three dimensional nonlinear analysis", *International Journal of Civil Engineering*, Received: February 2011, Revised: January 2012,Accepted: June 2012

[3] 1.A. Oner, S. Akyuz, *An experimental study on optimum usage of GGBS for the compressive strength of concrete*, Cement & Concrete Composites 29 (2007) 505–514

[4]. ACI Committee 233. *Ground granulated blast-furnace slag as a cementitious constituent in concrete*, ACI 233R-95, American Concrete Institute; 1995.

[5]. Hogan FJ, Meusel JW. *Evaluation for durability and strength development of a ground granulated blast furnace slag*. Cement Concrete Aggr 1981;3:40–52.

[6]. Ganesh Babu K, Sree Rama Kumar V. *Efficiency of GGBS in concrete*. Cement Concrete Res 2000;30:1031–6.

[7]. Bukovská, P., Karmazínová, M., Neubauerová, P. *Buckling Resistance of Steel Tubular Columns Filled by High-strength Concrete*, In Proceedings of the 5th WSEAS International Conference on Engineering Mechanics, Structures, Engineering Geology, WSEAS Press: Cambridge 2012, pp. 172–177. ISBN 978-1-61804-071-8

[8]. Portoles JM, Romero ML, Bonet JL, Filippou FC. *Experimental study of high strength concrete-filled circular tubular columns under eccentric loading*. J Constr Steel Res 2011;67:623–33.

[9]. L.-H. Han, Y.-F." Performance of concrete-encased CFST stub columns under axial compression". Journal of Constructional Steel Research 93 (2014) 62–76

[10]. R. Yu et al. "Development of an eco-friendly Ultra-High Performance Concrete (UHPC) with efficient cement and mineral admixtures uses". Cement & Concrete Composites 55 (2015) 383–394

[11] Wang.Q ,Guan.P(2004)" *Experimental study on the strength and ductility of steel tubular columns filled with steel-reinforced concrete"* Engineering Structures 26 -907–915

[12] P.K.Gupta and S.M.Sarda(2007)"Experimental and computational study of concrete filled steel tubular column under axial loa"-journals of construction steel research,vol63,pp182-193

[13] Ramana gopal(2004)"test on fiber reinforce steel tubular column"-journals of steel and composite structures,vol4,pp37-48

[14] Brauns.j(1999)" analysis of stress state in concrete filled steel column,journals of construction steel research,vol 49,pp(189-196)

[15] Muhammad Naseem Baig, FAN Jiansheng, NIE Jianguo, "Strength of Concrete Filled Steel Tubular Columns", *Tsinghua science and technology issn* 1007-0214 05/15 Volume 11, Number 6, December 2006, 657-666.

[16] Arivalagan.S , Kandasamy.S, "Study on Concrete–Filled Steel Member Subjected to Cyclic Loading", *International Journal Of Civil And Structural Engineering* Volume 1, No 3, 2010: 0976 – 4399

[17] Fan Hong and Lihua Xu, "Experimental Studies on Monotonic Behaviour of Concrete-Filled Steel Square Tubular Column-Steel Beam Connection", *The 14th World Conference on Earthquake Engineering* October 12-17, 2008, Beijing, China

[18]. Papadakis VG, Tsimas S. *Supplementary cementing materials in concrete Part I: efficiency and design*. Cement Concrete Res 2002;32:1525–32.

[19]. Oner A, Akyuz S, Yildiz R. *An experimental study on strength development of concrete containing fly ash and optimum usage of flyash in concrete*. Cement Concrete Res 2005

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A Conceptual Approach to Officer Selection and Officer Like Qualities

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Abstract- Failure to conduct a good professional selection for officers is an unforgivable error and will lead to military incompetence. The quality of any officer selection system needs to be assessed with alacrity. One needs to know, rather than believe or hope, that the right applicants are selected and assigned to jobs for which they are best suited. This is of paramount importance to the military commanders since the quality of the officer corps is vital for the conduct of military operations which can have dramatic consequences both for the military and their country in times of war. A good officer selection system should consider the applicants as partners in the process of finding the most appropriate person for the vacancies. This is a different philosophy to the one that once prevailed in which the applicants were more treated like cattle that had to be led through an anonymous and cold selection machine. Considering the applicants as partners will be accomplished by a series of actions and attitudes and both sides need to treat each other with dignity.

Index Terms- Selection System , Military Competence, Officer Like Qualities (OLQs),Personal Qualities (PQs), Leader, Manager, Logistics and

I. INTRODUCTION

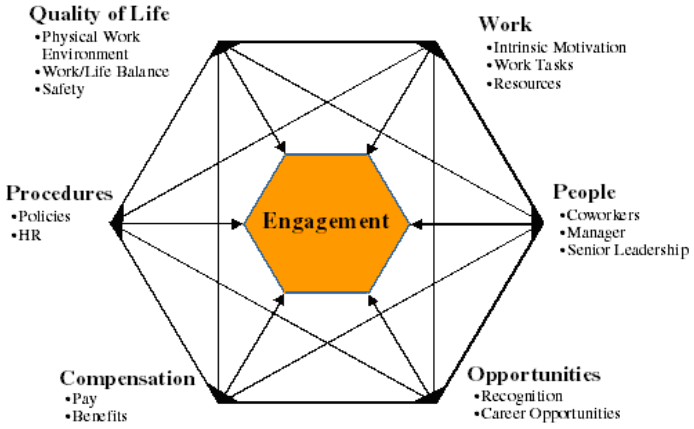
All armed forces have a requirement to enlist junior officers and that there are a number of applicants, mainly civilian, who are prepared to join. Typically, enlistees will go through an initial training phase, including both academic and military training, as a first step for a full military career. Such a setting is often thought as being very natural but in fact it is built on a series of fundamental options.For example, not all armed forces including India recruit officers from the civilian population. For instance, the Israeli Defense Force recruits its officers from among the enlisted NCO's. Other countries such as Austria recruit officers amongst draftees. In India, SCO and ACC commission is restricted to service personnel only.This form of internal recruitment has the advantage that the applicants are experienced and proficient in the subordinate role and know the organization well. Moreover, such a system gives many opportunities to assess the suitability of an applicant to become an officer. Under such a system however, it is likely that a number of potential officer-applicants will refrain from joining the Forces in the junior ranks because of the less appealing job and the uncertainty that his service as private will have the intended outcome, namely of becoming an officer.

II. JOB PROFILING

Large organizations require a wide variety of people with diversified competencies. The times where persons were able to become proficient in any specialty have now passed and it is one of the main challenges to the Human Resource Management (HRM) staff to provide the organization with the right set of people, proficient in particular fields. The way in which the HRM attempts to do so can vary. Some Forces hire large numbers of officers who already have a university degree, whereas others still rely on the recruitment of high school graduates and organize in-house academic training in a limited number of specialties. Further academic training at civilian universities is then frequently needed to provide the Forces with the required specialists. New models whereby officers leave the military to gain new competencies in civilian organizations and then come back to the military also take place. These fundamental options of HRM undoubtedly influence officer selection. However, within the scope of this paper we will reduce the officer selection issue to a generic situation in which a number of unknown candidates apply for a set of diversified officer jobs.

Hewitt Associates model of employees is an excellent account of interacting forces like Quality of Life, Work, People, Opportunities, Compensation and Procedures. This is enumerated beautifully as follows:

MODEL OF EMPLOYEE ENGAGEMENT(HEWITT ASSOCIATES 2004)



Hewitt Associates(2004): Employee Engagement at Double Digit Growth Companies

III. General context

Selection situations cannot be considered without reference to the context in which they occur. Let us review some elements that influence the selection systems.

3.1 First what is the selection ratio? How many applicants are there for each vacant position? With low selection ratios, one should take care not to reject applicants too easily whereas high selection ratios will risk imposing a major burden on the selection institution.

The overall number of applicants and vacancies is also important. When these are large, it is possible to use a stable normative population against which you can assess an individual applicant. When the numbers involved are small, this is no longer possible because of the fluctuations that are typical in small numbers. In order to assess an individual and to decide whether s/he can be enlisted, it is then necessary to compare all persons applying for the same set of jobs. This leads to batch classification.

Another important point is that of the legal dispositions and ethical guidelines which are applicable for most selection situations. For instance, there is no choice other than to comply with the existing rules and laws. One should, however, **always attempt to have legal texts modified when such changes would permit sounder selection practices.**

Societal awareness is also key. The managers of an officer selection system must recognize that the military is embedded in the broader society, as is their recruitment. This is not only relevant for marketing purposes, which are not discussed in this chapter, but also for the whole organization of the selection system. For instance, in some countries, if the applicants are mainly attending school, it is not too hard to ask them to spend a couple of days for officer selection during the week, whereas if the applicants are mostly working, you risk losing a good proportion of them if you can't organize their selection outside their working hours. Other issues related to societal awareness can be highlighted by some questions: Are the applicants computer literate enough to use computer testing without problems? Is it necessary to pay their travel costs to be sure that they will show up? Is it necessary to provide lodging? Is the time between application and enlistment comparable to an average civilian selection system? As one can imagine, the list could go on. The fundamental point is that it probably would be counterproductive to design an officer selection system without acknowledging the fact that the applicants typically live in a civilian world which has its own, inherent set of characteristics. A good way to be aware of the expectations, beliefs and problems of the applicant group is to use surveys.

3.2. **Systemic approach**

It is particularly interesting to see the selection problem within a systemic context. Considering that the ultimate goal is to provide proficient persons for vacant jobs, it is useful to see both selection and training as means to achieve this goal. When analyzing the competencies required to perform a job well, or, in other words, conducting a professional occupational analysis, it becomes possible to decide whether each of the competencies has to be present either before enlistment or at the end of the training period. The specific selection methodology must then ensure that applicants meet the selection requirements and the training- methodology can guarantee that the applicants meet the training requirements.

In terms of data processing, the selection and classification issue can be described as follows: when new candidates apply, they are often totally unknown to the Forces. During a short period of time, usually just a few days, a lot of useful information about them is gathered. All selection instruments measure some aspects of the individuals on a specific scale and with a particular error. This set of data can be seen as the competency profiles of

the applicants. In order to estimate the appropriateness of the enlistment of an individual, it is necessary to compare his or her profile with the requested competency profile for particular entries.

If one of the major parts in the selection process is to measure particular qualities in order to estimate whether an individual is able to become an officer, the subsequent question is clear: What

This question is far from easy. A typical approach consists of having some experts enumerating the qualities that are believed to be important for officers. Unfortunately, such an approach invariably leads to a very long list of qualities that probably describe Alexander the Great well, but not the kind of persons we are likely to encounter in a normal applicant group. In other words, the enumeration of desired officer qualities describes the archetypal officer rather than typical people and is therefore of little help in the selection and classification process.

In theory, one should perform a job analysis to find out what qualities are important to achieve success in the officer job. Those qualities could then be assessed during selection in order to predict later success. The difficulty of the implementation of such a model is that the jobs that junior officers have to perform are quite varied. In most Forces, it is normal that junior officers are eventually promoted to more senior positions, which will generally require an additional set of qualifications and qualities. Accordingly, it is hard to define a limited set of required attributes.

To have efficient Forces it is necessary to have an officer corps composed of individuals with a broad range of competencies. A limited set of quite universal abilities is probably essential for any officer. For instance, these can include physical fitness, intelligence, emotional stability and good communication skills. Beyond these, differentiation is the key issue. The idea that an individual can be well suited to perform any function is becoming more and more anachronistic. Modern HRM systems will therefore recognize the individual competency profiles and capitalize on them through smart allocation. Yet it is surprising to see how persistent this idea of ‘the universal officer’ is. This is due to the fact that although it definitely leads to mediocrity, it is by far the easiest – not the best - solution for HRM.

IV. THE QUALITIES OF AN OFFICER

It is reasonable to assume that most of society regards the military officer as a leader. This chapter will provide an overview of the qualities of an officer considering both the pragmatic, hands-on opinion of the selector and trainer and also informed, scientific analysis taken from various studies over many years.In modern military organizations, the effective leader will also need sound management skills, particularly during the peacetime environment. Accordingly, leadership, in its broader sense, will also be discussed, along with the links and the differences between Leadership and Management.

Whilst the military officer will usually need to possess qualities both in leadership and in management, there will be occasions when such qualities will, to a certain extent, be rather peripheral to pre-requisite professional skills such as, for example, Legal and Medical. Specialist, professional requirements are not 'qualities' per se and, accordingly, they will not be discussed within the scope of this chapter. Officer qualities must be differentiated from other factors assessed at selection. Broadly defined, **these personal qualities (PQs) or Officer Like Qualities(OLQs) as they are called in Indian context refer to traits, states, needs, motives, goals, attitudes, interests, determining tendencies and general dispositions towards personal/social situations.** They are different from cognitive, intellectual factors and medical factors which will also be examined in that they usually form an intrinsic part of officer selection.

4.1. Leadership

Most officers lead a complex, technical life, with many highly specialized duties to perform. These duties are his responsibilities as an individual, and as a highly-trained, responsible member of an exacting profession. In addition, he has to lead his men. An officer does not exist for his individual, personal value, but for his ability to show the way and make his men want to follow. This is indeed the core of the officer's existence and, without it no hope exists of grappling with the tasks of command. It is seen at its simplest in warlike operations, but the power to lead smoothes the way of every task in every branch of a military organization, whether in war or peace. It breathes that vitality into an organization that will take a collection of men, buildings and machines, and waken them to purposeful, effective life. How is it done? First, by force of character. Clearly, people are not all born with the same characteristics, and some from their earliest years have felt the power to show others the way, and to influence their minds. We call them born leaders, and they are just that; born with strong, independent, assertive minds just as some are born with a good natural physique. But this is not to say that the characteristics of effective leadership cannot be acquired, just as a good physique can be cultivated with suitable effort.

In all of the words spoken and written about leadership, one fundamental point continually emerges; namely that, for most, the skills of leadership are not normally acquired instantly. The training of a leader, whether it be formal or through experiences, takes many years. Appropriate experiences are necessary, both to build and develop the leader's own force of character, and also to increase his ability to influence others.

4.2 So, what is leadership? In the simplest of terms, leadership can be defined as "art of getting things done" or, perhaps, the combination of example, persuasion and compulsion that makes the military subordinate do what is wanted of him. Clearly, in a military environment, things have to be done, but leadership is not just getting things done, but getting them done in the way in which the leader wants them done, in all conditions, and with the consent of the team, however grudging that consent may be. Some, if not many, military leaders do not lead effectively. They hold a title and they are figureheads at the head of the pack. Their leadership is a facade and there is little of substance behind the mask of authority defined by the badge of rank. Clothes of authority, however, cannot in themselves generate either ability or effectiveness as a leader. Clearly also, the abilities and effectiveness of any leader are only as strong as are perceived by those who are led.

4.3 Most military organizations have a highly structured bureaucracy. Unfortunately, in peacetime, these bureaucracies are often able to develop and promote the 'Empty Suits', an appropriate Americanism which describes individuals who dress and present well, who are able to identify the right, vital progressive routes for themselves, but who have only limited raw and genuine skills of leadership, save for one essential facet, that of not putting their feet wrong. Such individuals are, in essence, light-weight 'polystyrenes'; they merely fill a place. However, they remain clean-coated and trouble free, and thus they progress, whilst those with more genuine substance depart, often out of frustration. Unfortunately, polystyrene cannot "rock a boat", it cannot step out of line, it cannot stimulate change, it does not take risks and, certainly, it cannot inspire. In times of peace, the 'polystyrene' empty suits remain the guardians of the status quo, the keepers of the book of rules and the stifles of energy and initiative. Their reliability is without question, but so is their predictability. Simply, their leadership is mundane.

4.4 A real leader must be an agent for change, an inspirer and developer who is able to show the way forward, integrate people and ideas and be prepared to instigate rapidly the most effective option. Particularly, in times of tension or war, an effective leader will have to be able to bring both colleagues and subordinates along in a way that is at once identified as pragmatic, meaningful and militarily cost-effective.

Military and naval history is full of effective leaders such as Gen KM Cariappa, Gen SHFJ Manekshaw, George Washington, Wellington, Nelson, Bonaparte, Montgomery and Rommel who rose to the top, not by preferment or substantial support from acolytes, but simply because of their abilities, both strategic and personal, which enabled them to inspire their men and, most importantly, achieve military success.

4.5 In past conflicts, battles and wars were usually lengthy. Incompetent or irrelevant leaders could be, and usually were, identified, replaced and sometimes even shot! Inspirational leaders could develop their forte and earn recognition by success. However, most recent international wars have lasted for just a few weeks, and future wars can be expected to follow this trend. NATO planners are well aware that they will have to fight with the men and materiel that they have to hand and in stock. Perhaps even more significantly though, battles will have to be directed and fought by the leaders already appointed and in place. The 'polystyrene', empty-suit commander would be found wanting and no doubt would be identified in the aftermath during the soul-searching of 'Lessons Learned' – but at what cost?

In war, a leader should not have to compromise. In war, it is unlikely that a real leader would accept compromise. Yet the 'Empty Suit', whose life and career had developed out of frequent compromise and assent, would probably find the transition to the warrior's outlook in times of conflict an impossible hurdle.

V. Leaders and Managers

The differentiation between a good leader and an effective manager are, to many, nebulous. Simply however, managers are usually measured by their performance within set, pre-determined parameters. Leaders should be judged by higher requirements, often not pre-set and, especially in times of conflict, usually surprising. That said, it is difficult to imagine that an effective manager would not have some skills of leadership within his persona. Similarly, it would be surprising to find an effective leader who was bereft of management skills. However, the fundamental, singular difference between Management and Leadership is that Leadership is about effective change-making and the single-minded application and enforcement of that change, however unpalatable the change may be. Military leaders, overall, must have a breadth of long-term vision, be decisive and independent, act and stand firm, be a warrior, speak openly, plainly and frankly, learn quickly from defeats and mistakes, go forward with unswerving fortitude, and know and appreciate the requirements and interests of subordinates. The qualities and skills of a leader are unlikely to be totally intrinsic and they would have to be developed over many years and with much, appropriate experience. Yet, to a great extent, there would have to be an innate and solid foundation, coupled also with flair and charisma. Sometimes the qualities of leadership would be natural, but mostly they would metamorphose by effective, early nurturing and constant, later development. Conversely, management skills can be taught and they can also be learned. That said, management is not necessarily a routine process. Management problems vary considerably and a pre-set formula for effective management would rarely work. However, management can be effective without flair or charisma; genuine leadership, particularly at higher levels, cannot. De facto, leadership has to be flexible and imaginative with positive and often urgent, effective reaction to the unexpected. **In sum**, leadership requires extraordinary attributes above and beyond those of management and the simple, efficient organization of the status quo. However, that is not to suggest or infer that management is easy and leadership is necessarily difficult. The required capabilities, however, are different and can be summed up by the following list: UNCLASSIFIED Defense Technical Information Center Compilation Part Notice ADP010368 TITLE: Officer Qualities DISTRIBUTION: Approved for public release, distribution unlimited This paper is part of the following report: TITLE: Officer Selection [la Selection des officiers] To order the complete compilation report, use: ADA387133 The component part is provided here to allow users access to individually authored sections f proceedings, annals, symposia, ect. However, the component should be considered within the context of the overall compilation report and not as a stand-alone technical report.

5.1 The qualities of an officer have been analyzed and defined countless times, over many centuries. Probably, there is no single accurate description which can encompass completely these myriad views and opinions. This presentation will be a personal view on officer qualities by a UK officer with 2 five-year experiences in selecting officer cadets and then training then during their initial officer training. Discussion will revolve around the qualities of an officer and will try to differentiate the true, effective leader from those who sometimes wear the trappings of rank without, perhaps, having many real leadership qualities. There is often confusion between Management and Leadership and so the differences between the 2 styles will be briefly analyzed. Listed also for consideration will be the leadership qualities which are regarded as important by 4 separate NATO military academies. Clearly, these lists are for

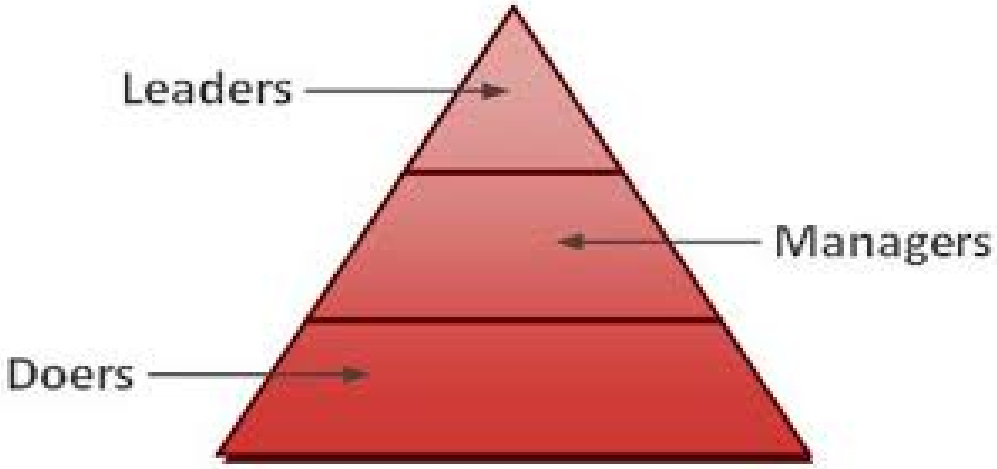
the ideal, generic officer and it is interesting to note the difference in emphasis between the various lists of the different training establishments. The paper will finally move on to Officer Selection and highlight some of the qualities, raw or potential, which can be identified and assessed during an officer selection process. What is Leadership? Most officers lead a complex, technical life, with many highly-specialized duties to perform. These duties are his responsibilities as an individual, and as a highly-trained, responsible member of an exacting profession. In addition, an officer has to lead his men. An officer does not exist for his individual, personal value, but for his ability to show the way and make his men want to follow. This is indeed the core of the officer's existence and, without it, no hope exists of grappling with the tasks of command. It is seen at its simplest in warlike operations, but the power to lead smoothes the way of every task in every branch of a military organization, whether in war or peace. It breathes that vitality into an organization that will take a collection of men, buildings and machines, and waken them to purposeful, effective life. How is this done? First, and perhaps ideally, by innate force of character. Clearly, people are not all born with the same characteristics, and some from their earliest years have felt the power to show others the way, and to influence their minds. We call them born leaders, and they are just that; born with strong, independent, assertive minds just as some individuals are born with a good, natural physique. But this is not to say that the characteristics of effective leadership cannot be taught and acquired, just as a good physique can be cultivated with suitable effort. In all of the words spoken and written about leadership, one fundamental point continually emerges; namely that, for most, the skills and qualities of leadership are not normally acquired instantly. The training of a leader, whether it be formal or through experiences, takes many years. Appropriate experiences are necessary, both to build and develop the leader's own force of character, and also to increase his ability to influence others. So, what is Leadership? In the simplest of terms, Leadership can be defined as "getting things done" or, perhaps, the combination of example, persuasion and compulsion that makes the military subordinate do what is wanted of him. Clearly, in a military environment, things have to be done, but leadership is not just getting things done, but getting them done in the way in which the leader wants them done, in all conditions, and with the consent of the team, however grudging that consent may be. Some, if not many, military leaders do not lead effectively. They hold a title and they are figureheads at the head of the pack. However, their leadership is a facade and there is little of substance behind the mask of authority defined by the badge of rank. Clothes of authority, however, cannot in themselves generate either ability or effectiveness as a leader. Clearly also, the abilities and effectiveness of any leader are only as strong as are perceived by those who are led. Paper presented at the RTO HFM Workshop on "Officer Selection", held in Monterey, USA, 9-11 November 1999, and published in RTO MP-55.

5.2 Most military organizations have a highly-structured bureaucracy. bureaucracies are often able to develop and promote the 'Empty Suits', an appropriate euphemism which describes individuals who dress and present well, who are able to identify the right, vital progressive routes for themselves, but who have very limited raw and genuine skills of leadership, save for one essential facet, that of not putting their feet wrong. Such individuals are, in essence, light-weight 'polystyrenes', they merely fill a place. However, they remain clean-coated and trouble free, and thus they progress, whilst those with more genuine substance depart, often out of frustration.

5.3 Unfortunately, polystyrene cannot "rock a boat", it cannot step out of line, it cannot stimulate change, it does not take risks and, certainly, it cannot inspire. In times of peace, the 'polystyrene' empty suits remain the guardians of the status quo, the keepers of the book of rules and the stiflers of energy and initiative. Their reliability is without question, but so is their predictability. Simply, their leadership is mundane. Unfortunately, in peacetime, these A real leader must be an agent for change, an inspirer and developer who is able to show the way forward, integrate people and ideas and be prepared to instigate rapidly the most effective option. Particularly, in times of tension or war, an effective leader will have to be able to bring both colleagues and subordinates along in a way that is at once identified as pragmatic, meaningful and militarily cost-effective. Military and naval history is full of effective leaders such as Washington, Wellington, Nelson, Bonaparte, Montgomery and Rommel who rose to the top, not by preferment or substantial support from acolytes, but simply because of their abilities, both strategic and personal, which enabled them to inspire their men and, most importantly, achieve military success. In past conflicts, battles and wars were usually lengthy. Incompetent or irrelevant leaders could be, and usually were, identified, replaced and sometimes they were even shot! Inspirational leaders could develop their forte and earn recognition by success. However., most recent, international wars have lasted for just a few weeks, and future wars can be expected to follow this trend. NATO planners are well aware that they will have to fight with the men and materiel that they have to hand and in stock. Perhaps even more significantly though, battles will have to be directed and fought by the leaders already appointed and in place. The 'polystyrene', empty-suit commander would be found wanting and no doubt would be identified in the aftermath during the soul-searching of 'Lessons Learned' - but at what cost? It almost goes without saving that, in war, a leader should not have to compromise. In war, it is unlikely that a real leader would accept compromise. Yet the 'Empty Suit', whose life and career had developed out of frequent compromise and assent, would probably find the transition to the warrior's outlook in times of conflict an impossible hurdle. Leaders and Managers The differentiation between a good leader and an effective manager is, to many, nebulous. Simply however, managers are usually measured by their performance within set, pre-determined parameters. Leaders should be judged by higher requirements, often not pre-set and, especially in times of conflict, usually surprising. That said, it is difficult to imagine that an effective manager would not have some skills of leadership within his persona. Similarly, it would be surprising to find an effective leader who was bereft of management skills. However, the fundamental, singular difference between Management and Leadership is that Leadership particularly is about effective change-making and the single-minded application and enforcement of that change, however unpalatable the change may be. Military leaders, overall, must have a breadth of long-term vision, be decisive and independent, act and stand firm, be a

warrior, speak openly, plainly and frankly, learn quickly from defeats and mistakes, go forward with unswerving fortitude, and know and appreciate the requirements and interests of subordinates. The qualities and skills of a leader are unlikely to be totally intrinsic and they would have to be developed over many years and with muck appropriate experience. Yet, to a great extent, there would have to be an innate and solid foundation, coupled also with flair and charisma. Sometimes the qualities of leadership would be natural, but mostly they would metamorphose by effective, early nurturing and constant, later development. Conversely, management skills can be taught more easily and they can also be learned. That said, management is not necessarily a routine process. Management problems vary considerably and a pre-set formula for effective management would rarely work. However, management can be effective without flair or charisma; genuine leadership, particularly at higher levels, cannot. De facto, leadership has to be flexible and imaginative with positive and often urgent, effective reaction to the unexpected.

5.3 In **summary**, Leadership requires extraordinary attributes above and beyond those of management and the simple, efficient organization of the status quo. However, that is not to suggest or infer that management is easy and leadership is necessarily difficult. The required capabilities, however, are different and can be summed up by the following list: The Leader The Manager Inspires Thinks Motivates Initiates change Challenges Creates Probates Shapes actions Dictates Takes decisions Sets objectives Sets the pace Driving force Unmethodical Front of camera Inspires loyalty Apart from others Self sufficient Controls Does Organizes Adjusts to change Accepts current practice Administers Reacts Responds to circumstances Follows through Implements decisions Gets results Concentrates on procedure Coordinator Methodical Back stage Motivated by discipline Involved with others Depends on organization The Assessment of Leadership Qualities for Selection Over the years, every military organization concerned with leadership training and development has developed its own list of 'Leadership Qualities'. The following lists are just 4 examples from many: These lists were obtained some 5-6 years ago. It is possible that the lists have changed since and so, the sources have not been attributed. They are useful, however, in highlighting the differences of emphasis between differing armed forces and nations. A B 1. Bearing 2. Courage (Physical and Moral) 3. Decisiveness 4. Endurance 5. Initiative 6. Integrity 7. Judgment 8. Justice 9. Loyalty 10. Tact 11. Unselfishness 1. Confidence 2. Determination 3. Initiative 4. Awareness 5. Effective Intelligence 6. Decisiveness 7. Manner 8. Self-analysis C D 1. Loyalty 2. Professional Competence 3. Courage 4. Honesty 5. Common Sense 6. Good Judgment 7. Confidence 8. Initiative 9. Tact 1. Integrity 2. Knowledge 3. Courage 4. Decisiveness 5. Dependability 6. Initiative 7. Tact 8. Justice 9. Enthusiasm 10. Self Control 11. Humour 12. Personal Example 13. Energy 14. Enthusiasm 15. Perseverance 16. Decisiveness 17. Justice 10. Bearing 11. Endurance 12. Unselfishness 13. Loyalty 14. Judgment None of the lists are complete, yet none of the lists are inadequate. Opinions obviously vary as to qualities needed by a military leader and the particular emphasis placed on them. Clearly, the 'great' leader would have most of the qualities in substantial strength, perhaps out of an amalgam from these lists. However, most leaders will be short of some of them. It can be seen that some qualities are common to nearly all lists, and they are the fundamental requirements for the military leader, to a certain extent regardless of rank. Significantly, you will note that none of the lists include flair, although initiative, perhaps in this case meaning the same, is in all of them. Similarly, none of the lists include charisma, which is sometimes difficult to define, but an easily identifiable quality seen in so many great leaders. Confidence, a vital quality in a leader, is omitted from some of the lists. Not that this is necessarily surprising or significant however, because it would be easy to argue that any leader with a substantial number of the qualities within any of the lists would, inherently, possess appropriate self-confidence. Confidence, however, has to be a vital quality and one promoted more by the leader than by anybody else. If the leader is certain of his own ability to lead, and this facet can certainly be developed and strengthened by training, and confirmed by experience, then the leader will also be able to generate confidence within the team, which also is so vital to success. In recognizing and accepting that no list of leadership qualities is likely to be complete, lists could probably be reduced without losing too much in the way of positive effect. commander in World War 2. listed the qualities he regarded as essential in a leader in the simple, following terms: Field Marshal Lord Harding, a British Absolute Fitness Complete Integrity Enduring Courage Daring Initiative Undaunted Willpower Knowledge Judgment Team Spirit Are all Officers Leaders? It would be an understandable misconception if all military officers were expected and required to be genuine leaders. Whilst true leadership, for some officers, is a paramount pre-requisite, in other officers, raw leadership skills are much less important. As the roles of the officer vary enormously, so does the preferred list of qualities required by the individual. However, the closer the officer is to the battle, with the consequent, greater risk to life, then the more dynamic and decisive the leader will need to be. Even in times of war, the rear echelons and the support staff, because of their comparatively, risk-free existence, will not usually need quite the abundance of raw qualities required by the warrior under fire. It follows therefore that, when identifying officer potential during the selection process, due regard should be given to the individual's planned future employment as an officer. For instance, the quality requirements for the potential platoon commander, fighter pilot or submariner will certainly be different to those pre-requisite qualities for the engineer or logistician. Officer Selection Whilst the differing roles of an officer will usually require a different emphasis on particular qualities most, if not all, NATO officer selection systems can aim to identify generic potential only. Later, professional training will then identify and develop the specific qualities to type. The word potential is significant. A selection system, by its very nature, has to have a programme which, at best, runs for just a few days.



LEADERS MANAGERS AND DOERS HEIRARCHY

VI. THE ASSESSMENT OF LEADERSHIP QUALITIES FOR SELECTION

Over the years, every military organization concerned with leadership training and development has developed its own list of 'Leadership Qualities'. The following lists are just 5 examples from many:

6.1 Indian Army
Factor – I
(a) Effective Inteeligence
(b) Reasoning Ability
(c) Organising Ability
(d) Power of Expression
Factor – II Social Adjustment
(e) Social Adaptability
(f) Co-operation
(g) Sense of Responsibility
Factor – III Social Effectiveness
(h) Initiative
(i) Self Confidence
(j) Speed of Decision
(k) Ability to Influence the Group
(l) Liveliness
Factor – IV Dynamic
(m) Determination
(n) Courage
(o) Stamina

6.2 US ARMY
(a) Bearing
(b) Courage (Physical and Moral)
(c) Decisiveness
(d) Endurance
(e) Initiative
(f) Integrity
(g) Judgement
(h) Justice
(i) Loyalty
(j) Tact
(k) Unselfishness

6.3 ROYAL AIR FORCE COLLEGE
(a) Confidence
(b) Determination
(c) Initiative
(d) Awareness
(e) Effective Intelligence
(f) Decisiveness
(g) Manner
(h) Self-analysis

6.4 CANADIAN ARMED FORCES

(a) Professional Competence
(b) Courage
(c) Loyalty
(d) Honesty
(e) Common Sense
(f) Good Judgement
(g) Confidence
(h) Initiative
(i) Tact
(j) Self Control
(k) Humour
(l) Personal Example
(m) Energy
(n) Enthusiasm
(o) Perseverance
(p) Decisiveness
(q) .Justice

6.5 US MARINE CORPS

(a) Integrity
(b) Knowledge
(c) Courage
(d) Decisiveness
(e) Dependability
(f) Initiative

(g) Tact
(h) Justice
(i) Enthusiasm
(k) Bearing
(l) Endurance
(m) Unselfishness
(n) Loyalty
(o) Judgment

None of the lists are complete, yet none of the lists are inadequate. Opinions vary as to qualities needed by a military leader and the particular emphasis placed on them. Clearly, the 'great' leader would have most of the qualities in substantial strength, perhaps out of an amalgam from the lists above. However, most leaders will be short of some of them. It can be seen that some qualities are common to nearly all lists, and they are the fundamental requirements for the military leader, to a certain extent regardless of rank. Significantly, none of the lists include flair, although initiative, perhaps in this case meaning the same, is in all of them. Similarly, none of the lists include charisma, sometimes difficult to define, but an easily identifiable quality seen in so many great leaders. Confidence, a vital quality in a leader, is omitted from some of the lists. Not that this is necessarily significant however, because it would be easy to argue that any leader with a substantial number of the qualities within any of the lists would, inherently, possess appropriate self-confidence. Confidence, however, has to be a vital quality and one promoted more by the leader than by anybody else. If he is certain of his own ability to lead, and this facet can certainly can be developed and strengthened by training and confirmed by experience, then the leader will also be able to generate confidence within the team, which is so vital to success.

In recognizing and accepting that no list of leadership qualities is likely to be complete, lists could probably be reduced without losing too much in the way of positive effect. Field Marshal Lord Harding, a British commander in World War 2, listed the qualities he regarded as essential in a leader in the simple, following terms:
(a) Absolute Fitness
(b) Complete Integrity
(c) Enduring Courage
(d) Daring Initiative
(e) Undaunted Willpower
(f) Knowledge
(g) Judgment
(h) Team Spirit

9. In general, leadership qualities can be structured into 3 main areas: 'approach to people', 'approach to task', and 'individual orientation'. The figure below highlights this model of officers leadership structure. Each circle represents an important aspect of military officers' roles and some of the PQs that are relevant to each of those aspects. Of course, many of the PQs can be related to more than one area; this model is just a guide. It would be an understandable misconception if all military officers were expected and required to be genuine leaders. Whilst true leadership, for some officers, is a paramount pre-requisite, in other officers,raw leadership skills are much less important. As the roles of the officer vary enormously, so does the preferred list of qualities required by the individual. However, the closer the officer is to the battle, with the consequent, greater risk to life, then the more dynamic and decisive the leader will need to be. Even in times of war, the rear echelons and the support staff, because of their comparatively, risk-free existence, will not usually need quite the abundance of raw qualities required by the warrior under fire. It follows therefore that, when identifying officer potential during the selection process, due regard should be given to the individual's planned future employment as an officer. The quality requirements for instance for the potential platoon commander, fighter pilot or submariner will probably be different to those pre-requisite qualities for the engineer or logistician.Whilst the differing roles of an officer will usually require a different emphasis on qualities most, if not all NATO officer selection systems can aim to identify generic potential only. Later, professional training will then identify and develop the specific qualities to type. The word potential is significant. A selection system, by its very nature, has to have a programme which, at best, runs for just a few days. Whilst some true qualities in a candidate may possibly emerge and be identified during the selection process, an effective assessment system has to be geared to look more for potential in a candidate than inherent attributes.

VII. Officer qualities for the generic candidate

No selection process can ensure a substantial, guaranteed end-product. The period of examination will invariably be short and it will sometimes provide only a snapshot of the candidate's potential. However, past history, and the candidate's record of development, will also be a very useful initial guide. Aptitude testing can give notice of the candidate's suitability for an aptitude-dependant branch and then further assessment, by interview and additional exercises, will help to ascertain the candidate's overall profile. At interview, close examination should reveal the following qualities and traits:

a. **Appearance and Bearing**. The candidate's appearance, bearing, grooming, distinguishing features and general presentation should be readily apparent within the first impressions formed at interview.

b. **Manner and Impact**. The candidate's conduct throughout the interview, along with his courtesy, tact, confidence, force of personality, presence, poise, polish, humour and alertness will add to the overall impact.

c. **Speech and Powers of Expression**. Dialogue with the candidate will elicit his ability to communicate. The quality of grammar, vocabulary, diction, general fluency, logic, projection and animation will all indicate the overall effectiveness of expression.

d. **Activities and Interests**. The well-rounded candidate should have had a varied, interesting and fulfilling lifestyle. Whilst it is important to bear in mind the individual's background (that is, general opportunities and financial limitations) the range and extent of spare-time activities are important to indicate signs of commitment, depth of involvement, achievement, level of responsibility, spirit of adventure, determination, initiative,

enterprise and self-reliance within an overall balance of interests and pursuits.

e. **Academic Level and Potential**. Whilst minimum levels of academic qualifications will be set, the manner and east of obtaining qualifications, together with the level of commitment, diligence and attitude towards study will all give indications of the individual's further academic potential.

f**. Breadth and Depth of Outlook**. The candidate's general awareness of military matters and current affairs should confirm a maturity of outlook and a general ability to reason, giving also some indications of general intellect.

g. **Motivation**. The candidate's determination towards his military goals should be ascertained. Sometimes the motivation will have previous substantiation. It will be important to ascertain that the candidate is clear about, and would relish, the commitment and dedication demanded of the officer corps.

These qualities are said to be carrying equal weight age in selection and are spelt out to be equal in Indian context. This is not true. With experience in Armed Forces, it is a well known fact that courage, co-operation and Sense of Responsibility coupled with Reasoning Ability and Social Adjustment are the most important factors in a war, hence, must carry more weight age than the other qualities. **War diaries of units are testimony to these issues.**

VIII. Organization

In setting up an officer selection system one has to deal with a number practical issues. This section will review and comment on a number of them.

12.1. **Qualifications of personnel involved.**

A professional selection system requires professional personnel. This is quite obvious yet not always realized. In particular, there is the issue of who is conducting the selection interviews. Should psychologists be used, providing that they have sufficient knowledge of the jobs they assess for, or should we use officers who would be trained as interviewers? This debate should conclude in favour of the psychologist. The only argument in favour of the officers is that of their experience in the military. The question is then how relevant that experience is. In most cases, it will be limited to a more or less specific trade and bears the risk of being completely obsolete. In such conditions, the military experience could prove to be rather counter-productive. On the other hand, it is quite obvious that a psychologist is much better trained to detect indicators of possible personality and motivational problem areas. Of course, a better solution, but an expensive one, is to **have both psychologists and officers conduct an interview** and then integrate their findings. This is **presently being practiced in India** and will not be commented upon further.

12..2. **One tiered or multiple tiered selection process**?

If the Forces are lucky enough to have a much larger number of applicants than is needed, the question arises of how to reduce that number in an appropriate way to prevent the selection centres being either unnecessarily large or unable to cope with their workload. Another reason to reduce that number is that it is unethical to impose a long and intense selection program on applicants for whom it is quite obvious from the beginning that their probability of enlistment is minimal. A typical approach to counter this consists of including cheaper screening instruments such as psychometric tests in the beginning of the selection program. A cut-off score can then be set to reduce the number of applicants that would be allowed to continue the selection process. Measurement of general intelligence is usually the number one favorite to play this role. A word of caution is necessary however. The cut-off score should be set in such a way that enough applicants are allowed to continue. One should anticipate the proportion of applicants that will be rejected at each stage of selection, leaving sufficient applicants to allow a sound choice in the end. **The screening process in India needs modification since it has not been found to be reliable, valid and practical**. The reasons have been projected in the form of indicators.

12..3**. Sequential or batch classification**.

In general, when designing a selection system, it is necessary to choose between sequential or batch classification. Sequential classification means that the final decision on the acceptance and the assignment of an applicant is made immediately after the completion of the last selection test, generally while the applicant is still on the premises of the selection facility. Batch classification refers to the system where all applicants undergo the selection programme and only when all data are available from all applicants are the final decisions made. In the case of officer selection, one has to recognize the fact that, in most countries, officer induction is only organized once or twice a year. In such circumstances, it would be rather unwise to use sequential classification because it is known that the overall quality of the accepted applicants is better when all could be compared during the decision making process.

12.4. **The tri-service issue**.

Most countries have different Services for which they recruit officers. In some countries, such as India and the United States, recruiting for the different Services is organized by the Services in a rather independent way. The candidates apply to become an officer in a particular Service. In other countries, the applicants just apply to become officers and give their preferences regarding the Services they want to join. This is what is called the ‘tri-service’ approach, referring to the classical three Services; army, navy and air force. Both approaches have advantages and drawbacks. The advantage of what we will call the US system is that the selection system can be better tailored to the needs of the different Services. On the other hand, an applicant who fails when applying for one Service will have to start from scratch if s/he wants to apply for another Service. The tri-service approach on the other hand recognizes the fact that the selection criteria for the officers for the different Services are quite similar and that, among the applicants, many want to become officers but don’t care too much in what Service they will serve. By having them taking the same selection procedure, selection data is collected that can be weighted differently for the individual Services and the system can capitalize on the whole applicant population to find the best overall solution for the Forces. In general, one should apply following rule: if there is a

significant overlap in the applicant populations for the different Services, it might be more efficient to move to a tri-service approach.

12.5. **The order of the different parts in the selection process.**

As the selection process includes several selection tools, the sequence in which they have to be administered must be considered. This is especially true when some tools lead to rejection of applicants who don't meet certain standards. Two rules of thumb apply. The first says that the most selective selection tools have to be put first. These are the tools that reject the largest proportion of the applicants who are examined with the tool. The second rule says that the cheapest selection tools should be first. The system designer will have to balance these rules to organize the selection program. There might however be some additional considerations that have to be taken into account. Imagine for instance that the selection program includes brain mapping or a full spine radiography and that this is a very selective part of the process. It would be clearly advisable to set the radiography at the end of the process because of the radiation risks. Brain mapping being a slow and expensive process may not be a practical solution. The selection system officers/manager might also be tempted to have different selection sequences for different applicants. This would allow him to use 'parallel-processing' of applicants. For instance, when applicants arrive in the morning at the selection centre, half of the group could be sent to the medical assessment while the other half take computerized tests. After a certain time, they would switch activities. This increases the efficiency of the selection centre but is acceptable only if the sequence in which the applicants are examined with the selection tools does not influence the measurements. Imagine for instance that some applicants take physical fitness tests before lunch while others take them just after lunch. It is likely that the group performing after lunch will have lower results. As this is not necessarily due to lower aptitude, this is not acceptable. Moreover, the organizational limitations may not permit this set up.

12.6**. Selection in one or more locations**?

The easiest and soundest solution for officer selection is the centralized one: all applicants are processed in the same facility. Yet there are reasons why one could consider the decentralized alternative. Among these, the obvious one is that it can be difficult and expensive to bring the applicants to a centralized selection center. Reasons not to decentralize include cost and manning related aspects and methodological concerns .Methodologically, standardization is at stake. How could it be possible to guarantee that the applicants are treated in the same way in different locations? Some aspects are relatively easy to solve. Computer testing for instance can be quite similar in one place or another. It would be harder however to standardize medical assessment, interviews or group observation tasks. In general, the difficulty in standardizing the selection tools is directly related to the proportion of interpretation and subjectivity involved in the tool. Although the instructions will be identical for the different locations, it is likely that the assessment practice will evolve independently in the different settings. It is therefore important both to monitor the score distributions from the different locations and also to implement systems to reduce the possible lack of standardization. These can include:

(a) Centralized training of the assessors;

(b) Supervising personnel traveling from one location to the other to insure the consistent use of the selection tools in the different locations;

(c) Frequent rotation or exchanges among the assessors of the locations.

In making up his/her mind and decide about the centralization issue, the officer selection system officer/manager should balance different things:The additional costs due to the organization of decentralized selection (infrastructure, additional personnel, functioning costs);The inevitable loss of standardization and the costs involved with trying to minimize the loss;The benefits for the applicants and related to that, the effect on their application behavior;The savings from reduced reimbursement of travel or lodging costs.

12.7. **The image of the Military for applicants that are not selected**.

In the situation where many applicants are not accepted for enlistment, the selection system manager should be aware of the role that the selection system has in conveying a positive image of the Military to the civilians. In countries where there is no compulsory military service, many civilians have only very few direct contacts with the Military. Of course, all applicants have a certain opinion about the Military, usually a positive one – otherwise they wouldn't apply – but frequently only based upon the image projected by the media or the opinions in their immediate surroundings. It is important for the corporate image – and later recruitments – that even the applicants who are not selected return home with the feeling of a positive experience. This is best achieved through the use of modern infrastructure and equipment, efficient processing, professional assessment quality, openness and communication and client-friendliness.

12.8. **The role of the applicant in the selection process**.

A good officer selection system should consider the applicants as partners in the process of finding the most appropriate person for the vacancies. This is a different philosophy to the one that once prevailed in which the applicants were more treated like cattle that had to be led through an anonymous and cold selection machine. Considering the applicants as partners will be accomplished by a series of actions and attitudes such as:

(a) Consider the applicants as adults and treat them accordingly;

(b) Call upon their sense of responsibility and make them responsible for as much as possible;

(c) Provide enough information about the organization of the selection process and the decision making;

(d) Give the applicant feedback on how s/he performs on the different tasks in terms that s/he understands;

(e) Explain the applicant's options at all stages of the selection process;

(f) Respect the applicant's choices;

(g) Respect the confidentiality of the selection data;

(h) Offer the possibility of an in depth debriefing for applicants who fail;

12.9. **Traveling, meals and lodging expenses**.

The officer selection system officer/manager is very well aware of what it takes the Forces to organize the selection. S/he also should be aware of the costs to the applicants. In comprehensive officer selection systems, it is not unusual to require several days for selection. Moreover, it is often necessary to travel long distances to attend the selection center. One should also be aware of the growing tendency that many applicants consider becoming officer as just one of several career options. It is indeed increasingly frequent to see officer applicants applying for other jobs or universities simultaneously. This increases their overall 'selection-load' (as well as their selection training!). In such circumstances, applicant resource limitations can interfere with the officer selection process. If applying for officer selection these factors might be considered as overriding and therefore the potential candidate might not even apply. Whilst this might not be an issue when there are a sufficient number of applicants it is certainly a point when propensity to apply is low. What can the system manager do to reduce the burden imposed on the applicants? Here are a few tips:-

(a) If possible, reimburse travel costs;

(b) Alternatively, organize as much selection activity as possible close to where the applicants live (decentralization of the activities);

(c) If the selection procedure lasts for more than one day, plan the activities on successive days and provide free lodging (in military buildings or in nearby hotels);

(d) Use the applicant's time efficiently. It can be acceptable to have an officer selection program lasting several days but not if during these days, the applicant's main activity is waiting;

Reject applicants early if it is clear that s/he will not be accepted in the end. Put the most selective selection tools in the beginning; If possible, don't oblige the applicant to produce documents for which s/he has to pay or that take time to get. **In India, an AC III tier travel is reimbursed for first time attempters only**.

12.10. **Allow enough resources for Research and Development**

Selection systems require a lot of resources; infrastructure, highly specialized personnel, sophisticated equipment and functioning budgets. In periods of budget restriction and downsizing, managers are frequently under pressure to reduce costs. Managers who lack vision could probably be tempted to cut costs in the research and development (R&D) area which is often seen as of no immediate contribution to the day-to-day life of the selection business. However, this would be an unforgivable error. The reason is simple and well illustrated by selection systems that have lacked sufficient R&D capability in the past. The R&D personnel dealing with selection systems are there to insure the development or acquisition of new selection tools and to maintain the quality of existing tools. Their actions encompass the monitoring of the individual tools (score distribution, internal consistency, reliability, validity, bias, norms, utility, etc), the quality assessment of the overall selection system (set of tools in the system, decision making process, classification, system validity and utility) and the introduction of new tools when appropriate. Officer selection systems that discarded R&D are often using old selection tools for which very little current knowledge is available along with obsolete decision-making processes. For the system manager, that means that s/he allows the use of resources to perform the selection activities without knowing whether they are useful or could sustain scrutiny. That looks very much like poor management practice indeed.

13. **Issues on how to make the right decisions**

Once information is gathered from the applicants, decisions have to be made whether or not the applicant will be accepted for enlistment and, if so, for what specialty. In making these decisions, two types of selection errors can occur. We can accept applicants who will not become successful performers or we can reject applicants who would. Strategies exist to set acceptance standards based upon the quantified effects of both types of errors. It is still a widespread practice that some decisions are taken before the normal completion of the selection process. These decisions usually reject applicants who fail to meet certain cut-off scores and accordingly prevent them proceeding with the subsequent parts of the selection process. This leads to three comments concerning the use of cut-off scores. The first is related to the justification of such cut-off scores or any decision in rejecting an applicant, that is only based upon a single source of information or measurement result. The question to be addressed is: "are you absolutely sure that this applicant cannot turn out to be proficient in any of the vacant positions?" Second, having the standard error of measurement in mind, and knowing that relationships between selection instruments and performance ratings are essentially probabilistic, one realizes that the choice of a cut-off score can be extremely hard and should be done with extreme caution. Third, one must be aware of the combined effects of multiple cut-offs. That effect is cumulative and this affects both the number and the quality of the applicants that are still in the running at the end of the selection process. Multiple cut-off scores guarantee that an applicant meets a series of minimal requirements but nothing more. Too many cut-offs are in favor of applicants with 'flat' competency profiles and are a risk for applicants with a much higher average competence but having a problem in a specific area.

Setting a cut-off score that eliminates a large proportion of the applicants checkmates the usefulness of the other selection-tools and distorts dramatically the intended result. The person in charge of the overall selection process must pay great attention to this. In many cases, officer selection systems feature different elements such as psychometric tests, medical exams, physical tests and academic exams that are organized in a rather independent way and for which cut-off scores are proposed by different groups of specialists. Mainly, there is a tendency to over-emphasize the importance of one's own field and therefore suggesting very severe cut-offs. It is then the responsibility of the person in charge of the overall system to assess the appropriateness of the different cut-off scores. This is not easy because of the disparity of the fields involved and the susceptibility of many specialists. Statistics can help a lot in making sound decisions.

Besides rejection of applicants through the use of cut-off scores, which from a methodological point of view really should be limited to a minimum, we have to make more complex decisions. To make these, it is useful to work with holistic competency-profiles. In order to make the appropriate decisions, it will be necessary to quantify the desirability or usefulness of accepting an applicant for a vacant position. That quantification will be referred to as the payoff-value. The computing of payoff values for each applicant-job combination is not an easy task. The major difficulties arise from the differences in scales used for the measurements during the selection process (nominal, ordinal, interval), the differences in measurement quality of the selection tools (reliability and validity), the difficulty in establishing the relative importance of data originating from disparate fields and the integration of applicant preferences.

Once payoff values are computed on comparable scales for all applicant-job combinations, it becomes possible to make the appropriate final decisions. In simple situations, where all vacant jobs are the same, a one-dimensional ranking of the applicants is sufficient to identify the applicants who will be accepted. From the moment where different kinds of jobs are vacant, the method of simple ranking is no longer the best solution. For instance, this is the case when a single ranking is done and where applicants can choose between the different jobs according to their ranking. This yields clearly sub-optimal results. More sophisticated classification methods are then required. These are available13 and make it possible to maximize the payoffs for the group of selected candidates.

Although models exist for that kind of complex decision-making, the use of selection boards is still widespread in officer selection. Without going into details here, it should be said that selection boards can be valuable in their role of assessing certain applicant qualities, but their use should be avoided in decision making processes involving much data and many persons within the selection process.

In India, candidates are selected based on a table of selection which has gives skewed values when applied to a candidate's main scores and conference scores. The percentage of marks allotted by the same assessor to the same candidate during the conference is manifold than the percentage of marks scored by the candidate when he has been given marks by individual assessors earlier. This anomaly needs to be set right.

IX. Quality assessment of a selection system

The quality of any officer selection system needs to be assessed. There are two good reasons for this. Firstly, one needs to know, rather than believe or hope, that the right applicants are selected and assigned to jobs for which they are best suited. This is of paramount importance to the military commanders since the quality of the officer corps is vital for the conduct of military operations which can have dramatic consequences both for the military and their country as illustrated in Norman Dixon's book On the Psychology of Military Incompetence. Failure to conduct a good professional selection for officers is an unforgivable error. The second reason for the continuous evaluation of the quality of a selection system, is the increasing demand to justify selection decisions made concerning individual applicants or specific groups. In the end, such justification cannot be sustained unless there is verifiable evidence of the predictive validity of the selection system.

One critical decision concerning the quality assessment is the choice of external criteria defining who is a 'good officer' and who is performing less well. In many cases, the choice will be a trade-off between relevance, timeliness and measurement quality. Training results for instance, have the advantage of being pretty well standardized and available shortly after the selection. This ensures that feedback loops are kept short but they are usually of very little relevance because they often over-emphasize academic skills. Since the choice of the external criteria will in the end determine what kind of applicants will be accepted, it is normal that the choice of these criteria should be made by the overall personnel policy makers. It is obvious, but not always that evident, that the chosen criteria should be quantified as a sound measurement and that such data needs to be made available to the persons in charge of the selection system quality assessment.

A system should not rely on a single external criterion since none is perfect but rather it ought to consider a series of quality indicators. These should include both quality indicators independent of officer performance assessments and a representative set of indicators of the performance of the officers. Whatever the result of the quality assessment, one should always consider ways to improve the selection system. This needs to be done by trying alternatives for the different selection tools and for the use of those tools in the decision making process. In doing so, one has always to remember not to use a new tool in the decision making process before its quality has been proven.

X. The fairness of the selection process

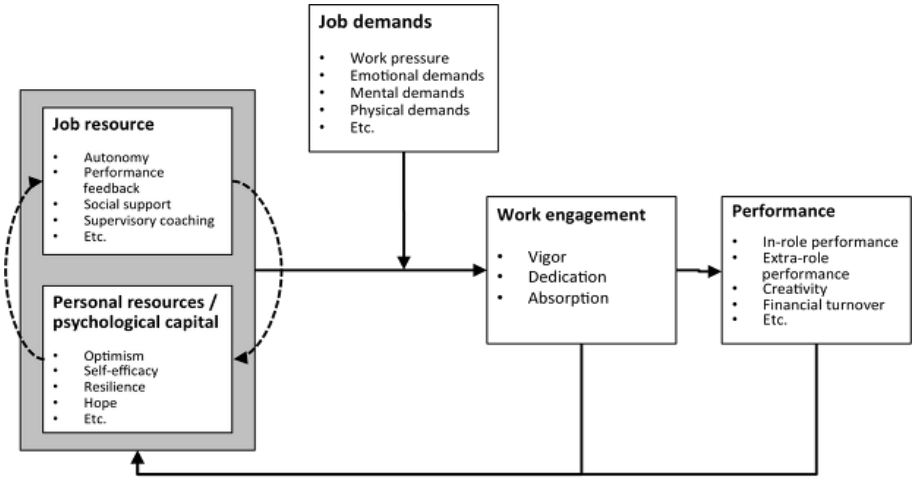
A recent concern related to selection in general is that of fairness for the applicants. This is especially relevant for officer selection, since the government organizes selection and the relevance of the officer corps for the general population is often questioned. Special interest is devoted to the adverse impact of elements in the selection process for females and ethnic minorities. In this area, two different situations need to be identified,one in which different groups have the same level of abilities bur different scores due to biased measurement tools and the second in which different groups indeed have different levels of ability.

The first deals with the situation in which different groups are known, or at least supposed to have similar aptitudes or characteristics but different measurement scores, because of inadequate measurement-tool design. In such situations, better measurement tools should be designed. As a short-term solution, one could at least take group differences into account when estimating individual performance. A totally different situation occurs when different groups are known to have dissimilar aptitudes or characteristics. For instance, if the height of an individual is considered, it will be noted that the male population is, on average, taller. This is not due to inadequate measurement

tools. The scientific approach to such a situation is to start from the occupational analysis (assuming this analysis was not biased!) and select For example the Belgian Armed Forces Psychometric Model

The best fitting person independently of gender or minority membership. Another approach that often prevails against the scientific one is based on ethical, philosophical, societal or political grounds. That approach states that females, or persons belonging to certain minorities, must have fair chances of being selected The possibility of lower scores. Such policies can lead to a specific quota for females or minority members. Although such an intention would be praiseworthy, one should realize that this is realized at the expense of optimal selection and classification. An attempt to avoid quotas without having adverse impact would be to focus on competency profiles and incorporate in them the aptitudes for which females or minority members are known to perform equally or better (such as physical agility versus strength, sustained attention, etc).

JOB DEMANDS RESOURCES MODEL OF WORK ENGAGEMENT



JD-R Model of Work Engagement (Bakker & Leiter, 2010, p. 187)

XI. Cost & benefit concerns

Some will look at an officer selection system from a purely cost and benefits point of view. This makes some sense. Cost and benefits issues are important. Selection and classification decisions are based upon a limited set of observations and measures. It therefore can be argued that a better assessment can be done during training. Naturally, this is provided that all applicants would be allowed to start the training. In situations where the selection ratio is close to one, this might be considered: there would no selection, and all applicants would start the training and suitability would be assessed during training. This is the situation that occurs in Austria where compulsory military service exists and where officer candidates are assessed while performing their training as draftees. This system is worthy of comment. First, imagine what would happen if there is no medical screening and, for instance, there are medical problems during the physical training such as back-injuries or cardio-vascular accidents. What would be the consequences for the applicant and for the Forces? Can the Forces be sued? If that is the case, this throws a new light to the cost-benefits topic. Second, there are social aspects that need to be considered. While it is acceptable to ask an applicant to spend a few hours to a couple of days for the officer selection process, it would be hard to require them to spend weeks or even months and maybe even quit another job before being sure that they are accepted.

In the more frequently occurring situation in which the number of vacancies is set in advance and the number of applicants is significantly larger, the cost-benefits discussion needs to be addressed. The zero-costs approach would consist of accepting the first candidates who apply until all positions are filled or, alternatively, randomly select the required number from amongst the applicants. Clearly these solutions would yield very poor results. Beyond the zero-costs approach, selection tools will be added to the procedure. The addition of each tool implies costs, additional burden on the applicants and the increased loss of applicants if the tool leads to rejection. On the benefit side, good selection tools reduce the risks of diverse problems after enlistment.

How far should one go then with adding selection tools? Let us consider an example in the medical selection area and use two well-known movies to illustrate the point. The first is ‘Schindler’s List’. There is a scene in which one can see the ‘medical selection’ of hundreds of persons in a prisoner camp in Poland. They have to undress and are quickly screened by a

person in the white outfit of a doctor. The 'doctor' decides, in a matter of seconds, whether the person is fit for labor or not. This selection is probably much better than random selection; it is very cheap but obviously not very accurate. The other extreme is shown in the movie 'The Right Stuff'. A good portion of that movie is devoted to the medical selection of the first astronauts. This selection is very sophisticated, expensive and time consuming and puts a lot of strain on the applicants. The result is that the selected astronauts are 'guaranteed' to be very healthy. When we consider officer selection, we will probably want a medical selection somewhere in between the two extremes. It is important to realize that there is an optimum balance between very unsophisticated, cheap and quick selection procedures and the highly sophisticated, expensive and time-consuming one. Moving from the cheap end to the expensive one is not linear however. For instance, a nurse who asks the applicant to read characters on a wall-chart and performs a simple color perception test can do the assessment of the visual perception. Alternatively, an ophthalmologist can perform the same assessment using a set of sophisticated tools. Here, it is quite doubtful whether the increase of assessment quality would compensate for the tremendous increase in costs when using the specialist in considering the overall purpose of officer selection. Also, the increase of selection accuracy yield by the addition of a selection tool is dependent on the other tools already present in the procedure. In technical terms, we speak of the incremental validity of a selection tool, or of the usefulness of a selection tool. As put by **Blum and Naylor**, "The utility of a selection device is the degree to which its use improves the quality of the individuals selected beyond what would have occurred had that device not been used.". Note that we took an example in the medical selection area, but the same phenomena occur in all fields of selection.

If an acceptable external criterion exists, and the statistical relations between the selection data and that criterion are known, it becomes possible to use statistical techniques to determine what selection tools are worth while adding to a selection procedure. Regression models allow the construction of a selection battery step-wise for instance, only adding a tool when it increases the multiple correlation with the external criterion.
It is then up to the selection system officer/manager to evaluate whether the increased predictive validity compensates for the additional costs resulting from the use of the extra selection tool.

XII. Conclusions

Given that each officer selection system is deeply embedded in its general legal, societal, political and military context, it is unrealistic to pursue the implementation of a single, universal optimal selection system. Yet, a number of rules and methods are invariably required in order to ensure that a particular officer selection system is sound and appropriate. The respect of these rules and methods can only be guaranteed by professional specialists because of the complexity involved. In one of the first accounts of selection for the military, it was God himself who dictated the selection process. But since He doesn't appear to be involved in this area any more, a whole set of specialists have to do their best to replace Him! These include the personnel needed to assess the different competencies (nurses, medical doctors, psychologists, sports monitors, and teachers) and the personnel involved with setting up and managing the overall system (I/O psychologists, operations research specialists, legal advisers, statisticians, computer specialists and personnel policy makers). The ultimate decisions concerning any selection system have to be made by the personnel policy makers, not by the personnel in charge of selection or training, since any selection system is only a - very powerful - tool placed at the disposal of the Human Resource Managers.

References

[1] Blum, M. L., & Naylor, J. C. (1968). Industrial Psychology, its theoretical and social foundations (Rev. ed.) New York: Harper & Row.

[2] LESCREVE, F. Data integration and classification for an officer selection system. In NATO- RTO Meeting proceedings 55 'Officer Selection', August 2000

[3] Bakker, A.B., & Leiter, M.P. (2010). Where to go from here? Integration and future research on work engagement. Work engagement: A handbook of essential theory and research. New York: Psychology Press.

[4] Harter, J., Schmidt, F., Asplund, J., Killham, E. and Agrawal, S. (2009). "Causal Impact of Employee Work Perceptions on the Bottom Line of Organisations," Perspectives on Psychological Science 5(4): 378-389

[5] Hewitt Associates (2004). Employee engagement at double-digit growth companies, Research Brief.

[6] Kenexa Research Institute. White paper (2009). The Impact of Employee Engagement.

[7] Penna (2007). Meaning at Work Research Report. Available online from http://www.e- penna.com/newsopinion/research.aspx [retrieved on 16 Aug 2014]

[8] Retrieved from website # http www.indianarmy.gov.in

[9] Retrieved from website # http www.lakshyaindia.co.nr

[10] Retrieved from website# http www.ssbcrack.in

[11] Right Management (2006) Measuring True Employee Engagement. Philadelphia: Right Management.

[12] Robert W Thompson, Officer Qualities, ResearchGate, 07/2000.

[13] Schaufeli, W. B., Salanova, M., Gonza´lez-Roma´, V., &Bakker, A. B. (2002). The measurement of engagement and burnout: A two sample confirmatory factor analytic approach. Journal of Happiness Studies, 3, 71–92.

[14] Squadron Leader Robert W Thompson RAF Officer and Aircrew Selection Centre Royal Air Force College Cranwell Seaford, Lincolnshire, Officer Qualities, NG34 8GZ United Kingdom

[15] Towers Perrin (2003), Working today: understanding what drives employee engagement. Towers Perrin.

[16] Towers Watson (2012). Towers Watson 2012 European Talent Survey: Reconnecting with Employees: Attracting, Retaining, and Engaging Your Workforce. Research Report. London, UK

[17] Sarkar(2011).Employee engagement: The Indian Context.Journal of Human Resources

[18] Lewis, C.I., 1929, Mind and the World Order London: Constable.

[19] Lewis, David, 1966, "An Argument for the Identity Theory", Journal of Philosophy 63 17–25.

—, 1988, "Veridical Hallucination and Prosthetic Vision" In Dancy (ed.) 1988.

[20] Lycan, W.G., 1996, Consciousness and Experience Cambridge, Mass.: MIT Press.

—, 1999, Mind and Cognition Second Edition. Oxford: Blackwell.

[21] Martin, M.G.F., 1992, "Sight and Touch" in Crane (ed.) 1992, 196–215.

[22] Thau, Michael, 2002, Consciousness and Cognition Oxford: Oxford University Press.

[23] Valberg, J.J., 1992, The Puzzle of Experience. Oxford: Clarendon Press.

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Screening and Identifying Delhi school going adolescents (12-15 yrs) with Pre Hypertension and hypertension

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***Abstract*- Objective:** To determine the prevalence of pre hypertension and hypertension among school going adolescents and to investigate the association between blood pressure (BP) and different indicators of obesity.

Materials and Methods: Cross sectional study with 877 subjects in age group of 12-15 years were selected from four public schools of Delhi. Based on Body Mass Index, Waist Circumference, Waist to height ratio and family history, subjects were screened. Of the screened subjects' blood pressure was measured. Blood pressure values were compared with reference charts given by Fourth report on the diagnosis, evaluation, and treatment of high blood pressure in children and adolescents (2004) to classify subjects as normal, pre hypertensive or hypertensive.

Results: Prevalence of overweight and obesity among subjects was 14.7% and 16.6% respectively. Subjects with waist circumference greater than 90 percentile were 20.5% and 23.1% of subjects had waist to height ratio greater than 0.5. As per reporting, 12.34% of subjects had first degree familial history diabetes , hypertension or obesity . Thus 33.2% of subjects who were screened. blood pressure measured 69.4% of subjects were normal , 14% had pre hypertension and 16.6 had hypertension(stage 1 or stage 2). Statistically significant positive correlation of Systolic blood pressure was seen with weight (r=0.4; P<0.001), height (r=0.2; P<0.001), fat percentage (r=0.3; P<0.001), WC (r=0.3; P<0.001) and BMI (r=0.3; P<0.001).Diastolic blood pressure was positively correlated with weight (r=0.4; P<0.001), height (r=0.3; P<0.001), fat percentage (r=0.2; P<0.001), WC (r=0.3; P<0.001),BMI (r=0.3; P<0.001)

Conclusion: High prevalence of pre hypertension and hypertension among study subjects indicates the need of proactive preventive measures with focus on diet and physical activity to avoid future hypertensive epidemic and its co-morbidities.

***Index Terms*-** Obesity, BMI, Waist Circumference, Waist to height ratio , Adolescence, Hypertension

I. Introduction

Hypertension is a major health problem across the globe due to its high prevalence and association with increased risk of cardiovascular diseases (CVD) (1). Presence of CVD in an individual poses an impact on the overall growth and economy of a country both in direct and indirect ways. Direct costs include impact on families, healthcare sectors including consultation, investigations, medications, hospitalization, treating complications, transportation and time. Indirect costs include impact on society and government, which are related to productivity costs, work days lost, low productivity, disability payment, social security and depression(2). Various international organisations and researchers have provided ample evidence that hypertension in adults has its origin in childhood (3, 4). However, it goes undetected if not specifically looked for (5). Consequently screening of high risk adolescents and detection of hypertension would allow prophylactic interventions with the aim to decrease morbidity and mortality due to CVD in adulthood.

Although the prevalence of hypertension among adolescents is increasing but it is still not getting attention of public health professionals. There is need for a simple, easy and practical screening procedure that uses a single measurement which can help in determining whether further measurement of BP is needed or not. There is published data which says that obesity (6,7) is closely associated with hypertension. Thus the aim of present study was (i) to estimate the prevalence of pre hypertension and hypertension among screened subjects and (ii) to investigate the association between BP and different obesity indicators among subjects (12-15) of Delhi.

II. Material and Methods

It was a cross sectional school based study on adolescents (aged 12-15 yrs) of Delhi. The study consisted of two components (i) Screening of high risk subjects and (ii) Identification of subjects with hypertension and pre hypertension. Sample size for the study was calculated as 900 considering prevalence 21.5% (8) with level of significance 5%, 3% margin of error and 20% drop out and non response. As per Directorate of Education, in Delhi, public schools are located in 12 zones totalling 1291 public schools (as on August 2012) .Through simple random sampling method , four zones were selected. From these selected zones, four public co-ed schools were selected through purposive sampling. All the selected schools had nearly the same fee structure and infrastructure facilities. From every selected school, six sections from class VIth to IXth were selected through application of computer generated random tables. Students in these six classes were approached. Thus by this way, from every school, 225 adolescents were selected.

Permission of this study was obtained from Lady Irwin College Institutional Ethics Committee and Management of every School. Informed written consent was obtained from one of the child's parents and in addition assent was obtained from the child before conducting the study. Any subject with secondary cause of obesity, using of corticosteroids or subjects with age less than 12 and greater than 15 yrs or subject with any

physical disability were excluded from the study. If the subject fulfilled any of the following criteria (Subject with Body Mass Index (BMI) greater than 85 percentile and /or with Waist Circumference (WC) greater than 90 percentile and /or with Waist to height ratio (WtHr) greater than 0.5 and/or first degree family history of obesity or diabetes or hypertension or heart disease), then subjects was screened for blood pressure measurement.

Data on general information was collected by using pre designed and pre tested questionnaire and anthropometric measurements were taken by using standardised tools and techniques (9). Weight was measured using a digital scale. Daily the scale was calibrated and duplicate readings were taken for maintaining reliability and validity. Each student's weight was recorded to the nearest 0.1 kg. Height was measured using a microtoise and was recorded to the nearest 0.1 cm. For every subject duplicate readings of height were recorded and mean was calculated.

BMI was calculated for all participants, who then were neither classified as overweight, obese, or neither overweight nor obese according to WHO cut off. The WHO system defines overweight as a BMI > 1 SD and obesity as a BMI > 2 SD from the mean of the WHO reference population (10).

For WC, the tape was positioned at the midpoint of the last palpable rib and the top of the hip bone, making sure to wrap the tape over the same spot on the opposite side. Subject was made to stand with their feet together with weight evenly distributed across both feet; the arms were held in a relaxed position at the sides; subjects were asked to breathe normally a few times, and then make a normal expiration. By this way , duplicate reading were measured to the nearest 0.1 cm, making sure to keep the measuring tape snug but not tight enough to cause compression of the skin (10). Through this, WC and WtHr were calculated.

For analysis of WC of adolescents, there are no standard cut off values. In the current study, reference values by Kuriyan et al (11) have been used. For waist to height ratio cut off value for all the age groups which can be used globally is 0.5(12).

For estimating the subject's body fat, bio impedance analysis (BIA) was done. The subjects were made to stand barefoot on the scale for simultaneous measurements of body weight and impedance, with manual entry of the subject's gender, age , body type (standard or athletic) and height into the system via a digital keyboard. The subject's percentage body fat was displayed immediately. Certain precautions were taken to maintain the accuracy in BIA readings like BIA was not performed after the games period or just after exercise as the reading obtained may be lower than normal; nor after meals as the reading obtained may be higher than normal; the temperature of the medical room while taking reading was ambient, as cold temperature alters the reading.

Blood pressure (BP) measurements were done in school medical room where subjects were seated and the cubital fossa was supported at heart level, after at least 5 minutes rest. BP was measured using a mercury sphygmomanometer, with appropriate cuff. First tapping sound and disappearance of Kortkoff sound were taken as systolic and diastolic blood pressure respectively. In case of a high reading, BP was measured again after an interval of 10 minutes. 3 readings were taken maintaining an interval of 2 minutes between the readings. Systolic BP (SBP) and/or Diastolic BP (DBP) >90th percentile and <95th percentile was considered as pre hypertension; and SBP and/or DBP >95th percentile were classified as hypertensive (13).

III. Statistical Analysis

Data was entered in Microsoft access sheet and analysed using STATA 13. Both the descriptive and inferential data analysis were applied using the appropriate statistical test of significance. The confidence interval of 95% and significant difference of < 0.05 were taken as valid for test of significance.

IV. Results

The study excluded 21 subjects due to incomplete data for age, weight and height; 2 subjects withdrew their participation in between the course of study. Thus the final sample included 877 adolescents in phase 1, 64.3% (564) males and 35.7%(313) females. The mean age of the subjects was 13.04 ± 13.04 yrs. As per (table 1) maximum number of subjects 37.97 %(333) were in age group of 12- <13 and the least number of study subjects were in the age group of 15- <16 years.

Table 1- Age and Sex wise distribution of the Study subjects (N=877)

Age (Yrs)	Males n (%)	Females n (%)	Total
12- < 13	217 (38.4)	116 (37)	333
13 - <14	158 (28)	90 (28.7)	248
14 - <15	136 (24.1)	82 (26.1)	218
15- <16	53 (9.4)	25 (8)	78
Total	564 (64.3)	313 (35.7)	877

Mean BMI for males and females was 20.1 ± 4.4 and 20.5 ± 4.8 respectively with no statistical difference (p=0.82). Nearly 129 (14.7%) of the subjects were overweight and 163 (18.6%) were obese based on WHO (2007) reference values (Table 2). No change was seen when age adjusted combined prevalence of overweight and obesity was calculated (table 3). However, change was seen in gender adjusted combined prevalence which was 31.7 and 30.2 respectively.

Table 2: Classification of weight status of school going adolescents by gender (N=877)

WHO	Neither overweight nor obese n(%)	Overweight n(%)	Obese n(%)	P-Value
12 years	219 (65.77)	57 (17.12)	57 (17.12)	0.601
13 years	162 (65.32)	36 (14.52)	50 (20.16)	
14 years	148 (67.89)	29 (13.3)	41 (18.81)	
15 years	56 (71.79)	7 (8.97)	15 (19.23)	
Total	585 (66.7)	129 (14.71)	163 (18.59)	

*Neither overweight nor obese includes normal and underweight subjects

Table 3: Classification of weight status of school going adolescents by age (N=877)

WHO Classification System (2004)	*Neither overweight nor obese n (%)	Overweight n(%)	Obese n(%)	P-Value
Male	377 (66.84)	79 (14.01)	108 (19.15)	0.669
Female	208 (66.45)	50 (15.97)	55 (17.57)	
Total	585 (66.7)	129 (14.71)	163 (18.59)	

*Neither overweight nor obese includes normal and underweight subjects

Mean WtHr ratio of subjects was 0.43 ±.08 and it remained the same for males and females with no statistical difference (p=0.1). 23.1% (203) of subjects had value greater than 0.5 which is a global cut off for all the age groups [12]. However there was no statistical difference in males 20.7 % (138) and females 20.7% (65) (P = 0.213). Similarly there was no significant difference in waist to height ratio for subjects in different age categories.

On analysis of data for WC, mean WC of subject was 66.5 ± 13.1 cm and mean WC of males was significantly higher than of females 67.2 ± 13.3 cm and 65.3± 12.5cm respectively (p=0.04). WC greater than 90 percentile was seen in 20.5% (180) of subjects. On further investigation, a highly significant difference in males 23.4% (132) and females 15.3% (48) was seen (p=0.005) for WC>90 percentile. However no statistical difference was seen for WC at different ages.

On the basis of reporting, 12.34% (108) of subjects had first degree relatives with diabetes and /or obesity and / or hypertension.

On the basis of pre set screening criteria (BMI, WtHr, WC and first degree familial history) 33.2% (292) subjects were screened for further measurement of BP; however only 271 subjects agreed for BP measurement. Although none of the screened subject had first degree familial history as the only criteria out of all screening criteria.

Profile of screened subjects

Out of 271 subjects, 66.05 % (179) were males and 33.95% (92) were females. Mean age of subjects was 13 yrs. As per (table 4) maximum number of subjects 105 (38.74%) were in age group of 12- <13 and the least number of study subjects were in the age group of 15- <16 years.

Table 4: Age and Sex wise distribution of the screened subjects (N=271)

Age	Males n (%)	Females n (%)	Total
12- < 13	73 (40.8)	32 (34.78)	105
13 - <14	53 (29.6)	26 (28.26)	79
14 - <15	40 (22.34)	27 (29.30)	67
15- <16	13 (7.3)	7 (7.60)	20
Total	**179 (66.05)**	**92 (33.95)**	**271**

Table 5 Distribution of screening criteria among screened subjects (N=271)

S.No	Anthropometric Variable	Males n(%)	Female n(%)	P-value
1	**Weight Status** Normal weight Overweight Obese	 7(3.9) 49(27.37) 123(85.4)	 5(5.4) 34(36.9) 53(57.6)	0.193
2	Waist circumference (>90 percentile)	125 (69.8)	46 (50)	0.001
3	Wt to ht ratio (0.5)	138 (77.09)	61(67.3)	0.08
4	Family history	63(35.1)	38 (41.3)	0.325

Mean BMI of screened subject was 25.45±3.5, and a significant difference was seen in mean BMI of males (25.14 ± 3.27) and females (25.14 ± 3.27) (p=0.04). Amongst screened subjects, very few were normal weight, where as majority were overweight or obese as per WHO BMI classification (table 5). Weight status distribution of subject's was seen at different ages; only at age 14 yrs, results were significant (p=0.05). Males had significantly higher waist circumference than females but when the difference was studied at different ages, it was only at age 14 and 15 years the results were statistically significant (p= 0.000 and 0.035). Similarly for waist to height ratio, males had higher value than the females and when seen for different ages, it was only at age 14 yrs when results were statistically significant (p=0.003)

BP measurement of screened subjects (high BMI and/or WC and/or WtHr) indicated 69.4% (188) had normal BP, 14% (38) had pre hypertension and 16.6% (45) were hypertensive (stage 1 or stage 2). Prevalence of hypertension among overweight subjects (BMI> 85 percentile) was 13.2% and among obese subjects (BMI>95 percentile) was 18.75 (p<0.05).To estimate the gender difference , prevalence of pre hypertension was 18.6% and 15.2% amongst males and females respectively and hypertension was 16.2% in males and 17.3% in females ; however difference was not statistically significant(p<0.05).

Systolic Blood pressure (SBP)

Graphical distribution of SBP is depicted in fig 1. Mean systolic blood pressure of subjects was 115.6 ± 11.3 mm/hg. No gender difference was seen in mean SBP of males(115.4 ± 12.1 mm/hg) and females(116.0 ± 9.7 mm/hg) (p=0.6) As per systolic blood pressure measurement, 69.8% (186) of subjects were normal, 14.76% (40) had pre hypertension , 13.65% (37) had stage 1 hypertension and 2.9% (8) had stage 2 hypertension. Among males and females no difference was seen for different category of BP (table 6). Though difference was seen in males and females at all ages, it was only at age 15 where males and females showed statistically significant difference in BP category (p=0.05)

Statistically significant positive correlation of SBP was seen with weight (r=0.4; P<0.001), height (r=0.2; P<0.001), fat percentage (r=0.3; P<0.001), WC (r=0.3; P<0.001) and BMI (r=0.3; P<0.001)

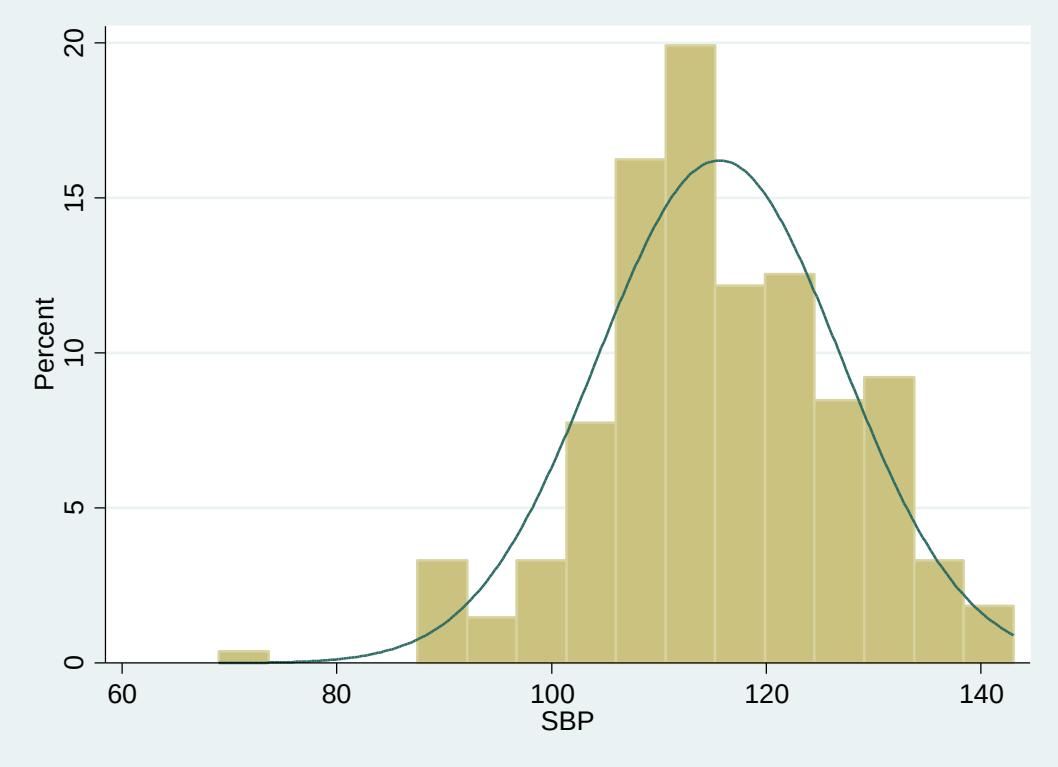

Fig 1: Graphical distribution of Systolic Blood pressure

Table 6: Prevalence of hypertension among screened subjects based on SBP (N=271)

SBP	Males n (%)	Females n(%)	Total	P value
Normal (<90percentile)	125(69.8)	61(66.3)	186	**0.833**
Pre hypertension (>90 <95)	25 (19.3)	15 (16.3)	40	
Stage 1 hypertension (95+5)	23 (12.8)	14 (15.2)	37	
Stage 2 hypertension (99+5)	6 (3.3)	2 (2.1)	8	

Diastolic Blood pressure (DBP)

Graphical distribution of DBP indicates a normal distribution (fig 2). Mean diastolic blood pressure of subjects was 67.9 ± 7.4 mm/hg. No gender difference was seen, mean DBP of males and females was 68.0 ± 7.2 mm/hg, 67.7 ± 7.7 mm/hg respectively (p=0.7).

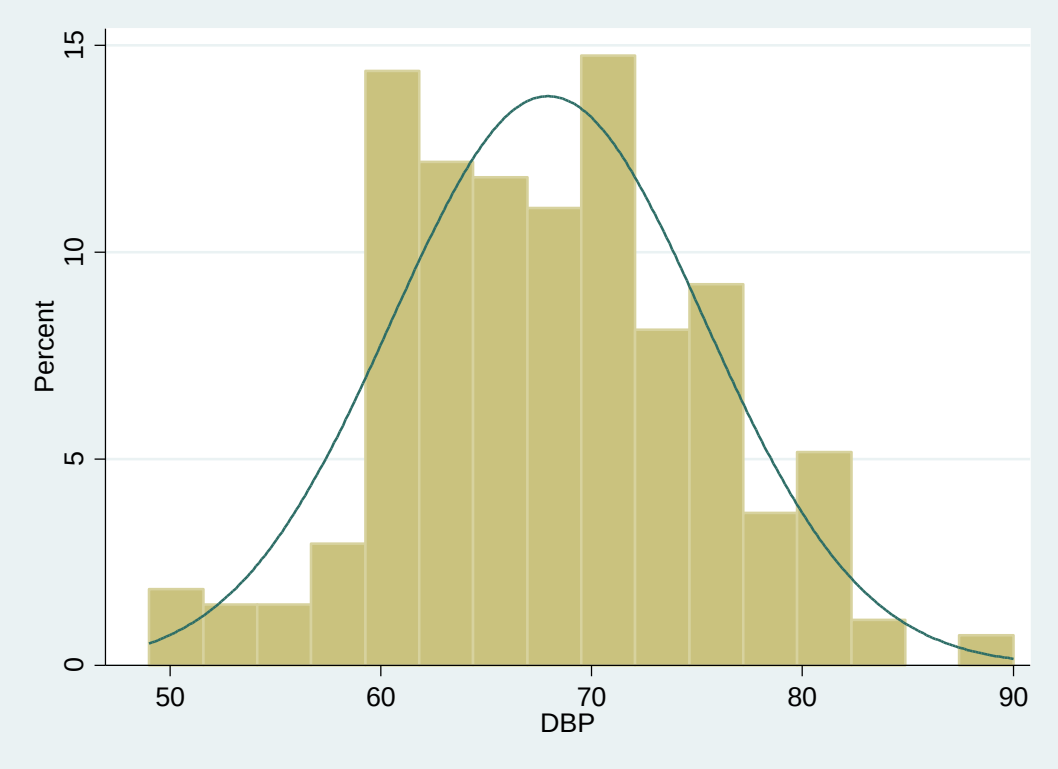

Fig 2: Graphical representation of diastolic blood pressure

As per diastolic blood pressure measurement, 86.72% (235) of subjects were normal, 10.7% (29) had pre hypertension, 2.21%(6) had stage 1 hypertension and 0.3% (1) had stage 2 hypertension. Among males and females no difference was seen (table 7).However; no statistical difference was seen when prevalence was estimated at different ages for males and females (p=0.5)

Statistically significant positive correlation of DBP was seen with weight (r=0.4; P<0.001), height (r=0.3; P<0.001), fat percentage (r=0.2; P<0.001), WC (r=0.3; P<0.001), BMI (r=0.3; P<0.001)

Table 7: Prevalence of hypertension among screened subjects based on DBP (N=271)

DBP	Males n (%)	Females n (%)	Total	P value
Normal (<90percentile)	**154(86)**	**81 (88)**	**235**	0.199
Pre hypertension (>90 <95)	**22(12.2)**	**7 (7.6)**	**29**	
Stage 1 hypertension (95+5)	**2 (1.1)**	**4 (4.3)**	**6**	
Stage 2 hypertension (99+5)	**1(0.5)**	**0 (0)**	**1**	

V. Discussion

Increasing prevalence of overweight and obesity among adolescents is a matter of concern. While the obesity rates have levelled off in developed nations but in developing countries like India, it is still in transition phases of the nutrition stabilization. The associated health risks with excess weight includes hypertension, hyperinsulinemia, glucose intolerance, type 2 diabetes, dyslipidemia, increased risk of early cardiac disease and psychosocial difficulties. Thus the current study has been done with school going adolescents mainly to study presence of obesity and hypertension in this group. Significant association of hypertension (SBP and/ or DBP) with BMI was seen in this study. These findings were similar to studies done in India viz study in Wardha in 2012 (14) , Aligarh in 2012 (15) , Kochi in 2010 (16) , Delhi in 2006 (17) , Ludhiana in 2004 (18) . In the present study, prevalence of hypertension among the adolescents who were screened (either high BMI and /or high waist circumference and /or or high waist to height ratio) was studied. Prevalence of pre hypertension and hypertension among overweight and obese adolescents was 14% and 16.6% respectively; this indicates it is a major public health problem. Similar reporting of prevalence of pre hypertension among overweight (by BMI) adolescents has been reported in other parts of India like Odisha in 2014 (19) and Ludhiana in 2004 (18).

A few studies have shown less prevalence like in Karnatka in 2004 (20) but prevalence of hypertension in obese subjects was reported much higher in comparison to our findings (18, 20, 21). The finding of present study signifies an alarming situation which requires some form of intervention as recommended by the Fourth Task Force (13).

The increasing evidence from observational studies have suggested that SBP is more important prognostic determinant of CVDs than DBP (22) and this can be generalized for adolescents. In adolescents mainly BP abnormality seen is usually a high SBP. In the current study too, SBP classified 13.65% with stage 1 hypertension and 2.9% with stage 2 hypertension where as DBP classified a few subjects to be hypertensive. Similar findings have been reported by other authors (8, 23).

In our study, statistically significant correlation was observed between BMI, weight , height , fat percentage and WC with SBP and DBP. Similar findings have been presented by other authors (15, 24).

VI. Conclusion

In conclusion early detection of obesity could be considered as a crucial screening step for identification of adolescents with hypertension, since in all private schools, anthropometric measurements are taken as a part of health check up. Thus the only effort needed by school staff is to take such measurements regularly and correctly so that high risk subjects can be separated and their BP can be measured. Other alternative is, school should encourage research organisations to do health related studies in school. Another step which is required is implementation of nutrition education program with focus on diet and practical physical activity sessions in schools and home for sensitising the subjects regarding obesity management which is considered as a risk factor for hypertension. This will not only prevent hypertension but also co-morbidities associated with it.

References

[1] The Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure: the JNC 7 report. JAMA. 2003 May 21;289(19):2560-72

[2] Pradeepa R, Prabhakaran D and Mohan V.Emerging Economies and Diabetes and Cardiovascular Disease. Diabetes Technol Ther 2012 Jun; 14 Suppl 1:S59-67

[3] Moura AA, Silva MA , Ferraz MR, Rivera IR. Prevalence of high blood pressure in children and adolescents from the city of Maceió, Brazil. J Pediatr (Rio J). 2004 Jan-Feb;80(1):35-40.

[4] Anand T, G. K. Ingle, G. S. Meena, Jugal Kishore, and Rajesh Kumar. Hypertension and Its Correlates among School Adolescents in Delhi. Int J Prev Med. 2014 Mar; 5 Suppl 1: S65–S70.

[5] Agarwal VK, Sharan R, Srivastava AK, Kumar P, Pandey CM. Blood pressure profile in children of age 3-15 years. Indian Pediatr. 1983 Dec;20(12):921-5.

[6] Stabouli S, Kotsis V, Papamichael C, Constantopoulos A, Zakopoulos N. Adolescent obesity is associated with high ambulatory blood pressure and increased carotidintimalmedial thickness. J Pediatr 2005; 147:651-6.

[7] Muntner P, HeJ, Cutler JA, Wildman RP, Whelton PK. Trends in blood pressure among children and adolescents. JAMA 2004; 291:2107-13.

[8] Sundar JS, Adaikalam JMS, Parameswari S, Valarmarthi S, Kalpana S, et al. Prevalence and Determinants of Hypertension among Urban School Children in the Age Group of 13- 17 Years in, Chennai, Tamilnadu. Epidemiol 2013 ; 3: 130.

[9] WHO STEPS Surveillance Manual: The WHO STEP wise approach to chronic disease risk factor surveillance. Geneva, World Health Organization. World Health Organization 2005.

[10] De Onis M, Onyango AW, Borghi E, Siyam A, Nishida C, Siekmann J. Development of a WHO growth reference for school-aged children and adolescents. Bull World Health Organ. 2007; 85(9):660-7.

[11] Kuriyan R, Thomas T, Lokesh DP, Sheth NR, Mahendra A, Joy R, Sumithra S, Bhat S, Kurpad AV. Waist circumference and waist for height percentiles in urban South Indian children aged 3-16 years. Indian Pediatr. 2011;48(10):765-71.

[12] Hsieh SD, Yoshinaga H, Muto T, Sakurai Y, Kosaka K. Health risks among Japanese men with moderate body mass index. Int J Obes Relat Metab Disord 2000; 24: 358–362.

[13] National High Blood Pressure Education Program Working Group on High Blood Pressure in Children and Adolescents. The fourth report on the diagnosis, evaluation, and treatment of high blood pressure in children and adolescents. Pediatrics. 2004; 114: 555-76.

[14] Kumar J, Deshmukh PR, Garg BS. Prevalence and correlates of sustained hypertension in adolescents of rural Wardha, central India. Indian J Pediatr. 2012 Sep;79(9):1206-12.

[15] Durrani AM, Fatima W. Determinants of blood pressure distribution in school children. European Journal of Public Health, 2012 ; 22 (3), 369–73

[16] M Raj, K R Sundaram, M Paul, A Sudhakar and R K Kumar. Body mass index trend and its association with blood pressure distribution in children. Journal of Human Hypertension 2010; 24: 652–658

[17] Singh AK , Maheshwari A, Sharma N, Anand K Lifestyle associated risk factors in adolescents. Indian J Pediatr. 2006 ;73 (10):901-6

[18] Mohan B, Kumar N, Aslam N, et al. Prevalence of sustained hypertension and obesity in urban and rural school going children in Ludhiana. Indian Heart J. 2004;56:310–14

[19] Bagudai S , Nanda P, Kodidala SR. Prevalence of obesity & hypertension in adolescent school going children of berhampur, odisha, india. Int J Physiother Res 2014;2(6):777-80

[20] Baradol RV, Patil S, Ranagol A. Prevalence of overweight and obesity and hypertension among school going children and adolescents in North Karnatka: A cross sectional study. Int J Med Public Health 2014; 4:260-4.

[21] Buch N, Goyal JP, Kumar N, Parmar I, Shah VB, Charan J. J Cardiovasc Dis Res. 2011; 2(4): 228-232.

[22] Sever P. The preeminence of systolic blood pressure measurement in the management of patients with high blood pressure. Medicographia 104. 2010; 32:250–53.

[23] Kaur S, Sachdev H, Dwivedi SN, Lakshmi R, Kapil U, Sareen N. Association of Obesity with Hypertension Amongst School- Age Children Belonging to Lower income group and middle income group in national capital territory of Delhi. Indian J Community Med 2013; 38:175-9.

[24] Vivek V, Singh S K. Prevalence of Hypertension in Gujarati School Going Children and Adolescents in Anand District. Natl J Community Med 2012; 3(3):452-7.

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Funding Source: None
Conflict of Interest: None

The Research on various protocol for efficient data dissemination in vehicular ad hoc network

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Abstract- Vehicular ad hoc wireless networks (VANETs) are a particularly challenging class of mobile ad hoc wireless networks (MANETs) that are currently attracting the extensive attention ofresearch in the field of wireless networking as well as automotive industries. ANETs exhibits stronger challenges than that in other general MANETs. Infrastructure-free environments and higher dynamic network topology cause frequent network partition. Moreover, vehicular ad hoc wireless networks is often deployed by the constraint of roadways where trees, buildings and other assorted obstacles influence the practical transmission effects as compared to generic open fields. we proposed APL Algorithm data node technique with APAL algorithm for better data dissemination

Index Terms- data dissemination,APAL,VANET,HNDT

I. INTRODUCTION

VANET also serves as a large scale wireless sensor network for future ITS because every modern vehicle can be regarded as a super sensor node. For example, every new vehicle are usually equipped with light sensors ,one or more cameras , microphone, wireless radio or GPS receiver , which will enable them to communicate with each other and with roadside equipments. VANET consist of vehicles with on –board sensors and road side units (RSU), which provide communication between vehicle -to-vehicles (V2V) and vehicles –to-RSU (V2R). Figure 1 gives the illustration of VANET [10] .In the below figure, vehicles V1, V2 and V3 have access to a roadside infrastructure which have limited coverage area[11]

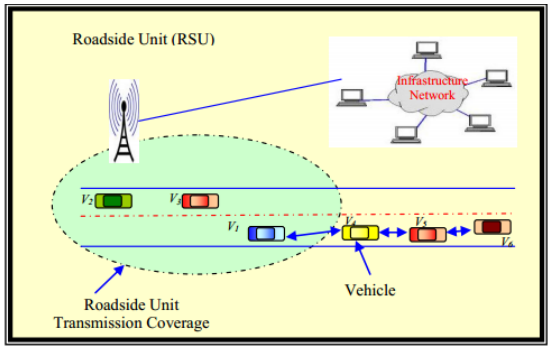

Figure 1: Vehicular Ad Hoc Network

1.clustering of vehicle : in a clustering structure the vehicle nodes are divides into number of virtual groups based on c certain rules.these virtual groups are called clusters [3]. Equipped vehicles form dynamic clusters and the ones that are more adequate become cluster head. CH is responsible for controlling the data propagation inside and between the clusters. The dynamic clusters are themselves mobile, moving along with the high-speed vehicles; this ensures that even with high-speed vehicles, the moving cluster architecture result in relatively stable topology, as long as velocity of the vehicles remains more or less the same.[1]

2. chaning of clusters : chaining of clusters could be don by the CH. The clusters members in a clusters communicate with their CH. This CH node can communicate beyond the clusters boundaries using a clustyer control channel. Then send this status information to the next CH node which in turn transmits the information to next CH node. The process repeated and forms chaining in clusters until the one of the CH node that have received the packets in the communication range of RSU [1].

II. RELATED WORK

Rakesh [1] VANETs (Vehicular Ad hoc Networks) are upcoming wireless network environment for Intelligent Transportation Systems (ITS). Most VANET applications are built upon the datapush communication model, where information is disseminated to a set of vehicles. The diversity of the VANET applications and their potential communication protocols needs a systematic literature survey.

M.Chitra [2] Broadcasting is the process of sending a message from one node to all other nodes in an ad hoc network. It is a fundamental operation for communication in ad hoc networks as it allows for the update of network information, route discovery and other operations as well. In this paper, we review the pros and cons of different broadcasting methods in VANET. Also, the broadcast storm problem and broadcast suppression techniques for broadcasting in Vehicular Ad hoc Networks (VANET) are discussed, because blindly broadcasting the packets cause several problems that affect the quality of service in VANET. In order to avoid broadcast storm problem this paper provides a survey of some of the existing broadcast suppression techniques in vehicular environment.

Sunil kumar [4] states that Less than a century since the automobile was made affordable enough for the general public, hundreds of millions of vehicles now travel along highways and streets around the world. Innovations in safety,

comfort, and convenience have made vast improvements in automobiles during that time, and now new technologies promise to change the face of vehicular travel once again. Vehicular ad hoc network (VANET) is network which provides the communication between vehicle to vehicle for p r o v i d i n g i n f o r m a t i o n t o travelers with new features and applications that have never previously been possible. This paper focuses on vehicle to vehicle (V2V) communications in VANET. Lot of research is going on for determining route between source and destination vehicles for routing the information with good packet delivery ratio.

Brij bihari dubey [6] said In vehicular ad hoc networks data transfer is typically done with the help of multihop communication in which the high speed vehicles are acting as the data carrier. The vehicles areconstrained to move on definite path depending on the road layout and the traffic conditions. In vehicular ad hoc network multihop data delivery is very complicated job because of the high mobility and frequent disconnections occurring in the vehicular networks. The biggest challenge in vehicular ad hoc networks is the collection of information like accident, speed limit, any obstacle on road, road condition, traffic condition, commercial advertisement, etc, for the safety and convenience purpose. In many dissemination techniques, the vehicle carries the packet until it finds any other vehicle in his range which is moving towards the direction of the destination and then it forwards the packet to that vehicle. Since the road layouts are already defined, the vehicle selects the next road having minimum latency to forward the packet to the destination. We can only calculate the probabilistic estimate that which path should be followed for minimizing delay so that limited available bandwidth can be efficiently utilizes

Moumena [7] said that The rapid evolution of wireless communication capabilities and vehicular technology would allow traffic data to be disseminated by traveling vehicles in the near future. Vehicular Ad hoc Networks (VANETs) are self-organizing networks that can significantly improve traffic safety and travel comfort, without requiring fixed infrastructure or centralized administration. However, data dissemination in VANET environment is a challenging task, mainly due to rapid changes in network topology and frequent fragmentation.

III. PROPOSED WORK

PROPOSED SCHEME APAL algorithm

1. When receive alert message
2. IF (receive alert message is for first time)
3. $\Delta\tau_I$ random between 1-100 ms
4. P_i random probalibility between 0.7-0.9
5. END IF
6. Count time = 0
7. Duplicate number =0
8. WHILE (Count time $<\beta$ && duplicate number is $>\alpha$)
9. WHILE ($\Delta\tau_I$ is not expired)
10. Listen for duplicate alert message
11. Count = number of received duplicate alert message.
12. END WHILE
13. IF(receive duplicate alert message)
14. Duplicate number = duplicate number + count
15. $P_{i+1} = p_i$/ duplicate number
16. $\Delta\tau_{i+1} = \Delta\tau_I *$ duplicate number
17. ELSE
18. Rebroadcast with p_i
19. IF (rebroadcast is successful)
20. $P_{i+1} = p_i/2$
21. $\Delta\tau_{i+1} = \Delta\tau_i$
22. END IF
23. END IF
24. Count time = count time + $\Delta\tau_i$
25. END WHILE

APAL algorithm is introduced. In contrast with the TLO algorithm which was discussed previously, APAL algorithm doesn't require any GPS location information. APAL becomes highly favorable than TLO, since accurate location information is difficult to calculate when vehicle moving at a high speed at real road environment. Thus APAL algorithm doesn't need any location information and the probability of the broadcast alert message is chosen adaptively to avoid the lost alert message problem and to minimize the broadcast problem.To curve the problems caused by flooding algorithms and restricted transmission,

IV. CONCLUSION

In vehicular Ad-Hoc networks the technology is changing very fast, the various algorithms are used for better data transmission a best algorithm is proposed according to the requirement. The efficient data dissemination techniques can provide significant benefits to vehicular ad hoc networks, in terms of both performance and reliability. Many data dissemination techniques for such networks have been proposed so far. Amongst the most popular one is helper data system. This Algorithm technique used to choose the reliable node for continuous data transmission. The propose Algorithm is used to choose selective node for forwarding the data with carry forward technique. .In future work, various data dissemination technique can be done with the help of various algorithm for efficient data security.

REFERENCES

[1] Rakesh kumar , mayank dave "A Review of Various VANET Data Dissemination Protocol" , International Journal of u- and e- Service, Science and Technology Vol. 5, No. 3, September, 2012

[2] M.Chitra , S. Siva Sathya "Efficient Broadcasting Mechanisms For Data Dissemination in Vehicular ad hoc networks" International Journal of Mobile Network Communications & Telematics (IJMNCT) Vol. 3, No.3, June 2013

[3] Annu mor " study of different type of data dissemination strategy in vanet" International Journal of Engineering Science and Innovative Technology, volume 1, issue 2 , November 2012.s

[4] Sunilkumar M. Bhagat* and Dr Vijay Wadhai " Study of Vanet Routing Protocols For End to End Delay"

[5] T. Sujitha1, S. Punitha Devi " Intelligent Transportation System for Vehicular Ad-Hoc Networks", International Journal of Emerging Technology and Advanced Engineering, Volume 4, Issue 3, March 2014

Brij bihari dubey, prashant kumar, neveen chauhan "

[6] A survey of data dissemination techniques used in vanet" International Journal of Computer Applications(0975 – 8887) volume 10 – no.7, November 2010.

[7] Moumena Chaqfeh, Abderrahmane Lakas, Imad Jawhar " A survey on data dissemination in vehicular ad hoc networks"

[8] Tamer Nadeem, Pravin Shankar, Liviu Iftode "A Comparative Study of Data Dissemination Models for VANETs"

[9] Evandro de Souza, Ioanis Nikolaidis, Pawel Gburzynski , "A New Aggregate Local Mobility (ALM) Clustering Algorithm for VANETs",.

[10] Moumena Chaqfeh, Abderrahmane Lakas, Imad Jawhar, "A survey on data dissemination in vehicular ad hoc networks", Elsevier 2014

[11] Sagarika Mohantya, Debasish Jenab, "Secure Data Aggregation in Vehicular Ad Hoc Networks: A Survey", ICCCS 2012

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Evaluation of Fire Protection Systems in Commercial Highrise Buildings for Fire Safety Optimization

A Case of Nairobi Central Business District

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Abstract- Among different types of occupancies, a commercial highrise building presents a greater challenge to fire protection due to its functionality, complexity and economic value. The key objective of the present paper was to examine the situation of physical (as opposed to non-physical) fire protection systems in fourteen randomly selected commercial highrise buildings in the Nairobi CBD for fire safety optimization. Methods used include; physical observations, document review and interviews. A multi-attribute evaluation model/approach was applied to establish sufficiency and/or suitability of fire protection systems in the light of the national regulations and approved standards. The study findings show that, save for the facilities of the disabled and the firefighting/evacuation lifts, other fire protection systems are mainly provided in the buildings. However, insufficient maintenance and/or unsuitable elements renders their safety performance low. The results of the analysis showed that portable fire extinguishers had the highest performance with 78.57% of the buildings sufficiently and suitably in terms of number, locations, servicing etc., while 0% of the building was sufficiently and/or suitably installed with a sprinkler system i.e. they all exhibited some deficiency in terms of coverage and maintenance issues. This could be associated with the cost factor. The results of other systems were as follows: Fire detection and alarm (14.29%); Escape route (50%); Emergency lighting (64.29%); Smoke control System (50.00%); Compartmentation (64.29%), Riser mains, hose reels and hydrants (64.29%); Fire Brigade access and facilities (64.29%); Safety signs and notices (7.14%); Portable fire extinguishers and Fire assembly points (28.57%). In view of the findings, it's recommended that increased efforts in inspection and maintenance of fire protection systems are considered to address the identified shortfalls throughout the project life. Provision for firefighting/evacuation lifts and facilities for the disabled persons should be considered during design of the commercial high-rise buildings.

Index Terms- Fire Protection Systems, Maintenance, Provision, Optimization, High rise buildings

I. INTRODUCTION

The advent of high-rise buildings in the 19th Century marked the beginning of sophisticated human habitation borne out of the ever-increasing competing demands for limited space in cities (NFPA, 2007). Coupled with its ability to accommodate many operations and people, high-rise buildings/occupancies are the best alternative available to many municipal governments in allocation of dwindling land sizes and spiralling prices experienced in many cities across the globe (CTBUH, 1999). High-rise buildings have continuously increased in numbers in all parts of the globe under the aegis of technological advancement and scientific innovations that have seen to it incorporation of requisite human life support systems. Air circulation, lighting, ease of movement supported by elevators and lifts have made high-rise occupants have equal comfort just as those using low-rise buildings. The National Fire Protection Association (NFPA, 2007) defines a highrise building as a building taller than 75 ft (23 meters) in height measured from the lowest level of fire department vehicle access to the floor of the highest occupiable storey.

In developed countries where inventories of most fire episodes and estimation of loss is undertaken, it has been established that each year, estimated 350,000 fires occur in the UK resulting to 10,000 injuries and material losses where about 180,000 fires occur in the workplaces. In England and Wales, the cost of fire has been estimated at £7.7bn annually, with domestic fire costing an average of £25,000 (Prem Chhetri, et al, 2009). According to a research carried out by Georgia Institute of Technology (1977), the United States consistently led other industrialised nations in various measures of fires loss i.e. lives, property, environmental degradation, time lost, and business among others.

Apart from conventional fire protection challenges in many occupancies, a high-rise building is also faced with other inherent, intractable challenges. They are such challenges as inaccessibility by fire equipment due to height factor; stair egress and smoke stack effects; discordant fire safety management within and between different floors; re-designing and changes from initial intended use and; complex vertical utility services especially the heating ventilating and air conditioning conduits (HVCAs). As opposed to non-structural fire protection systems/methods such as training, fire drills which are undertaken during operational phases of a project etc., most of physical systems and methods are installed during building design.

As elsewhere in the modern world, the emerging and existing high-rise buildings in the Nairobi CBD are also found in the milieu of fire protection challenges as evidenced by such fire episodes in Kimathi House (2012), Afya Centre (2010), the Utalii House (2010) and International Lifehouse (2009). Many

unreported and reported small fires are also experienced annually in many commercial high-rise buildings in the CBD.

In view of the preceding, this paper aims to evaluate the level of provision of structural/physical fire protection systems and methods in the realm of fire protection challenges inherent to commercial highrise buildings. Ultimately, it's envisaged that the findings of this research will immensely contribute in the optimization of fire safety in commercial high-rise buildings.

II. Fire Protection Systems

Conceptually, optimal fire protection can only be achieved through integration of three key fire safety elements. These are fire prevention, protection, and suppression. The concept in figure 1.0 below is used to demonstrate how an integrated fire safety planning and management system can be used to offer an overall fire safety in commercial high-rise buildings as illustrated below.

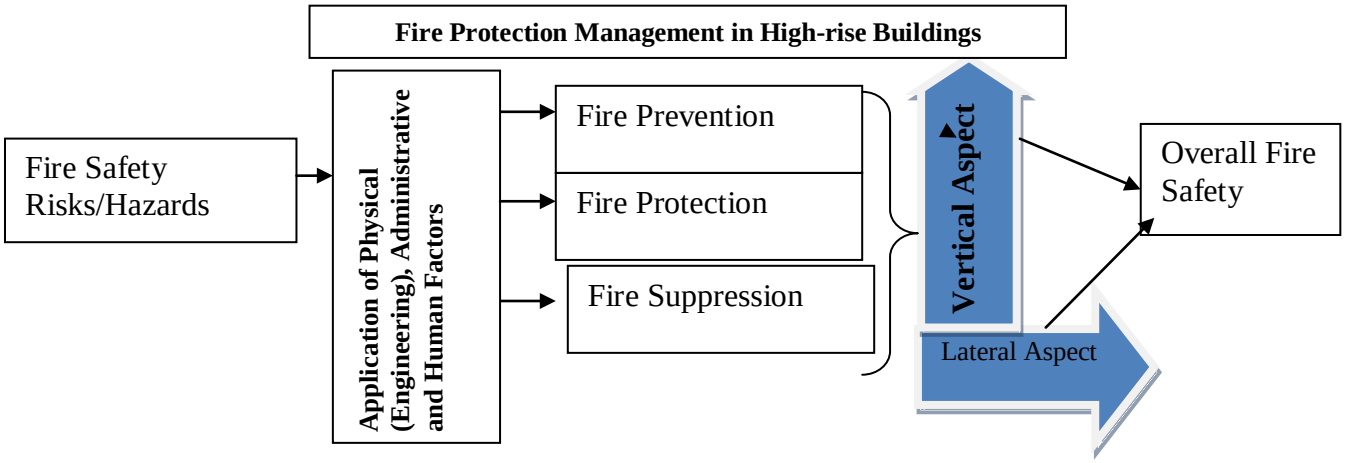

Figure 1.0: Systems Approach for Fire safety Management, (modified from P. Rama Murthy (2006) by author),

Fire prevention and suppression are concerned with control of fire from taking place and extinguishment respectively. Fire protection is a mechanism involving both fire prevention and suppression at design and occupation of a building. Normally, each of the three fire safety elements exhibit three critical safety controls i.e. physical control, management control and human control in fire safety management.

The NFPA guide to fire safety (2007), in respect to these controls, hierarchically provides that, where possible, risk should be avoided, risks which cannot be avoided should be assessed and evaluated and that risks should be combated at source, control measures should adapt to technical progress and dangerous substances /articles should be replaced by the non-dangerous or less dangerous. It further provides that, coherent overall prevention policy should be developed, which covers technology, organization of work and the influence of factors relating to the working environment and that priority should be given to collective protective measures and employees should be given appropriate instruction.

In practice, fire protection involves provision of fixed fire protection systems during construction of a building and thereafter installation and maintenance of specific fire protection equipment and installations. In time, most of fire protection systems will lose their vitality and functional capability due to myriad factors such as outright decay or obsolescence, vandalism, negligence, interference or change of user (CBTUH, 2007, ED Soja, et al 2000). All fire safety installations need to be tested individually, but interdependent fire safety installations need to be tested collectively to demonstrate satisfactory interfacing/ interlinking etc. Further, arrangements should be made for all fire protection systems such as fire detection and alarm systems, fire door control mechanisms, stair and lobby pressurization systems, evacuation and the fire-fighting lifts, portable and fixed fire extinguishers, emergency lighting systems and standby power systems to be regularly inspected and maintained (Muckett and Furness, 2010).

Despite lack of sufficient and solid legislation and policy framework for fire protection in Kenya, there still exist scattered statutes relevant to general fire safety in occupancies. A law specially formulated for the purposes of fire protection in high-rise buildings is non-existent. The Occupational Safety and Health Act (2007) is the main legislation governing general safety and health in workplaces. The key provisions in the Act related to fire protection include section 77-Access and safe place of employment, Section 78-Fire prevention, Section 81-Safety provisions in case of fire and Section 82-Evacuation procedures. The Factories and Other Places of Work (Fire Risk Reduction) rules Legal Notice 59, 2007 and the National Buildings Maintenance Policy which provides for effective maintenance that ensures adequate health, safety and environmental standards, return on investment, convenience and comfort for the building users. The legal requirement for fire protection systems provide in high-rise buildings is provided in the sections below:

Automatic water sprinkler: The legal provision for provision of automatic water suppression system is contained in the National Planning and Building Regulations, 2014, regulation SS 37. The Regulation requires that, with some exceptions, any building exceeding 30 meters in height or a basement storey more than 500m ^{2} or in any other storey which exceeds 500 m^2 in total floor area and such storey is not provided with breakable or openable panels be installed with an approved sprinkler system.

Fire detection and alarm system: The key statutory requirements for fire detection and alarm systems are found in the provisions of Fire Risk Reduction Rules, 2007, under rule No. 26 and No 28 and in the National Planning and Buildings 2014, regulation SS32.

Escape route: In the National Planning and Building Regulation, 2014 the requirement for provision escape route is contained in regulation SS18.1. The regulation requires that all buildings be provided with one or more escape routes that can be used in case of fire or other emergencies. The regulations also provide for the specifications for appropriate lighting and ventilation of such escape routes and stairways. The escape route should be well maintained, free of any obstructions, well light and provided with essential furniture to aid in movement and visibility of the route.

Emergency lighting: The building regulations require that, an independent supply of power is provided to provide energy for lighting during emergencies as per Reg.SS31 in the National Planning and Building Regulations, 2014.

Smoke control system: The Factories and Other Places of Work (Fire Risk Reduction) rules, Rule No 18 and regulation SS43 of the National Planning and Building, 2014 provide for provision of such facilities for control of smoke and/or fumes in workplaces or occupancies.

mains, hose reels and hydrants: The provision for riser mains, hose reels and hydrants for fire purposes are contained in various regulations in the National Planning and Building Regulations, 2014. Regulation SS34.1 requires that rational design of a fire installation make provision for water to be supplied in the quantity and at the pressure and rate of flow in accordance with BS 5306: Part1 to 7 of Regulation SS35.1 provides for hoses installation in any building of two or more storeys in height or in any single storey building of more than $250m^2$ in floor area at a rate of 1 hose reel for every $500m^2$ or part thereof of floor area of any storey. Regulation SS36.1 requires that they are provided in any building exceeding 12 m in height. The Fire Risk Reduction rules, Rule No 29 (1) requires that occupiers provide means of extinguishing fire at the workplace, while Section (4) requires that, where fire hose reels are provided and occupiers ensure that there is at least one fire hose reel are within the radius of 30 meters.

Facilities for the disabled: The National Building Regulations, 2014 provide for provision of firefighting and evacuation lifts and specifies the requirements for stretchers that can be used by persons with disability or the injured during emergency as provided under regulation SS50.1. Further, regulation SS 67.4 requires that every owner or occupier of a building shall have shall have arrangements for the evacuation of persons with special needs from a building in the event of a fire or other hazardous materials emergency. The Persons with Disabilities Act, 2003 provide for accessibility and movements of the disabled in workplaces and public buildings such as hand rails, visual signs etc.

Fire brigade access and facilities: The provision for fire brigade access and facilities are provided in regulation SS57, Section (1) of the regulation requires that no building should be erected on any site unless such site is provided with suitable access for the purposes of firefighting and rescue by the Fire Services of the local authority.

Fire safety signs and notices: The National Planning and Building Regulations, 2010 provide clear guidelines on requisite specification for fire safety signs and notices under regulation SS30 and regulation SS46. Regulation SS30.1 subsection (a) requires that any building having emergency routes be clearly marked and signposted to indicate the direction to be travelled in the case of any emergency.

Fire Extinguishers: These are first-aid fire extinguishers which are installed in the building for emergency purposes. They include among other portable CO2, dry chemical and powder, foam and water extinguishers strategically sited within the building premises. It is a legal requirement under the Fire Risk Reduction, rule 29 (1) to provide firefighting appliances includes, among others, fire extinguishers. Rule 30 subsection (1) requires that every occupier ensure that all means of extinguishing fire are properly maintained and provides the requirements for inspection and testing, record keeping and timing of examination and testing. Rule 31 provides specific requirements for distribution of the various types of fire extinguishers in workplace.

Fire assembly point: The essence of a fire assembly point for emergency is to provide a place where head count of the persons who are involved in the fire is done. It also used as a temporary station where people who are injured can be offered first aid or can be picked for more attention to the hospital by rescue personnel. The requirement for fire assembly point is provided in Rule No 24 of the Factories and Other Places of Work (Fire Risk Reduction) rules, 2007.The rule requires every occupier identify a location in the workplace where every worker shall assemble in the event of a fire.

III. Material and Methods

3.1 Description of Case studies

The project boundary is defined by the core Nairobi City (62 Km Sq) found in the larger Nairobi Metropolitan. Most of the high-rise buildings in the Nairobi Metropolitan are found within the CBD (encompasses areas within Wetland's, Upper Hill, Community, Parklands and the section bordered by Uhuru highway, Haile Selassie, Kirinyaga Road, University way). A request letter accompanied by an introduction letter from the Institute of Energy and Environmental Technology was used to get the permission to conduct the research in their buildings. The buildings involved in the survey exhibited mixed-use character with varied types of businesses such as schools, health centers, retail shops, especially clothing and office blocks, salons, cash transfer outlets, cyber cafes and restaurants among others. Others have some floors partitioned to create space for establishment of stalls commonly referred to as exhibitions. The situations of the buildings are as contained in the table 1:

Table 1: The buildings involved in the study

No	Name of the building	Date of Construction	No of floors	Location within the CBD
	Re-insurance plaza	1982	20	Harambee Avenue
	Anniversary Towers	1992	26	The University Way
	KICC	1973	31	City Hall Way
	Electr. House	1974	18	Harambee Avenue
	Eco bank	1983	19	Muindi Mbingu
	Tembo House	1985	7	Moi Avenue
	Rahim. Tower	1999	18	Upper Hill
	Afya center	1987	17	Tom Mboya Street
	Lonrho House	1990	20	Standard Street
	Stanbank House	1970	10	Moi Avenue
	Bandari Plaza	1985	14	Westlands
	Fedha	2008	10	Westlands
	ICEA	1981	19	Kenyatta Avenue
	I&M	2001	18	Loita Street

3.2 Sampling Design

A cross-sectional survey by use of mixed methods, quantitative and qualitative, was done on fourteen randomly selected commercial high-rise buildings in the Nairobi Metropolis. A requisite sample was generated by use of random tables where all the identified commercial high-rise buildings in the Metropolis were listed and involved in the sampling process (Kothari, 2014). Registry records from the department of City Planning and Architecture showed that the CBD has over 150 commercial high-rise buildings. By use of random tables, the researcher selected 25No buildings. However, in only 14No (9.3 %) of the buildings, the request to conduct research was accepted. Individual interview participants were selected through convenience and snowball sampling techniques (Mugenda and Mugenda, 2003). Some of the key resource persons from the Nairobi Fire Brigade (fire investigations section), Ministry of Public Works (Buildings section), Directorate of Occupational Safety and Health Services (DOSHS- Nairobi County) and the building managers in all the buildings involved in the survey.

3.3. Methods and Techniques

Physical observations and inspections by use of a pre-designed fire safety risk assessment checklist (NFPA, 2008), literature/document (inspection/maintenance reports, improvement orders) and; interviews to building managers, occupants and professionals in the construction sector were used in data collection. Each fire protection systems was checked or inspected against requirements of the national laws and standards to determine its sufficiency and/or suitability. International standards and practices were consulted where the local were deficient or non-existent. Due to diversity of fire protection systems and methods available for fire protection a multi-attribute Evaluation Model/Approach (Rasbash et al, 2004) was used. This helped compute the aggregate performance of the systems in respective buildings. An ordinal scale representing hierarchical levels A, B and C were used in determination of performance of each system or method in respective buildings where, A represented sufficient and/or suitable system, B represented insufficient or unsuitable system while C represented absence of a particular system or method.

IV. Analysis and Results

The analysis are based on the results of the observations or inspections of the various fire protection systems involved in the study as contained in table 2. As indicated in the section above **A** represents sufficiency and suitable situation of the system while **B** represents insufficiency and/or unsuitable situation. **C** represent absent or missing system.

Table 2: Status of fire protection systems status in buildings

Building Name	Sprinkler system	Fire Detection &Alarm	Escape route	Emergency Lighting	Smoke control system	Compartmentation	Riser mains, hose reels and	Facilities for the disabled	Fire brigade access &	Firefighting and evacuation	Safety signs and Notices	Portable Fire extinguishers	Fire Assembly Points
Reinsurance plaza	B	B	A	A	A	A	A	C	A	C	B	A	A
Anniv.Towers	B	B	A	B	A	B	A	C	B	C	B	A	B
KICC	B	B	A	A	A	B	A	C	A	C	B	A	A
Electricity House	C	B	B	B	A	A	B	C	B	C	B	B	B
Eco-Bank House	B	B	A	A	A	A	A	C	A	C	B	A	C
Tembo House	C	B	C	C	C	C	B	C	B	C	B	B	C
Rahim. Tower	B	A	B	A	A	A	A	C	A	C	B	A	A
Afya center	B	B	B	A	B	B	A	C	A	C	B	A	C
Lonrho House	B	B	B	A	B	A	A	C	A	C	B	A	C

Stanbank House		B	B	B	C	B	B	B	C	B	C	B	B	C
Bandari Plaza		B	B	B	B	B	A	B	C	A	C	B	A	C
Fedha Plaza		B	A	A	A	B	A	B	C	A	C	B	A	B
ICEA		B	B	A	A	B	A	A	C	B	C	B	A	C
I&M Building		B	A	A	A	A	A	A	C	A	C	A	A	C
No of Buildings	**A**	0	3	7	9	7	9	9	0	9	0	1	11	4
	B	12	11	6	3	6	4	5	0	5	0	13	3	3
	C	2	0	1	2	1	1	0	14	0	14	0	0	7

Key: A= Sufficient and Suitable B= Insufficient /Unsuitable C =Missing/Not available

The results of the analysis are presented in table 3.

Table 3: Summary of the status of fire protection systems

System	Sufficient/suitable		Insufficient /unsuitable		Missing/ Not available	
	No. of Buildings	**Percent (%)**	**No. of Buildings**	**Percent (%)**	**No of Buildings**	**Percent (%)**
Automatic sprinkler system	0	0.00	12	85.71	2	14.29
Fire detection and alarm	2	14.29	12	85.71	0	0.00
Escape route	7	50.00	6	42.86	1	7.14
Emergency lighting	9	64.29	3	21.43	2	14.29
Smoke control System	7	50.00	6	42.86	1	7.14
Compartmentation	9	64.29	4	28.57	1	7.14
Riser mains, hose reels and hydrants	9	64.29	5	35.71	0	0.00
Facilities for the disabled	0	0.00	0	0.00	14	100.00
Fire Brigade access and facilities	9	64.29	5	35.71	0	0.00
Firefighting and evacuation lifts	0	0.00	0	0.00	14	100.00
Safety signs and notices	1	7.14	13	92.86	0	0.00
Portable fire extinguishers	11	78.57	3	21.43	0	0.00
Fire assembly points	4	28.57	3	21.43	7	50.00

4.2 Results, findings and discussions

Automatic water sprinkler system: Although 85.71% of the buildings in the sample were found to be installed with water sprinkler systems, they exhibited insufficiency, while 14.29% had no sprinkler systems at all.

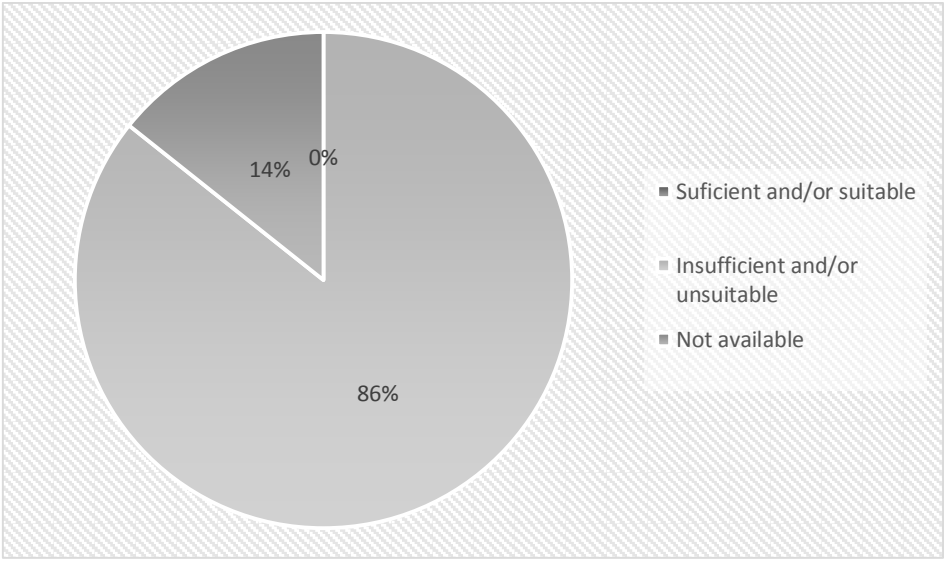

Figure 1: The proportion of buildings with or without sufficient and or/ suitable automatic water sprinkler system

Visual observations and review of internal and external inspections and maintenance reports showed that damage to

sprinkler heads, poor housekeeping (leading to dusty conditions which could trigger activation of alarm system), inadequate reserve water and poor implementation of the maintenance program after inspection as key factors that rendered the system insufficient. According to the fire experts in the construction industry, cost factors in installation of sprinkler systems is very high and it times can escalate the cost of a project by three percent up hence making distribution limited to basements only. According to the Fire brigade fire investigations none of the sprinkler systems in buildings in the CBD have ever actuated during fire episode hence putting doubt to their effectiveness. From the findings of the study, it's critical that, apart from provision of sprinkler systems they be inspected, tested and maintained at all times. It is also important that housekeeping is maintained to prevent unwanted alarms.

Fire detection and alarm system: The essence of an alarm system is to detect fire and/or smoke and keep the building occupants and fire attendants alert and evacuate the buildings if the danger of fire became eminent. In the survey all the buildings were found to be installed with an fire detection and alarm system. However deficiencies persisted. In the survey, it was found that 57.14% of the buildings had a sufficient and suitable fire detection alarm system. However, 42.86% exhibited insufficiency or unsuitability.

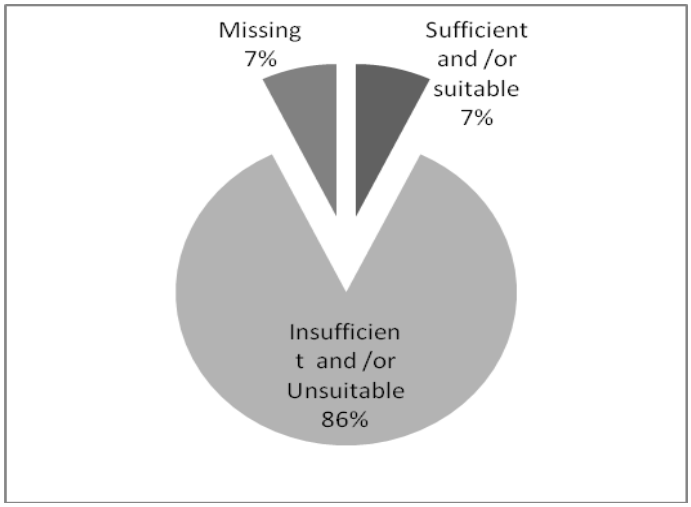

Figure 2: The proportion of buildings with or without sufficient and or/ suitable automatic fire detection and alarm system

Data from the responses from bulding managers, fire experts and occupants indicated that the shortfalls on fire detection and alarm system originate from maintenance-related issues such as rampant false alarms due to poor house-keeping (dusty conditions), smoke from smoking and kitchen, component loss or breakdown or sheer lack of maintenance. To achieve, a realiable fire and alarm system, there is a need to maintain cleaniliness in the buldings, conduct regular inspections and implementable maintennace schedules. There is also a need education or awareness creation aomgn the occupants.

Escape route: In the survey it was found that only 7.14% of the buildings had sufficient or suitable means of escape to safety, 85.71% were found to insufficient and/or unsuitable fire elements and 7.14% had no escape stairs or other means of escape.

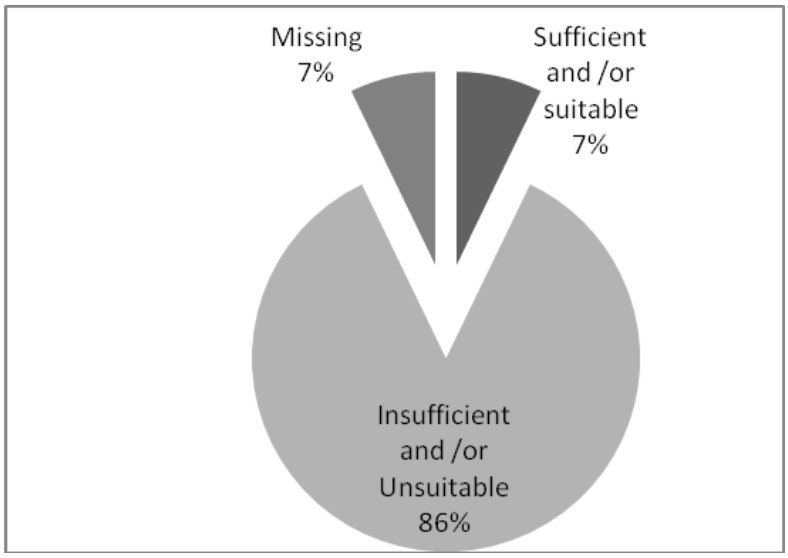

Figure 3: The proportion of buildings with or without sufficient and or/ suitable fire escape route

In the survey it was found that the deficiencies are in escape routes are connected to such factors as unclear or no exit signage leading to difficulties in finding the exact location of the escape route, obstructions, locking, etc.; smoke entering the escape route and escape stair due to poor escape route planning and the condition of fire doors, that is, either broken, locked, not self-locking etc. Inspection and maintenance is essential to achieve a safe (free of any obstructions) escape route. It should be well light and provided with essential furniture to aid in movement and visibility of the route. The occupants should be inducted on the use of the escape routes through fire drills.

Emergency lighting: The survey found out that, 64.29 % of the buildings had sufficient and suitable emergency lighting, 21.43% were either insufficient or unsuitable while 14.29% of the buildings had no supply dedicated for emergency.

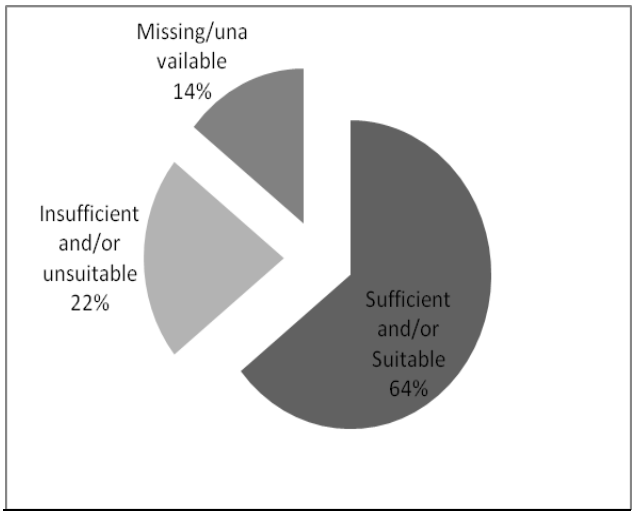

Figure 4: The proportion of buildings with or without sufficient and or/ suitable emergency lighting

The deficiency was found to be due to poor or improper maintenance and/or sheer negligence. Batteries kept for supplying power to the lights during emergencies are rarely checked to ascertain their condition nor replaced after they are commissioning.

Smoke control system: Rule No 18 and regulation SS43 of the National Planning and Building, 2010 provide for provision of such facilities for control of smoke and/or fumes in workplaces or occupancies. Smoke control is mainly done mechanically through stair and lobby pressurization to prevent smoke from spreading and entering the escape route or other areas in the building. As presented in the analysis above, 14.29% of the buildings had sufficient and suitable smoke control systems, 78.57% were insufficient or unsuitable and 7.14% had no any smoke control mechanism.

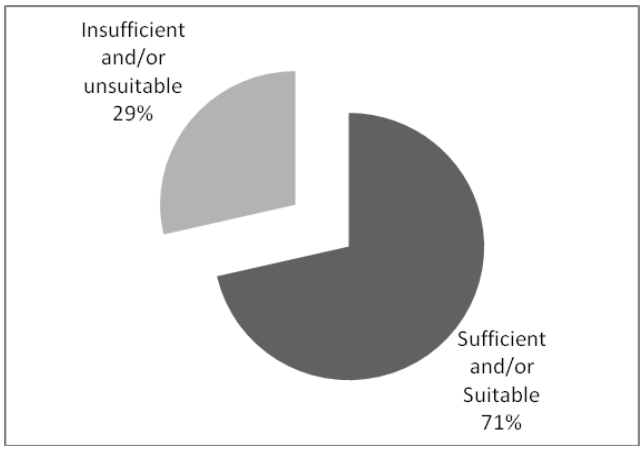

Figure 5: The proportion of buildings with or without sufficient and or/ suitable smoke control system

Insufficiency or unsuitability of the smoke control systems and the ventilating systems was to compromise to fire doors, for instance, hinged, broken etc., poor workmanship during repairs and poor or improper maintenance and inspection of the systems. The survey shown that, the systems are rarely tested to confirm their efficacy due to the cost factor and lack of expertise. Tests on stair and lobby pressurization is a rigorous process that will require experts.

Riser mains, hose reels and hydrants: The Fire Risk Reduction rules, Rule No 29 (1) requires that occupiers provide means of extinguishing fire at the workplace, Section (4) requires that, where fire hose reels are provided and occupiers ensure that there is at least one fire hose reel are within the radius of 30 meters**.** In view of the above requirements, the survey found out that 50.00% had sufficient and/or suitable components while the rest i.e. 50.00% were insufficient and /or unsuitable. The challenges and problems were found to be: blocking of the breaching inlets or outlets; lack of delivery hoses or inappropriate locations vis-à-vis access to the firefighters i.e. they cannot easily be reached or accessed due to long distances or blockage; deficiencies or lack of adequate water supply and improper maintenance of the facilities.

Facilities for the disabled: In buildings, all persons are supposed to be provided with a means to access and a means for evacuation during emergencies. Facilities for the disabled are those that would assist persons with disabilities i.e. persons with visual impairment, expectant mothers, the sick etc., in the event of fire emergency. Such facilities include temporary fire refuges or lifts and specially made evacuation lifts. In the survey it was found that none of the buildings had any facilities for the disabled in time of emergency. This can be partly attributed to the shortfalls in the Building Codes and also due to high expenditure that would be realized when a complete set of facilities for the disabled are provided in the building costs. Interviews with the built environment indicated that the main provisions for access, movement and safety in a building are considered for the majority user population. All the interviewees agreed that there is a need to consider facilities for the disabled during costing and design of a project.

Fire brigade access and facilities: In regard to the provision of the regulation, the survey found out that 57.14% were sufficient and suitable while 42.86% were not. The survey found that; lack of facilities to access internal upper parts of tall buildings especially firefighting lifts; protected firefighting lobbies for the fire personnel; blocked access routes to the buildings by vehicles and other infrastructures; blocked inlets and water sources; missing components such as delivery hoses, insufficient water supply and; inadequate information in the building to guide firemen and protect them from hazardous installations or materials as the challenges in maintenance of in fire brigade access and facilities.

Safety signs and notices: The fire legislations require that buildings be installed with requisite signs and notices that meet minimum criteria. They include directional signs and notices, warning signs and notices, prohibitory notices and signs.The survey found that only 7.14% of the buildings had sufficient and suitable fire signs and notices and 93.86% were found to be deficient or unsuitable. The findings indicate that, though most of buildings have been installed with signs and notices they are many problems associated with them. The key problems in regard to provision of fire safety signs and notices included improper locations, blocking and unclear messages or signs.

Fire Extinguishers: These are first-aid fire extinguishers which are installed in the building for emergency purposes. It is a legal requirement under the Fire Risk Reduction, rule 29 (1) to provide firefighting appliances includes, among others, fire extinguishers. The survey found that 78.57% of the buildings were well provided with sufficient and suitable fire extinguishers and 21.43% were not. It was observed that the main factors that highly constituted insufficiency and unsuitability included poor siting in the light of the type of fire or fire hazard, improper servicing, misuse of hose reels e.g. for floor cleaning, vandalism of nozzles and other accessories.

Fire assembly point: The requirement for fire assembly point is provided in Rule No 24 of the Factories and Other Places of Work (Fire Risk Reduction) rules, 2007.The rule requires every occupier identify a location in the workplace where every worker shall assemble in the event of a fire. The research showed that 28.57% had adequate fire assembly point, 21.43% were not while 50% had no fire assembly point. The key challenges found with the provision of assembly point was lack of adequate space in the city to locate the assembly point, other unrelated uses e.g. car wash, car park, storage of waste and other items.

V. Conclusion and Recommendations

In conclusion, it's noted that, although many commercial highrise buildings are provided with fire protection systems and methods such as fire detection and alarm system, portable and fixed fire extinguishers, maintenance still remains wanting. A key setback to maintenance is improper or lack of implementation of the recommendation made after inspections are performed. Further, the survey shows that all (100%) the buildings do not have critical fire protection systems such as firefighting and evacuation lifts and facilities for the disabled. In order to achieve optimal fire safety in commercial highrise buildings it's recommended that a) maintenance of fire protection systems and methods should be part of the occupier's management responsibility and should not be considered as an extra expense but rather as part of investment portfolio; b) thorough inspections, reporting, feedback and remedial actions should be undertaken with due diligence to protect the property, lives and/or the environment; c) projects undertaken for construction of commercial highrise buildings should provide for the firefighting and evacuation lifts in future. They should also consider installation of facilities for the disabled at design stage.

References

[1] C.R Kothari (2014), "Research Methodology: Methods and Techniques', 2nd Ed, New Age International Publishers

[2] C.Ray Astahi and David W. Rieski (2010), Industrial Safety and Health Management, 6th Ed. Pearson Education Inc, New Jersey

[3] Ed Soja et al (2011), Fire protection in Highrise Buildings; BCC, Melbourne, Victoria

[4] FPA, (2009), Fire Prevention, Fire Engineers Journal: The international journal for fire professionals, FPA

[5] Furness and Muckett (2010), "Introduction to Fire Safety Management", Elsevier Ltd, Burlington, UK

[6] Government of Kenya (2007).Occupational Safety and Health Act, 2007; Government Press, Nairobi

[7] Government of Kenya (2007), "Factories and Other Places Work (Fire Risk Reduction) Rules, L.N 59, 2007", Government Press, Nairobi

[8] Government of Kenya, (2010), "National Planning and Building Regulations, 2010", Government Press, Nairobi

[9] HSE (2009) Safety and Health in Highrise Occupancies, HSE, London

[10] http://www.ctbuh.org/ accessed 23rd April 2014

[11] http://www.emporis.com/statistics/tallest-buildings-nairobi Kenya accessed 29th April 2014

[12] Mugenda and Mugenda, (2003), "Research Methods (Quantitative and Qualitative Approaches)" 3rd Ed. ACTS, Nairobi

[13] NFPA 550 (2007), "Fire Safety Concepts Tree", National Fire Protection Association, Division Quincy, MA

[14] R. Kumar (2005). Research Methodology 2nd Ed. (A step-by-step guide for beginners), Sage Publications, and London

[15] Rasbash, D.J et al., (2004), "Evaluation of Fire Safety", John Wiley and Sons, England.

[16] Yatim, Y.M. and Harris, D.J., (2007), 'An Evaluation of Provision of Escape Routes in High

[17] Rise Residential Buildings – Malaysian Experience', Journal Alam Bina, Universiti Teknologi

[18] Malaysia, Jld, 09 No.04, pp.67 c 81.

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Assessment of Fire Escape Routes in Commercial High-Rise Buildings in the Nairobi CBD, Kenya

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Abstract- Due to the inherent fire risk in occupancies, it necessary that they are provided with suitable and sufficient escape route in case of fire emergency. This will ensure that occupants can get to a place of relative safety within the shortest period of time without travelling excessive distances or encountering hindrances. This paper is resultant of a study conducted on fourteen commercial highrise buildings in Nairobi CBD. It assesses essential fire escape route elements in the light of the requirements of the national regulations, laws and standards. Inspections, questionnaire survey, document review and interviews were used in the research. One hundred and nine (109) occupants responded to the questions poised to capture their perception, attitude and opinion on the escape route/s at their workstations. In the assessment 85.71% of the surveyed escape routes exhibited insufficient or unsuitable fire elements while only 7.14% of the buildings had sufficient and/or suitable and 7.14% had no escape stairs at all. Further, the results of the study show that, although fire escape routes are required as an integral part of the fire safety strategy, there still exist deficiencies in their provision. Unclear or no exit signage, obstruction and locking; poor escape route planning, lack of alternative escape route and the condition of fire doors are some of the challenges found with escape routes in the buildings. In view of the results, escape routes should be adequate, easily accessible, properly marked, well lit and have in place requisite facilities to enable easy movement and safety of the people. The escape route should also be routinely inspected to ensure no inhibitions are found to prevent people from using the route effectively. Lastly, the responsible authorities and persons should make sure that inspections are done and records made on remedial actions undertaken to correct present hazardous situation/s.

Index Terms- Fire escape route, means of escape, relative safety, highrise buildings

I. Introduction

Provision of escape route in any occupancy emanates from the need to ensure that all persons in buildings can easily and quickly get to a place of relative safety in the event of fire or other dangers without obstructions. A fire escape route in highrise buildings, unlike low-rise buildings, is more critical in the event of fire due to the height factor and the number of occupants at any one particular time. Insufficient or absence of an elaborate fire escape route is likely to cause a calamitous situation in the event of fire in such occupancies. At a minimum a fire escape route should be easily accessible and identifiable by the occupants and adequate enough to accommodate all the persons in the shortest time possible. It should also be well lit, properly ventilated, and free of any hindrances or blockages and protected from spread of fire and smoke by use of fire doors. Further, escape routes should be fitted with such facilities as balustrades, rails and means for communication to the outside.

The principal legislation that relate to fire safety in Kenya, namely, Factories and Other Places of Work (Fire Risk Reduction) rules require that all workplaces are provided with adequate means of escape while the Life Safety Code 101 (2000) developed by National Fire Protection Association (NFPA), provides that in circumstances where a disabled person is unable to escape unaided and might need to find a place of relative safety a refuge should be provided. According to a survey carried out by Nairobi Central Business District Association (NCBDA) in 2009**,** more than half (50%) of highrise buildings in the City have no adequate fire escape routes. The report cited obstruction of the staircases along the escape, lack of emergency lighting and compromised fire doors i.e. hinged, blocked or completely removed, as key setbacks in provision of escape routes. In view of the preceding, this study aims at examining the provision, in terms of sufficiency and suitability of safety elements, of fire escape routes in fourteen commercial highrise buildings in the Nairobi Central Business District (CBD). The findings of the research will assist the occupiers, designers and the authorities realize the shortfalls in provision of fire escape route in commercial highrise buildings, thus improve on the safety of the occupants.

II. Review of Literature

Conceptually, a good management of fire safety is essential to ensure that fires are unlikely to occur; that if they do occur they are likely to be controlled or contained quickly, effectively and safely; or that, if a fire does occur and grow, everyone in the premises is able to escape to a place of total safety easily and quickly (Furness and Muckett, 2007). The principal objective of provision of an escape route in occupancies is to ensure that people can get to a place of relative safety within the shortest period of time without travelling excessive distances or being delayed by 'bottlenecks'(FPA, 2007). . The route should at all points, be wide enough to allow the persons using such route to move rapidly along it and it must not, at any time, be obstructed in any way. The regulations also provide for the specifications for appropriate lighting and ventilation of such escape routes and stairways. Elements of escape route such as steps, handrail, balustrade and staircase slope should have been designed and installed in such a way that they are safe to use (Yatim, 2009).

Yatim, 2009 (pg 168) notes that ' escape routes in high-rise residential buildings are supposed to provide a safe egress for the building occupants to reach at the safe designated area and that elements of escape route such as steps, handrail, balustrade and staircase slope should have been designed and installed in such a way that they are safe to use'.

Yatim, 2009, also identifies other critical elements of fire escape routes such as means of escape routes for disabled such as provision of means of warning, consideration of escape time and vertical escape. As regards the means of escape he recommends that buildings should have additional measures for aiding the evacuation of disabled people. These include such measures as visual alarms and personal vibrating pagers linked to the alarm system. He also recommends that disabled persons be escorted or even carried to a safe place since they may need to rest for a while as they make their escape. In order to minimize the amount of time taken to escape, he notes, the following matters should be considered: clear signage indicating escape routes which are maintained and that escape routes should be kept clear of obstacles. Likewise, Life Safety Code 101 (2000) developed by National Fire Protection Association (NFPA), provides that in circumstances where a disabled person is unable to escape unaided and might need to find a place of relative safety a refuge should be provided. A refuge in a protected stairway is an internal stairway intended for use as escape route, it may also be used for everyday use. The protection use enclosing elements of fire resistant walling and doors (NFPA, 2007).

In Kenya, the legislative, policy and standards requirements for fire protection systems in buildings emphasize the need for maintenance, monitoring through inspections and reporting for effective protection of lives, property and /or environment. Despite lack of sufficient and solid legislation and policy framework for fire protection in Kenya, there still exist scattered statutes relevant to general fire safety in occupancies. A law specially formulated for the purposes of fire protection in highrise buildings is not there. The Occupational Safety and Health Act (2007) is the main legislation governing general safety and health in workplaces. The key provisions in the Act related to fire protection include section 77-Access and safe place of employment, Section 78-Fire prevention, Section 81-Safety provisions in case of fire and Section 82-Evacuation procedures. Other legislative instruments include the Factories and Other Places of Work (Fire Risk Reduction) rules Legal Notice 59, 2007 and the National Buildings Maintenance Policy which provides for effective maintenance that ensures adequate health, safety and environmental standards, return on investment, convenience and comfort for the building users.

III. Materials and Methods

3.1 Case studies

The project boundary is defined by the core Nairobi City (62 Km Sq) found in the larger Nairobi Metropolitan. Most of the high-rise buildings in the Nairobi Metropolitan are found within the Nairobi Metropolis, especially the CBD. High-rise are building structures with over 7 storeys or 23 meters high measured from the sidewalk to the highest occupiable level, NFPA (2000). A request letter accompanied by an introduction letter from the Institute of Energy and Environmental Technology was used to get the permission to conduct the research in their buildings. The buildings involved in the survey exhibited mixed-use character with varied types of businesses such as schools, health centers, retail shops, especially clothing and office blocks, salons, cash transfer outlets, cyber cafes and restaurants among others. Others have some floors partitioned to create space for establishment of stalls commonly referred to as exhibitions. Registry records from the the department of city planning and architecture showed that the CBD has over 150 commercial highrise buildings (the CBD encompasses areas within Wetland's, Upper Hill, Community, Parklands and the section bordered by Uhuru highway, Haile Selassie, Kirinyaga road, Globe Cinema, Kijabe Road back to Uhuru highway). By use of random tables, the researcher selected 25No. buildings, however, in only 14No (9.3 %) of the buildings the request to conduct research in these premises was accepted. The situations of the buildings are as contained in the table below:

Table 1: The buildings involved in the study

No	Name of the building	Date of Construction	No of floors	Location within the CBD
	Re-insurance plaza	1982	20	Harambee Avenue
	Anniversary Towers	1992	26	The University Way
	KICC	1973	31	Between Harambee Avenue City Hall Way
	Electr. House	1974	18	Harambee Avenue
	Eco bank	1983	19	Muindi Mbingu
	Tembo House	1985	7	Moi Avenue
	Rahim. Tower	1999	18	Upper Hill
	Afya center	1987	17	Tom Mboya Street
	Lonrho House	1990	20	Standard Street
	Stanbank House	1970	10	Moi Avenue
	Bandari Plaza	1985	14	Westlands
	Fedha	2008	10	Westlands
	ICEA	1981	19	Kenyatta Avenue
	I&M	2001	18	Loita Street

3.2 Methods

a) Sampling

The methodological approach was a synergy of quantitative and qualitative methods subjected to fourteen commercial high-rise buildings. Data was collected through a) a pre-designed

checklist where the researcher accessed the escape routes and noted the shortfalls; b) document reviews and c) interviews of building managers and the occupants. The requisite sample was generated by use of random tables where all the 154 commercial high-rise buildings in the CBD were listed and involved in the sampling process. Individuals to participate in the interviews were selected through convenience and snow-ball sampling techniques. A pre-set questionnaire was administered to 109 respondents (occupants) to capture their perception, opinions, knowledge and attitude of on such elements as distance to the escape route, marking and lighting, maintenance, stairway protection and adequacy of the escape route. The responses were measured by use of Likert scale with varying responses range, that is, Agree/Yes, Partly Agree, Disagree/No, Totally Agree and Not applicable/I don't know.

IV. Analysis and Results

The analysis of the adequacy of the escape route was done based on NFPA (2007) adequacy criterion, i.e., sufficiency and suitability. As indicated above, several sources of data or research methods were employed in the survey. These are observations, interviews and the questionnaire survey. The sections provide the analysis and results in each tool.

a) Inspection of the escape route

A predesigned checklist (adopted from NFPA, 2007) was used in inspecting the situation/s of the various requisite elements for an escape route such as size, slope, lighting, signage, and distance. The adequacy of the route was checked against its sufficiency and/or suitability in the light of the national legislation (the building regulations) and standards. Through observations it was found that only 7.14% of the buildings had sufficient and/or suitable escape routes, 85.71% exhibited insufficiency or unsuitability while 7.14% had no escape routes at all. The results are illustrated in the figure 1 below.

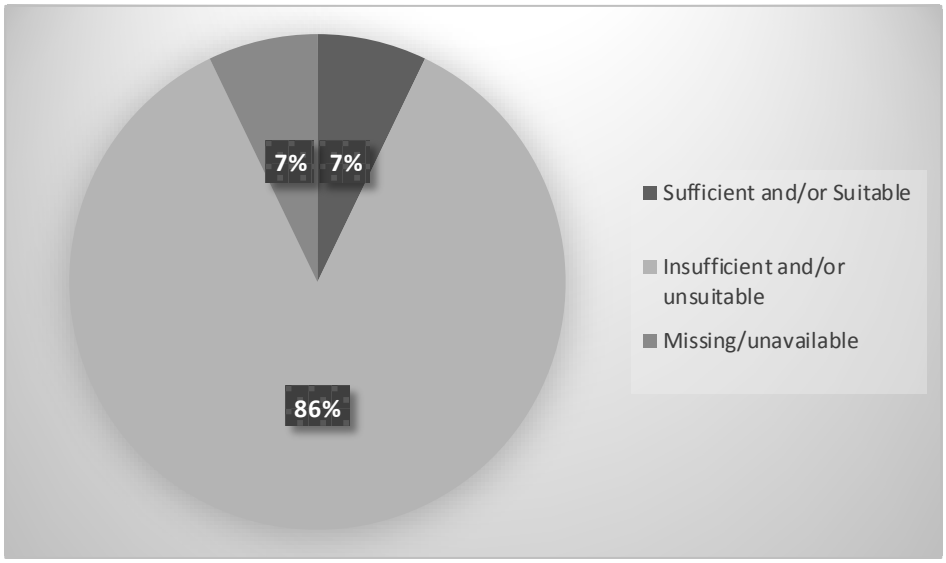

Figure 1: Observations on provision of means of escape in buildings

The survey found that only 7.14% of the buildings had sufficient or suitable means of escape to safety, 85.71% had exhibited insufficiency while 7.14% had no escape stairs. . The deficiencies noted are wide ranging and cumulatively define the fire safety performance of a building. The key shortfalls in escape route include unclear or no exit signage, obstruction and locking; to poor escape route planning, hence prone to entry of smoke; the number of people occupying the building at one particular time exceeding the design factor; lack of facilities for disabled people, lack of alternative escape route; and the condition of fire doors, that is broken, padlocked and not self-locking.

b) Questionnaire analysis

The occupants were interrogated on several aspects of a suitable fire escape route such as distance, marking and lighting, stairway protection etc. as discussed in the sections below.

i) **Distance to the place of relative safety**

Normally, distance from the position of the occupants to the nearest escape route and thereafter should be short enough to allow respondents to reach a place of relative safety in the shortest time possible. In the survey, the responses were as illustrated in the figure below.

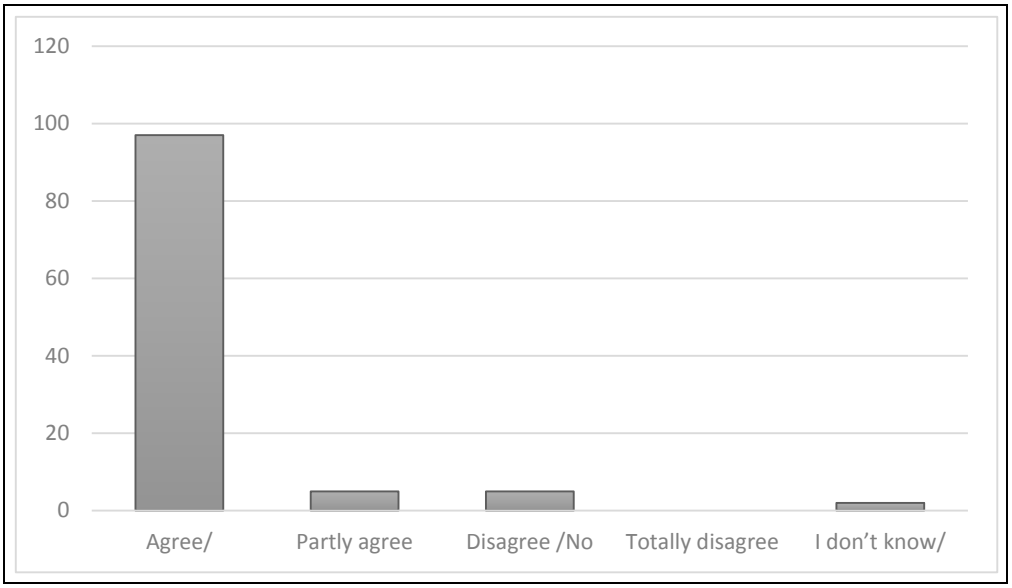

Figure 2: The level of agreement of the distance to the escape route

The results above indicate that majority (89%) of the respondent were contented with the distance of travel to place of relative safety. The means, in most of the buildings, the occupants would be able to identify and reach the escape route in time to safety.

ii) **Marking and lighting of the escape route**

Marking of the escape route is important to offer an opportunity to the occupants to identify the route easily. The building codes requires that any building having emergency routes be clearly marked and signposted to indicate the direction to be travelled in the case of any emergency. The Occupational Safety and Health Act, 2007, Part VIII, Section 8, subsection (7), requires that every, window, door or other exit affording means of escape in case of fire or giving access thereto, other than the means of exit in ordinary use, be distinctively and conspicuously marked by a notice printed in red letters of an adequate size . The escape route should also be provided with emergency lighting in times of darkness lasting for duration adequate to facilitate evacuation of all the persons. It also requires that the escape routes are well illuminated to allow person using the route be able to see clearly. Tactile floors and braille inscriptions are also necessary to persons with visual problems. In the survey the buildings were found to perform differently in terms of provision of such elements. The results are as presented in the figure 2 below.

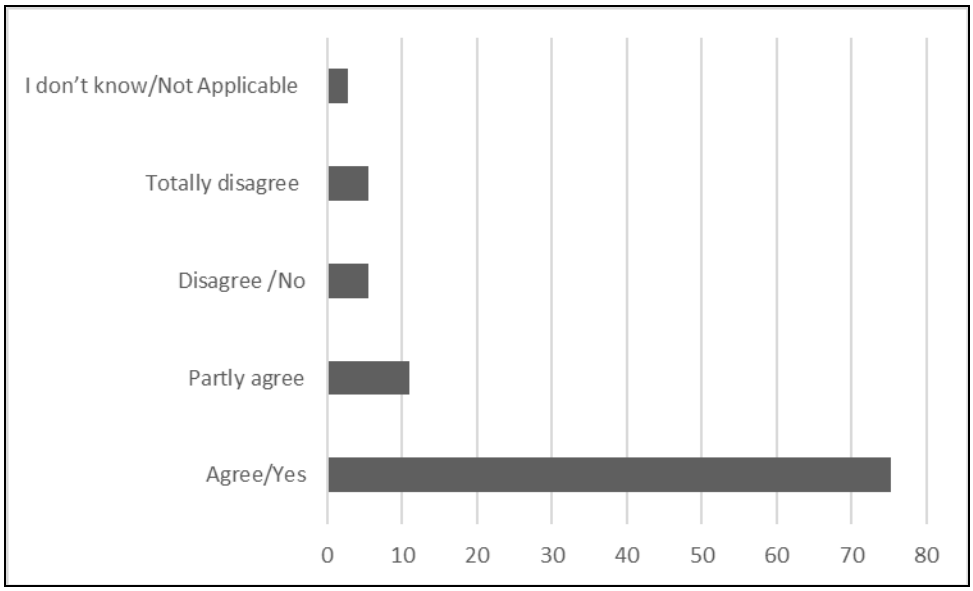

Figure 3: The Marking and lighting of the escape route

As shown above, the 75% of the respondents agreed that the escape routes are well marked and lit while 11% of the respondents partly agreed.

iii) Maintenance of escape route

The escape route should be well maintained, free of any obstructions, well light and provided with essential furniture to aid in movement and visibility of the route. This will make the escape usable during emergencies. Maintenance will also allow remove of unwanted materials or obstructions along the route. The responses are illustrated in the figure below.

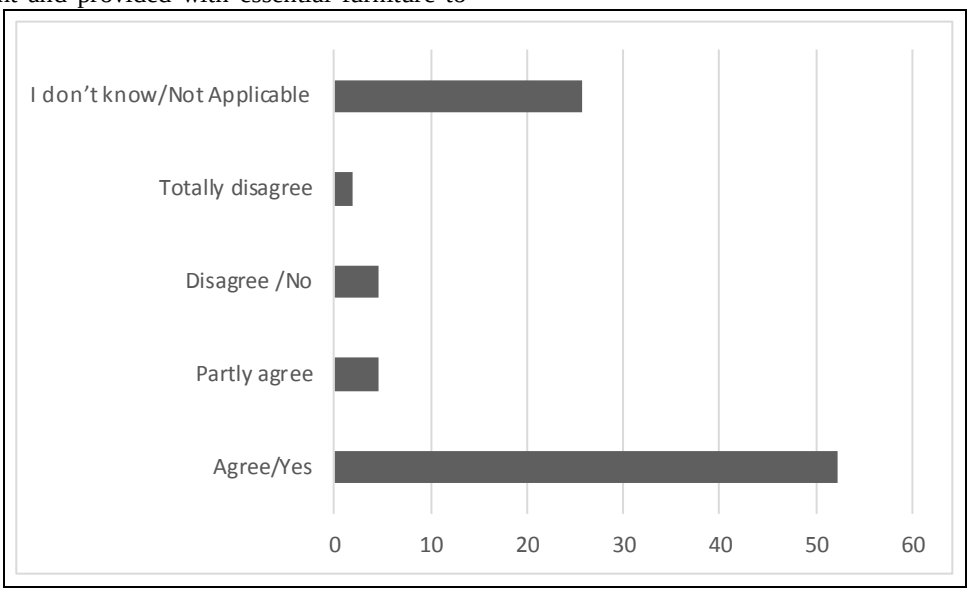

Figure 4: Level of agreement with maintenance of the escape route

The responses show that 52% of the respondents were satisfied with maintenance of fire escape route in their premises, 30.28% had reservations while the rest variously not satisfied (constituting 17% of the respondents).

iv) Stairway protection

The building regulations, regulation SS25.6, provides that where any stairway forms part of an emergency route such stairway shall, throughout its length, be provided with a handrail on each side. Regulation SS26 requires that a stairway is provided with ventilation to the outside of the building at each storey level or ventilated by means of a roof ventilator and such ventilator be permanently open. The stairways are also supposed to be protected from intrusion and spread of smoke and heat through provision of fire-rated. Smoke and smoke products, if not stopped from entering the escape route may lead to deaths through asphyxiation.

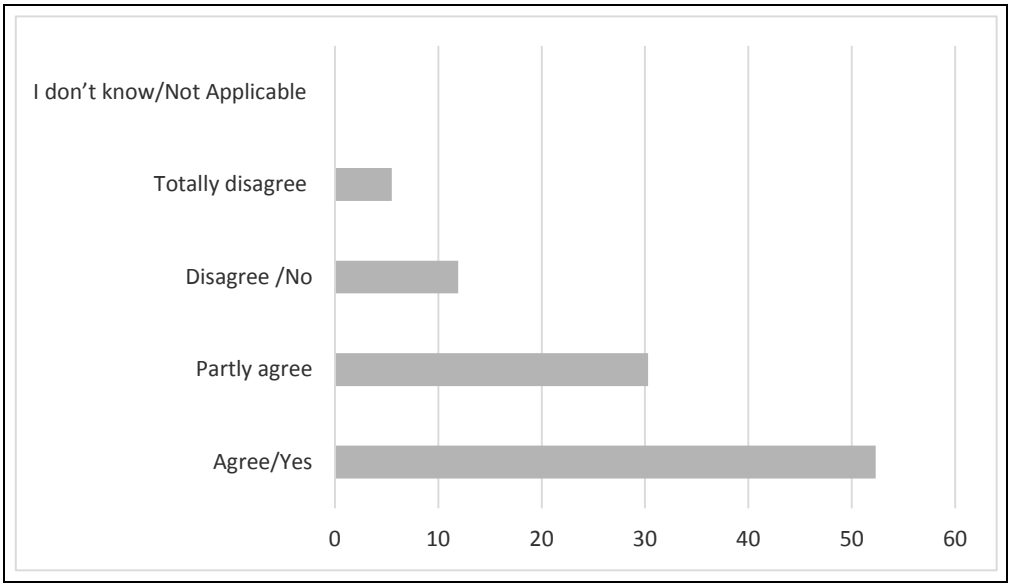

Figure 5: Level of agreement by occupants on fire escape protection

As indicated in the analysis above, 52.30% of the respondents were comfortable that the escape route is well protected, 4.59% were partially contented while the 17.42% were not. The proportion of the respondents who had no idea (25.69%) could be associated with persons who have never used the escape routes/ staircases or are likely to have not participated in fire drills. The results are indicative that protection of escape stairway protection needs to be improved.

v) Need for an additional escape route

The investigations showed that over 70% of the respondents expressed a need for an extra escape route. This could be associated by the high number of occupants in the premises. Also, the respondents could have experienced the confusion, congestion and struggle that emerge after an alarm is set off during trials or after a false alarm.

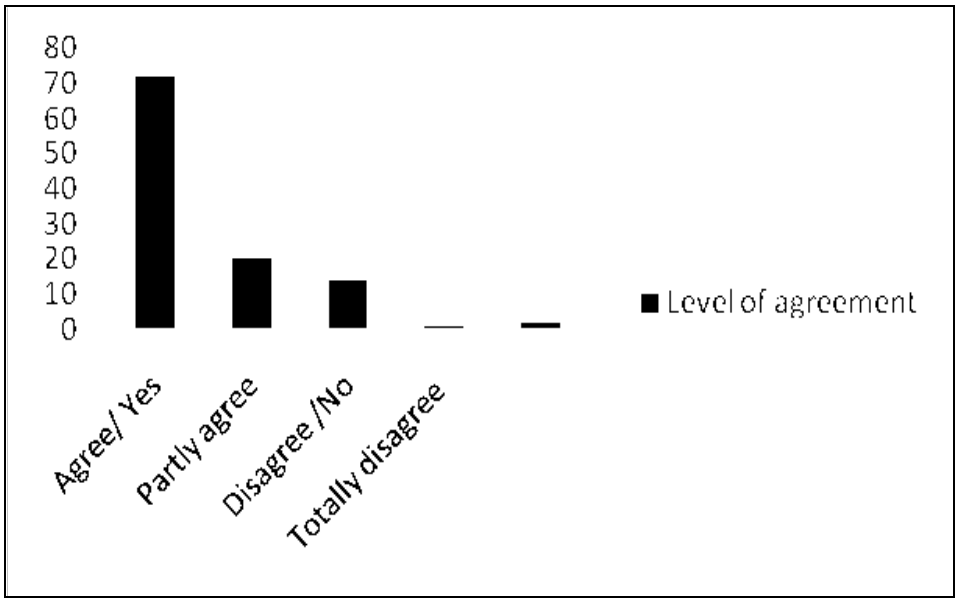

Figure 6: Level of agreement on the provision of additional fire escape route

The results show that there is a need for more than one fire escape routes in commercial high-rise buildings especially where the user surpass the number of occupants**.**

V. Conclusions and Recommendations

As indicated in the methodology, physical observations, literature review, interviews and questionnaires were the key tools for data collection. Data analyzed from literature review, observations and interviews made during the survey it was clear that; a) unclear or no exit signage, obstruction, locking, etc.; b) poor escape route planning and lighting ; c) the number of people occupying the building at one particular time exceeding the design factor; d) lack of facilities for disabled people to evacuate from the building; e) lack of alternative escape route provided in the building; f) the condition of fire doors, that is, broken, locked, not self-locking etc. and; g) lack of smoke control/removal mechanism as key challenges in provision of escape routes. The occupants variously expressed their opinions and perceptions in regard to the provision of the escape routes. The analysis has showed that majority of the occupants (respondents) agreed that the distance to the place of relative safety is adequate (89%), 52% agreed that maintenance and stairway protection are adequate while 80% felt a need for an extra escape route at their respective premises.

To this end, it's recommended that, to enhance use and safety of escape routes in commercial high-rise buildings, there is a need to correct the shortfalls such as unclear exit signs, obstructions in the access and stairway and provide for adequate escape route that can accommodate all the occupants at the shortest time possible and provide facilities for the persons with disabilities. New buildings should install fire fighting/evacuation lifts to defeat the challenges due the height of the building.

References

[1] Abdulla, Jelani, (2001), "Fire in tall building: Occupants safety and owners' liability" Kuala Lumpar, International Law Book Services

[2] C.R Kothari (2014), "Research Methodology: Methods and Techniques', 3rd Ed, New Age International Publishers

[3] FPA, (2007), Fire Prevention, Fire Engineers Journal: The international journal for fire professionals, FPA

[4] Furness and Muckett (2010), "Introduction to Fire Safety Management", Elsevier Ltd, Burlington, UK

[5] Government of Kenya (2007), "Factories and Other Places Work (Fire Risk Reduction) Rules, L.N 59, 2007", Government Press, Nairobi

[6] Government of Kenya, (2010), "National Planning and Building Regulations, 2010", Government Press, Nairobi

[7] FPA, (2003), "Design guide for the Fire Protection of Buildings: Essential Principles", Fire Protection Association, London

[8] Mugenda and Mugenda, (2003), "Research Methods (Quantitative and Qualitative Approaches)" 2nd Ed. ACTS, Nairobi

[9] R. Kumar (2005). Research Methodology 2nd Ed. (A step-by step- guide for beginners), Sage Publications, and London

[10] Ranjit Kumar, (2005), "Research Methodology – A step-by step guide for beginners", Sage Publications, London.

[11] Yatim, Y.M. and Harris, D.J., (2007a), 'An Evaluation of Provision of Escape Routes in High-Rise Residential Buildings – Malaysian Experience', Journal Alam Bina, Universiti Teknologi Malaysia, Jld, 09 No.04, pp.67 - 81.

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Preference of Sports Journalism in Sri Lanka

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Abstract- Sport is a field which is in very essential for a development of nations improve health and confidence. To fulfil this task, the newspapers can be perform a great job. When the sports journalist do this tasks, he becomes a principal part of a mission of a nation. Sports activities development is important for the personal confidence, social efficiency and good health. In that case media has huge responsibilities. In order to make the enthusiasm and participation more people for sports, the journalist has a great responsibility.

All the people must participate in sports without divide and deference. And also it has an equal right. Partially of sports newspaper reporting is a barrier for the sports development of future. At present, reporting of sports based one game and they accomplish without basics of media. The researcher tries to explore with this research, to study partially of the sport journalism in Sri Lanka. Method of research was the contained analysis. This research methodology is suited to analyses newspaper content. Study population in the research was all *sinhala* daily newspaper in Sri Lanka. Selected sample were two leading newspaper "*DIWAINA* and *DINAMINA*". 104 news headlines were collected randomly and mixed sample method. The data collected by Old reserves of the National Library and the National Archive Department of Sri Lanka. The Microsoft excel software used for data analysis.

It revealed that both newspaper were moderately partied in sport journalism particularly reporting of cricket and both newspaper showed 51% for cricket in their headline coverage. It conclude that more preference has given for the sport of cricket in the sport journalism in Sri Lanka.

Index Terms- preference, Sports News Reporting, Diwaina and Dinamina, Sport Journalism, Cricket.

I. Introduction and Purpose

The Newspaper, one form of the media which has long become a means of communication, has an important role as well as a potential power in our society. It has an important role in human's life since it gives people information about the surrounding situation or what is happening in the world. People get information about various news concerning economy, politic, sport or other local, national and international events.

Among these event specially attention for sport journalism in this study. Sport is a field which is in very essential for a development of nations improve health and confidence. To fulfil this task, the newspapers can be perform a great job. When the sports journalist do this tasks, he becomes a principal part of a mission of a nation. Sports activities development is important for the personal confidence, social efficiency and good health. In that case media has huge responsibilities. In order to make the enthusiasm and participation more people for sports, the journalist has a great responsibility. All the people must participate in sports without divide and deference. And also it has an equal right. Partially of sports newspaper reporting is a barrier for the sports development of future. At present, reporting of sports based one game and they accomplish without basics of media. The researcher tries to explore with this research, to study partially of the sport journalism in Sri Lanka. Under the research title of Explanatory Study on Preference of Sports Journalism in Sri Lanka.

II. Research Methodology

Since selecting main news headlines of sports pages of chosen newspapers, "Contained Analysis" is used as research methodology. Experts agree that this research methodology is suitable for identifying the mass media inclusion. According to "Jim macnamara", this research methodology is suited to analyses interviews, conversation scripts, cinema content, rupavahini content, newspaper and magazine content as well as advertisement content. This study is based totally on secondary data. So this research methodology is most suited and important out of all. As well as The Microsoft excel software used for data analysis.

III. Sampling

Sampling was data based on the selected Sinhala newspapers including "DIWAINA, DINAMINA" .Here these Sinhala newspapers was selected because the times of publishing are quite high. Therefor even minor incident is not going to be missed by this approach. So the credibility of these data is increased. There is another reason to select Sinhala newspapers. It is because most of subscribers are utilizing Sinhala newspapers.

Shoomarker and Rees used the methodology which was presented in main 03 points.

1. Selecting media structure

Print media was selected as the media structure and the main news headline of each selected newspaper's sports page is considered as the shunner.

2. Selecting the incident and time

The news headline has been selected as the incident and 2012 year selected as the time. The year 2012 was selected due to the balanced background for sports.

3. Selecting the sample including content of media and time

The time duration is based on the whole 2012 year and it covered main news headlines of premier sports pages in daily

Sinhala newspapers through that we can select a sample which more simpler than early.

Jimmacnamara introduced 04 methods to select samples.

1. Properly random sample usage

A unit likes special number, date, time or every x selection

2. Selecting with a purpose

Selecting all documents about definite basic point

3. Instalment method

Selecting a part of documents or some event

4. Selecting mixed samples

Here 01 and 03 methods were used more in this study. There 104 news headlines were collected randomly and mixed sample method. The data collected by Old reserves of the National Library and the National Archive Department of Sri Lanka.

IV. Findings

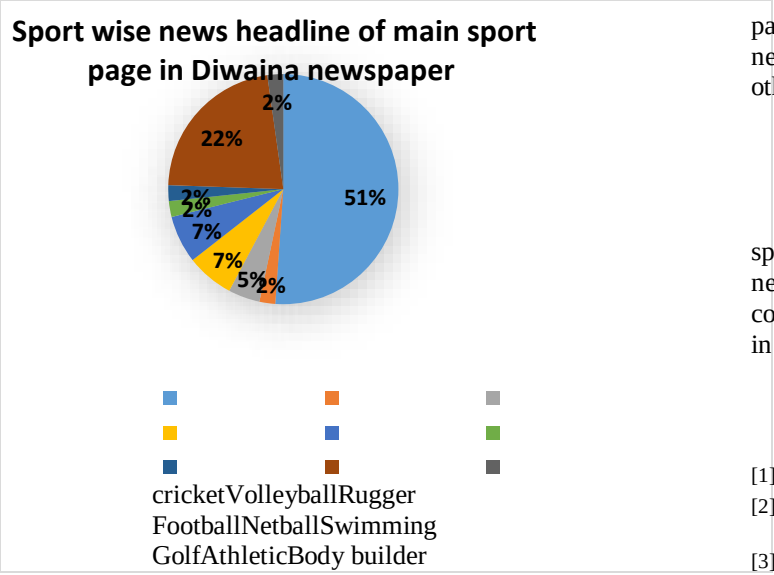

Figure 01

The cricket is the main highlighted headline coverage in the *Diwaina* newspaper. It has huge disparity than each other sport headlines.

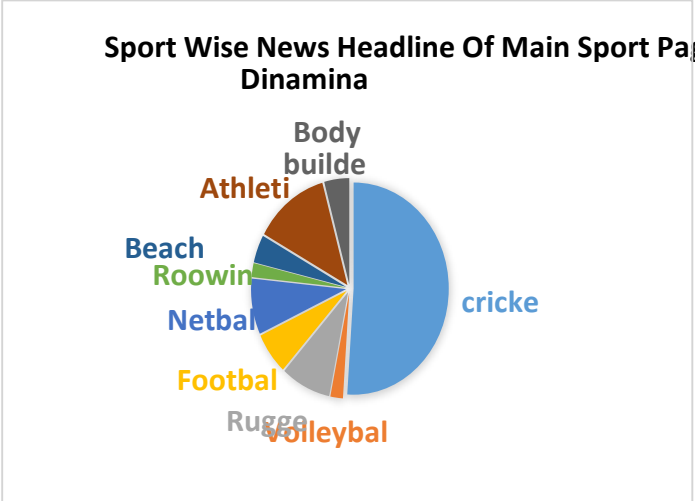

Figure 02

In above figure of Sport wise news headline of main sport page in *Dinamina* newspaper, same characterizes with *Diwaina* newspaper. The cricket is the main sport news headline than each other sports. It is 51.1precentage.

V. Conclusion

It revealed that both newspaper were moderately partied in sport journalism particularly reporting of cricket and both newspaper showed 51% for cricket in their headline coverage. It conclude that more preference has given for the sport of cricket in the sport journalism in Sri Lanka.

References

[1] Athhed Davide, 1986, media power, saga publication.

[2] Kariyawasam Thissa, principals of newspaper Art, 1976, Godage, maradhana, page36

[3] Koppett, L. (1994). Sports illusion, sports reality: reporter's view of sports, journalism and society. Urbana: University of Illinois Press.

[4] Rowe, D. (1992). Modes of sports writing. In P. Dahlgren, & C. Sparks (Eds.), Journalism and popular culture

[5] Boyle, R. (2006). Sports Journalism: Context and Issues: London: Sage Publications

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Effect of caffeic acid and pioglitazone in an experimental model of metabolic syndrome

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***Abstract*- Objective:** Incidence of metabolic syndrome (MS) is strongly associated with increased fructose consumption. This study aimed to elucidate the role of pioglitazone (Pio), caffeic acid (CA) and their combination on fructose-induced MS. **Materials and methods:** Seven groups of rats (n=8) were used. Groups 1-3 were fed on normal diet and received 1% Tween 80 (normal control), Pio (2.7 mg/kg) and CA (20 mg/kg), respectively. Groups 4-7 were fed on fructose-enriched diet (FED) for 15 weeks. The 4th group served as positive control group, and the remaining groups received Pio, CA and their combination, respectively. Treatments started 10 weeks after the beginning of fructose feeding. At the end of the study, blood samples were collected for estimation of MS related markers. **Results:** Induction of MS was associated with increased weight gain and insulin resistance coupled with elevated levels of blood glucose, insulin, uric acid, urea, creatinine and lipids as well as activities of liver transaminases. FED also reduced glutathione peroxidase activity and total antioxidant capacity, increased nitric oxide and lipid peroxides contents parallel to increased serum levels of leptin and tumor necrosis factor-alpha. Treatment with Pio or CA attenuated most of the changes associated with MS. Besides, combination of both agents further improved disease markers. **Conclusion:** The present results reveal the benefits of co-administration of CA and Pio in MS.

***Index Terms*-** Caffeic acid, insulin resistance, metabolic syndrome, oxidative stress, pioglitazone.

I. INTRODUCTION

Metabolic syndrome (MS) is currently a major worldwide epidemic. It represents by definition a disorder related to imbalance of energy utilization and storage. Its features include abdominal obesity, hypertension, dyslipidemia, insulin resistance with elevated fasting blood glucose, and glucose intolerance as well as establishment of pro-thrombotic and pro-inflammatory states **(Grundy et al., 2004)**.

At present the MS is already affecting more than a quarter of the world's adult population. Its prevalence is further growing in both adults and children due to a life style characterized by high calorie nutrition combined with low physical activity **(Ford et al., 2010; Friend et al., 2013)**.

Epidemiological and biochemical studies strongly indicate that consumption of a fructose-enriched diet (FED) contributes to increased prevalence of the modern epidemic of obesity, the basis for MS **(Astrup and Finer, 2000)** and insulin resistance **(Stanhope and Havel, 2008)**.

Pioglitazone (Pio) is one of thiazolidinediones which are synthetic peroxisome proliferator-activated receptor gamma (PPAR-γ) agonists that regulate several cellular functions decreasing insulin resistance **(González-Ortiz et al., 2007)**. Pioglitazone also exerts beneficial effects on the plasma lipid profile, leading to a lower risk of acute myocardial infarction, stroke, or heart failure **(Goldberg et al., 2005; Graham et al., 2010)**.

Natural products have proven historically to be a promising pool of structures for drug discovery and a significant research effort has recently been undertaken to explore the PPAR-γ - activating potential of a wide range of natural products originating from traditionally used medicinal plants or dietary sources **(Wang et al., 2014)**. Caffeic acid (CA) is a widespread phenolic acid that occurs naturally in many agricultural products such as fruits, vegetables, wine, olive oil, and coffee **(Mattila and Kumpulainen, 2002)**. Caffeic acid is a potent antioxidant with metal chelating properties **(Psotová et al., 2003)** as well as anti-inflammatory **(Chao et al., 2010)** and antidiabetic activities **(Gülçin, 2006)**.

Accordingly, the present study was designed to investigate the beneficial effect of Pio and CA treatments and their combination in fructose-fed rats and evaluate their effects on insulin resistance, lipid profiles and oxidative stress biomarkers and as well as liver and kidney function tests.

II. MATERIAL AND METHODS

Experimental animals

Fifty six adult male Wistar rats, weighing 120-150 g were used in the present study. Rats were housed in separated metal cages and maintained under the standard laboratory environmental conditions; temperature 25±2ºC and 12:12 h light/dark cycle with free access to food and water ad libitum. All rats were acclimatized for minimum period of one week prior to the beginning of study. All experimental protocols were approved by the ethics committee at the Faculty of Pharmacy, Cairo University.

Chemicals and drugs

Pioglitazone was kindly provided as a gift from Uni-Pharma Co (Egypt). Caffeic acid was purchased from Sigma Aldrich (USA). Each drug was suspended in 1% Tween 80 shortly before administration to animals. Fructose was purchased from El-Nasr Pharmaceutical and Chemical Industries (Cairo, Egypt). All other chemicals included were of the highest analytical grade available.

Induction of metabolic syndrome

MS was induced by feeding rats a FED for 10 weeks according to the method described by Bezerra et al. **(Bezerra et al., 2001)**.

Experimental design

After acclimatization to the laboratory conditions, the animals were randomly divided into seven groups (n=8) placed in individual cages and classified as follows:

Groups 1-3 were fed on normal diet and received 1% Tween 80 (normal control), Pio (2.7 mg/kg) and CA (20 mg/kg), respectively. Groups 4-7 were fed on FED for 15 weeks. The 4th group served as positive control group (FED-control), and the remaining groups received Pio, CA and their combination, respectively. Treatments started 10 weeks after the beginning of fructose feeding and continued for another 5 weeks.

Sampling

Blood sampling

By the end of the treatment period, animals were fasted for 12 h, weighed and blood samples were withdrawn from the retro-orbital venous plexus under light ether anesthesia for the separation of serum and plasma samples. Serum samples were used for the determination of the levels of glucose, insulin, lipids, leptin, tumor necrosis factor-alpha (TNF-α), creatinine, uric acid and urea as well as the activities of serum alanine transaminase (ALT) and aspartate aminotransferase (AST). Plasma samples were used to estimate the activity of glutathione peroxidase (GPx).

In addition, LDL-cholesterol (LDL-C) as well as indicators of insulin resistance, insulin sensitivity and β-cell function were calculated.

Homogenates sampling

Following blood samples collection, animals were anesthetized then sacrificed by decapitation. Livers and kidneys were rapidly excised and weighed. Then parts of the livers were used to prepare 10% homogenates. The prepared homogenates were used for the estimation of oxidative stress biomarkers including total antioxidant capacity (TAC) as well as the contents of lipid peroxides measured as malondialdehyde (MDA) and total nitrate/nitrite as an index of nitric oxide (NO).

Determination of the chosen parameters

Determination of body weight gain, liver and kidney indices

Body weight gain (%) was calculated using the following formula: Body weight gain (%) = Final body weight (after treatment) –Initial body weight (before treatment) / Initial body weight × 100.

Liver and kidney indices were calculated using the following formula: Organ index = Organ weight / Final body weight × 100.

Determination of serum fasting blood glucose (FBG), fasting insulin and leptin levels

FBG was measured using glucose diagnostic kit according to manufacturer's instructions based on the principle described by **Trinder (1969)**. Insulin and leptin in samples were estimated using enzyme linked immunosorbent assay (ELISA) diagnostic kits according to the method described by **Olsson and Carlsson (2005)**.

Determination of insulin resistance, insulin sensitivity and β-cell function

Insulin resistance and β -cell function were done using homeostasis model assessment (HOMA) **(Mattewes et al., 1985)**. Insulin sensitivity was calculated using quantitative insulin sensitivity check index (QISCKI) **(Katz et al., 2000)**.

Determination of serum total cholesterol, high density lipoprotein-cholesterol (HDL-C), triglyceride (TG) and LDL-C

Total cholesterol and HDL-C levels were determined using reagent kits obtained from BioChain, USA according to the methods described by **Richmond (1973)** and **Burstein et al. (1970)**, respectively. TG was determined according to the method described by **Schettler (1980)** using reagent kit obtained from Cayman Chemical Co., (USA). LDL-C was calculated according to the formula described by **Friedewald et al. (1972)**. LDL - C = Total cholesterol - HDL - (TG/5).

Determination of serum TNF-α level and ALT and AST activities

Serum TNF-α was estimated using solid phase two-site enzyme immunoassay diagnostic kit according to the method described by **Vilcek and Lee (1991)**. ALT and AST activities were determined using reagent kits obtained from Teco diagnostics (USA) according to the method of **Reitman and Frankel (1957)**.

Determination of serum urea, creatinine and uric acid levels

Urea and creatinine levels were determined using reagent kits obtained from BioAssay (USA) according to the methods described by **Fawcett and Scott (1960)** and **Bartels et al. (1972)**, respectively. Uric acid was determined according to the method of **Barham and Trinder (1972)** using reagent kit obtained from Bio Scientific Co. (USA).

Determination of oxidative stress biomarkers

Determination of plasma GPx activity and liver NO content were done using reagent kits obtained from Sigma-Aldrich (USA) according to the methods described by **Paglia and Valentine (1967)** and **Miranda et al. (2001)**, respectively. The method described by **Koracevic et al. (2001)** was used for the assessment of liver TAC content using kit obtained from Cayman (USA). MDA content of the liver was determined according to the method of **Fee and Teitelbaum (1972)** using reagent kit obtained from Cell Biolabs Inc. (USA).

Statistical Analysis

Data were expressed as means ± standard error (SE). Statistical analysis was performed using Graphpad prism software program, version 5.01 (GraphPad Softwae, Inc., San Diego, USA).

One-way analysis of variance (ANOVA) followed by Tukey-Kramer multiple comparisons test was used for

comparison of means of different groups. The level of statistical significance was set at $p < 0.05$.

III. RESULTS

Effects of Pio, CA and their combination on body weight gain as well as liver and kidney indices.

As shown in Table 1, feeding rats with FED for 15 weeks showed significant increases in body weight and liver index as compared to normal-control (NC) group. Treatment of insulin resistant rats with the combination of Pio and CA significantly decreased body weight gain by 28.86% as compared to FED-C group. Moreover, treatment of FED-fed rats with CA significantly reduced kidney index by 43.23% when compared to FED-C group (Table 1).

Effects of Pio, CA and their combination on parameters related to insulin level and insulin resistance.

As shown in Table 2, feeding rats with FED for 15 weeks showed a significant increase in insulin resistance as well as serum glucose and insulin levels as compared to NC-group. On the other hand, FED decreased insulin sensitivity and β-cell function significantly as compared to NC group. Treatment of FED-fed rats with Pio or CA alone or in combination significantly decreased serum insulin levels by 42.08%, 39.10% and 29.12%, respectively as well as FBG levels by 47.79%, 45.74% and 35.28%, successfully when compared to FED control (FED-C) group. Moreover, treatment of FED-fed rats with Pio or CA alone or in combination significantly decreased insulin resistance by 69.63%, 66.70%% and 53.79%, respectively and increased insulin sensitivity by 15.68%, 14.46% and 9.62%, respectively when compared to FED-C group. Also, results showed that treatment of FED-fed rats with Pio or CA alone significantly enhanced β-cell function by 97.79% and 85.76%, respectively as compared to FED-C group (Table 2).

Effects of Pio, CA and their combination on lipid profile.

FED significantly elevated total cholesterol, LDL-C, TG levels and TG/HDL-C ratio as compared to NC group. Moreover, FED decreased HDL-C markedly when compared to NC group. Treatment of FED-fed rats with Pio or CA alone or in combination significantly decreased TG levels by 16.47%, 26.04% and 29.26%, respectively and TG/HDL-C ratios by 49.66%, 52.35% and 58.50%, respectively as compared to FED-C group. Treatment of FED-fed rats with CA alone or in combination with Pio significantly reduced total cholesterol levels by 20.25% and 30.48%, respectively as well as LDL-C levels by 33.51% and 48.97%, respectively as compared to FED-C group (Table 3).

Effects Pio, CA and their combination on liver and kidney function tests.

FED significantly increased urea, creatinine and uric acid levels as well as ALT and AST activities when compared to NC-group. Treatment of FED-fed rats with Pio or CA alone or in combination markedly reduced urea levels by 36.77%, 26.01% and 32.92%, respectively as compared to FED-C group. Likewise, treatment of FED-fed rats with Pio alone or combined with CA significantly decreased creatinine levels by 26.44% and 14.42%, respectively as well as ALT activities by 39.01% and 26.47%, respectively and AST activities by 22.17% and 17.32, respectively as compared to FED-C group (Table 4). Moreover, administration of CA alone or in combination with Pio significantly decreased serum uric acid levels by 39.81% and 44.75%, respectively when compared to FED-C group (Table 4).

Effects of Pio, CA and their combination on leptin and TNF-α.

As shown in Figure 1, feeding rats with FED for 15 weeks showed significant increases in serum leptin and TNF-α levels when compared to NC-group. Treatment of FED-fed rats with CA alone or in combination with Pio, significantly reduced serum leptin levels by 26.91% and 36.11%, respectively as compared to FED-C group (Figure 1A). Treatment of FED-fed rats with Pio or CA alone or in combination markedly reduced TNF-α levels by 53.09%, 51.50% and 62.30%, respectively when compared to FED-C group (Figure 1B).

Table (1): Effects of Pio, CA and their combination on body weight gain serum glucose and insulin levels as well as liver and kidney indices in normal and FED-fed rats.

Groups / Parameters	NC	NC + Pio	NC + CA	FED-C	FED + Pio	FED + CA	FED + Pio + CA
Body weight gain (%)	29.28±1.57	32.52±3.46	25.71±1.34	57.03*±4.92	60.68*±4.06	43.21$^{@}$±2.33	40.57$^{\dagger@}$±3.53
Liver index (%)	2.94±0.13	2.97±0.20	2.98±0.25	4.22*±0.39	3.37±0.22	4.12±0.27	3.98±0.32
Kidney index (%)	0.53±0.08	0.40±0.05	0.48±0.04	0.77±0.09	0.52±0.08	0.44†±0.07	0.52±0.05

Results were expressed as mean ± S.E.M. (n = 8).
Statistical analysis was carried out by one-way ANOVA followed by Tukey-Kramer multiple comparison test.
∗ p <0.05 versus NC group.
† p <0.05 versus FED-C group.
@ p < 0.05 versus pioglitazone treated group.
NC, Normal control; FED-C, Fructose-enriched diet control; Pio, Pioglitazone; CA, Caffeic acid.

Effects of Pio, CA and their combination on oxidative stress biomarkers.

FED significantly decreased TAC level and GPx activity as compared to NC- group (Figure2A & B). Moreover, FED elevated MDA and NO contents significantly when compared to NC- group (Figure 2C & D). Treatment of FED-fed rats with Pio or CA alone or in combination markedly increased the activities of GPx significantly by 58.22%, 47.95% and 67.96%, respectively and decreased MDA contents by 39.26%, 68.38% and 64.16%, respectively parallel to reduced NO contents by 34.74%, 49.54% and 52.80%, respectively as compared to FED-C group (Figure2 B-D). Treatment of FED-fed rats with CA alone or combined with Pio significantly elevated TAC contents by 61.70% and 55.61%, respectively as compared to FED-C group (Figure 2A).

IV. DISCUSSION

Results of the present study revealed that feeding rats with FED for 15 weeks induced body weight gain, hyperglycemia, dyslipidemia, hyperinsulinemia, hyperuricemia, oxidative stress, pancreatic dysfunction and insulin resistance. The present results are in harmony with those of other investigators **(Alzamendi et al., 2009 and 2012)** which make this animal model a useful tool

Table (2): Effects of Pio, CA and their combination on parameters related to insulin level and insulin resistance in normal and FED-fed rats.

Groups / Parameters	NC	NC + Pio	NC + CA	FED-C	FED + Pio	FED + CA	FED + Pio + CA
Insulin resistance	2.14±0.16	2.05±0.10	2.23±0.09	15.25*±1.05	4.63*†±0.12	5.08*†±0.37	7.05$^{*\dagger@}$± 0.30
Insulin sensitivity	0.34±0.003	0.34±0.002	0.33±0.002	0.26*±0.002	0.31*†±0.001	0.30*†±0.002	0.29$^{*\dagger@}$±0.002
β-cell function	215.31±36.11	243.43±31.70	250.70±37.96	88.88*±10.47	175.80†±15.61	165.10†±13.68	129.60*±6.67
FBG (mg/dl)	82.80±3.72	75.80±4.12	83.00±3.67	195.00*±6.08	101.80*†±2.38	105.80*†±1.86	126.20$^{*\dagger@}$± 1.39
Fasting serum insulin (µIU/ml)	10.42±0.40	11.02±0.58	10.94±0.59	31.94*±2.72	18.50*†±0.75	19.45*†±1.39	22.64*†±0.98

Results were expressed as mean ± S.E.M. (n = 8).
Statistical analysis was carried out by one-way ANOVA followed by Tukey-Kramer multiple comparison test.
∗ p <0.05 versus NC group.
† p <0.05 versus FED-C group.
@ p < 0.05 versus pioglitazone treated group.
NC, Normal control; FED-C, Fructose-enriched diet control; Pio, Pioglitazone; CA, Caffeic acid; FBG, Fasting blood glucose.

to either study the underlying mechanism of such changes or to test the effectiveness of different treatment strategies.

Micronutrients such as natural antioxidants have received recently a great deal of attention with respect to their efficacy in treating the insulin-resistance syndrome complications. Caffeic acid is a phenolic acid compound which is naturally found in many plant foods such as carrots, tomatoes, strawberries and blueberries **(Sellappan et al., 2002)**. It has been documented that these phenolic acids possess anti-oxidative activities such as scavenging free radicals and chelating metal ions (**Makena and Chung, 2007; Prakash et al., 2007)**.

The present results revealed that CA significantly decreased kidney index as compared to FED-C group which might be attributed to the reduction in serum uric acid level, which in turn leads to attenuation of uric acid-induced alterations in the renal tissue.

Findings of the present study showed that treatment of insulin-resistant rats with CA for 5 weeks significantly decreased FBG, insulin and leptin levels when compared to FED-C rats, these results are in harmony with **Okutan et al. (2005) and Park and Min (2006)** who reported that CA has an antidiabetic effect in streptozotocin-induced diabetic rats. The hypoglycemic effect of CA may be due to enhanced transport of blood glucose to adipose tissue. Moreover, CA seemed to suppress the hepatic glucose output by enhancing hepatic glucose utilization and inhibiting glucose over-production **(Jung et al., 2006)**. A significant decrease in insulin by CA is due to improving peripheral insulin action and exerting beneficial effects on pancreatic β-cells **(Guerre-Millo et al., 2000; Kim et al., 2003; Bergeron et al., 2006)**. This in turn improves leptin level as it is positively correlated with the insulin level **(Cho et al., 2010)**. Likewise, CA significantly decreased insulin resistance as well as enhanced insulin sensitivity and β-cells function as compared to FED-C group. The initial adaptation to the insulin resistance is one of islet β-cell hyperplasia resulting in marked hyperinsulinemia (**Orland and Permutt, 1987**) and as mentioned above and reported by **Jung et al. (2006)**, CA decreased insulin and insulin resistance significantly which in

turn preserved β-cell architecture. The authors also reported that islet surface area in pancreas is relatively greater in CA-supplemented rats.

The present study revealed that CA decreased total cholesterol, TG and TG/HDL-ratio, significantly as well as it markedly increased serum LDL-C level when compared to FED-C group. These results are in harmony with **Chao et al. (2009) and Cho et al. (2010)**. The mechanism of CA effect on lipid profile could be attributed to the significant inhibition of fatty acid synthase, 3-hydroxy-3-methylglutaryl CoA (HMG-CoA) reductase and cholesterol acyltransferase (acyl-CoA) activities, while it increased fatty acid β-oxidation activity and peroxisome proliferator-activated receptors-α (PPAR α), one of nuclear transcription factors that act as lipid sensors and regulate lipid metabolism **(Willson and Wahli, 1997)** expression in the liver, which suggests that CA inhibited fatty acid and cholesterol synthesis and

Table (3): Effects of Pio, CA and their combination on lipid profile in normal and FED-fed rats.

Groups / Parameters	NC	NC + Pio	NC + CA	FED	FED + Pio	FED + CA	FED + Pio + CA
Total Cholesterol (mg/dl)	124.90±4.06	135.70±4.85	120.10±4.10	245.40*±14.74	249.00*±11.53	195.69$^{*\dagger@}$±11.56	170.63$^{*\dagger@}$±10.91
LDL-C (mg/dl)	43.59±6.32	60.42±7.04	52.58±5.39	173.10*±10.66	163.51*±3.15	115.10$^{*\dagger@}$±10.43	88.33$^{*\dagger@}$±5.61
TG (mg/dl)	76.60±4.91	64.40±5.98	49.60±4.17	195.51*±8.02	163.33*†±7..31	144.61*†±6.50	138.30*†±6.15
HDL-C (mg/dl)	66.00±2.93	62.40±4.74	57.60±5.24	33.40*±5.13	53.60±5.77	51.60±5.80	54.60±4.80
TG / HDL-C ratio	1.17±0.08	1.07±0.16	0.90±0.15	6.32*±0.77	3.18*†±0.35	3.01*†±0.49	2.62†±0.26

Results were expressed as mean ± S.E.M. (n = 8).
Statistical analysis was carried out by one-way ANOVA followed by Tukey-Kramer multiple comparison test.
∗ p <0.05 versus NC group.
† p <0.05 versus FED-C group.
@ p < 0.05 versus pioglitazone treated group.
NC, Normal control; FED-C, Fructose-enriched diet control; Pio, Pioglitazone; CA, Caffeic acid; LDL-C, Low density lipoprotein-cholesterol; TG, Triglyceride; HDL-C, High density lipoprotein-cholesterol.

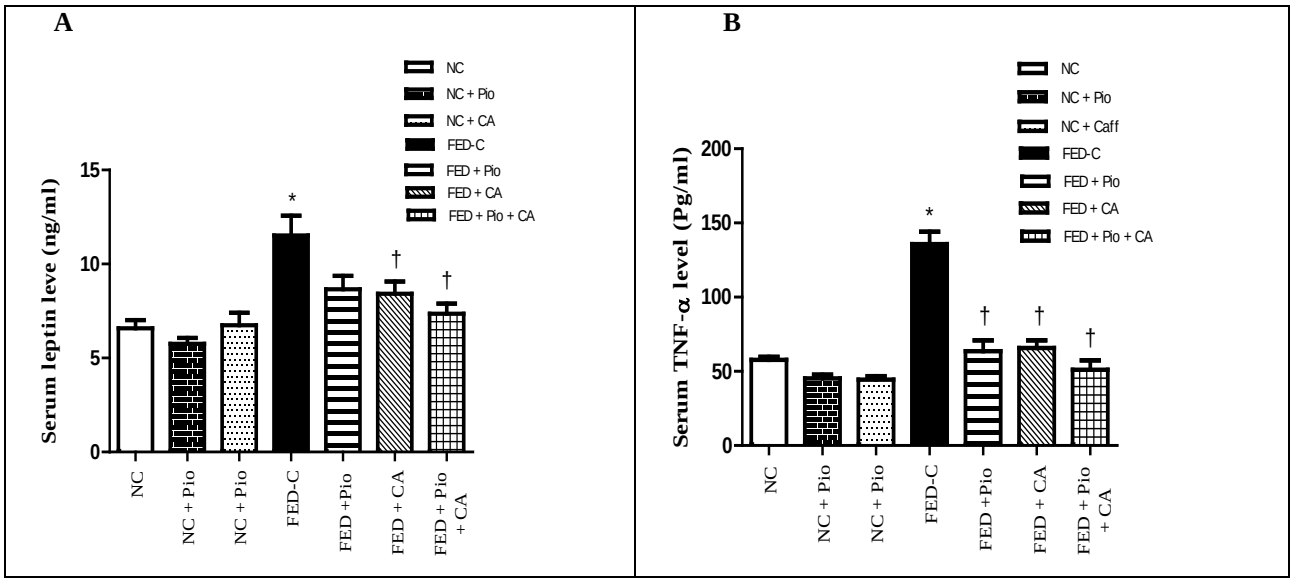

Figure (1): Effects of Pio, CA and their combination on serum levels of: A- Leptin, B- TNF-α in normal and FED-fed rats.
Results were expressed as mean ± S.E.M. (n = 8).
Statistical analysis was carried out by one-way ANOVA followed by Tukey-Kramer multiple comparison test.
* p <0.05 versus NC group.

† p <0.05 versus FED-C group.
@ p < 0.05 versus pioglitazone treated group.
NC, Normal control; FED-C, Fructose-enriched diet control; Pio, Pioglitazone; CA, Caffeic acid, TNF-α, Tumor necrosis factor- alpha

stimulated fatty acid oxidation in the liver **(Cho et al., 2010)**. Moreover, CA significantly, reduced serum TNF-α level as compared to FED-C group, this result is in accordance with **Guerriero et al. (2011)**, who reported that CA decreased the production of pro-inflammatory cytokines such as TNF-α, IL-1β and IL-8 and the increased that of anti-inflammatory cytokines such as IL-10.

Likewise, CA reduced serum urea and uric acid significantly as compared to FED-C group. The present results are in line with that of **Rehman and Sultana (2011)**. In addition, **Pari and Karthikesan (2007)** reported that CA seems to maintain the structural integrity of liver and kidney membrane against alcohol challenge. Moreover, ferulic acid, a metabolite of CA significantly reduced the alcohol-induced toxicity in rats **(Rukkumani et al., 2004)**.

In the current study, CA significantly elevated plasma GPx activity as well as TAC in liver tissue. In addition it reduced MDA and NO contents in liver tissue. These results are in accordance with those of **Rehman and Sultana (2011) and Chao et al. (2009)**. CA has the ability to scavenge the free radicals **(Jung et al., 2006)** and attenuate the lipid peroxidation as indicated by increased levels of enzymatic antioxidants in the liver **Özyurt et al., (2006)** via the ability of its phenolic hydroxyl group to quench free radicals **(Devipriya et al., 2008**). In addition, CA may also act as a chain breaking antioxidant, thereby terminating the chain reaction of lipid peroxidation and minimizing its deleterious effects **(Nardini et al., 1998)**.

Treatment of insulin resistant rats with Pio was associated with significant decreases in serum glucose and insulin levels as well as improved insulin sensitivity when compared to FED-C group; these results are in harmony with **Schaalan (2012) and Singh et al. (2014).** Pioglitazone caused a reduction in serum glucose levels in various animal species by acting as an insulin sensitizer **(Murakami et al., 1998)**. Moreover, the positive effect of Pio on glucose was previously documented in several insulin resistance models **(Ding et al., 2005; Vijay et al., 2009)** and can be attributed to its agonistic activity on PPARγ which impart metabolic effects that ultimately mitigate insulin resistance in adipose tissues and liver **(Westerink and Visseren, 2011)**.

Likewise, Pio enhanced β-cell function significantly as compared to FED-C group; this result is in harmony with that of **González-Ortiz et al. (2007)**.

PPAR-γ agonist protects pancreatic islets under conditions of islet fat accumulation from lipotoxicity by regulating TG partitioning among tissues **(Matsui et al., 2004)**. This opinion supports the present results about TG, as Pio significantly reduced serum TG with no significant changes in serum HDL-C, LDL-C and total cholesterol levels. Similar results have been reported by **Bhosale et al. (2013)**.

The present study revealed that treatment of FED-fed rats with Pio nearly normalized serum TNF-α. Similarly, **Collino et al. (2010)** reported that daily administration of Pio to high cholesterol and fructose diet-rats restored TNF-α to the basal levels.

The present study showed that treatment of FED-fed rats with Pio significantly decreased serum AST and ALT activities as compared to FED-fed rats. Likewise, **Shokouh et al. (2013)** reported that Pio has beneficial effects on both ALT and AST activities in non-diabetic MS patients. This beneficial effect of Pio could be explained by its anti-inflammatory effect mediated by activation of PPARγ on macrophages **(Awara et al., 2005)** resulting in decreased production of the pro-inflammatory cytokines as TNF-α. Moreover, Pio significantly decreased serum urea and creatinine levels in insulin resistant-rats when compared to FED-control group, these results are in harmony with those of **Grover and Bafna (2013) and Peng et al. (2014)**.

The current results have confirmed the potential antioxidant effect of Pio in MS. It was found that treating insulin-resistant rats with Pio was accompanied by a marked reduction in NO and MDA contents in the liver and a significant elevation in plasma GPx activity. These results are in harmony with **Rabbani et al. (2010) and Vandana et al. (2014)**. Antioxidant activity of Pio is reported to be mediated by blocking the vicious cycle of ROS production, improving insulin sensitivity and halting the pro-inflammatory signaling transduction **(Hsiao et al., 2008)**.

The present results revealed that the combination of CA with Pio in FED-fed rats significantly reduced body weight and serum total cholesterol, LDL-C as well as uric acid levels as compared to Pio-treated group.

In the same pattern, the combination of CA and Pio had a marked antioxidant effect as it significantly elevated TAC and reduced MDA contents, significantly when compared to Pio-treated group.

The present results provide an evidence that both drugs enhance the effect of each other on MS symptoms as well as oxidative stress biomarkers.

The current results are supported by those of **Kumar et al. (2010)**, who reported that combination of Pio and CA produces better results as compared to each of them alone.

V. Conclusions

In conclusion, CA alone or combined with Pio, could improve certain metabolic risk factors in experimentally induced MS by reducing glucose, insulin resistance as well as oxidative stress and inflammatory biomarkers. Further studies are warranted to validate the conclusions.

Table (4): Effects of Pio, CA and their combination on liver and kidney function tests in normal and FED-fed rats.

Group / Parameters	NC	NC + Pio	NC + CA	FED-C	FED + Pio	FED + CA	FED + Pio + CA
Urea (mg/dl)	14.61±0.66	12.34±0.56	13.88±0.70	30.68*±1.17	19.40*†±1.07	22.70*†±1.14	20.58*†±1.80
Creatinine(mg/dl)	0.48±0.02	0.42±0.03	0.52±0.02	0.83*±0.02	0.61*†±0.025	0.74$^{*@}$±0.03	0.71*†±0.01
Uric acid (mg/dl)	3.76±0.22	3.86 ±0.17	3.02±0.18	6.48*±0.44	5.40*±0.48	3.90†±0.35	3.58$^{\dagger@}$±0.34
ALT (U/L)	37.60±2.48	32.83±3.04	41.76±3.40	85.23*±7.11	51.98†±5.74	71.63*±5.08	62.67*†±4.32
AST (U/L)	61.30±3.22	59.55±2.78	65.39±3.25	157.02*±6.39	122.20*†±6.04	140.40*±7.71	129.81*†±5.18

Results were expressed as mean ± S.E.M. (n = 8).
Statistical analysis was carried out by one-way ANOVA followed by Tukey-Kramer multiple comparison test.
∗ p <0.05 versus NC group.
† p <0.05 versus FED-C group.
@ p < 0.05 versus pioglitazone treated group.
NC, Normal control; FED-C, Fructose-enriched diet control; Pio, Pioglitazone; CA, Caffeic acid; ALT, Alanine aminotransferase; AST, Aspartate aminotransferase.

REFERENCES

[1] Alzamendi, A., Giovambattista, A., García, M. E., Rebolledo, O. R., Gagliardino, J. J. and Spinedi, E. (2012). Effect of pioglitazone on the fructose-induced abdominal adipose tissuedysfunction. PPAR Res.;2012:259093.

[2] Alzamendi, A., Giovambattista, A., Raschia, A., Madrid, V., Gaillard, R. C., Rebolledo, O., Gagliardino, J. J. and Spinedi, E. (2009). Fructose-rich diet-induced abdominal adipose tissue endocrine dysfunction in normal male rats. Endocrine.;35(2):227-232.

[3] Astrup, A. and Finer, N. (2000). Redefining Type 2 diabetes: 'diabesity' or 'obesity dependent diabetes mellitus'? Obes. Rev.;1(2):57–59.

[4] Awara, W. M., el-Sisi, A. E., el-Refaei, M., el-Naa, M. M. and Desoky, K. (2005). Insulinotropic and anti-inflammatory effects of rosiglitazone in experimental autoimmune diabetes. Rev. Diabet. Stud., 2(3): 146-156.

[5] Barham, D. and Trinder, P. (1972). Enzymatic determination of uric acid. Analyst., 97: 142-145.

[6] Bartels, H., Böhmer , M. and Heierli, C. (1972). Serum creatinine determination without protein precipitation. Cli. Chem. Acta.,37: 193-197.

[7] Bergeron, R., Yao, J., Woods, J. W., Zycband, E. I., Liu, C., Li, Z., Adams, A., Berger, J. P., Zhang, B. B., Moller, D. E. and Doebber, T. W. (2006). Peroxisome proliferator-activated receptor (PPAR)-alpha agonism prevents the onset of type 2 diabetes in Zucker diabetic fatty rats: A comparison with PPAR gamma agonism. Endocrinology.; 147(9):4252-4262.

[8] Bezerra, R. M., Ueno, M., Silva, M. S., Tavares, D. Q., Carvalho, C. R., Saad, M. J. and Gontijo, J. A. (2001). A high-fructose diet induces insulin resistance but not blood pressure changes in normotensive rats. Braz. J. Med. Biol. Res.;34(9):1155-1160.

[9] Bhosale, R. R., Jadhav, R. R., Padwal, S. L. and Deshmukh, V. S. (2013). Hypolipidemic and antioxidant activities of pioglitazone in hyperlipidemic rats. Int. J. Basic Clin. Pharmacol.;2(1): 77-82.

[10] Burstein, M., Scholnick, H. R. and Morfix, R. (1970). Rapid method for the isolation of lipoproteins from human serum by precipitation with polyanions. J. Lipid Res.;11(6):583–595.

[11] Chao, C. Y., Mong, M. C., Chan, K. C. & Yin, M. C. (2010). Anti-glycative and anti-inflammatory effects of caffeic acid and ellagic acid in kidney of diabetic mice. Mol. Nutr. Food Res.;54(3):388-395.

[12] Chao, P. C., Hsu, C. C. and Yin, M. C. (2009). Anti-inflammatory and anti-coagulatory activities of caffeic acid and ellagic acid in cardiac tissue of diabetic mice. Nutr. Metab. (Lond).;6:33.

[13] Cho, A. S., Jeon, S. M., Kim, M. J., Yeo, J., Seo, K. I., Choi, M. S. and Lee, M. K. (2010). Chlorogenic acid exhibits anti-obesity property and improves lipid metabolism in high-fat diet-induced-obese mice. Food Chem. Toxicol.;48(3):937-943.

[14] Collino, M., Aragno, M., Castiglia, S., Miglio, G., Tomasinelli, C., Boccuzzi, G., Thiemermann, C. and Fantozzi, R. (2010). Pioglitazone improves lipid and insulin levels in overweight rats on a highcholesterol and fructose diet by decreasing hepatic inflammation. Br. J. Pharmacol.;160(8):1892-1902.

[15] Devipriya, N., Sudheer, A. R. and Menon, V. P. (2008). Caffeic acid protects human peripheral blood lymphocytes against gamma radiationinduced cellular damage. J. Biochem. Mol. Toxicol.;22(3):175–186.

[16] Ding, S. Y., Shen, Z. F., Chen, Y. T., Sun, S. J., Liu, Q. and Xie, M. Z. (2005). Pioglitazone can ameliorate insulin resistance in low-dose streptozotocin and high sucrose-fat diet induced obese rats. Acta. Pharmacol. Sin.;26(5): 575–580.

[17] Fawcett, J. K. and Scott, J. E. (1960). A rapid and precise method for the determination of urea. J. Clin. Pathol.;13:156-159.

[18] Fee, J. A. and Teitelbaum, H. D. (1972). Evidence that superoxide dismutase plays a role in protecting red blood cells against peroxidative hemolysis. Biochem. Biophys. Res. Commun.;49(1):150-158.

[19] Ford, E. S., Li, C. and Zhao, G. (2010). Prevalence and correlates of metabolic syndrome based on a harmonious definition among adults in the US. J. Diabetes; 2(3): 180–193.

[20] Friedewald, W. T., Levy, R. I. and Fredrickson, D. S. (1972). Estimation of the concentration of low-density lipoprotein cholesterol in plasma, without use of the preparative ultracentrifuge. Clin. Chem.;18(6): 499-502.

[21] Friend, A., Craig, L. and Turner, S. (2013). The prevalence of metabolic syndrome in children: a systematic review of the literature. Metab. Syndr. Relat. Disord.;11(2): 71–80.

[22] Goldberg, R. B., Kendall, D. M., Deeg, M. A., Buse, J. B., Zagar, A. J., Pinaire, J. A., Tan, M. H., Khan, M. A., Perez, A. T. and Jacober, S. J.; GLAI Study Investigators. (2005). A comparison of lipid and glycemic effects of pioglitazone and rosiglitazone in patients with type 2 diabetes and dyslipidemia. Diabetes Care;28(7): 1547–1554.

[23] González-Ortiz, M., Hernández-Salazar, E., Kam-Ramos, A. M. and Martínez-Abundis, E. (2007). Effect of pioglitazone on insulin secretion in patients with both impaired fasting glucose and impaired glucose tolerance. Diabetes Res. Clin. Pract.;75(1):115-118.

[24] Graham, D. J., Ouellet-Hellstrom, R., MaCurdy, T. E., Ali, F., Sholley, C., Worrall, C. and Kelman, J. A. (2010). Risk of acute myocardial infarction, stroke, heart failure, and death in elderly Medicare patients treated with rosiglitazone or pioglitazone. JAMA.; 304(4): 411–418.

[25] Grover, N. and Bafna, P. (2013). Protective effect of coadministration of Cassia auriculata and pioglitazone in diabetic rats. Eur. J. Exp. Bio.; 3(2):231-241

[26] Grundy, S. M., Brewer, HB. Jr., Cleeman, J. I., Smith, SC. Jr., Lenfant, C.; American Heart Association; National Heart, Lung, and Blood Institute (2004). Definition of metabolic syndrome: report of the National Heart, Lung, and Blood Institute/ American Heart Association conference on scientific issues related to definition. Circulation; 27;109(3):433-438.

[27] Guerre-Millo, M., Gervois, P., Raspé, E., Madsen, L., Poulain, P., Derudas, B., Herbert, J. M., Winegar, D. A., Willson, T. M., Fruchart, J. C., Berge, R. K. and Staels, B. (2000). Peroxisome proliferator-activated receptor alpha activators improve insulin sensitivity and reduce adiposity. J. Biol. Chem.;275(22):16638-16642.

[28] Guerriero, E., Sorice, A., Capone, F., Costantini, S., Palladino, P., D'ischia, M. and Castello, G. (2011). Effects of lipoic acid, caffeic acid and a synthesized lipoyl-caffeic conjugate on human hepatoma cell lines. Molecules.;16(8):6365-6377.

[29] Gülçin, İ. (2006). Antioxidant activity of caffeic acid (3,4-dihydroxycinnamic acid). Toxicolo.; 217,(2-3):213-220.

[30] Hsiao, P. J., Hsieh, T. J., Kuo, K. K., Hung, W. W., Tsai, K. B., Yang, C. H., Yu, M. L. and Shin, S. J. (2008). Pioglitazone retrieves hepatic antioxidant DNA repair in a mice model of high fat diet. BMC. Mol. Biol.;9:82.

[31] Jung, U. J., Lee, M. K., Park, Y. B., Jeon, S. M. and Choi, M. S. (2006). Antihyperglycemic and antioxidant properties of caffeic acid in db/db mice. J. Pharmacol. Exp. Ther.; 318(2): 476-483.

[32] Katz, A., Nambi, S. S., Mather, K., Baron, A. D., Follmann, D. A., Sullivan, G. and Quon, M. J. (2000). Quantitative insulin sensitivity check index: a simple, accurate method for assessing insulin sensitivity in humans. J. Clin. Endocrinol. Metab.;85(7):2402-2410.

[33] Kim, H. K., Jeong, T. S., Lee, M. K., Park, Y. B. and Choi, M. S. (2003). Lipid-lowering efficacy of hesperetin metabolites in high-cholesterol fed rats. Clin. Chim. Acta. ;327(1-2):129-137.

[34] Koracevic, D., Koracevic, G., Djordjevic, V., S. and Cosic, V. (2001). Method for the measurement of antioxidant activity in human fluids. J. Clin. Pathol;54(5): 356-361.

[35] Kumar, A., Vashist, A. and Kumar, P. (2010). Potential role of pioglitazone, caffeic acid and their combination against fatigue syndrome-induced behavioural, biochemical and mitochondrial alterations in mice Inflammopharmacol.; 8(5):241–251.

[36] Makena, P. S. and Chung, K. T. (2007). Effects of various plant polyphenols on bladder carcinogen benzidine-induced mutagenicity. Food Chem. Toxicol.;45(10):1899-1909.

[37] Matsui, J., Terauchi, Y., Kubota, N., Takamoto, I., Eto, K., Yamashita, T., Komeda, K., Yamauchi, T., Kamon, J., Kita, S., Noda, M. and Kadowaki, T. (2004). Pioglitazone reduces islet triglyceride content and restores impaired glucose-stimulated insulin secretion in heterozygous peroxisome proliferator-activated receptor-gamma-deficient mice on a high-fat diet. Diabetes.;53(11):2844-2854.

[38] Matthews, D. R., Hosker, J. P., Rudenski, A. S., Naylor, B. A., Treacher, D. F. and Turner, R. C. (1985). Homeostasis model assessment: insulin resistance and beta-cell function from fasting plasma glucose and insulin concentrations in man. Diabetologia.,28(7), 412-419.

[39] Mattila, P. and Kumpulainen, J. (2002). Determination of free and total phenolic acids in plantderived foods by HPLC with diode-array detection. J. Agric. Food Chem.;50(13) :3660-3667.

[40] Miranda, K. M., Espey, M. G., and Wink, D. A. (2001). A rapid, simple spectrophotometric method for simultaneous detection of nitrate and nitrite. Nitric Oxide.;5(1): 62–71.

[41] Murakami, K., Tobe, K., Ide, T., Mochizuki, T., Ohashi, M., Akanuma, Y., Yazaki, Y. and Kadowaki, T. (1998). A novel insulin sensitizer acts as a coligand for peroxisome proliferator-activated receptor-alpha (PPAR-alpha) and PPAR-gamma: effect of PPAR-alpha activation on abnormal lipid metabolism in liver of Zucker fatty rats. Diabetes, 47(12):1841-1847.

[42] Nardini, M., Pisu, P., Gentili, V., Natella, F., Di Felice, M., Piccolella, E. and Scaccini, C. (1998). Effect of caffeic acid on tert-butyl hydroperoxide-induced oxidative stress in U937. Free Radic. Biol. Med.;25(9):1098-1105.

[43] Okutan, H., Ozcelikb, N., Yilmazb, H. R., and Uzb, E. (2005). Effects of caffeic acid phenethyl ester on lipid peroxidation and antioxidant enzymes in diabetic rat heart. Clin. Biochem.; 38(2): 191-196.

[44] Olsson, R. and Carlsson, P. O. (2005). Better vascular engraftment and function in pancreatic islets transplanted without prior culture. Diabetologia 48(3):469-476

[45] Orland, M. J. and Permutt. M. A. (1987). Quantitative analysis of pancreatic proinsulin mRNA in genetically diabetic (db/db) mice. Diabetes.;36(3): 341-347

[46] Özyurt, B., Güleç, M., Özyurt, H., Ekici, F., Atis, Ö. and Akbas, A. (2006). The effect of antioxidant caffeic acid phenethyl ester (CAPE) on some enzyme activities in cisplatin-induced neurotoxicity in rats. Eur. J. Gen. Med.;3(4):167–172.

[47] Paglia, D.E. and Valentine, W.N. (1967). Studies on the quantitative and qualitative characterization of erythrocyte glutathione peroxidase. J. Lab. Clin. Med., 70(1):158-169.

[48] Pari, L. and Karthikesan, K. (2007). Protective role of caffeic acid against alcohol induced biochemical changes in rats. Fundam. Clin. Pharmacol.;21(4):355-361.

[49] Park, S. H. and Min, T. S. (2006). Caffeic acid phenethyl ester ameliorates changes in IGFs secretion and gene expression in streptozotocin-induced diabetic rats. Life Sci.;78(15): 1741-1747.

[50] Peng, X. H., Liang, P. Y., Ou, S. J. and Zu, X. B. (2014). Protective effect of pioglitazone on kidney injury in diabetic rats. Asian Pac. J. Trop. Med.; 7(10):819-822.

[51] Prakash, D., Suri, S., Upadhyay, G. and Singh, B. N. (2007). Total phenol, antioxidant and free radical scavenging activities of some medicinal plants. Int. J. Food Sci. Nutr.;58(1):18-28.

[52] Psotová , J., Lasovský, J. and Vicar, J. (2003). Metal-chelating properties, electrochemical behavior, scavenging and cytoprotective activities of six natural phenolics. Biomed. Pap. Med. Fac. Univ. Palacky. Olomouc. Czech. Repub.;147(2):147-153.

ORIGINAL RESEARC

[53] Rabbani, S. I., Devi, K. and Khanam, S. (2010). Pioglitazone, a PPAR-gamma ligand inhibited the nicotinamide-streptozotocin induced sperm abnormalities in type-2 diabetic Wistar rats. Pak. J. Pharm. Sci.;23(3):326-331.

[54] Rehman, M. U. and Sultana, S. (2011). Attenuation of oxidative stress, inflammation and early markers of tumor promotion by caffeic acid in Fe-NTA exposed kidneys of Wistar rats. Mol Cell Biochem.; 357(1-2):115-124.

[55] Reitman, S. and Frankel S. (1957). A colorimetric method for the determination of serum glutamic oxalacetic and glutamic pyruvic transaminases. Am. J. Clin. Pathol.;28(1):56-63.

[56] Richmond, W. (1973). Preparation and properties of a cholesterol oxidase from Nocardia sp. and its application to the enzymatic assay of total cholesterol in serum. Clin. Chem.;19(12):1350-1356.

[57] Rukkumani, R., Aruna, K., Suresh Varma, P. and Padmanabhan Menon, V. (2004). Hepatoprotective role of ferulic acid: a dose-dependent study. J. Med. Food.; 7(4):456-461.

[58] Schaalan, M. F. (2012). Effects of pioglitazone and/or simvastatin on circulating TNFα and adiponectin levels in insulin resistance. J. Immunotoxicol.; 9(2):201-209.

[59] Schettler, G. (1980). Serum triglycerides. Dtsch. Med. Wochenschr.;105(15):504.

[60] Sellappan, S., Akoh, C. C. and Krewer, G. (2002). Phenolic compounds and antioxidant capacity of Georgia-grown blueberries and blackberries. J. Agric. Food Chem.;50(8):2432-2438.

[61] Shokouh, P., Joharimoghadam, A., Roohafza, H., Sadeghi, M., Golabchi, A., Boshtam, M. and Sarrafzadegan, N. (2013). Effects of Pioglitazone on Asymmetric Dimethylarginine and Componentsof the Metabolic Syndrome in Nondiabetic Patients (EPICAMP Study): ADouble-Blind, Randomized Clinical Trial. PPAR. Res.; 2013:358074.

[62] Singh, B., Sangle, G. V., Murugan, J., Umrani, R., Roy, S., Kulkarni, O., Semwal, A., Unnikrishnan, M. and Jain, M. (2014).
Effect of combination treatment of S-amlodipine with peroxisome proliferator-activated receptor agonists on metabolic and cardiovascular parameters in Zucker fa/fa rats. Diabetol. Metab. Syndr.; 28;6(1):45.

[63] Stanhope, K. L., Havel ,P. J. (2008). Endocrine and metabolic effects of consuming beverages sweetened with fructose, glucose, sucrose, or high-fructose corn syrup. Am. J. Clin. Nutr.;88(6):1733S-1737S.

[64] Trinder, P. (1969). Determination of blood glucose using 4-amino phenazone as oxygen acceptor. J. Clin. Pathol., 22(2), 246.

[65] Vandana, S. Nade, Laxman, A. Kawale, Prathmesh, S. Deshmukh and Yogesh, K. Patil. (2014). Protection against endothelial dysfunction by pioglitazone and irbesartan in fructose-fed diabetic rats. Int. J. Dev. Tec.; 4(3): 197-203.

[66] Vijay, S. K., Mishra, M., Kumar, H. and Tripathi, K. (2009). Effect of pioglitazone and rosiglitazone on mediators of endothelial
dysfunction, markers of angiogenesis and inflammatory cytokines in Type-2 diabetes. Acta. Diabetol.; 46(1):27–33.

[67] Vilcek, J. and Lee, T. H. (1991). Tumor necrosis factor. New insights into the molecular mechanisms of its multiple actions. J. Biol. Chem.;266(12): 7313-7316.

[68] Wang, L., Waltenberger, B., Pferschy-Wenzig, E. M., Blunder, M., Liu, X., Malainer, C., Blazevic, T., Schwaiger, S., Rollinger, J. M., Heiss, E. H., Schuster, D., Kopp, B., Bauer, R., Stuppner, H., Dirsch, V. M. and Atanasov, A. G. (2014). Natural product agonists of peroxisome proliferator-activated receptor gamma (PPARγ): a review Biochem. Pharmacol.;92(1):73-89.

[69] Westerink, J. and Visseren, F. L. (2011). Pharmacological and nonpharmacological interventions to influence adipose tissue function. Cardiovasc. Diabetol.; 10:13.

[70] Willson, T. M. and Wahli, W. (1997). Peroxisome proliferator-activated receptor agonists. Curr. Opin. Chem. Biol.;1(2):235-241.

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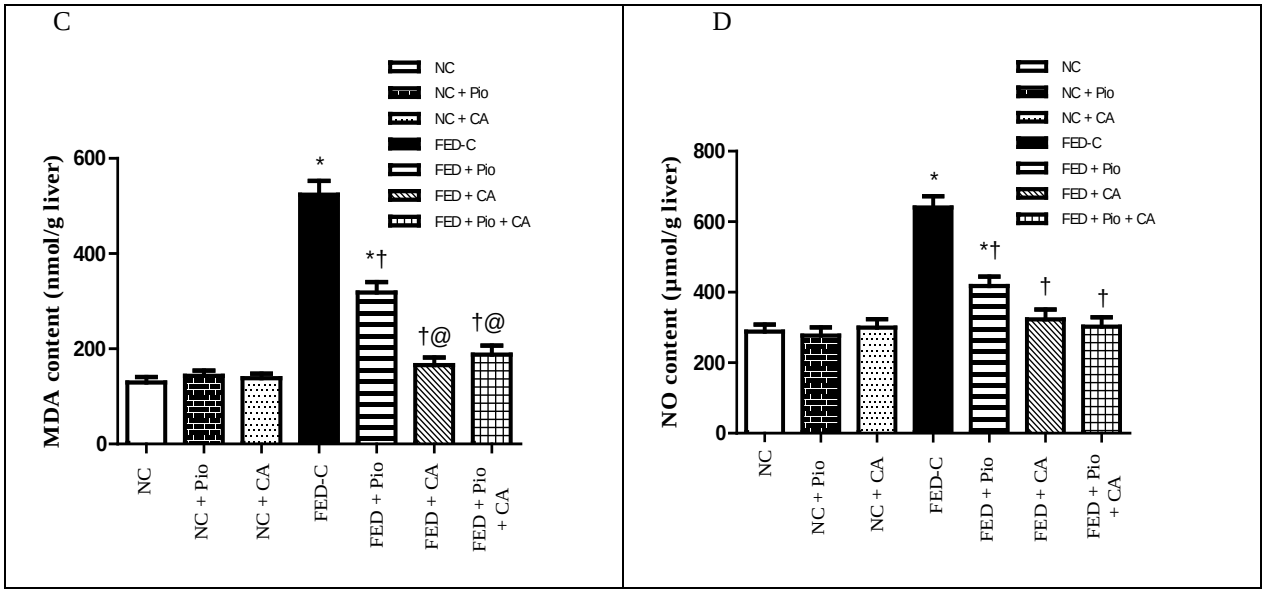

Figure (2): Effects of Pio, CA and their combination on: A- TAC content, B- GPx activity, C- MDA and D- NO contents in normal and FED-fed rats.

Results were expressed as mean ± S.E.M. (n = 8).
Statistical analysis was carried out by one-way ANOVA followed by Tukey-Kramer multiple comparison test.
∗ p <0.05 versus NC group.
† p <0.05 versus FED-C group.
@ p < 0.05 versus pioglitazone treated group.
NC, Normal control; FED-C, Fructose-enriched diet control; Pio, Pioglitazone; CA, Caffeic acid, TAC, Total antioxidant capacity, GPx, Glutathione peroxidase, MDA, Malondialdehyde, NO, Nitric oxide.

The Influence of Learning Aplication Model and Assessment Techniques of Toward Basic Physics I1 Learning Achievement (An Experiment of Department Physics of Fmipa Unima)

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Abstract- Research purposes to determine the effect of learning activities, assessment techniques and the influence of interaction on learning achievement Basic Physics II,. The method used is an experimental method with a 2 x 2 factorial design. Implementation of learning activities and assessment techniques as the treatment variable, the results of learning Basic Physics II as the response variable. The sample in this study were students of Physics Department of class A and class B are determined by the number of respondents multistage sampling 76 students. Analytical techniques used to examine the effect ANCOVA main factors (main effect) and the influence of the interaction factor (interaction effect).The study concluded that implementation of lesson study and performance assessment techniques more effectively improve learning achievement Basic Physics II compared with conventional learning techniques with a written assessment test. Suggested in the courseBasic Physics II and using lesson study as a form of performance assessment activities in the lecture course are seeded in the first year Physics with Mathematics and Science.

Index Terms- Learning Aplication Model, Techniques Assessment, Basic Physics II Learning Achievement.

I. INTRODUCTION

Learning activities and forms of assessment are two things commonly done by educators in the learning process in most all of the learning process. One of the social issues or hot topics in education recently discussed which is about appealing to lesson study, is emerging as one of the ways to overcome the problematic learning now is viewed less effective. Learning accounting practices of this kind are more likely to emphasize on how teachers teach (teacher-centered) than on how students learn (student-centered), and the overall results can be understood as it turns out not much contributes to quality improvement processes and learning outcomes. Forms of activities lesson study can be used as an alternative to encourage the occurrence of a change of the learning process in Indonesia towards a much more effective (Slamet, 2007:1). Education is currently facing three major challenges: (1) raise awareness about the importance of related pihat problem solving skills, (2) optimizing way of assessing problem solving skills, and (3) explore how to develop and maintain skills problem solving (Samuel Greiff, et al, 2001).

Lesson study is one form of strategic learning activity to create an academic atmosphere conducive to improvement of the quality of the lectures. Learning through lesson study senior lecturer got an excellent opportunity to provide coaching to young Professor, who had been less done (Istamar, and Ibrohim, 2008:10-11). Stages of activity lesson study which started from the plan, do and see very provides a very good lecturer for the team in optimizing the design of the lecture, the process of implementing and evaluating learning activities for students. Lesson study can be a good option in Basic Physics Lecture II activities. Stages in lesson study provide time and space for faculty and students to create and innovate in the learning process and other related parties to be able to develop the lesson study to further the interests of the quality improvement process and the results of student learning.

Performance appraisal is one form of assessment that is considered relatively precise measuring results learning student or students. Performance appraisal provides an opportunity to the student or students to demonstrate their learning as a whole works ranging from the process until at the end which can be rated by others, such as teachers or lecturers. Physics lessons that have characterized the science where the characteristics of the lesson require appraisal that requires behavior ability of knowledge, attitude and psychomotor. Performance assessment a good alternative assessment to be carried out in learning physics. As a science, physics requires reasoning that is high enough to be understood by him, the person who has a high intelligence affects the results of the study of physics. Intellegency as the ability of adapting to the environment or to learn from the experience. Where humans live and interact in a complex environment and therefore requires the ability to adapt to the environment (Dalyono, 2007:183).

The scope of the material base of Physics II includes 3 units of matter are: 1. Waves, 2.-Optical Power-Magnet and 3. Modern Physics. The scope of material for research experiments are restricted to three principal topics of optical wave-material-that is, the subject of the symptoms of Geombang, the nature of the Wave and optical geometry. The selection of the subject matter of discussion is based on the student's level of ease for conducting observations of physical phenomena which do not require complex laboratory equipment. On the learning process of the students can directly perform observations of physical phenomena and data capture learning environment around the campus and student residence.

This research aims to find out: 1. The difference in the results of the Basic Physics II students taught learning activities with lesson study and the results of the Basic Physics II students taught with the conventional learning activities, after controlling for student intelligence, 2. The difference in the results of the basic physics II students are given an assessment of the performance and results of Basic physics II students are given a written test assessment, after controlling for students ' intelligence. 3. The influence of the interaction between the implementation of learning activities and assessment of the results of learning Basic Physics II after controlling intelligent students, 4. The difference in the results of the Basic Physics II students taught with lesson study was given a performance assessment, and the results of the Basic Physics II students taught with conventional and given a performance appraisal, after controlling for student intelligence, 5. The difference in the results of the Basic Physics II students taught with lesson study was given a written test, assessment and outcomes studied Basic Physics II students taught with conventional and given a written test assessment, after controlling for student intelligence, 6. The difference in the results of the Basic Physics II students taught with lesson study was given a performance assessment, and the results of the Basic Physics II students taught with lesson study and given the assessment of the written test, after controlling for student intelligence, and 7. The difference in the results of the Basic Physics II students taught with conventional given performance assessment, and the results of the Basic Physics II students taught with conventional and given a written test assessment, after controlling for students ' intelligence.

Learning is a process that is characterized by the presence of changes in a person. Changes as a result of the learning process can be shown in various forms such as changing knowledge, understanding, attitudes and behavior, his skill, whose prowess and his ability, power reaction, power reception and other aspects of the individual. Therefore, learning is an active process, learning is a process of mereaksi of all the situations that exist around the individual. Learning is a process which is directed towards a goal, do the process through a variety of experiences. Learning is the process of seeing, observing, understand something. (Sudjana, N. 2002:28).

Learning is an activity that is working and is a very fundamental element in implementing each type and level of education. This means that the successful or failure of achievement of the objectives of education was very very depending on the learning process of the students experienced, either when he was at school or home surroundings or his own family. Therefore the correct understanding about the meaning of learning with all aspects, forms and manifestation is absolutely necessary by educators in particular teachers. Errors or incomplete perception of teachers towards learning and things related to learning will result in less qualytie learning outcomes achieved learners (Muhibbin Shah, 2010:87). Learning is a process, an activity and not an outcome or goal. Learn not only remember, but more broadly than that, i.e. experience. The results of learning rather than a mastery of the results of the exercise but rather a change in behaviour (Hamalik, 2011:27)

Learning process there are five kinds of abilities that can be observed on the student as a result of his studies as follows: (1) the intellectual Skills, or procedural knowledge that includes learning the concepts, principles and problem-solving that is obtained through the presentation of the material in schools, (2) Cognitive Strategies, namely the ability to control and regulate the activities of thinking and learning on his own, (3) verbal Information, namely the ability to describe something with words with the set up information-relevant information (4) motor skills, i.e. the ability to implement and coordinate the movements associated with muscle, and (5) attitude, i.e. internal ability to choose one's deportment actions based on emotions, beliefs and intellectual factors (Aunnurahman, 2009:49).

The learning process can be distinguished into three phases or episodes, namely: (1) the information is in any information obtained, there are lessons that supplement the knowledge which has been owned, some are smooth and the task, there is also information that contradicts what has been known previously, (2) Transformation. This information should be analyzed, modified or ditrasformasi into the form of a more abstract or conceptual to be used for things that are more spacious. In this case the teacher aid is indispensable, and (3) the evaluation assessing up to know the knowledge acquired and transformed it can be used to understand the symptoms of others. In the process of learning the third episode above always occurs (Nasution, 2009:9-10).

Lesson Study as one of the models of the construction professions educators through the study of collaborative learning and sustainable based on the principles of mutual learning and kolegalitas to build a learning community (Slamet, 2007:4). The process of discussion in lesson study is submission of the results of observation of the observer, which focus on the activity of students. Suggestions and criticism of the process activyties lesson study should depart from student behavior in the classroom, or in other words that all suggestions for refinement at the next stage should be based on data and facts that happened in class (Hendayana dkk, 2008:9).

Natural light covers symptoms associated with vision and optics to develop as a science that a little or a lot do not rely on this behavior. The sound associated with the hearing, acoustics developed as a science that deals with it. Heat related to the physical senses, and over the years the study of heat (thermodynamics) is a branch of physics other autonomous. Motion of course is the most common of symptoms observed nature directly, developing early mechanics from other branches of physics. (Alonzo, and Finn. 1999:4). The basic requirements for the solution is the observed symptoms. The Opinion Of Sears. and Zemansky (1987:1) to the effect that physics is the science that studies the natural events which allow research with experiment, the physical measurements of what is to come by, mathematically and rendering based on common rules.

According to Sears Physics is a science about measurement (measurement science). Understanding physics is also delivered by Tipler that physics is associated with matter and energy with the laws that regulate the movement of particles and waves, interactions between particles, sitaf properties of molecules, atoms and nuclei, and with larger-scale systems such as gas, liquid and solid (Tipler, 1998:1). The main constituent of physics are physical quantities which are used to declare the laws of Physics for example: length, mass, time, force, speed, meetings (density), relativity, temperature, light intensity, and many more of the other (Resnick and Halliday, 1987:3).

Physics is the science that seeks to understand the rules of nature that is so beautiful and with the mess can be described mathematically. The math in this case serves as a communication language of science including physics. Science and human needs over the next four centuries this shows a very dramatic progress thanks to the success of humans in analyzing and describe nature mathematically. Mundilarto (2002:5) physical education should be able to be a strong impetus for the emergence of an attitude of curiosity and openness towards new ideas as well as quantitative analytical thinking habits. In physical education students should look in order for consciousness physics grown not only as an academic activity, but rather as a way to understand the world in which human life.

The assessment is part of an evaluation process or procedure undertaken to obtain information about the participants of the study, starting from the level of primary education until College. Assessment is defined as a formal effort to determine the position or status of the students associated with the education variable was specified. It can also be argued that the assessment is a procedure that can be used to obtain information about a person's achievements or performance. It can also be argued that the assessment is a procedure that can be used to obtain information about a person's achievements or performance (BSNP, 2007:3).

Assessment is an important component in education. Efforts to improve the quality of education can be reached through the enhancement of the quality of learning and the quality of his judgement. The two are intertwined, a good learning system will produce a good quality learning. The quality of this study can be seen from the judgment (Mardapi, 2007:5). Popham stated there are 4 purposes of assessment, namely: 1) diagnose the strengths and weaknesses of learners, 2) monitors the progress of learners, 3) gives value (grade) on learners, and 4) determine the effectiveness of learning done educators. Simplification of the opinions of Popham, formulating the assessment objective 3, i.e. for: 1) diagnose the knowledge and skills of learners, 2) monitors the progress of the students related to the learning objectives, and 3) provide data to provide value to the learners (Popham, 1995:141).

Performance assessment is a form of observation and assessment directly and systematic way from the performance of students with reference to a predetermined performance criteria (Soekrisno 2005:1) performance assessment often dipertukakan with authentic assessment. Understanding is essentially the assessment (assessment), which requires that students demonstrate the performance, not answered or select answer from a series of possible answers. For example, in the assessment of performance (Performance Assessment), students are asked to explain in detail in its own way about the completion of the application of Newton's laws by using a pulley. Through the way students are expected to demonstrate control of the physics problem solving and learning outcomes in a way that's true.

Performance appraisal, a person can be told to do a binary response to a question in accordance with a statute. This dual response constitutes the information needed to determine a person's performance in a particular field. Therefore, performance assessment dimensions measured are double, not single dimension such as the traditional test Mardapi, (2007:76). Performance assessment is the assessment of the data acquisition process, the application of knowledge and skills, through the learning process that shows the ability of the students in the process as well as product (Zainul, 2005:4). Popham said that, performance assessment is an approach towards measuring the status of students based on the results of the work or complete a task in a set (Popham, 1995:45).

On the performance assessment of things that get attention are important in terms of score. When the performance assessment will be given the sekor to conclude the test-taker performance achievement level, then used two approaches, namely: holistic and analytic methods of mentode. Holistic method is used when the score gives only one fruit score or value (single twig) based on the overall assessment of the results of the test-taker performance. Analytic method of the penskor (rater) gave judgment on a variety of different aspects related to performance is assessed (Setiadi, 2008:10).

To form a habit of students to always learn on a regular basis and foster student learning motivation then administering the test as often as possible and repeated in frekuensional will be easy to remember and there is the influence of time of administering tests against the results of learning physics (Munasco, 2013:39). Aiken suggests that a test is used as a tool to assess a person's behavior or performance tingka (Aiken, 1979:474). The test is a procedure popular consultations were made in the form of standardized tasks and given to individuals or groups to be worked on, is answered or responded to complaints, whether in oral or written form, deed (Djaali, and Muhammad). Azwar suggests that a test is a procedure that is systematic way, that is done based on the goals and procedures are clear. Tests do observations on the behaviour of a person and describes the behavior with the help of the scale numbers or classification systems (Saif, 2005:3). Djaali and Muldjono (2008:11) States a written test also known as the pencil and paper test, that test where the test is executing in asking the details of the question was done in writing and test-taker give an answer in writing.

Ainun, and Ekaningrum (2008:2) stated a written test is a test where the question and answer in the form of writing material. In answering the question of students do not always have to respond in the form of writing kalaimat answers but may also be in the form of coloring, signaled, describing graphs, charts and more. Evaluator a written test is a commonly used measurement techniques and included in the verbal test group.

Intelligence is the ability of problem solving in all situations that are new or contain the problem. Problem solving in all circumstances this includes personal problems, problems of social, cultural, and academic problems, problems of economic family (Dalyono, 2009:185). Intelligence can be formulated with the maturity to do the activities and achieving the accomplishments which thinking plays a major role. From a person's behaviour, conversation, action, reaction, one can judge whether that person is intelligent, astute, clever or otherwise stupid, fool, slow. Although to get information more reliably through the intelligence tests psychological test by psychologists. Intelligence behaviour by a number of characteristics as follows: (1) conduct which is ready to do the changes that need to be against the new conditions, not rigid; (2) conduct that aim; (3) the behaviour of a fast, immediate reactions; (4) terorrganisir behaviour, i.e. There is good coordination between the private

conditions in a solved issue; (5) conduct which is controlled by the powerful motivation; and (6) conduct which "success oriented" (Sagala, 2009:81).

The opinion that said, intelligence is a certain amount of psychological structures that exist on a specific level of development. According to Cites, and Super intelligence is the ability to adapt to the environment or to learn from the experience. According to Garrett, the intelligence was at least includes the necessary capabilities to problem-solving that requires understanding, and using symbol-symbol. According to Robert j. Sternberg intelligence is the capacity to learn from experience, and the ability to adapt to the surrounding environment. Or the intelligentsia is the proficiency to learn from the experience and the ability to berdaptasi with the environment (Djaali, 2011:63-65).

Conventional learning are often used when a teacher in the process of the lesson that more material presentation freeform from teachers. Serving greater emphasis to clarify something material that is not known or understood by students. Alternatively they tend to in methods of lecture and q & a varies or other methods which allow compliance with the characteristics of the subject matter and the existence of the mental process of the activity of the students to see the links contained in the subject matter (Suruddin, 2010, 95). Lecture method in learning there almost everywhere in school and in college. A lecture or lectures may (1) provide the motivation to generate interest with a topic related to the goals, (2) inform the student about the results of learning expected of students and (3) can attempt to guide in the lesson. Students may also do not have sufficient apersepsi materials to explore a college lecture, and therefore it would be boring. To be able to add to the effectiveness of College learning media can be used such as pictures, charts, demonstrations and other props. On the process of college students ' assessing rarely found, or no feedback and therefore not lecture presents good conditions for the learning process (Nasution, 2010:199-200).

II. RESEARCH METHODS

This research is generally aimed to know the influence of lesson study and the assessment of performance against the results of the study of basic Physics II, after controlling for students ' intelligence. This research was carried out in the Department of Science Physics UNIMA in Tondano lasted for three months with details of face to face twice a week. Basic Physics II course 4 credits, which runs on the even semester, is the month of the beginning of February until the end of 2012 April 2012 academic year 2011/2012. The methods used in this research is a method of experimentation with a 2 x 2 factorial design. Variables are bound is the result of Basic Physics II. Treat the factors are (1) learning activities lesson study and conventional, (2) the form of a performance assessment, and the assessment of the written test.

The population in this research is a first year student in the Department of Physics of Science together with UNIMA academic year 2011/2012. The student population consists of 6 Department of physics class that includes 4 classes education courses of physics and Physics Studies Program grade 2. Determination of the sample in this study done by multistage random sampling, namely with the following stages: First randomly drawn 4 classroom Educational Program, then the second stage determines the subject of treatment of learning through selected draw 2 class i.e. class A and class b. class A experiment with learning activities lesson study and class B class as a comparison with the conventional learning activities. The third stage determines the subject of treatment and learning activities lesson study and conventional treatment will receive a performance appraisal and assessment of the written test. Distribution of grouping members of the class as in Table 1.

Table 1. Research Samples For Each Treatment Group

Learning (A) / Assessment (B)		Learning Activities: *Lesson Study* (A_1) (Y)	Learning Activities: Conventional (A_2) (Y)	Total
B	Performance Assessment (B_1)	Physics clas A 19 students	Physics clas B 19 students	38 Students.
	The Written Assessment (B_2)	Physics clas A 19 students	Physics clas B 19 students	38 students.
Total		38 students	38 students	76 students.

Description: Y : Basic Physics II Study Results

Instrument collecting data in this study that is. Results of the data collection instrument Learning Basic Physics II student Instrument collecting data about the results of the study of physics students use basic test writing essay form. The development of test instruments results studied physics Basic II test results of Basic physics II students created in form, a test to measure students ' ability of description in the mastery of Basic Physics II. To instrument the basic Physics II study results are compiled in accordance with the curriculum in Basic Physics II matakuliah sibabus used in the Department of Science Physics, UNIMA. Testing validity and Reliabiltas. The validation tests are conducted in two forms, namely the analysis of qualitative and quantitative analysis. Qualitative analysis done with the review panelists, and quantitative analysis performed with the

correlation score with a score of grain total yield trial tests. Review Panelists

Based on the results of the calculation of the reliability coefficients obtained judgments between panelists of 0.87. These results show that the consistency of the results between panelists belongs to high so to 12 grains of matter results Basic physics II with attention to suggestions from panelists is said to be adequate for testing instruments. 1. the validity of a Test item: the Validation performed on 12 grain test forms written essay to menggukur Basic Physics learning out comes II. From the results of a test question that tested retrieved 10 buir of valid matter.

Reliabiltas: test of 10 questions valid trial results, then continued with the reliability coefficient test results obtained using the formula coefficient of apha as follows:, those values have a good reliability as an instrument. Data collection includes: 1) the collection of data about the results of the study of Basic Physics II, the results of the tests carried out using Basic physics II which have been standardized, implemented at the end of the execution of the experiments. Test results of Basic physics II made in the form of essays, question 2). The collection of data about the level of intelligence of the students is done before execution of the experiments carried out. Technique of data analysis includes descriptive analysis, requirements analysis and test analysis of inferensial. Prior to the analysis of inferensial for testing the hypothesis of research first conducted the analysis prerequisite test include: (1) test of normality, its homogeneity test (2), (3) testing linearity, (4) keberartian test kovariat influence against variables bound, and (5) of the regression line alignment test. Testing of its homogeneity of the treatment groups in the study done by test-F and test Bartllet that States there is no difference in variance between groups tested, thus the data on these groups come from populations which are homogeneous, whereas for the regression Line Alignment test also use test-F with the result that the regression lines on all the factors aligned cells.

III. THE RESULTS OF THE RESEARCH AND THE DISCUSSION

Based on the results of the analysis of univariate GLM procedure (Design A B A * B X) through SPSS version 17, will present the results of hypothesis testing as follows:

Table 2. Summary of the results of the test with ANKOVA F about the difference the average results of Basic Physics II (Y) After controlling for student Intelligence (X)

Source	*Type II Sum of Squares*	*df*	*Mean Square*	*F*	*Sig.*
Intercept	1.021	1	1.021	.043	.836
X	15671.488	1	15671.488	664.227	.000
A	1033.117	1	1033.117	43.788	.000
B	1452.631	1	1452.631	61.569	.000
B * A	100.017	1	100.017	4.239	.043
Error	1675.143	71	23.594		
Total	804581.000	76			
Corrected Total	19375.408	75			

a. R Squared = .914 (Adjusted R Squared = .909)

Based on the results of the analysis are presented in table 8 it can be described as follows.

1. The difference in the results of the Basic Physics II Learning between students who were given a Lesson Study learning activities and who were given Conventional learning activities

Statistical hypothesis 1 as follows:

H_0: $\mu A_1 \leq \mu A_2$

H_1: $\mu A_1 > \mu A_2$

The results of the analysis of hypothesis testing 1 indicates that H_0 is rejected based on Test-F, row A value of F_{count} = 43.78 greater than 3.98. Thus it can be concluded that there is a difference in Basic Physics II study results between a group of students who were given a lesson study learning activities with a group of students who were given conventional learning activities after controlling intelligence students. The results of the calculations of the mean field data XA_1 XA_2 = 106,395 while the average = 97,447 means it can be concluded that the results of the study of Basic Physics II between a group of students who were given a lesson study learning activities is higher compared to the Group of students who were given conventional learning activities.

2. The difference in the results of the Study of Basic Physics II between the students who were given a performance appraisal and students who were given a written Test Assessment

Statistical hypothesis 2 as follows

H_0: $\mu B_1 \leq \mu B_2$

H_1: $\mu B_1 > \mu B_2$

The results of the analysis of hypothesis testing: 2 shows that H_0 is rejected based on the test F, line B with a value of F_{count} = 61,57. The value of F_{count} is greater than F_{table} (0.05; 1.75) = 3.98. Thus it can be concluded that there is a difference in Basic Physics II study results between groups of students are given a performance appraisal and a group of students who were given a written test assessment, after easily controlling intelligence students. The results of a calculation of data in front

of average XB_1 XB_2 105,816 whereas average = = 98,026 meaning can be summed up the results of the study of Basic Physics II between a group of students was given a higher performance rating compared with a group of students who were given a written test assessment

3. The influence of the interaction between learning activities and assessment of the results of the Study of Basic Physics II student.

3 statistical hypothesis as follows.

H_0: Int. A x B = 0

H_1: Int. A x B $\neq$ 0

The results of the analysis of hypothesis testing 3 indicates that H_0 is rejected based on statistical Test, factor F A * B to the value of F = 4,24 count greater than F_{tabel} (0.05; 1.75) = 3.98. Thus it can be concluded that there is an influence of the interaction between learning activities and assessment of the results of learning Basic Physics II

4. Difference of Basic Physics II Study Results between students who were given a Lesson Study learning activities and performance assessment with students who were given Conventional learning activities and given a performance appraisal.

Table 3. Hypothesis Test Of Influence of All Factors With Each Factor B

Source	*Type II Sum of Squares*	*df*	*Mean Square*	*F*	*Sig.*
Corrected Model	17700.265[a]	4	4425.066	187.554	.000
Intercept	1.021	1	1.021	.043	.836
X	15671.488	1	15671.488	664.227	.000
B	1450.984	1	1450.984	61.499	.000
B * A	1133.133	2	566.567	24.014	.000
Error	1675.143	71	23.594		
Total	804581.000	76			
Corrected Total	19375.408	75			

Table 4. The Parameter Estimates Average Y All Factor A For Each Factor B

Parameter	*B*	*Std. Error*	*t*	*Sig.*	*95% Confidence Interval*	
					Lower Bound	*Upper Bound*
Intercept	-9.984	4.203	-2.375	.020	-18.365	-1.602
X	1.018	.040	25.773	.000	.940	1.097
[B=1.00]	6.454	1.576	4.094	.000	3.311	9.598
[B=2.00]	0[a]	.	.	.	.	.
[B=1.00] * [A=1.00]	9.679	1.579	6.129	.000	6.530	12.828
[B=1.00] * [A=2.00]	0[a]	.	.	.	.	.
[B=2.00] * [A=1.00]	5.078	1.577	3.220	.002	1.934	8.223
[B=2.00] * [A=2.00]	0[a]	.	.	.	.	.

4 statistical hypothesis as follows.

H_0: $\mu A_1B_1 \leq \mu A_2B_1$

H_1: $\mu A_1B_1 > \mu A_2B_1$

The results of the analysis show that 4 hypothesis testing: H_0 is rejected on the basis of the test statistic t, a value t_{count} = 6,13 the value greater than t_{table} (0.05; 75) = 1.67. Thus the conclusion to be drawn that for students who were given a lesson study learning activities and assessment of performance, there is a difference in Basic Physics II study results with students who are taught and given a conventional assessment of performance after controlling intelligence students. The results of the calculation of the data field in front of the average XA_1B_1 = 111,210 while XA_2B_1 = 100,421 meaning can be summed up the results of the study of Basic Physics II taught learning activities with lesson study was given a higher performance rating compared with students who were taught with the conventional learning activities and performance assessment.

5. The difference in the results of the Basic Physics II Learning between students who were given a Lesson Study learning activities and given a written Test Assessment with students who were given Conventional learning activities and given a written Test Assessment

5 statistical hypothesis as follows.

H_0: $\mu A_1B_2 \geq \mu A_2B_2$
H_1: $\mu A_1B_2 < \mu A_2B_2$

The results of the analysis of hypothesis testing 5 indicates that H_0 is accepted based on the test statistic Value t. t_{count} = 3,22 that value greater than t_{table} (0.05; 75) = 1.67. Thus the results of the learning of students who are taught learning activities with lesson study and given the assessment of the written Test, there is a significant difference between students who were taught with the conventional learning activities and assessment of the written test was given after controlling intelligence students. The results of the calculation of the data field in front of the average XA_1B_2 = 101,578 while XA_2B_2 = 94,473 means it can be concluded that students who were taught with lesson study was given a written test, assessment of the results of Basic Physics II students learn higher compared to conventional learning activities fed and given the assessment of the written test.

6. The difference in the results of the Basic Physics II Learning between students who were given a Lesson Study learning activities and performance assessment with students who were given a Lesson study learning activities and given a written Test Assessment

Statistical hypotheses 6 as follows.

H_0: $\mu A_1B_1 \leq \mu A_1B_2$
H_1: $\mu A_1B_1 > \mu A_1B_2$

Table 5. Test Hypotheses About All The B Factor Each Factor A

Source	*Type II Sum of Squares*	*df*	*Mean Square*	*F*	*Sig.*
Corrected Model	17700.265[a]	4	4425.066	187.554	.000
Intercept	1.021	1	1.021	.043	.836
X	15671.488	1	15671.488	664.227	.000
A	1031.470	1	1031.470	43.718	.000
B * A	1552.648	2	776.324	32.904	.000
Error	1675.143	71	23.594		
Total	804581.000	76			
Corrected Total	19375.408	75			

a. R Squared = .914 (Adjusted R Squared = .909)

Table 6. The Parameter Estimates Average Y All Factors B For Each Factor A

Parameter	*B*	*Std. Error*	*t*	*Sig.*	*95% Confidence Interval*	
					Lower Bound	*Upper Bound*
Intercept	-9.984	4.203	-2.375	.020	-18.365	-1.602
X	1.018	.040	25.773	.000	.940	1.097
[A=1.00]	5.078	1.577	3.220	.002	1.934	8.223
[A=2.00]	0[a]	.	.	.	.	.
[B=1.00] * [A=1.00]	11.055	1.580	6.995	.000	7.904	14.206
[B=1.00] * [A=2.00]	6.454	1.576	4.094	.000	3.311	9.598
[B=2.00] * [A=1.00]	0[a]	.	.	.	.	.
[B=2.00] * [A=2.00]	0[a]	.	.	.	.	.

The results of the analysis of hypothesis testing 6 indicates that H0 is rejected on the basis of the test statistic Value t. t_{count} = 6.99 that value greater than t_{table} (0.05; 75) = 1.67. Thus the results of the learning of students who are taught learning activities with lesson study and given a performance appraisal, there is a significant difference between students who were taught learning activities with lesson study and given the assessment of the written test after controlling intelligence students. The results of the calculation of the data field in front of the average XA_1B_1 = 111,210 while XA_1B_2 = 101,578 rate means it can be concluded that for the Group of students who were taught learning activities with lesson study, the results of the study of basic Physics II students are given a higher performance rating compared with a group of students who were given a written test assessment.

7. The difference in the results of the basic Physics II Learning between students who were given Conventional learning activities and performance assessment with students who were given Conventional learning activities and given a written Test Assessment

7 Statistical hypothesis as follows.

H_0: $\mu A_2B_1 \geq \mu A_2B_2$
H_1: $\mu A_2B_1 < \mu A_2B_2$

The results of the analysis of hypothesis testing 7 indicates that H_0 is accepted based on the test statistic Value t. t_{count} = 4.10 the value greater than t_{table} (0.05; 75) = 1.67. Thus for the Group of students who are taught with the conventional learning activities there is a difference in the results of the Basic Physics II between a group of students who were given a performance appraisal with a group of students who were given a written test assessment after controlling intelligence students. The results of the calculation of the data field in front of the average XA_2B_1 = 100,421 while average XA_2B_2 = 94,473 means it can be concluded that for the Group of students who were taught learning activities with lesson study, the results of the study of Basic Physics II students are given a higher performance rating compared with a group of students who were given a written test assessment.

IV. DISCUSSION OF RESEARCH RESULTS

The results showed that the variables of learning activities and assessment form have significant influence towards the results of the Basic Physics II student learning (Y) after controlling for student intelligence (X). The discussion will then be discussed on the basis of research findings and the results of hypothesis testing as follows.

1. Basic Physics II Study Results of Students Given Learning Activity Lesson Study Was Higher Than The Basic Physics II Study Results of Students Who Were Given Conventional Learning Activities.

The results of hypothesis testing indicate that there is a difference of Basic Physics II learning outcomes among students who were given the learning activity lesson study and conventional. Therefore it is in the process of Basic Physics Lecture II to achieve better results, then it can use learning activities lesson study. At the lecture using lesson study many things which may be exercised both by lecturers and students. Lesson study learning activities implemented through the stages of the plan, do and see. Plan is planning activities the activities of the course are held together by a team of Basic Physics lecturer II. Activities plan becomes very important in lecture Moreover, the lecture is held on a relatively new students on campus. Stages of the activities of the lesson study since the beginning of the lecture is already inviting the team to formulate the lecturer shared planning process lecture.

At this stage these are process IE do lectures, where on stage do present Lecturer team to carry out observations on the implementation of perkuliahanan. The lecture led by a lecturer of the model and the process of lectures presented is the result of a shared formula when plan. Meanwhile a team of lecturers were present to observe the process and record all activity lecture lectures were held. Observations made of early learning activities to complete. At the time of reflection Professor model can provide an explanation of some of the things could have changed from the initial planning together. On reflection the explanation it is urgently needed by the participants of the reflection.

Based on the steps and learning activities lesson study above, the results of this research show that there was a very positive influence on learning activities between lesson study with the results of the Basic Physics II students majoring in physics.

2. Basic Physics II Study Results of Students With Higher Performance Assessment Activities From Basic Physics II Study Results of Students Given The Assessment of The Written Test.

The process always lecture will be followed by assessment activities, and assessments has a very important role in determining the success of a lecture. Good judgment will produce a proper follow-up also comes down to evaluation and the final result in the form of proper decision-making. Assessment that is able to reveal all the potential good of students academic knowledge, skills and attitudes is a better assessment than if the assessment on just one aspect only. (Supardi, 2011:101-125). Explain the increase in the quality of education is done through process improvement efforts of learning using a variety of learning methods and assessment.

Performance assessment is a form of assessment that allows students can show all the academic potential to gain maximum value. For example, the ability of the students on the basic physics of materials II staple material waves not only assessed the ability of the student to answer the question or answer the question at the time of the exam of the semester through writing, but how the student is able to demonstrate physical phenomena from the concept of the wave, and is able to analyze and provide a description of the observed phenomenon both through practice in the laboratory as well as a natural phenomenon in the context of the surrounding environment. Assessment of ability of thoroughly like this can not be done only through a written test, but it can be done through penillaian performance. Aspects that cannot be judged with the written test can be assessed from observation.

Highly effective performance assessment is carried out to find out all the academic potential especially with regard to the potential of the academic field of science. Physics as a science lesson is absolutely right to do assessments through the process

of science, where it concluded a process of performance must be demonstrated, observed, analyzed and reported the results of the analysis of the physical fonomenan are studied.

Based on the results of this research are then retrieved an outcome that, Basic Physics Lecture II by implementing performance assessment form shows a higher yield compared to the results of a study of Basic Physics II apply assessment test writing.

3. There Is The Influence of The Interaction Between Learning Activities And Assessment of The Results of Learning Basic Physics II.

Based on the results of the analysis through hypothesis testing showed that the presence of influence between factors of learning activities with the form of assessment after controlling intelligence students. This state indicates that the difference in the results of the study of Basic Physics II after controlling intelligence ditentuan by student learning activities and assessment forms provided. This means that the influence of the interaction will give meaning if done on the effects of each level are given treat.

The level of treatment in question is: (1) a special group that was given a learning activity lesson study, the results of the study of Basic Physics II in a group performance rating higher than Basic Physics II study results in a written test assessment group, (2) a special group who were given conventional learning activities, Basic Physics II study results in a group performance rating higher than Basic Physics I studied physics results in a written test assessment group , (3) a special group that was given a learning activity lesson study, the results of the study of Basic Physics II in a group performance rating higher than Basic Physics II study results were given conventional learning activities in a group performance assessment, and (4) a special group who were given conventional learning activities, Basic Physics II study results in a group performance rating higher than Basic Physics II study results in a written test assessment group.

4. For Students That Are Learning Activities Lesson Study And Given The Higher Performance Assessment of University Students Who Were Given Conventional Learning Activities Were Given Performance Assessment.

Lesson study learning activities contribute an excellent start of planning (plan), the implementation of a learning activity (do) to the reflection (see). The involvement of a team of lecturers gave a lot of enter to make a lecture went well, lecturers-professors contribute to the implementation of the lecture. Different is the case with conventional perkukiahan, engagement between professors is very small, sehinnga a little insert that can be retrieved or almost no involvement of other teams in the lecturer lectures applying conventional activities.

In the process of applying and learning activities with lectures and lesson study and assessment of pkinerja is very encouraging for students to pay attention to all the steps of learning activities lesson study of the course. Mehmet Erkol, Mustafa Kisoglu, and Erdogan Buyukkasap (2010) *Procedia Sosial and Behavioral Sciences 2 (2010) 2310-2314)*

A good learning conditions provide opportunities for students to learn the existence of. Student learning entitlement needs to be formed while attending. Through the observations of individual students in a lecture, will be retrieved information on whether students are learning or not. Observation learning and learning outcomes assessment form will give you a good influence against the learning outcomes of students.

Based on the results of the research results that are obtained through learning activities lesson study by applying the results of performance assessment of student learning in Basic Physics Lecture II higher than Basic Physics Lecture I with the assessment of the written test.

5. For Students That Are Learning Activities Lesson Study And Given A Written Test Assessment Higher Than Students Who Were Given Conventional Learning Activities Given The Assessment of The Written Test.

Lecture by applying the learning activity lesson study gives a good insight for the mutual exchange of information knowledge, experience in particular in the learning activities. Coaching more junior professors are encouraged to implement the activities of the lesson study. Lesson study provides enough room to do the academic communication between fellow professors, lecturers and students as well as college students and college students. Study lesson learning activity tends to give emphasis on the akativitas aspects of the student during the learning process, so that it can proceed with doing the measurement results of the study. How that can be done to measure the success of the study is to provide an assessment of the written test results showed that if classes are implemented with lesson study continued with a written appraisal.

A good learning activities can be very giving influence on student learning outcomes. Same thing if the assessment process that performed well will affect the process of the preparation of student learning in the face of exams or tests. The written assessment is how to measure student learning success. Therefore a study lesson learning activity then continued with the implementation of a written evaluation showed the success of student learning. The results obtained that the activity of lesson study and given a written assessment is lower if the lecture was carried out with conventional and given a written test.

6. For Students That Are Learning Activities Lesson Study And Given The Higher Performance Assessment of University Students Who Were Given The Learning Activity Lesson Study Was Given A Written Test Assessment.

Learning activities lesson study is one form of learning activities ranging from the design of early learning activities, implementation up to the end of the learning activity i.e. Reflection learning always involves a team of associate professors. Learning activities lesson study work patterns form a team of lecturers together that allows adding insight between professors to build better learning performance. Excellence always happens on learning activities lesson study is how the initiators attempted to observe student learning activities. On the activities of the lesson study of the students observed the activity of learning changes the time of lectures, so hopefully there isn't a student who does not note their learning activities during the lecture. Recording or recording learning activities students become accurate data when doing a reflection after completion of the learning activity. The advantage of learning activities lesson study is always the end of learning activities undertaken reflection learning activities completed are followed. Reflections always produce how the following lectures better than today.

The process includes many lecture lecturer teams certainly more profits is going. The assessment will be done more maximum when compared to if the assessment is only done on its own. Basic Physics II as one of the lessons of science urgently needs scientific activity, which in its activities require students to demonstrate the process of physical science. The physical process to do, observed, analyzed and reported. The process of science activities in the Basic Physics is absolutely right if his judgement is done with the performance appraisal, so that the measurement of the results of the study rmahasiswa can be more than the maximum, if only performed with an assessment based on the results of the written test. Performance assessment requires that students demonstrate physical phenomena of the concept to be learned. This situation much better if studied physics just by relying on the written test assessment. The assessment of the written test is hard pressed to reveal the science skills that should be possessed by students majoring in physics. The assessment of the written test can also give the impression of a speculative students in answering the question.

Based on the results of hypothesis testing demonstrates to students that are learning activities lesson study and given the higher performance assessment results of Basic Physics II learning from students that are learning activities lesson study was given a written test assessment.

7. For Students Who Were Given The Conventional Learning Activities And Higher Performance Assessment of University Students Who Were Given Conventional Learning Activities Given The Assessment of The Written Test.

Classes implementing the beajar activities of the conventional lecture is commonly used in lectures at this time. Basically each lecturer always apply a conventional lecture lecture only if done on its own. Conventional lecture intended lecture was held by a start of the process of planning, implementation to the evaluation process. On the conventional learning activities in the process of implementation also apply various approaches, and learning strategies and learning activities as well as lesson study. Perbedaaannya more on lesson study always involves togetherness lecturer from planning till the end, whereas in more conventional peransendiri lecturer, very few team roles Professor. To be optimal the conventional lecture if diikuiti with good judgment, which allows students to learn thoroughly without learning in speculation. To reduce the speculation on how to learn student lecturers should be able to develop a form of assessment that can effectively measure the academic potential of all students.

Performance assessment can be effective for students ' learning results megukur because in the performance assessment of University students are required to know the process of beginning an activity until the end. Therefore the results of research show that the results of the study of Basic Physics II students by implementing performance assessment using conventional lower compared to the results of a study of Basic Physics I apply conventional assessment tests are given in writing.

V. CONCLUSIONS

Based on the above discussion it was concluded as follows: 1. The results of the study of Basic Physics II Group of students being taught learning activities with lesson study was higher than the results of the study of Basic Physics II Group of students taught with the conventional learning activities. 2. The results of the study of Basic Physics II student groups who were given performance rating higher than Basic Physics II study results student groups that were given the assessment of the written test. 3. There is Interaction and learning activities with the activities of the assessment of the results of learning Basic Physics II. 4. The results of the study of Basic Physics II Group of students taught with Lesson study and given the higher performance assessment of the results of Basic Physics II study group of students taught with the conventional learning activities and performance assessment. 5. The results of the study of Basic Physics II. Group of students taught with lesson study and given a written assessment of the results of the study of Basic Physics II Group of students taught with conventional and given a written assessment. 6. The results of the study of Basic Physics II Group of students taught with Lesson study and given the higher performance assessment of the results of Basic Physics II study group of students taught with lesson study and given a written assessment, and 7. The results of the study of Basic Physics II student groups who were given conventional learning activities with the peniaian of performance lower than the results of a study of Basic Physics II student groups who were given conventional learning activities with a written appraisal.

REFERENCES

[1] Aiken, Lewis r. Rating Scales & Checklists, Evaluating Behavior, Personality, and Attitudes. New York: John Wiley Sons, Inc. & 1996.

[2] Ainun, Salim, Th. E. Nuraen. Written tests Jakarta: Department of Education Assessment Center research and Development Agency, 2008.

[3] Aunurrahman. Learning and learning. Bandung: Alfabeta, 2009.

[4] National Education Standards Body. Guide the assessment group of Subjects natural science and technology. Jakarta: BSNP, 2007.

[5] Bambang, r. Soekrisno, Aryan (http://rbaryans.wordpress.com/2010/10/25/asesmen-kinerja-performance/.Oktober 2005), (accessed 5 April 2011).

[6] Dalyono, M. Psychology Education. Jakarta: Cipta Reneka, 2007.

[7] Djaali. Psychology Of Education. Jakara: Earth Revised, a 2012.

[8] Djaali, and Praise Muljono. Measurements In The Field Of Education. Jakarta: Grasindo, 2008.

[9] Djaali and Mohammed Farouk. Methodology Of Social Research. Jakarta: Supreme Blessing, 2005.

[10] Dungus, F. "The Effect of The Application of The Lesson Study And Assessment of Performance Against An Increase In The Results of The Basic Physics I, By Controlling The Intelligent Students". Dissertation. Jakarta: The Jakarta State University Graduate Programs. 2012.

[11] Samuel Greiff, Wustenberg, s., Csapo, b., Demetriou, Andreas Hautamaki.,.,., C Arthur Graesser, and Martin, r. (2014) Domain-General Problem Solving Skills and Education in the 21st Century, the Journal Educational Research Review 13 (2014) 74-83

[12] Halliday, r. and Resnick. Physics Volume 1, Pantur Silaban translation and Erwin Sucipto. Jakarta: Eason, 1997.

[13] Hendayana, s. et al. Lesson Study, A Strategy To Increase Keprofesionalan Educators. Bandung: UPI Press, 2006.

[14] Ibrahim and Mohammed Nur. Teaching Based On Problem. Surabaya: University Press, 2003.

[15] Marcelano, Alonso and Finn, j. Edward. Fundamental of Physics Vol 1, translation: Lea Joon. Jakarta: Eason, 1992.

[16] Mardapi, Djemari. Engineering Drafting Instrument Test and Non-test. Yogyakarta: Publisher Partners Cendikia Press, 2007.

[17] Mehmet Erkol, Mustafa Kisoglu, and Erdogan Buyukkasap (2010). The Effect Of Implementation Of Science Writing Heuristic On Students ' Achievement And Attitudes Toward Laboratory In Introductory Physics Laboratory. Procedia Social and Behavioral Sciences 2 (2010) 2310-2314)

[18] Muhibbin, Shah. Psychology Of Education. Bandung: PT. Teen Rosdakarya, 2010.

[19] Munasco, The Form Of The Test, The Qualification Of Teachers And The Learning Of Physics By Controlling The Initial Ability. Journal Of Educational Evaluation: UNJ Graduate Programs. Vol. 4, no. 1, March, 2013: (37-51)

[20] Mundilarto. Capita Selekta Physics Education. Yogyakarta: Faculty Of Mathematics And Natural Sciences UNY, 2002.

[21] Nasution. Various Approaches In The Process Of Learning And Teaching. Jakarta: PT Earth Revised, 2010.

[22] Oemar, Hamalik, The Process Of Teaching And Learning. Jakarta: PT Earth Revised, a 2012.

[23] Popham, W. James. Classroom Assessment What Teachers Need to Know. London: Allyn and Bacon, 1995.

[24] Sears, Francis w. and Mark w. Zemansky. University Physics Vol 1, translation of Soedarjana and Achmad Amir. Bandung: Binacipta 1987.

[25] Syamsuri, Istamar and Ibrohim. Lesson Study (Study Of Learning). Malang: UM ENGINEERING, 2008.

[26] Sudjana, Nana. The Assessment Of Teaching And Learning Outcomes. Bandung: PT Teen Rosdakarya, 2005.

[27] Setiadi, Today. Performance Assessment. Jakarta: Ministry Of National Education The Agency's research and development, 2006.

[28] Suruddin. "The Influence Of Class-Based Assessment And Learning Methods Against The Results Of The Learning Of Mathematics, After Controlling The Early Knowledge Of Math Students". Dissertation. Jakarta: The Jakarta State University Graduate Programs. 2009.

[29] Sagala, Syaiful. The Concept And Meaning Of Learning To Help Solve Problematic Learning And Teaching. Bandung: Alfabeta 2001.

[30] Supardi, Influence The Frequency Of Assessment Of Fomatif Learning And Independence Against The Results Of Learning Calculus By Controlling The Initial Capabilities Of Students. Journal Of Educational Evaluation Of PPS State University Of Jakarta. Vol. 2, no. 1, March 2011:101-121.

[31] Tipler, James. Physics For Science And Engineering. Translation: Lea vol. 1 Joon Jakarta: Eason, 1989.

[32] Zainul, Asmawi. Alternative Just My Assesment. Jakarta: Inter-university Centre for the enhancement and development of instructional activities of higher education Department of national education, 2005.

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Influence of the doping of the absorber and the charged defects on the electrical performance of CIGS solar cells

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Abstract- In this paper, we have tried to show the importance of doping and defects charged on CIGS solar cells. Indeed according to our simulations, we could see that the electrical performance of these types of cells highly dependent on these two parameters. We also studied the dependence between doping and charged defects on the evolution of the electrical parameters. It was found that the results with neutral defects different from those charged with defects. The doping level for best performance (solar cell with Cu-poor absorber) is lowest with neutral defects than with the charged defects.

Index Terms- charged defect, CIGS, Cu-rich, Cu-poor, Doping.

I. INTRODUCTION

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Our model is based on CIGS Numos Baseline SCAPS but with some modifications. We will vary the doping 10^{14} to 10^{18} cm^{-3} and see the evolution of the electrical parameters. We will consider two cases: the first WERE defects are considered neutral, and the second defects will be charged. All simulations are performed at a temperature of 300 K. Illuminated characteristics have been simulated under AM1.5G illumination conditions with a power density of 100 mW/cm^2.

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d [nm]	3000	50	50	200
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χ [eV]	4.5	4.2	4.45	4.45
E_g [eV]	1.1	2.4	3.3	3.4
ν_n [cm/s]	10^7	10^7	10^7	10^7
ν_p [cm/s]	10^7	10^7	10^7	10^7
μ_N [cm^2/Vs]	100	100	100	100
μ_P [cm^2 /Vs]	25	25	25	25
$\lvert N_A\text{-}N_D\rvert$ [cm^{-3}]	10^{14}; 10^{15};10^{16}; 10^{17} or 10^{18}	10^{17}	10^{18}	10^{18}

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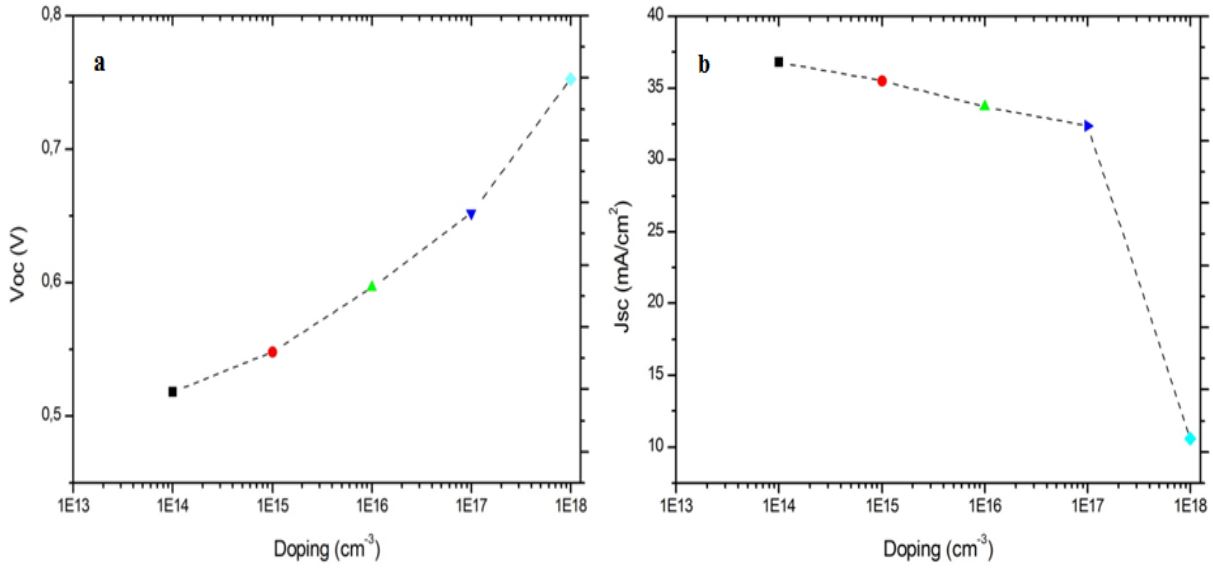

Figure 1: Variation of Voc (a) and the Jsc (b) according to doping.

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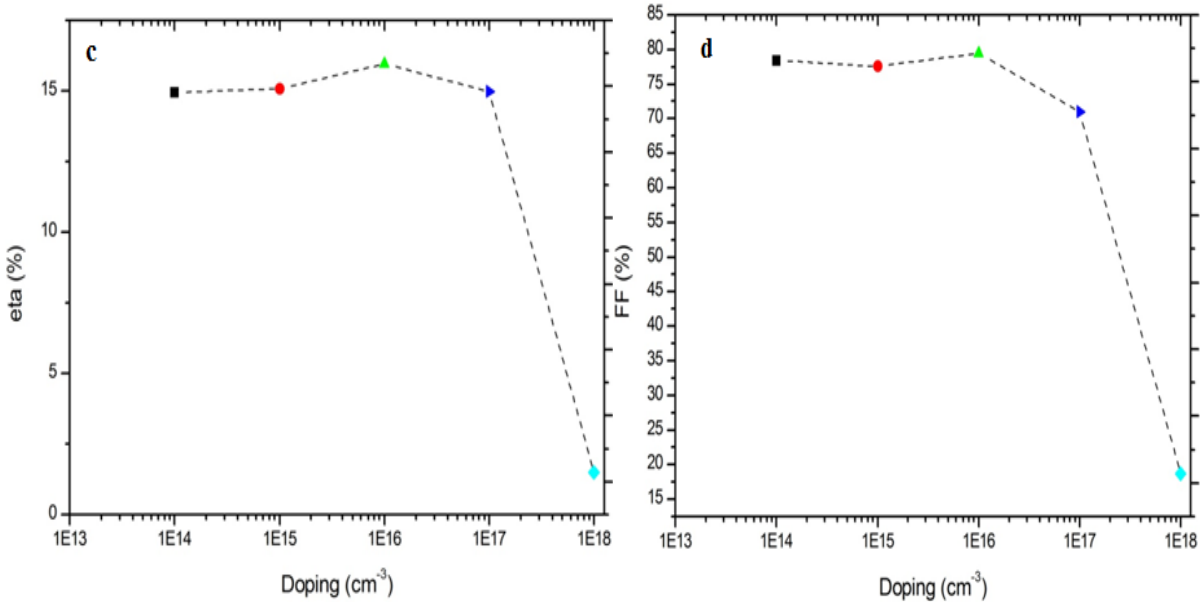
fact that a high doping density may cause the reduction of carrier life time and at the same time the current as we shown in Figure (b) [5]. There is a decrease in the short circuit current depending on the degree of doping of the absorber, of Cu-poor cell in the Cu-rich cell.



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In this part, we have done the simulations considering the deep defects as charged. Table 3 was used. The results are shown in Table 6.

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Doping (cm^{-3})	Voc (Volt)	Jsc (mA/cm^2)	FF (%)	η (%)
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With the change of the types of defects, there is a general decrease in electrical parameters, but moving in the same direction as if the defects were neutral except for the fill factor. For this, a significant decrease is observed at $10^{16}cm^{-3}$. The fact that a decrease of the electrical parameters is because with neutral defects were not recombination of minority carriers into the bulk of the absorber against the defects responsible for the recombination is important. Same is observed fluctuations and donor-acceptor transitions.

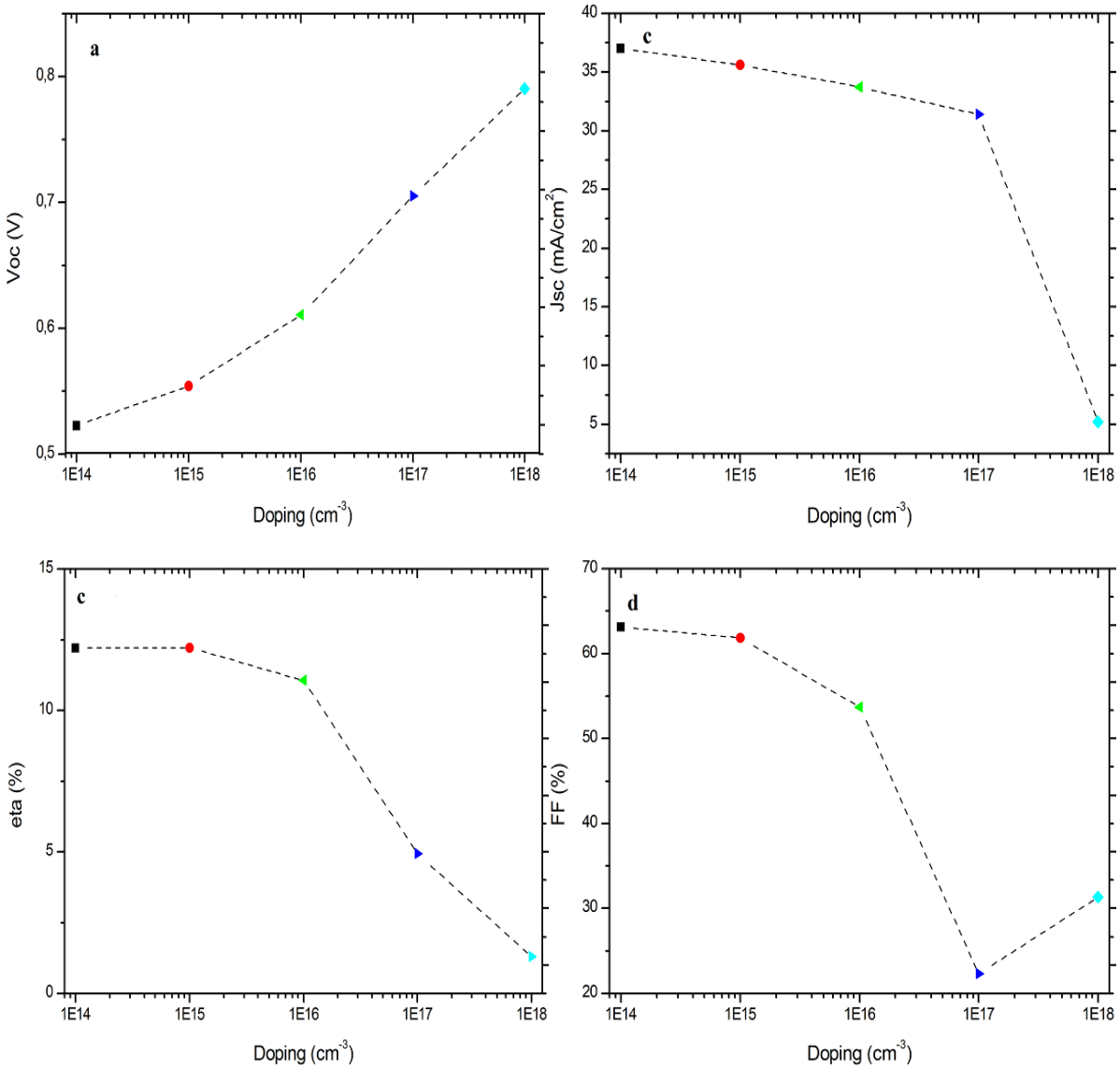

Figure 3: Variation in electrical parameters according to doping: Voc (a); Jsc (b); η (c); FF (d).

Here, the best efficiency is obtained for doping between 10^{14} and 10^{15}cm-3. Currently the best efficiency is always obtained with the cell with a Cu-poor absorber, although Cu-rich absorbers have more good transport properties. The change of the charge defect has the major effect of reducing the doping level of the best cell efficiency.

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REFERENCES

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Influence of the doping of the absorber and the charged defects on the electrical performance of CIGS solar cells

SOCE Mouhamadou Mamour*, DIENG Moustapha **, EHEMBA Alain Kassine, DIALLO Demba**, WADE Ibrahima****

* Department of Physique, Semi conductor Laboratory University Cheikh Anta DIOP
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Abstract- In this paper, we have tried to show the importance of doping and defects charged on CIGS solar cells. Indeed according to our simulations, we could see that the electrical performance of these types of cells highly dependent on these two parameters. We also studied the dependence between doping and charged defects on the evolution of the electrical parameters. It was found that the results with neutral defects different from those charged with defects. The doping level for best performance (solar cell with Cu-poor absorber) is lowest with neutral defects than with the charged defects.

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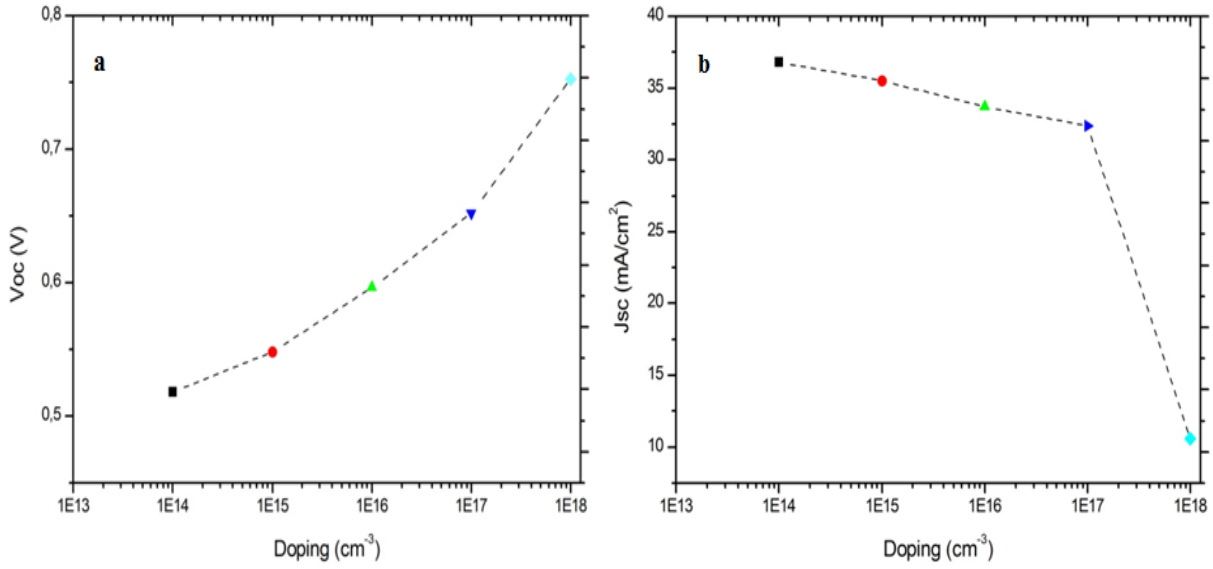

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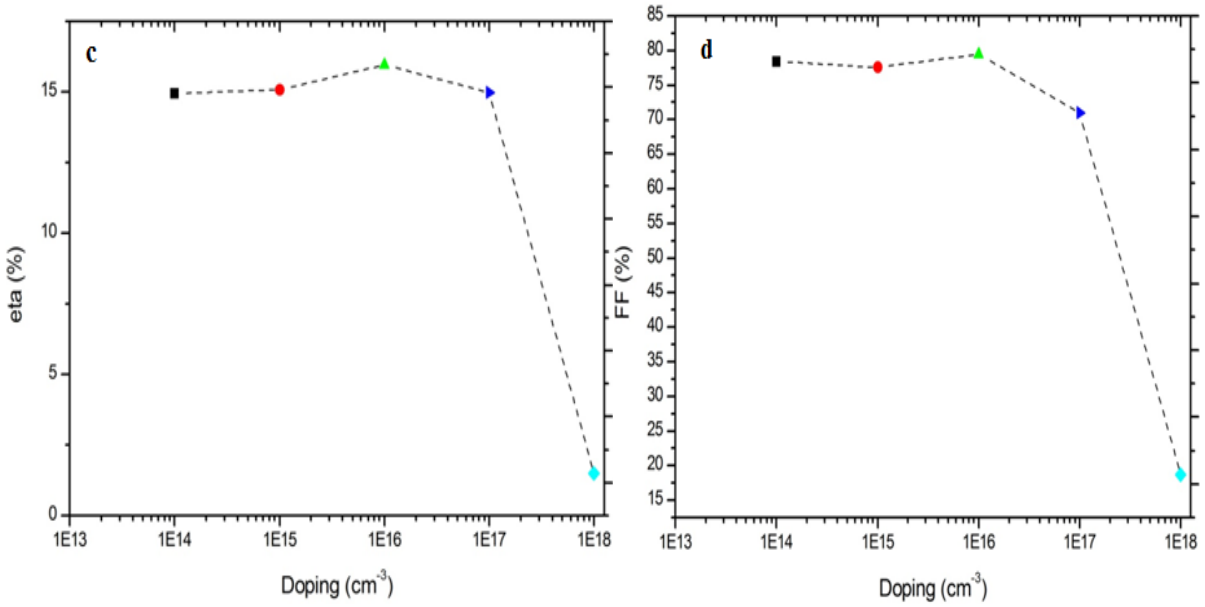

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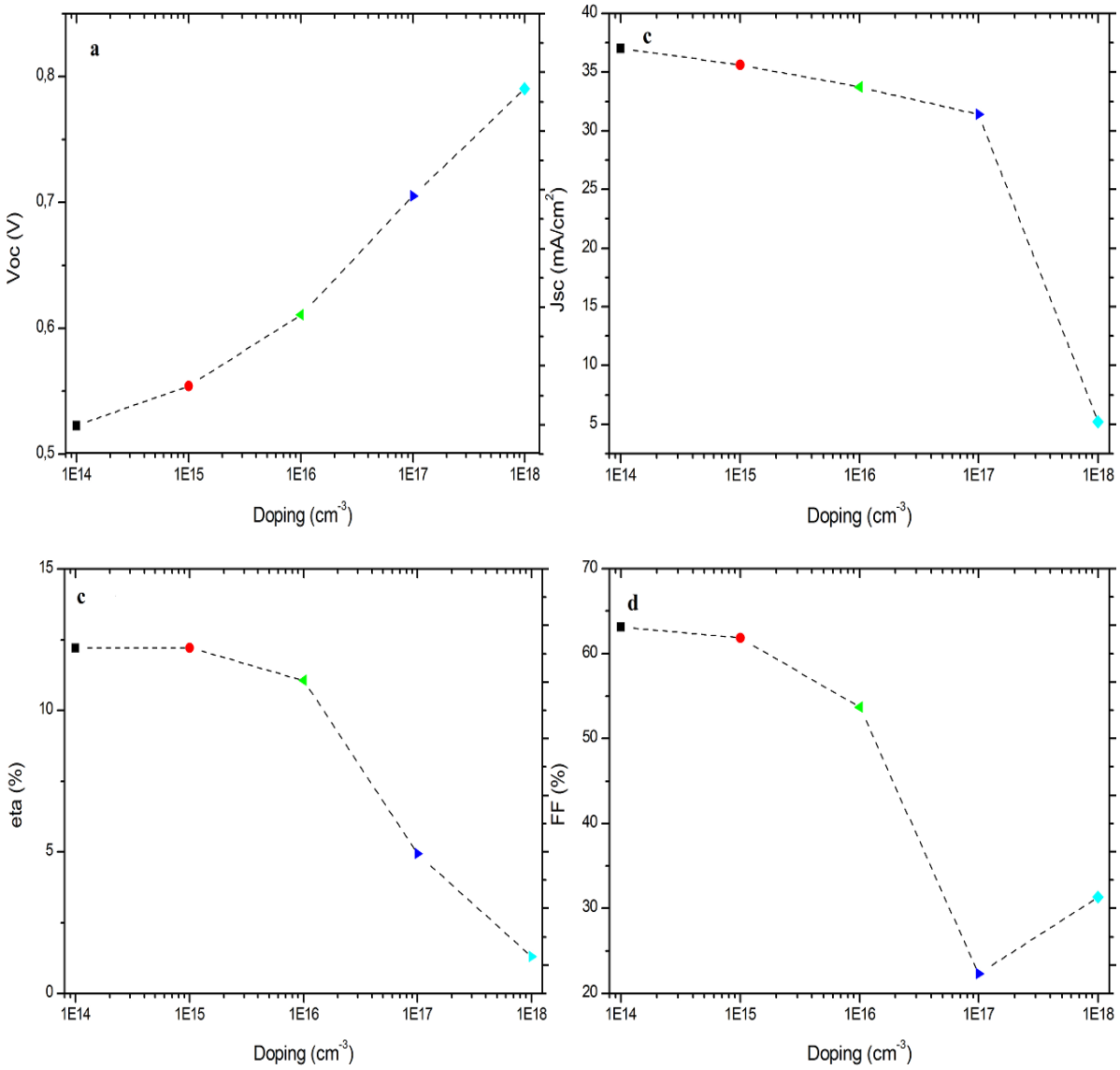

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Comparative Analysis of RCC and Steel-Concrete-Composite (B+G+ 11 Storey) Building

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Abstract - *Steel-concrete-composite buildings are formed by connecting the steel beams with concrete slab or profiled deck slab with the help of mechanical shear connectors so that slab and beam act as a single unit. In the present work, options of construction of (B+G+11storey) commercial building, situated in Kolhapur, with steel-concrete-composite and RCC are studied and compared with each other. Equivalent linear Static Method of Analysis explained in ETABS* version 15 *software is used and results are compared for different parameters. Comparative parameter includes roof deflections, base shear, storey drifts, for the building and axial forces and bending moments for column's and beams at different level. It is observed that steel-concrete-composite building is found to be more safe and economical and better option.*

Key Words: S*teel-concrete-composite, RCC,* Shear connector, ETAB software, *Equivalent linear Static Method*

I. Introduction

In the past, structural engineers had the choice masonry building. Today multi-story buildings in India are constructed with R.C.C framed structure or Steel framed structure. Recentlythe trend of going towards composite structure has started and growing in us.

But the failure of many these buildings due to earthquake have forced engineer to look for the alternative method of construction. Use of composite or hybrid material remains the particular interest, due to its significant potential in improving the overall performance through modest changes in manufacturing and constructional technologies. In India, many consulting engineers are reluctant to accept the use of steel-concrete-composite structure because of its unfamiliarity and complexity in analysis and design. But literature shows that if properly configured, steel-concrete-composite system can provide economical structural systems to resist lateral load with high durability, rapid erection and superior seismic performance characteristics. As comparatively new and no updated design codes are available for the same[1], there is a need to study the composite analysis and design of the multi-story buildings keeping in view of the rapid development in this field. Hence same can be studied in Indian context.

In the present work, comparative study of RCC and Steel-Concrete-Composite (B+G+11Storey) Building is made.Comparative study includes roof deflections, base shear, storey drifts, for the building and axial forces and bending moments for column and beam, are compared for two buildings.Seismic behavior of building under seismic forces as per IS 1893-2002 are observed.

II.Composite Construction

Composite construction combines properties of concrete and steel. Steel-concrete-composite building has become now a day's quite popular because of its advantages over conventional In composite construction the two different materials are tied together by the use of shear studs at the interface having lesser depth which saves the material cost considerably. Thermal expansion (coefficient of thermal expansion) of both, concrete and steel being is nearly same. Therefore, there is no induction of different thermal stresses in the section under variation of temperature.

A steel concrete composite building consists of a composite column,structural steel beam, over which are reinforced concrete slab is cast with shear connectors between beam and slabs as shown in fig.1..The composite action reduces the beam depth. Rolled steel sections themselves are found adequate frequently for buildings and built-up girders are generally unnecessary.The composite beam can also be constructed with profiled sheeting with concrete topping or with cast in place or precast reinforced concrete slab.

A steel concrete composite column is conventionally a compression member in which the steel element is a structural steel section. There are three types of composite columns used in practice which are Concrete Encased, Concrete-filled, and Battered Section.

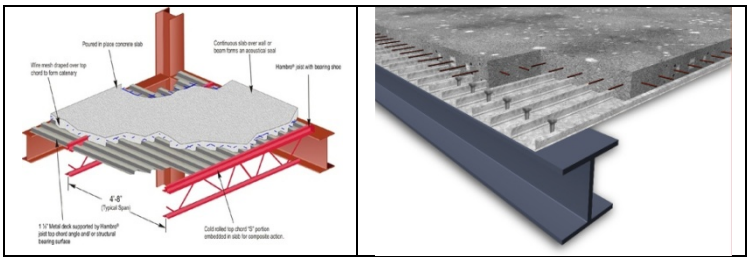

Fig1-Typical composite construction, column-footing (left) and beam-slab (right)

III. Linear static Analysis for Lateral load

IS 1893 gives procedure to satisfy the objectives[3]. This can be achieved by elastic structural response and limiting the storey drifts to minimize damage. The inelastic deformation demands are smaller than their deformation capacities on account of gravity loads and deterioration of stiffness and strength due to loading. Displacement is the key parameter for performance during earthquake rather than force or strength. Deformation can be classified in to three categories as roof displacement, Story drifts & other internal deformations and inelastic deformations for structural components and elements. These movements occur due to rigid body displacement and shear deformations.

High base shear and moment can be avoided due to

- high shear capacity requirement,
- development of ductility in elements and structure under gravity and lateral loads and hence stresses, and
- controlling lateral displacement, story drifts , forces and moments in the structure

To study the above issues, composite and RCC model has been studied and compared for the parameters mentioned. This will give the idea about the behavior of the building. The static analysis of building model is performed using IS 1893 and software ETAB version 15. Models are analyzed for lateral load (earthquake) in two lateral X and Y direction. While performing the analysis, slab is considered as rigid diaphragm. RCC model was designed as per code IS 456: 2000 [4] and composite system was designed as per code AISC 360-10 [8].

IV. Project details of Architectural plan:

Architectural plan educational building with area 41.28 x 17.21m^2 is shown in fig.2, constructed at Kolhapur, Maharashtra. Other considered during analysis are as follows. Other details of educational complex and site conditions are mentioned in table 1.

- Live load : 4 kN / m^2
- Super Dead Load : 3 kN/ m^2
- Slab thickness : 150mm
- Lift shaft : 300 mm thick shear wall
- Earthquake Zone : III
- Soil type : Hard soil
- Importance factor : 1
- Time period : User Defined
- Reduction factor : 3
- Damping Ratio : 5%
- Wind Speed : 39 m/s

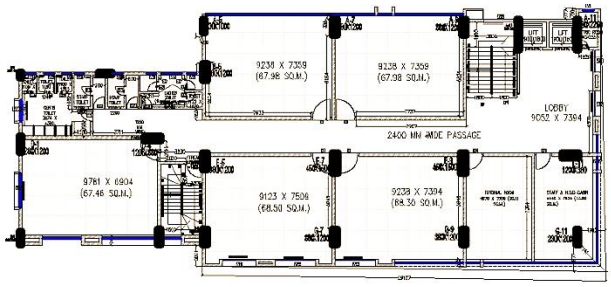

Fig 2- Typical floor Plan

Table 1-Project details

Particular	Details	Remarks
Depth of foundation	3m below GL	Basement provided
Number of stories	11	Story height - 3m
Thickness of walls	230mm	External walls
Tie at bottom level	3m interval	At 3 levels
Parking storey	2 stories	Basement and 1st floor
Parapet height	1.5m	
Type of foundation	Raft	Columns-fixed
Lift	Centre shaft	Machine roomat top
RCC water tank	Over staircase columns	At terrace level

Fig. 3 and 4 shows the typical structural plan and 3D elevation of the model respectively to be analysed.

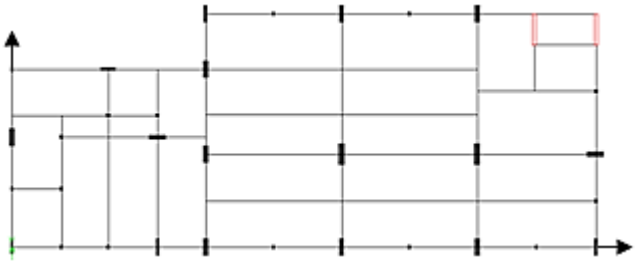

Fig3 - Typical plan for all floors of buildings in ETAB .

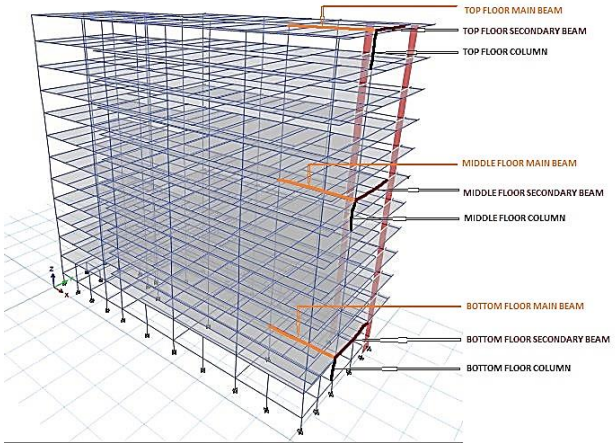

Fig. 4 – Typical 3D Model showing the selected elenments.

With above data , the models were constructed, analysed and designed as per 456 and AISC code. The sizes of the different members in different model has been finalized as per strength as well as displacement requirements. The summary of final sizes for different elements are as follows. Table 2 shows of beam and column sizes used during design and analysis. Table 3 shows properties of materials used.

Table 2- Beam and column Sizes

Particular	RCC	Composite	Levels
Main beams	0.30m x 0.60m	ISMB300	Basement to 1st Floor
Secondary Beams	0.23m x 0.60m	ISMB450	
Main beams	0.38m x0.6m	ISMB 600	2nd to 10th Floor
Secondary Beams	0.3m x 0.6m	ISMB450	
Columns	0.38m x 1.2m	0.23m x 1 m withISMB450embedded	Basement upto 1st Floor
	0.23m x 1 m	0.23m x 1 m withISMB300embedded	1st to 10th Floor

Table 3- Properties of material

Name of materials	E, MPa	ν	α	G, MPa	Unit Weight, kN/m³	Fc, MPa	Fc, MPa
M30	27386.13	0.2	9.9E-06	11410.89	25	30	-
STEEL	199947.98	0.3	1.17E-05	76903.07	76.8195	344.74	448.16

V. Results of analysis in two different models

Following are the results of analysis. Comparison of parameters mentioned is tabulated in following tables. Response of Storey displacement and Drift for earthquake in X and Y direction is shown in fig 5 and 6 respectively. Results are presented for load combination 1.5(DL + LL + EQX/WL). Mass source is from load, which is, lumped at story levels. Contribution of dead load was 100% and from live load was 50% as live load is more than 3 kN/m^2. In modal analysis, CQC method of combination was used and SRSS method was followed for directional combination. 12 modes were considered in modal analysis. Response spectrum method was used to apply earthquake load as per IS 1893 [5] and wind load as per IS 875[6].

Table 4-Roof displacement

Load combination	Parameter	Type of Model	
		RCC	COMPOSITE
DL+LL+EQX	UX, mm	213.6	102.1
	UY, mm	-13.7	-13.9

	UZ, mm	-14.1	-11.6
DL+LL+WLX	UX, mm	22	16.2
	UY, mm	-31.8	-18.4
	UZ, mm	-13.6	-11.5

Table 5- shows Base shear, base moment, torsional moment due to earthquake and wind loads for the load combination dead load plus live load plus, earthquake or wind load. It is seen that the base shear is more in case of RCC than Composite structure. Vertical reaction is same in all the cases irrespective of earthquake/wind load applied in x and y direction. The torsional moment is observed to be same in both model. Bending moment about the transverse axis of load applied is more than the moment about self-direction. These moment is little bit more in case of earthquake load combinations.

Table 5-Base shear, base moment, torsion due to earthquake and wind load

Load Combination	Parameter	Type of model	
		RCC	Composite
DLLLEQX	Base Shear (in kN)	-6,357.68	-5,807
	Base Moment (in kN-m)	11,05,462	10,11,275
	Torsion (in kN-m)	55,710.01	50,977.71
DLLLWX	Base Shear (in kN)	-940.072	-940.072
	Base Moment (in kN-m)	12,70,602	11,76,414
	Torsion (in kN-m)	8,806.779	8,806.779

Fig.5a and b shows the variation of drift along the storey height. It is seen that story drift is less in case of earthquake load and more in case of wind load.
Story drift in case of composite structure is less than RCC structure to both loads (earthquake and wind).

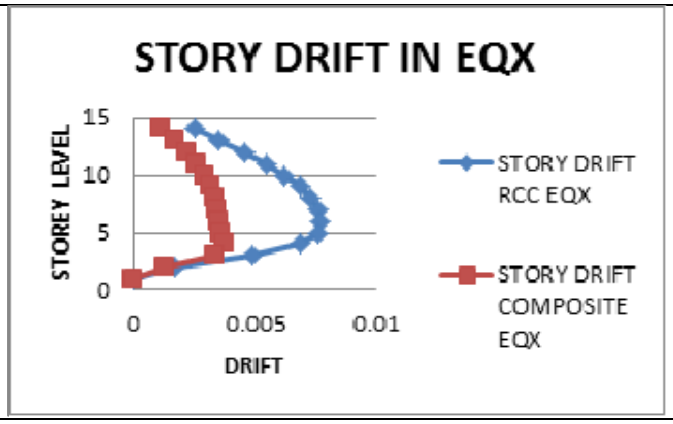

Fig 5a) - Response of story drift in X direction due to earthquake

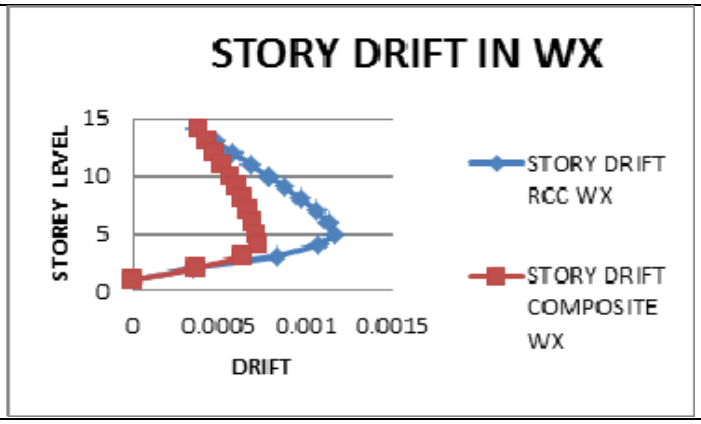

Fig 5 b) - Response of story drift due to wind load along x direction respectively

Fig 6a and b shows variation of story shear along story height. Story shear is more in case of earthquake load than wind load. Story shear is less in case of composite structure.

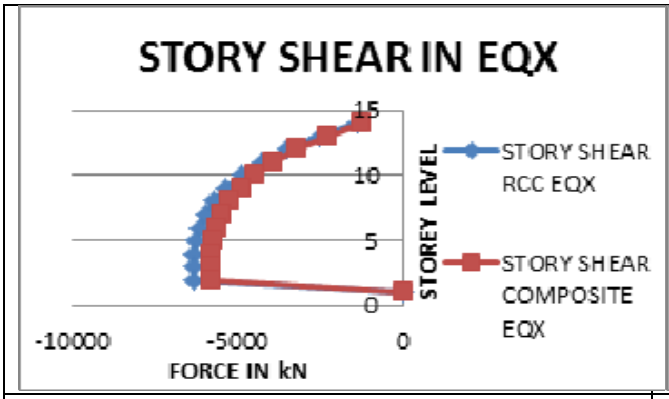

Fig 6 a) - Response of story shear in X direction due to earthquake

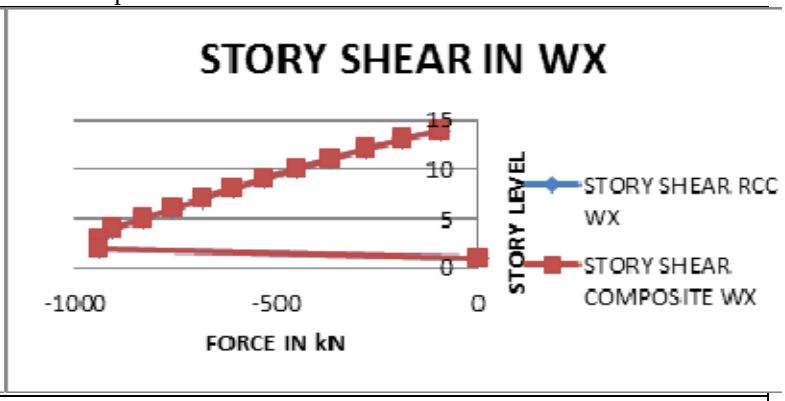

Fig 6 b) - Response of story sheardue to wind load along x direction respectively

Table 6 : Max. values of different action of AF,SF, BM and TM for main beams at different story for RCC and Composite

Action	Level	Max value for RCC		Max value for Composite		Remark
		End 1	End 2	End 1	End 2	
AF	Top	0	0	0	0	Axial force in beam is absent.
	Middle	0	0	0	0	
	basement	8.53	8.53	53.97	54.14	
SF	Top	-161.14	227.76	-156.21	211.51	Shear force decreases from top to bottom.
	Middle	-49.72	340.46	-18.77	345.53	
	basement	47.57	87.21	120.64	141.42	
BM	Top	-160	-344.37	-197.96	-380.58	BM is higher in middle level beams . In top level beam , BM is less.
	Middle	266.89	-736.45	281.51	-917.99	
	basement	234.60	-260.07	446.23	-537.42	
TM	Top	30.10	-36.66	0.085	-0.099	TM is negligible for Bottom beams and max. for top level beam
	Middle	31.88	-38.53	0.0685	-0.099	
	basement	-0.16	-0.16	-0.0213	-0.0074	
All action are less for Composite structure						

Table 7 : Max. values of different action of AF,SF, BM and TM for secondary beam at different story for RCC and Composite

Action	Level	Max value for RCC		Max value for Composite		Remark
		End 1	End 2	End 1	End 2	
AF	Top	0	0	0	0	Axial force in beam is absent.
	Middle	0	0	0	0	
	basement	-23.51	-23.51	-15.71	-15.71	
SF	Top	-145.80	169.32	-133.51	181.33	Shear force decreases from top to bottom.
	Middle	-161.12	199.73	-149.49	194.08	
	basement	-22.18	42.94	-19.39	35.14	
BM	Top	-211.19	-244.75	-135.68	-255.87	BM is higher in middle level beams . In top level beam , BM is less.
	Middle	-239.34	-309	-192.37	-285.85	
	basement	1.89	-39.98	0.49	-31.01	
TM	Top	-7.60	2.89	-0.045	0.0301	TM is negligible for Bottom beams and max. for top level beam
	Middle	-23.15	8.27	-0.17	0.0969	
	basement	-5.23	-5.23	-0.049	-0.049	
All action are less for Composite structure						

Table 8: Max. values of different action of AF,SF, BM and TM for column at different story for RCC and Composite

Action	Level	Max value for RCC		Max value for Composite		Remark
		End 1	End 2	End 1	End 2	
AF	Top	-634.32	-634.32	-526.26	-526.26	Axial force increase For RCC structure From top to bottom
	Middle	-4119.35	-4119.35	-3578.95	-3578.95	
	basement	-8408.75	-8408.75	-7708.61	-7708.61	
SF	Top	-32.60	-32.60	145.43	145.43	Shear force increase For RCC structure From top to bottom
	Middle	316.35	316.35	336.22	336.22	
	basement	682.26	682.26	511.13	511.13	
BM	Top	-410.5	-332.25	91.76	-235.46	BM increase For RCC structure From top to bottom
	Middle	226.77	-532.47	454.68	-301.82	
	basement	3255.90	2641.86	1355.96	972.61	
TM	Top	-1.89	-1.89	-2.63	-2.63	Negligible TM
	Middle	0.651	0.651	-2.24	-2.24	
	basement	-0.25	-0.25	-0.78	-0.78	
All action are less for Composite structure						

VI. CONCLUSION:

- The reduction in the self-weight of the Steel-Concrete Composite structure is reduced by is 9.48 % as compared to R.C.C. frame Structure.
- Shear forces in main beams in composite structure are increased by average **39.43%** as compared to R.C.C. framed structure while in secondary beams in composite structure are reduced by average **14.39** % as compared to RCC framed structure.
- Bending moments in main beams in composite structure are increased **52.57**% as compared to R.C.C. framed structure while in secondary beams in composite structure are reduced by average **28.93** % as compared to RCC framed structure.
- Axial forces in column in Composite framed structure have been reduced by average reduced by average **9.08 %** as compared to RCC framed structure.
- Overall response of composite structure is better than RCC structure i.e. composite structure produces less displacement , resist more structure forces/ action. Earthquake response is more than wind load.
- In both the options the values of story displacements are within the permissible limits as per code limits. Still roof displacement and drift with earthquake in X and Y direction are less in Composite framed structure as to R.C.C. framed structure. This may be due to more ductility in case of Composite structure as compared to the R.C.C. which is best suited under the effect of lateral forces.

From the observations and concluding remark, it can be said that Steel-Concrete-Composite option is better than RCC for high rise building.

VII. REFERENCES:

1. [1] Institute for steel development & Growth, "B+G+40 Storied Residential Building with Steel-Concrete Composite Option*" India, Dec 2007.*
2. [2] M. Nageh, “How To Model and Design High Rise Building Using ETABs Program” *Cairo* 2007.
3. [3] M. Willford, A. Whittaker and R. Klemencic, “Recommendations for Seismic Design of High-Rise Buildings” *Council of Tall building and urban habitat* Feb 2008.
4. [4] IS: 456, Code of practice for plain and reinforced concrete code of practice, Bureau of Indian Standards, New Delhi, 2000.
5. [5] IS: 1893, Criteria for earthquake resistant design of structures –general provisions for buildings, Part 1, Bureau of Indian Standards, New Delhi, 2002.
6. [6] IS: 875, “code of practice for design load (other than earthquake) for buildings and structures” Bureau of Indian Standards, New Delhi, 2002.
7. [7] IS: 800, Code of practice for general construction in steel, Bureau of Indian Standards, New Delhi, 2007.
8. [8] AISC 360-10, Specification of structural steel building, An American national standard, American Institute Of Steel Construction, Inc., 2005.
9. [9] IS: 11384, Code of practice for composite construction in structural steel and concrete, Bureau of Indian Standards, New Delhi, 1985.

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The Role of Corporate Social Responsibility for an Inclusive Growth in the Society

"The practice of CSR in the context of rural development in India"

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Abstract- In a corporate structure, there are many stakeholders, one of them are business houses or companies. These business houses contribute significantly to its pool that affect their internal stakeholders and support the initiatives of the company openhandedly. In India companies like Tata and Birla are practicing Corporate Social Responsibility (CSR) for decades, long before CSR become a popular base. There are many areas where companies have played a key role in addressing issues of education, health, environment and livelihoods through their statements of CSR throughout the country. According to the United Nations and the European Commission, CSR leads to the triple bottom line concept, environmental protection and the fight for social justice. It is important that the business sector identify, promote and implement effective policies and practices to achieve triple bottom line.

The study shows that all companies surveyed appear to have Policies and practices of CSR. Most companies design and implementation of CSR initiatives in area of work covers the entire community. It has also been revealed during the study that many companies promote and implement CSR initiatives through Human Resources Dept., foundation or collaboration with NGOs, but there is lack of fully fledged CSR dept. CSR initiatives undertaken by the Indian companies for rural development have a positive effect and impact on the overall development of society and business.

Index Terms- CSR Initiatives, Social justice, Policies & Practices, Development.

I. INTRODUCTION

Undoubtedly, the vast majority of the poor in India, people living in villages and towns are in a state of neglect and underdevelopment with the poor people. The problems of hunger, ignorance, poor health, high mortality and illiteracy are more serious in rural areas than in urban areas. Not only due to lack of equipment resources but also because of the defects in our planning investment process and model. India has the potential to meet these challenges in rural areas. However, the government efforts may not be sufficient to provide basic services to its citizens. It is increasingly recognized that progress and welfare of society is not only the responsibility of government but many other stakeholders must be involved to achieve the development goal. The corporate sector has a vital role to play in ensuring that the private investment flows in these rural areas that have been left out of the development process till date and work for sustainable development of rural areas in general.

Companies are considered as part of society and therefore act in a socially responsible manner beyond economic performance (KPMG and ASSOCHAM, 2008). As a result of this change in title from business of profit with social responsibility, many companies are supporting the concept of CSR. It is essentially a concept whereby companies decide voluntarily to contribute to society, making it better and cleaner in terms of environment (European Commission, 2001). In general, CSR is considered "The commitment of businesses to contribute to sustainable development as well as to economic development by working with employers, their families, local community and society as a whole and improve their quality of life, so that it is good for business and for development. A widely cited definition by the World Business Council for Sustainable Development the state of development that "Corporate Social Responsibility is the continuing commitment by business to behave ethically and contribute to economic development while improving the quality of life of workers and their families and the local community and society at large." (WBCSD, 1999).

Therefore, the meaning of CSR is two folded. First, it presents an ethics an organization should practice for its internal as well as external employees. . On the other hand, it means that the responsibility of an organization for the environment and the society in which it operates. CSR is considered as a mean or a medium by which companies give something back to society. Its mission is to provide innovative solutions for the social and environmental challenges. But the challenge for business and professional community is to identify priorities and areas of CSR interventions that are important in the context of rural development sector.

Therefore, it is necessary to study and understand business, how companies are using their CSR initiatives or what is the impact of social responsibility activities in the socio-economic development of the rural population.

II. LITERATURE REVIEW

Historically, CSR has been seen as Events for Developed countries. Having a large body of literature has amalgamated the practices of CSR in the context of developed countries. However, the literature on the theory and practice of CSR in developing countries remains low (Belal, 2001). Only a few studies are carried out which have examined the CSR practice in India. Various investigations in different parts and time period and also in classical literature of India have shown the practice of CSR in various Corporations in India. In long back in historical times Kautilya's 'Arthashastra' talk about merchants doing trading and also having responsibilities towards the local society. Although in ancient India, the responsibilities towards betterment of society were voluntary and not mandatory.

In 1987, Khan and Atkinson conducted a study. It was a comparative study on the attitudes of social responsibility management in India and Britain. The study shows that most India executives have initiated CSR activities for companies because they feel that it is also company's responsibilities that companies should share their profits not only with their shareholders and employees but also the suppliers, society and the state. A survey by TERI Europe and ORG-MARG was conducted in 2001 in many cities. In India it was revealed that more than 60% of people feel that the giant business families and corporations should take up these issues and help in bridging the gap between the rich and the poor, reduction in the cases of violation human rights, social problems to be resolved and increase in economic stability.

Some of the surveys as;

- Corporate Participation in Social Development India by Partners in Change (PIC).
- Changing the image: 2001 State of Corporate Responsibility Survey of India by the Tata Institute of Energy Research Institute (TERI).
- Corporate Social Responsibility: Perceptions of Indian business by the Centre for Social Markets (CSM).
- Corporate Social Responsibility Survey 2002, India presented by the British Council, UNDP.
- The Confederation of Industries in India and Price Water House Coopers has also featured the emerging CSR trends in India and also involvement of India in the CSR processes.

The conclusions of the all these surveys emphasized that in India philanthropy is the most important driver of CSR for the companies, followed by the brand image construction, followed by employee morale and ethics. Centre for Social Markets, a study in 2003 found out that social responsibility was seen as a significant business within the business without taking into consideration the firm size, age, sector, location, primary object or status.

A study on Iron Ore Mining in Goa, which shows many large mining companies have their own initiatives towards the Environment and Social Development. However, a formal CSR policy and planning. Chauhan and Verma (2007) found that roads, pollution and power are the major concern for businesses CSR activities in relation to the area in which they are least concern that is communication and education. Another study by Dutta and Durgamohan (2009) found that education holds the first place followed by health and social causes. Similarly, a survey conducted by CSM (2001), presented the various motives of the companies taking up various parameters of CSR. The different dimensions of CSR, which companies value and are assessed upon are national wealth, employment, environmental services social and health programs, including literacy. In a survey of CSR reporting in Asia Chapple and Moon (2005) found that nearly three quarters of large companies in India have shown in their reports and brochures to have been following the policies and practices of CSR. The EU Green Paper (2001) identifies two main dimensions of business implementation of CSR in an internal dimension in-company and external dimension of stakeholder participation.

The above result of different specialists in different points in time implies that they have rightly observed CSR performance in India and have highlighted the CSR practices for business in India. But there has been little attention to this aspect considered rural enterprises people as stakeholders? If so, what CSR initiatives are taken to rural development? How does the company entities to implement development programs with their business strategy? Finally, what is the impact of CSR programs in socio-economic development of rural areas population in India?

III. THE STUDY

In an effort to understand the answers to the above issues, this study was conducted in 12 public and private companies in India.

IV. THE OBJECTIVES OF THE STUDY

1. To study and understand the CSR initiatives are adopted by some public and private India enterprises for rural development;

2. To review the approach to work and businesses. And their mode of action for the implementation of CSR initiatives;

3. To assess the impact of socio-economic measures on CSR development of rural India.

V. METHODOLOGY

To study the above objectives, 12 public & private India companies/firms were selected. While selection of these companies, efforts were made to select a variety of sectors for a full & clear image. Therefore, the selected companies are from different industrial sectors such as pharmaceuticals (Mr. Reddy's Lab, Lupin, India), metals (Vedanta aluminum Ltd.), Tata Steel, Steel Authority of India Limited (SAIL), financial institution (ICICI Bank), chemicals & fertilizers (Ambuja Cement Ltd), InfoTech (Satyam PC), consumer durables (Coca-Cola India, Inc.) power (NTPC), Oil & Petroleum (India & Bharat Petroleum), Oil, manufacturing company (Asian Paints). The methodology of this study was based on internet-based research; literature review seems to understand the practice of CSR in the context of rural

development India. For purposes of analysis of CSR initiatives for rural areas development have been divided into five areas: livelihoods, health, education, environment and infrastructure.

LIMITATIONS

Main limitation of this study is that only a small sample of Indian business companies is selected. The collection of information of the written literature is from the various business websites and non-primary data was collected from the internet and journals available.

VI. RESULTS AND DISCUSSION

CSR policies and initiatives

The study shows that all the companies presented themselves as they have the CSR policies and also practices CSR. A large number of companies reflect their CSR philosophy or social, environmental and ethical objectives & their mission, vision documents, organizational policy and plans. However, even if surveyed firms have CSR policies and objectives but there was no relationship between the agenda of the company and the Millennium Development Goals (MDGs). The companies adopting CSR initiatives for rural development in India. From the study it can also be noted that Education is the priority for many companies which were taken, followed by health and improving standards of livelihoods.

About 50% of respondents take CSR initiatives in the infrastructure sector & 57% in the environment which includes events like tree planting, the awareness creations among the masses on the environmental issues, etc. It is also surprising that even if the central govt. & the State govt. have separate departments for education and health sector, these two are the priority issues for the firms and are often under the banner of CSR in both public and private companies in India.

Business focus on the work and Modes of action

As a criterion for CSR is concerns, it appears that most companies have CSR adopted in its global business approach strategy. Therefore, they managed to fulfill the objectives of both, the companies and social development. This way of working is not primarily relief, welfare and services, but is durable development oriented, which will have long term benefits. Vedanta Aluminium Ltd, Tata Steel, Dr. Reddy's Laboratories Lupin India, Ambuja Cement Ltd., Bharat Petroleum, SAIL believes in human and social sustainable development through poverty reduction and capacity building of the rural population. One such example in this respect is Lupin India Ltd, which launched a project to sustainable development in 154 villages across Rajasthan. The plan in place of providing gradual assistance which does not result in an effective fight against development of poverty can be seen as adequate or comprehensive action plan for future prospects because it includes a regular farm income production, agricultural land cultivation and orchards programs, forage conservation systems, sericulture and recycling programs of water, establishing of medical centers and initiating educational programs for adult literacy and credit policies and systems. Moreover Aditya Birla Group, Asian Paints believe in the concept of guardianship management and the focus of CSR is still at work welfare oriented. CSR interventions for IT companies companies are philanthropic in nature, as contribution in the form financial aids, assets and facilities.

The study shows that companies implement CSR rural development programs through four types of institutions. They are:

1. CSR activities carried out directly by the company
(i) By the division of CSR itself.
(ii) Through Human Resources Department.
(iii) The local management of manufacturing plant.
2. CSR activities carried out by a foundation.
3. CSR activities implemented through partnership with NGO's, academic institutions, international organizations and agencies.
4. CSR activities implemented through partnership with the government.

The study shows that out of the12 companies surveyed, 2 companies implemented their CSR initiatives directly by divisions dedicated to CSR that are responsible for planning and executing these activities. In 2 other companies, CSR initiatives are applied through local management of the factory and Human Resources Department (HRD). Many companies as Tata Steel, India's Lupin, NTPC, Dr.Reddy s' Laboratories, Satyam Computers, Ambuja Cement Ltd, establish foundations dedicated to the implementation of CSR rural development initiatives. Most of these foundations promote the participation of communities in planning and implementing its CSR activities. It is also interesting to note that these foundation which have implemented its programs in collaboration with government departments, are a good example of Private-Public Partnership (PPP). For example, Dr.Reddy ' foundation is in collaboration with the rural development department of the GoI. Similarly Satyam Foundation is also working with Government of Andhra Pradesh (GoAP).

The study also found that four companies who have or do not have their own foundations, are partners with NGOs to implement CSR initiatives. In the agreement for the above, the company provides funds, infrastructure, while NGO provides base level support for implementation of CSR activities. An example is Bharat Petroleum that have tied up with the Gramin Sociel Welfare Shares of the company and the Rural Development Community in Tamil Nadu, Vivekananda Kendra Kalyan Girjana Bhubaneswar (Orissa) to service social welfare at the grassroots level.

The impact of social responsibility programs in the rural poor

The impact of CSR programs resulted in a sample of 12 leading companies in India have been classified in five areas: livelihood, health, education, environment and infrastructure.

Livelihoods: The Grameen-LABS is a program implemented by Dr.Reddy ' Foundation in collaboration with rural development Department;. GOI is to provide livelihood to around 35,000 youths in the rural India between the age of 18-25 years in 7 states of India. Outcomes of livelihood support programs by Bharat Petroleum show that SHG members are in the stable income group with INR 2,000 p.m. and members of the

banana plantations and poultry are working to earn extra income of INR 7000-8000 p.a.

Health: The study shows that many companies organize a series of health camps to create health awareness and education on health on various issues such as vaccination, blood donation, water purification pills, condom distribution etc. Till 2007-08, SAIL conducted 267 health camps for the benefit of over 4.5 lakh people. In Lanjigarh (Orissa) Vedanta Aluminium Ltd. covers 53 villages with 32,000 inhabitants, providing free medicine, treatment and referral service their mobile units. Tata Family Health Initiatives Foundation (TSFIF) has established "Lifeline Express" Wheeled Hospital has helped more than 50,000 patients in Jharkhand, Orissa and Chhatisgarh.

Education: Aditya Birla Group provided education to 62,000 children living near the plants by running 26 formal schools. SAIL maintains approximately 138 schools in outlying areas of SAIL plants/units in the country where more than 80,000 children receive education (Kumar 2008). Asian Paints establishment of “Shree Gattu Vidyalaya", a school providing education to 25,000 children from class I to X, by this effort formal education have reached to rural areas and helped the children there. Similarly, Satyam Computers have developed 170 modern schools benefiting 40,000 rural children. Schools "Project Smiles" with the support of Coca-Cola India Inc. was started and completed in 20 schools. It left its impact on the lives of approximately 10,000 children.

Environment: Towards Sustainable Development and management of natural resource, many companies have been working on tree plantation, watershed management, and waste management, wind firms etc; for example, SAIL has planted 13.5 million trees in and around the SAIL plants or mines till date. Watershed Development Programme by Ambuja Cement Ltd has covered 9,000 hectares in the last four years. Sustainable water management continues to lead the priority list of Coca-Cola India Inc. So far, the company water initiatives have improved the lives of more than 1,40,000 people & raise awareness on the essential importance of water conservation among the millions of people.

Infrastructure: Of the 12 companies surveyed only six companies offer different infrastructures facilities such as construction and road development, installation of electricity, water, sanitation, schools, health Center, community, etc. Welfare Lupin Human welfare and Research Foundation initiated the scheme "Apna Gaon Apna Kam". This scheme covered 38,000 villages in Rajasthan and almost all areas have the school buildings, potable water, ponds, connecting roads, community centers, and electricity. SAIL has participated in the construction and repair of 33 km of pucca roads per year, providing nearly two lakh people in 435 villages to access to the modern infrastructure each year. In Andhra Pradesh in collaboration with Hyderabad Urban Development Agency, local rural communities and NGOs, Coca- Cola India has helped 16 thousand people of “Saroor Nayar” to restore existing "check dam" the water catchment areas.

VII. CONCLUSION

The conclusion of this study is that social responsibility is considered as an important activity issue of Indian companies, regardless of size, sector, objective of the company, the location of the company. Because Indians companies are realizing that without socio-economic development of local communities, there cannot be stability and sustainability of economic activities to compete with the global market.

The study shows that all companies surveyed appear to have Policies and practices of CSR. Most companies design and implementation of CSR initiatives in area of work covers the entire community. A wide range CSR initiatives ranging from income generation subsistence activities, the health checkup camps, mobile health services, education, adult literacy, agriculture development, provision of drinking water management and natural resources development, infrastructure services are developed by these companies. Although way of working is switching from philanthropic development to sustainable welfare but there was no association between company CSR Agenda and the Millennium Development Goals. It has also been revealed during the study that many companies promote and implement CSR initiatives through Human Resources Department, foundation or collaboration with NGOs, but there is lack of fully fledged Corporate Social Responsibility department. CSR initiatives undertaken by the Indian companies for rural development have a positive effect and impact on the overall development of society and business.

VIII. RECOMMENDATIONS

1. The company must align with the objectives of CSR national targets under the Millennium Millennium Development Goals (MDGs).
2. The company must have a division dedicated to CSR well-trained, qualified and experienced professionals from social science or social work Sociology, Rural Development and Development Studies and experience in management for a better planning, implementation and evaluation of CSR initiatives.
3. CSR programs implemented by the Indian companies must be based on felt needs of local population so as their participation in the program can be improved. It is also necessary to create jobs and economic activity in the rural community to uplift the masses.
4. Social audits should be conducted by an external source agency to evaluate the performance of CSR of a Company.
5. The government can encourage the big players of the business world to take into account the ethical, social and environmental issues of the country. The government should play the role of motivator, catalyst, facilitator rather than director of corporate social responsibility
6. An annual report on social responsibility must be prepared to highlight the company commitment to sustainable community development.

ACKNOWLEDGEMENT

This research paper is made possible through the help and support from everyone, including: Mother, Husband, Family, Teachers, Friends and in essence, all sentient beings.

I take this opportunity to offer my thanks to Shri. S. H. Lagali, Administrator, Dr. B. M. Nuchhi, Principal and Prof. K. S. Patil, HOD of commerce, BLDEA's Comm, BHS Arts and TGP Science college, Jamkhandi for their support and encouragement.

My Special thanks to Dr. B. M. Kalshetty and Dr. T. P. Giraddi to provide valuable information and advices.

Finally, I sincerely thank to my Mother, Husband Shri. Vivek Hiremath and my son Shlok, who are my constant source of inspiration for bearing me and assisting me in my academic career.

REFERENCES

[1] Maon, F., A. Lindgreen and V. Swaen, 2009.'Designing and implementing Corporate Social Responsibility: An integrative framework grounded F in theory and practice', Journal of Business Ethics, web.

[2] 2. Hanke, T. and W. Stark, 2009. Strategy Development: Conceptual Framework on Corporate Social Responsibility. Journal of Business Ethics,web.

[3] 3. Chaudhri and Wang, 2007. Communicating CSR on the Internet A Case Study of the Top 100 Information Technology Companies in India, Management Communication Quarterly, 21(2): 232-247.

[4] 4. Saeed, 2010. Corporate Social Performance of Indian FMCG Companies, Issues in Social and Environmental Accounting, 3:2.

[5] 5. Ascoli, Kimberly, and Tamar Benzaken. "Public Policy and the Promotion of Corporate Social

[6] Responsibility." DR-CAFTA Responsible Competitiveness. N.p., Aug. 2009. Web.

[7] 6. Bhave, Ajay. "Experiences of the Role of Government in Promoting CSR Initiatives in the Private Sector." Lund University Publications. European Commission's Erasmus Mundus Programme, 2009. Web.

Websites:

[1] www.econpapers.com

[2] www.havardbusiness.org

[3] www.tatasteel.com

[4] www.smartphilanthrophy.com

[5] www.timesfoundation.com

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Impact of Tungan-Kawo Dam Irrigation Project on Rice Production Among Small Holder Farmers in Wushishi Local Government Area of Niger State-Nigeria

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Abstract- The study examined the impact of Tungan-Kawo dam irrigation project on rice production among small holder farmers in Wushishi Local Government Area of Niger State. Multi-stage sampling procedure was used to select 180 registered rice farmers in the study area. Data were obtained through a well structured questionnaire. Descriptive statistics and z-test statistic were employed for data analysis. Results revealed that the average output of participants (3076.67kg/ha) was significantly higher than the output of non-participants (1103.33kg/ha). The estimated average monthly income of participants was N59363.89 while non-participants earned N21322.22 per month. The difference in income was N38041.67 which could be expressed as 64 percent. The results further revealed that participants' level of living was estimated to be N1760292 while non-participants level of living was N854997.80. The major constraints faced by the participants of Tugan-Kawo irrigation projects were capital, limited irrigated land and problem of pests and diseases. About 93% of the respondents reported outbreak of pests and diseases. Quilea birds invasion was also found among the major constraints faced by the participants. Since the project had a positive and significant influence on rice production, it is recommended that a similar programme should continue to be implemented in the area after the implementation of Tugan-Kawo irrigation project.

Index Terms- Impact, Irrigation project, Rice production, Niger State

I. INTRODUCTION

Agricultural is an important sector for wealth creation and poverty reduction. According to Azeez (2002), a large percentage of Nigeria population derive their income from agriculture and agricultural related activities in which over 75% of rural inhabitants are farmers. However, over the years, the rate of growth in agricultural production has stagnated and failed to keep pace with the needs of rapidly growing population, resulting in a progressive rise in import bills for food. The gap between demand and supply of food continues to widen (CBN, 2009). In essence, agriculture's contribution to the national economy has been dwindling. This is so given that Nigeria has varied and complex constraints militating against the realization of increased agricultural output (Baiyegunhi *et al*., 2009)**.**

The major constraint to increased agricultural production in Nigeria is inadequacy of rainfall,l most especially in the Northern States, (Toro, 1997). Large areas of land are left uncultivated, especially in the Sahel region of the North. Irrigation in Nigeria has become an issue of vital importance considering present population growth rate. Recent report shows that Nigeria population is increasing by 3.5% annually, while food production is increasing by only 2.5%. The Food and Agriculture Organization (FAO) for instance, has warned that by the year 2025, Nigeria will no longer produce enough food to feed herself, solely from rain fed agriculture (FAO, 2003). One of the complimentary measures that could be taken is to intensify irrigated agriculture (Abubakar, 2001). To assure food security in the rice consuming countries of the World, rice production would have to be increased by 50% in these countries by 2025 and, this additional yield will have to be produced on less land with less usage of water, labour and chemicals (Zeng *et al*., 2004).

Irrigation is a powerful tool for rural economy. It can influence time of harvest which in turn can influence market prices thereby stabilizing farm economy. Bhattarai (2002) opined that irrigation development is like a normal good at the initial stage of development, where agrarian sector dominates over, and irrigation largely contributes to expansion of crop production and development of the nation. Like normal good, the demand for irrigation in any agrarian society increases steadily at the initial stages of development. Bai and Molnar (2008) observed that improved availability of irrigation water in agriculture will increase crop yield thereby increasing income and alleviating poverty among the adopting producers. It is perhaps the recognition of the above stated roles of irrigation that the Nigerian government embarked on irrigation development through River Basin Authorities, for example, the Tungan-Kawo Dam and irrigation project. This is one of the multi-purpose projects embarked upon by the Upper Niger River Basin Development Authority with the aim of providing farm efficiency and income, through optimum water conservation and utilization practices. The Authority realised that agriculture remains dominant in the region and is a strong influence on the region's economy. It was conceived as far back as 1955 by the defunct Northern Nigeria Governments as a solution to the frequent flooding of valuable agricultural land in the project area by Rivers Ubandawaki and Bankogi. The reservoir was, therefore, intended to provide controlled facilities for down-stream irrigation of a gross area of 900 hectares as well as flood and drainage control works for about 1,215 hectares (Upper Niger River Basin Development Authority, 1991).

In spite of the huge investments in irrigation schemes, the results are generally far below expectations. Hence, national objectives of irrigation development (e.g. self-sufficiency in

food, earnings from experts or savings from imports, higher rural incomes) are seldom realized. Although literature on the disappointing results has been multiplying since 1970, it appears that lessons learnt are not put into practice (Oosterbaan, 1985). Also, governments and non-governmental agencies have taken measures through the construction of dams, provision of farm inputs, credit facilities, extension services and other irrigation farming machines to intervene in the provision of irrigation resources (FAO, 2007). This is aimed at improving the availability of irrigation water in agriculture which could increase crop yield and which could in turn increase the standard of living and societal income (FAO, 2007). Literature has also shown that the Federal Government of Nigeria (FGN) and various other international donors and bilateral organisations have invested extensively in the Public Irrigation Sector in Nigeria. However, the sector's performance has not had the anticipated impact on national food security, employment opportunities and economic growth (FAO, 2004).

Research has been earlier conducted on the effect of irrigation development project on income and income distribution (Nagogo, 2011).However, the impact of irrigation projects on rice production and the livelihoods of the participants, particularly of Tungan-Kawo irrigation project has not been addressed. This study specifically assessed the impact of Tunga-Kawo irrigation project on rice production, income and level of living of the people and identifies the constraints encountered by the participants and the management of the Tungan-Kawo Irrigation Project.

II. Methodology

The study was conducted in Wushishi Local Government Area of Niger State. The state is located in the middle belt of Nigeria. It found between latitude $8^0$22'N and $11^0$30'N and longitude $3^0$30'N and $7^0$20'E. Niger State is in Guinea Savanna region of Nigeria. Niger State has a total of population of 3,950,249 (NPC, 2006) with a projected population of 4,772,024 as at 2012 when the data was collected. Wushishi Local government has a total of population of 81783 (NPC, 2006) with a projected population of 98796 as at 2012. It is bordered by Gbako Local Government to the south, Rafi and Bosso Local Government Areas to the east, Mariga Local Government Area to the north; Mashegu and Lavun Local Government Areas to the west.

Multi-stage sampling procedure was used for this study. Wushishi Local Government Area of Niger State is made up of two districts that is Wushishi and Zungeru districts. From the reconnaissance survey conducted as at 2011, a list of two-hundred and forty-three (243) participants was obtained from the programme office. Thirty seven percent (37) percent of irrigated participant farmers were randomly selected from the list of 162 participants in Wushishi district. Also, 37% of the participants were randomly selected from the list of 81 participants in Zungeru district. Therefore a total of 90 participants were used for the study. In order to effectively study the impact of Tugan Kawo irrigation project on participants, ninety (90) were also selected as a control group for comparative analysis. Each of the two group, participants and non-participants were ninety (90) participants each making a total of one hundred and eighty (180) respondents from the two districts in the study area. Also 10 management staff were randomly selected to assess the performance of the participants.

This study made use of primary source of information. The primary data were collected from the participating and non-participating rice farmers in the study area, as check list for the management of Tungan-Kawo Irrigation project. These were collected with the aid of structured questionnaire. The information that were collected included socio-economic characteristics as well as living condition of both participating and non-participating rice farmers, the impact of irrigation project on the output and income of the participating and non-participating farmers, the constraints encountered in the implementation of the irrigation project in the study area.

The data collected were analysed using descriptive statistics and Z-test statistic. Z-test model in this study compares the differences in crop output, income and level of living between the participants and non-participants of Tungan-Kawo irrigation project.

The Z-test model represented as follows:

$$Z = \frac{\bar{X} - \mu}{S_{\bar{X}}}$$

Where,
Z= The calculated Z-test
$\bar{X}$ = Mean of the samples
μ = Mew: the theoretical mean of the irrigated rice output, the peoples' income and level of living
$S_{\bar{X}}$ = Standard error of the mean
Z = Significant at 5% (two-tailed) test = 1.96

III. Results and Discussion

Impact of Tungan-Kawo Irrigation Project
Rice output of participants and non-participants

The results in Table 1 showed the impact of Tugan-Kawo dam irrigation project on rice output. It was revealed that the average rice output for the participants was 1.175tonne per year and the output of non-participants was 0.767 tonnes. The estimated difference was 0.407 and this was 35%. The calculated z-value was 3.41 and this was greater than z-table value (1.96) this implied that the output of the participants was significantly ($P<0.05$) higher than the output of non-participants which indicates that Tunga-Kawo irrigation project has impact on rice production in the study area. This result conforms with the apriori expectation because it is expected that participants of the projects would have access to facilities and extension information which in turn increase their yield.

Income of participants and non-participants

The result in Table 2 shows the income of participants and non-participants of Tungan-Kawo Irrigation project. It was revealed that the estimated average monthly income of participants was N59363.89 while non-participants earned N21322.22 per month. The difference in income was N38041.67 which could be expressed as 64%. per The calculated z-value was 7.5 and this was significant at 1% level of probability which

implied that the monthly income of the participant was significantly higher than monthly income of non-participants. These findings indicate that the project has significant influence on the income of the participating farmers. This result is similar with the findings of Abdullahi (2005) who found a significant difference in income between participants and non-participants in his study of some agricultural programmes. Based on the findings, the null hypothesis which states that there is no significant difference between income of participants and non-participants was rejected and the alternative that there is significant difference between the income of the Tungan-Kawo irrigation project participants and non-participants was accepted.

Participants and non-participants' level of living

The results in Table 3 revealed that participants' level of living which was estimated to be N1760292 while non-participants level of living was N854997.80. It was measured by the ownership and usage of assets possessed by the farmers and computed in a monetary value. The z-calculated on level of living (3.93) was greater than the critical z-value (1.96) and this was significant at 5% level of probability. Based on the findings of this study, the null hypothesis was rejected because Tugan-Kawo irrigation project has significant effect on level of living. The implication of this is that the participants' level of living was significantly higher compared to non-participants. These results implied that Tungan-Kawo irrigation projects exert positive and significant influence on the level of living of the participating farmers. This result is in agreement with the findings of Akpoko *et al.* (1998) in their study of impact of non-governmental agricultural extension training programme in Zaria, Nigeria.

Perceived benefits by participants of Tungan-Kawo irrigation project

The results presented in Table 4 showed the respondents opinion about the benefits of Tugan-Kawo irrigation project in the study area. About 99% perceived that the project gave them access roads. Only 18.89% perceived the provision of storage facilities while the majority (97) of the respondents perceived easy access to market. Those that perceived access to extension activities constitutes 93 %. This indicates that the extension component of the projects is functional and the agricultural information flows through extension agents to the project participants. About 94% perceived the supply of irrigation water was the benefits of the project. This indicates that majority of participating farmers had access to irrigation water as a result of the project. Musa (2004) observed that irrigation water is an important factors influencing participation and determining the crop output of the farmer.

Wage earning opportunities created by Tungan-Kawo irrigation project

As shown in Table 5, it was revealed that there was different income generating opportunities available to the participants of Tungan-Kawo irrigation project. This implied that respondents in the study area diversify their income sources for increased income and better level of living. About 98% of the respondents engaged in trading activities and this could be attributed to increased economic activities created by the projects. Those that engaged in craft work constitute 62% while fishing and bricklaying activities constitute 96% and 77% respectively. Furthermore, about 98% worked as hired labour while the project also created the opportunities of repairs of pump and machine. About 63% reported sales of machines spare parts as rural wage earning opportunities. Majority (77%) also reported commercial transportation which is also an income generating activities as a result of Tugan-Kawo irrigation project.

Constraints Faced by the Participants

The results presented in Table 6 showed that 92% of the respondents experienced quilea birds invasion. About 94% had problem of limited irrigated land. Irrigated farm land is very important in irrigated rice production as it determines the scale of rice production. About 97% had inadequate capital and this was ranked first among the constraints. Availability of capital would encourage farmers to invest on large scale irrigation farming. It will also enhance the adoption of improved farming practices. Pest and disease was also among the constraints faced by the farmers in the study area. About 93% of the respondents reported outbreak of pests and diseases.

IV. Conclusion and Recommendations

The findings reveal that the participants rice output, rice yield, income and level of living of the participants were significantly higher than the non-participants. This implies that the participants had more household basic needs and assets, means of transportation, farm implements, which reduce drudgery in farming. The major constraints faced by participant of Tugan-Kawo irrigation project were inadequate capital, quila bird invasion, inadequate irrigated land, high cost of maintenance, flooding, pest and diseases. These constraints might have reduced the positive impact of the project on the participants.

The findings revealed that the project had a positive influence on the output, income and level of living of the participants therefore it is recommended that a similar programme should continue to be implemented in the area after the implementation of Tugan-Kawo irrigation project. Inadequate funding was also one of the major constraints in the implementation process. Government and non-governmental agencies should always collaborate in the implementation of agriculture based programmes to put enough funding together for the implementation of agricultural programme.

Table 1: Impact of Tugan-Kawo Irrigation Project on the Rice Output

Group	Mean Output (tonne)	St. Error	St. Dev	95% confidence	Interval
Participants	1.175	0.087.81	0.833	1000.67	1349.63

Non-participants	0.767	0.074.46	0.706	619.74	915.63
Difference	0.407	0.119.44	1.133	170.13	644.80

z-value = 3.41*** *** P < 0.01

Table 2: Impact of Tugan-Kawo Irrigation Project on the Income

Group	Mean Income (N)	St. Error	St. Dev	95% confidence	Interval
Participants	59363.89	3774.081	35804.08	51864.87	66862.91
Non-participants	21322.22	2952.248	28007.49	15456.17	27188.28
Difference	38041.67	5045.208	47863.05	28016.95	48066.39

z-value = 7.5* * P < 0.01

Table 3: Impact of Tugan-Kawo Irrigation Project on the Level of Living

Group	Mean Livelihood (N)	St. Error	St. Dev	95% confidence	Interval
Participants	1760292	184725.8	1752463	1393246	2127339
Non-participants	854997.8	121801.3	1155508	612981.2	1097014
Difference	905294.7	229784.5	2179927	448717.8	1361872

z-value = 3.93* * P < 0.05

Table 4: Perceived Key Benefits by Participants of Tungan-Kawo Irrigation Project

Perceived Key Benefits by Participants of Tungan-Kawo Irrigation Project	Frequency*	Percentage	Rank
Access roads	89	98.89	1
Easy access to market	87	96.67	2
Supply of irrigation water	85	94.44	3
Access to extension services	84	93.33	4
Electricity	77	85.56	5
Health care services	76	84.44	6
Recreation	76	84.44	6
School	75	83.33	8
Community network	74	82.22	9
Storage facilities	17	18.89	10

* Multiple responses were allowed

Table 5: Wage Earning Opportunities Created by Tugan-Kawo Irrigation Project

Employment opportunities	Frequency	Percentage
Trading	88	97.78
Craftwork	56	62.22
Fishing	86	95.56
Bricklaying	54	60.00
Transportation	69	76.67
Hired farm labour	88	97.78
Repairs of pump machines	57	63.33
Sales of spare parts	57	63.33

Table 6: Constraints Faced by Farmers in Tungan-Kawo Irrigation Project

Problems	Frequency*	Percentage
Inadequate capital	87	96.66
Inadequate irrigated land	85	94.44
Pest and diseases	84	93.33
Quilea bird invasion	83	92.22
High cost of operation and maintenance	81	90.00
Flooding	5	5.56

*Multiple responses are allowed

REFERENCES

[1] Abubakar, S.S. (2001). Opening speech on the national workshop on participatory irrigation management of public sector irrigation scheme, Nigeria NAERLS/ABU, Zaria 20th – 30th March.

[2] Abdullahi, H. (2005). Effect of sassakawa global 2000 on small scale maize farmers in Kaduna State. Unpublished M.Sc. Thesis Department of Agricultural Extension and Rural Sociology, Ahmadu Bello University Zaria, Nigeria. PP.1-30

[3] Akpoko, J. G., Auta, S. J and Arokoyo, J. T. (1998). The impact of non-governmental agricultural extension training programmes: A case study of the Nigerian Tobacco Company, Zaria. Nigeria. Journal of Agricultural Extension, Zaria Nigeria: (1 and 2): 97-110.

[4] Azeez, I. O. (2002). Evaluation of media for disseminating forest conservation information in south-western Nigeria. Unpublished Ph. D Thesis Faculty of Agriculture and Forestry, University of Ibadan, Nigeria

[5] Bhandari, H. and Pandey, S. (2006). Economics of groundwater irrigation in nepal: Some farm level evidences. Journal of Agricultural and Applied Economics, 38:10-15.

[6] Baiyegunhi, L. J. S., Fraser, G. C. G. and Adewumi, M. O. (2009). Resource use efficiency in sole sorghum production in three villages of Kaduna State, Nigeria, African Journal of Agricultural Research Vol. 5 (3):172-177

[7] CBN (2009). Central Bank of Nigeria Statistical Bulletin on Food Crop Production in Nigeria.

[8] Food and Agricultural Organization (2003). Food and Agriculture Organization 2003. FAOSTAT http://faostata.fao.org/default.htm

[9] Food and Agriculture Organization (2004). National Irrigation Policy and Strategy for Nigeria. A Review of the Public Irrigation Sector and Guidelines. Pp 25

[10] Food and Agricultural Organization (2007). An Integrated Administration of an Irrigation Project. Case Study of Matrix Gil Secondary Council. Food and Agriculture Organization Report 2006, 25: 3-9.

[11] Musa, J.D. (2004). Effects of irrigation on the rural life. Lagos: Dobby publishers. Pp 122-136.

[12] Nagogo, M. N. (2011). The effect of irrigation development project on income and income distribution. Unpublished M.Sc. Department of Agricultural Economics and Extension, Usmanu Danfodio University, Sokoto.

[13] Oosterbaan, R. J. (1985). Modern Water-Control Systems for Agriculture in Developing Countries: Relief or Grief In: Traditional Irrigation Schemes and Potential for Potential for their Improvement. Irrigation Symposium. J. F. Mock, Deutscher V., Wefddeerwirtschaft and Kulturbau/DVWK Bull 9:81-210.

[14] Toro, M.S. (1997). A Drought Phenomena and Strategies towards Sustainable Irrigation Development, Nigerian Sahel region A Paper Presented at the Irrigation Week 22 – 27 March, Kano

[15] Upper Niger River Basin Development Authority (1991).Technical Brief on Tungan Kawo Irrigation Project.

[16] Zeng J, Lu X., Tang X., Tang Y. (2004). The System of Rice Intensification (SRI) for Super- High Yield 4th International Crop Science Congress, Brisbane, Australia. In: http://www.ciifad.cornell.edu/sri/countries.

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The Perceived Acceptability of the Computer-Assisted Language Learning Software in Teaching Mandarin as Foreign Language

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Abstract- Computer Assisted Language Learning (CALL) is as an approach to language teaching and learning in which the computer is used as an aid to the presentation, reinforcement and assessment of material to be learned, usually including a substantial interactive element. Recent researches have shown that human language is much more complex than it was previously thought. Many literatures are proving that the use of information and communication technology in language learning has several potential advantages. The major concern of this survey study is to determine the acceptability of Computer-Assisted Language Learning Software (CALLS) in teaching Mandarin as perceived by the students and teachers. CALL software was examined in terms of (1) instructional design, (2) program instructions, (3) program transition, (4) user interface, (5) user control, (6) phase control/branching and (7) error handling. The assessment of acceptability of the CALLS in teaching Mandarin was achieved using the five-point Likert scale with corresponding description. The overall means 4.48 and 4.45 which were obtained from the students and teachers' evaluation respectively, both has the descriptive interpretation of "*highly acceptable*". Both the students and the teachers expressed that the computer-assisted language learning software facilitated learning and that they desire to use CALLS for various Mandarin topics.

Index Terms- CAI Evaluation, Computer-Aided Instruction, Computer-Assisted Language Learning, Mandarin as foreign language, teaching and learning with technology

INTRODUCTION

With the development of user-friendly computers and software and the rapid reduction in their prices in the last decade, the use of computers has become widespread and has expanded in homes, offices, and schools. In the 21st century, everyone is required to use computers to some extent to function in our society (Kawabata 2006).

New technologies, or new uses of existing technologies, continue to provide unique opportunities for language learning (Godwin-Jones 2005). Recent years have shown an outburst of interest in using computers for language teaching and learning. Computers can be used as a powerful language learning tool in a classroom, an online learning environment as well as a blended learning environment.

The use of computers in the context of foreign language teaching continues to offer a great deal of potential to support students' literacy needs inside and outside the classroom. Kabawata stated that if we use computers in more interactive ways, they could be of great assistance in developing the learners' language acquisition.

Recent researches have shown that human language is much more complex than it was previously thought. Many literatures are proving that the use of computer technology in language learning has several potential advantages. Among these technologies, computer-assisted language learning (CALL) and technology-enhanced language learning (TELL) are often used in language education. In CALL, the computer assists learning, while in TELL, the computer and other technologies support learning.

Computer Assisted Language Learning is briefly defined by Levy (1997) as **"**the search for and study of applications of the computer in language teaching and learning**"** and a broad range of applications can serve on the CALL procedure.

A number of studies have been done concerning how the use of CALL affects the development of language learners' four skills; listening, speaking, reading and writing. Most report significant gains in reading and listening and most CALL programs are geared toward these receptive skills because of the current state of technology in linguistics.

As many educators point out that the current computer technology has many advantages for second language learning, the Bulacan State University has also seen what these benefits has to offer and initially integrated in foreign language subjects. Hence, this study aimed to determine the perceived acceptability of using CALL software in teaching and learning Mandarin as foreign language.

CONCEPTUAL FRAMEWORK

The use of information technology to support teaching, training, learning, entertainment and education in general emerged several decades ago. Educational technologies continue to advance the ways in which we teach and learn. Many claims about the relative value of the educational courseware have been made. Although it has been difficult to prove the advantages of educational software over conventional teaching, training and learning, its use has increased anyway and many attempts have been made to develop instructional courseware products for different subjects, in a wide variety of educational settings and of course different target groups.

In this context, this study determined the acceptability of the computer-assisted language learning software (CALLS) in teaching and learning Mandarin as foreign language based on CAI evaluation criteria as perceived by the students and the teachers. Figure 1 shows the conceptual model of the study. Figure 2 illustrates the flowchart of the evaluation of computer-assisted language learning software in Mandarin.

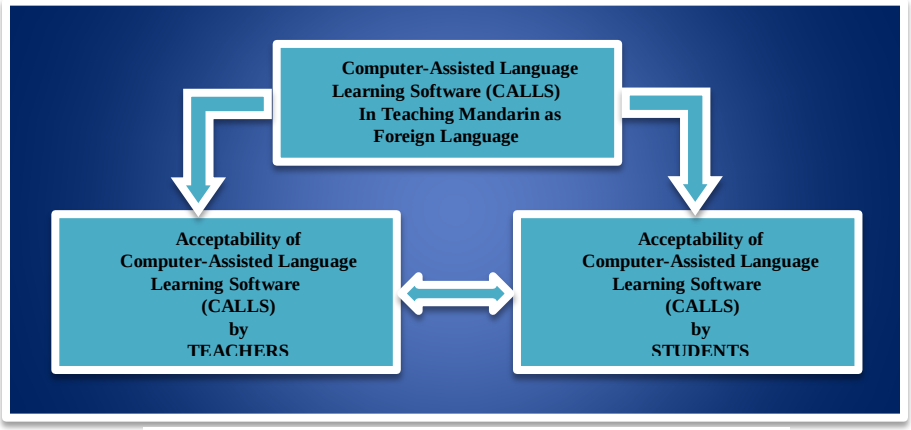

Figure 1. Conceptual Model of the Study

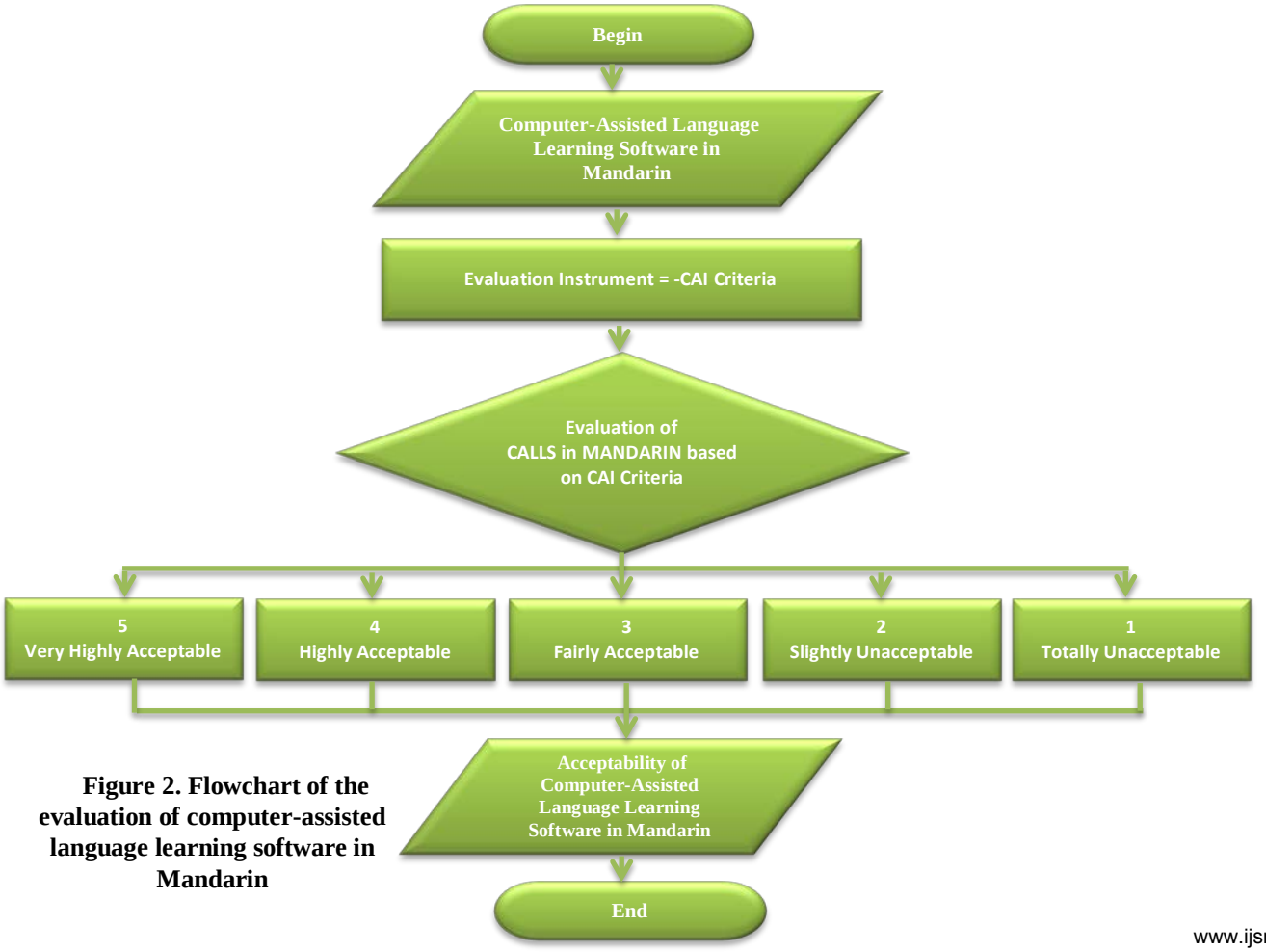

Figure 2. Flowchart of the evaluation of computer-assisted language learning software in Mandarin

STATEMENT OF THE PROBLEM

The major concern of the study is to determine the perceived acceptability of Computer-Assisted Language Learning Software (CALLS) in teaching Mandarin.

Specifically, the study sought to answer the following:

1. How may the acceptability of Computer-Assisted Language Learning Software (CALLS) in teaching Mandarin be described among teachers and students?

2. What is the significant difference in the level of acceptability of CALLS between teachers and students?

   Ho : There is no significant difference in the level of acceptability of CALLS between teachers and students?

   Ha : There is significant difference in the level of acceptability of CALLS between teachers and students?

METHODOLOGY OF THE STUDY

Research Method

The study is descriptive in nature thus; the major concern is to delineate the acceptability of using computer-assisted language learning software (CALLS) in teaching and learning Mandarin in a state university. Specifically, this study utilized survey method. A survey is a data collection tool used to gather information about individuals. A survey may focus on factual information about individuals, or it might aim to collect the opinions of the survey takers. A survey can be administered in a couple of different ways. In one method known as a structured interview, the researcher asks each participant the questions. In the other method known as a questionnaire, the participant fills out the survey on his or her own. This study employed the latter method. Surveys are generally standardized to ensure that they have reliability and validity. Standardization is also important so that the results can be generalized to the larger population. There are many advantages of using survey. Surveys allow researchers to collect a large amount of data in a relatively short period of time. Surveys are less expensive than many other data collection techniques. Surveys can be created quickly and administered easily. Surveys can be used to collect information on a wide range of things, including personal facts, attitudes, past behaviors and opinions.

Participants

This study considered purposive sampling to select the respondents. It is also known as judgmental, selective or subjective sampling for this sampling type relies on the judgment of the researcher when it comes to selecting the units that are to be studied. The main goal of purposive sampling is to focus on particular characteristics of a population that are of interest, which will best enable the researcher to answer the research questions.

Employing this sampling method, 130 total participants were selected in this study. The respondents were recruited from the classes in Foreign Language (Mandarin) conducted at the Bulacan State University, 1st semester SY 2014-2015. There were 125 student participants. The researcher also tapped a pool of five competent faculty members teaching the subject to use CALLS and scrutinize based on the given criteria. All the selected faculty members passed the international examination for Chinese language proficiency or HSK (Hanyu Shuiping Kaoshi). One passed HSK level 4, two passed level 3, and the other two passed level 2 and currently handling classes in Mandarin.

Instrument

There are seven criteria that were used to determine the acceptability of CALL software used in the Mandarin classes. CALL software was examined in terms of (1) instructional design, (2) program instructions, (3) program transition, (4) user interface, (5) user control, (6) phase control/branching and (7) error handling. There are several indicators for each criterion. The assessment of acceptability of the CALL software was achieved using the five-point Likert scale with corresponding description.

Data Gathering

Several sessions were scheduled for the use of the courseware in various topics in Mandarin. After the scheduled sessions, the faculty courteously allotted time during their classes for the students to participate and allowed them to evaluate the CALL software. Questionnaires were distributed to both the faculty and students. After explaining the criteria and the procedure to evaluate the courseware, the respondents started rating the language learning software. Questionnaires were collected for proper documentation and analysis.

Statistical Tool

The questionnaires were segregated to yield the results of the students and the teachers' evaluations of the software. The ratings for each indicator were tallied and the arithmetic means were computed. Arithmetic means for the seven criteria were also determined. The overall mean was obtained and interpreted following the description of the five-point Likert scale used in the instrument. The computed means of each criterion and the overall means of the students and teachers' evaluation were compared.

DISCUSSION OF THE RESULT

Two sets of data were examined in the study, one from the teachers and the other set from the students.

One hundred twenty five students participated in the study. This study group is consisted of 54 females and 71 males. The mean age was 19.50 with the standard deviation of 2.213. For the result of the evaluation, the means and interpretations for each indicator are shown in Table 1 **Summary of Survey Responses of the Students**. There are seven criteria/dimensions each with four indicators. The first dimension**, *instructional design***, garnered the mean rating of 4.42 with all the four indicators yielding the same evaluation of "highly acceptable". For the ***program instructions***, 4.35 rating was obtained interpreted also as "highly acceptable". In terms of the third criterion which is ***program transition***, the students rated it 4.45 which can also be described as "highly acceptable". In terms of ***user-interface*** and ***user-control***, the students seemed these both"very highly acceptable" having the ratings of 4.61 and 4.55 respectively. ***Phase-control/branching dimension*** is also highly acceptable" with the rating of 4.41. The last dimension, ***error-handling*** is "very highly acceptable" since it obtained the mean rating 4.57. The overall mean of 4.48 indicates that the students perceived that the CALL software in Mandarin is "highly acceptable" and it is a valuable learning supplement.

Correspondingly, five teachers handling foreign language classes in Mandarin participated in this study, one male and four females. All the selected faculty members are credible and experienced in this field since they all passed the international examination for Chinese language proficiency or HSK (Hanyu Shuiping Kaoshi). One passed HSK level 4, two passed level 3, and the other two passed level 2 and currently handling classes in Mandarin as foreign language. The results of their ratings were tabulated as presented in Table 2 **Summary of Survey Responses of the Teachers**.

The teachers seemed that the first dimension is "very highly acceptable", 4.50. They considered that there is congruence between objectives and teaching methods, activities and contents and that the program flow is logical. On the other hand, the next two dimensions garnered the same descriptive rating as in the students' evaluation. They both find CALLS "highly acceptable" in terms of program instructions and program transition. The teachers rated these dimensions 4.35 and 4.45 respectively. Similarly, user-interface dimension garnered the highest rating from the teachers, 4.75. Students and teachers both recognized the importance of graphics in learning motivations. User-control, 4.40 and phase-control/branching, 4.35 were both regarded "highly acceptable" by the teachers. With regards to error-handling, teachers, just like the learners, observed that the software is "very highly acceptable" giving it the rating of 4.55. The overall mean of 4.45 for the teachers' evaluation proves that the faculty respondents regarded the computer-assisted language learning software as "highly acceptable" in teaching foreign language.

The overall means 4.48 and 4.45 which were obtained from the students and teachers' evaluation respectively, both has the descriptive interpretation of "***highly acceptable***".

Table 1. Summary of Survey Responses of the Students

CRITERIA/DIMENSIONS	Frequency					Mean	Interpretation
	5	4	3	2	1		
1. Instructional Design						**4.42**	***Highly Acceptable***
1.1 There is congruence between objectives and teaching methods, activities and content.	74	39	12	0	0	4.50	*Highly Acceptable*
1.2 The software provides an evaluation of learner's performance congruent with competencies.	72	38	15	0	0	4.46	*Highly Acceptable*
1.3 The program flow is logical.	70	44	11	0	0	4.47	*Highly Acceptable*
1.4 Objectives are presented through the learning activities of the software.	49	57	19	0	0	4.24	*Highly Acceptable*
2. Program Instructions						**4.35**	***Highly Acceptable***
2.1 The program instructions are clear.	65	43	17	0	0	4.38	*Highly Acceptable*
2.2 The directions for proceeding to the next phase are clear.	63	47	15	0	0	4.38	*Highly Acceptable*
2.3 Adequate instruction is provided on how to enter responses.	69	46	10	0	0	4.47	*Highly Acceptable*

2.4 The instructions can be skipped or recalled as needed.	51	43	31	0	0	4.16	*Highly Acceptable*
3. Program Transition						**4.45**	***Highly Acceptable***
3.1 Screen transitions are smooth and unobtrusive.	65	45	15	0	0	4.40	*Highly Acceptable*
3.2 Means of user response input is appropriate and effective.	67	49	9	0	0	4.46	*Highly Acceptable*
3.3 Computer operation does not obstruct the program presentation.	72	41	12	0	0	4.48	*Highly Acceptable*
3.4 Input devices are effectively used for the lesson.	71	39	15	0	0	4.45	*Highly Acceptable*
4. User-Interface						**4.61**	***Very Highly Acceptable***
3.1 Smooth transitions of frames are present.	85	31	9	0	0	4.61	*Very Highly Acceptable*
3.2 The graphics, sounds and videos serve a clear purpose appropriate to intended audience.	92	23	10	0	0	4.66	*Very Highly Acceptable*
3.3 Background and text color are appropriately combined.	81	33	11	0	0	4.56	*Very Highly Acceptable*
3.4 The sentence and vocabulary are suited for the comprehension level of the learner.	85	34	6	0	0	4.63	*Very Highly Acceptable*
5. User-Control						**4.55**	***Very Highly Acceptable***
5.1 Adequate time to read and absorb text is provided if not user controlled.	77	38	10	0	0	4.54	*Very Highly Acceptable*
5.2 Users can restart the program at any point where they left off.	71	44	10	0	0	4.49	*Highly Acceptable*
5.3 User can easily exit the program at any time.	91	27	7	0	0	4.67	*Very Highly Acceptable*
5.4 User cannot get lost in the program.	80	26	19	0	0	4.49	*Highly Acceptable*
6. Phase-Control/Branching						**4.41**	***Highly Acceptable***
6.1 Program assesses content of responses rather than their form.	50	41	34	0	0	4.13	*Highly Acceptable*
6.2 Program branches when user is recurrently encountering error.	73	26	26	0	0	4.38	*Highly Acceptable*
6.3 When appropriate, program allows a variety of answers as being correct.	65	48	12	0	0	4.42	*Highly Acceptable*
6.4 Program does not give negative feedback for incorrect responses.	99	16	10	0	0	4.71	*Very Highly Acceptable*
7. Error –Handling						**4.57**	***Very Highly Acceptable***
7.1 Program effectively traps inappropriate user entries.	87	21	17	0	0	4.56	*Very Highly Acceptable*

7.2 There is no unexpected interruption due to wrong entries.	80	26	19	0	0	4.49	*Highly Acceptable*
7.3 User entry errors are handled with promptness.	95	30	0	0	0	4.76	*Very Highly Acceptable*
7.4 Incorrect entries will not cause the program to hang.	78	28	19	0	0	4.47	*Highly Acceptable*
OVERALL MEAN						***4.48***	***Highly Acceptable***

Table 2. Summary of Survey Responses of the Teachers

CRITERIA/DIMENSIONS	Frequency					Mean	Interpretation
	5	4	3	2	1		
1. Instructional Design						**4.50**	***Very Highly Acceptable***
1.1 There is congruence between objectives and teaching methods, activities and content.	3	2	0	0	0	4.60	*Very Highly Acceptable*
1.2 The software provides an evaluation of learner's performance congruent with competencies.	2	3	0	0	0	4.40	*Highly Acceptable*
1.3 The program flow is logical.	3	2	0	0	0	4.60	*Very Highly Acceptable*
1.4 Objectives are presented through the learning activities of the software.	2	3	0	0	0	4.40	*Highly Acceptable*
2. Program Instructions						**4.20**	***Highly Acceptable***
2.1 The program instructions are clear.	2	3	0	0	0	4.40	*Highly Acceptable*
2.2 The directions for proceeding to the next phase are clear.	2	3	0	0	0	4.40	*Highly Acceptable*
2.3 Adequate instruction is provided on how to enter responses.	2	3	0	0	0	4.40	*Highly Acceptable*
2.4 The instructions can be skipped or recalled as needed.	0	3	2	0	0	3.60	*Highly Acceptable*
3. Program Transition						**4.40**	***Highly Acceptable***
3.1 Screen transitions are smooth and unobtrusive.	2	3	0	0	0	4.40	*Highly Acceptable*
3.2 Means of user response input is appropriate and effective.	2	3	0	0	0	4.40	*Highly Acceptable*
3.3 Computer operation does not obstruct the program presentation.	2	3	0	0	0	4.40	*Highly Acceptable*
3.4 Input devices are effectively used for the lesson.	2	3	0	0	0	4.40	*Highly Acceptable*
4. User-Interface						**4.75**	***Very Highly Acceptable***
3.1 Smooth transitions of frames are present.	3	2	0	0	0	4.60	*Very Highly Acceptable*

3.2 The graphics, sounds and videos serve a clear purpose appropriate to intended audience.	4	1	0	0	0	4.80	*Very Highly Acceptable*
3.3 Background and text color are appropriately combined.	4	1	0	0	0	4.80	*Very Highly Acceptable*
3.4 The sentence and vocabulary are suited for the comprehension level of the learner.	4	1	0	0	0	4.80	*Very Highly Acceptable*
5. User-Control						**4.40**	***Highly Acceptable***
5.1 Adequate time to read and absorb text is provided if not user controlled.	2	3	0	0	0	4.40	*Highly Acceptable*
5.2 Users can restart the program at any point where they left off.	1	4	0	0	0	4.20	*Highly Acceptable*
5.3 User can easily exit the program at any time.	5	0	0	0	0	5.00	*Very Highly Acceptable*
5.4 User cannot get lost in the program.	0	5	0	0	0	4.00	*Highly Acceptable*
6. Phase-Control/Branching						**4.35**	***Highly Acceptable***
6.1 Program assesses content of responses rather than their form.	1	4	0	0	0	4.20	*Highly Acceptable*
6.2 Program branches when user is recurrently encountering error.	1	4	0	0	0	4.20	*Highly Acceptable*
6.3 When appropriate, program allows a variety of answers as being correct.	0	5	0	0	0	4.00	*Highly Acceptable*
6.4 Program does not give negative feedback for incorrect responses.	5	0	0	0	0	5.00	*Very Highly Acceptable*
7. Error –Handling						**4.55**	***Very Highly Acceptable***
7.1 Program effectively traps inappropriate user entries.	3	2	0	0	0	4.60	*Very Highly Acceptable*
7.2 There is no unexpected interruption due to wrong entries.	1	4	0	0	0	4.20	*Highly Acceptable*
7.3 User entry errors are handled with promptness.	5	0	0	0	0	5.00	*Very Highly Acceptable*
7.4 Incorrect entries will not cause the program to hang.	2	3	0	0	0	4.40	*Highly Acceptable*
OVERALL MEAN						***4.45***	***Highly Acceptable***

Legend:

4.50	-	*5.00*	*Very Highly Acceptable*
3.50	-	*4.49*	*Highly Acceptable*
2.50	-	*3.49*	*Fairly Acceptable*
1.50	-	*2.49*	*Slightly Unacceptable*
1.00	-	*1.49*	*Totally Unacceptable*

FINDINGS

The major concern of the study is to determine the perceived acceptability of Computer-Assisted Language Learning Software (CALLS) in teaching Mandarin. The study sought to answer the two specific questions. Based on the methods and techniques implemented on this study, the following findings are being presented:

(1) How may the acceptability of Computer-Assisted Language Learning Software (CALLS) in teaching Mandarin be described among teachers and students?

Table 3 presented the comparison of the descriptive interpretation for the students and teachers' evaluation on the acceptability of CALLs in Mandarin.

The result of the survey shows that the students and the teachers almost have the same level of acceptance in five out of seven dimensions. They only vary in the level of acceptability in terms ***Instructional Design*** and ***User Control*** criteria. The students rated the first dimensions as "highly acceptable" while the teachers rated it "very highly acceptable". Pertaining to the fifth dimension, the students more likely appreciate the user control feature than the teachers.

(2) What is the significant difference in the level of acceptability of CALLS between teachers and students?

As shown in Table 3. Comparison of the Students and Teachers' Evaluation of CALLS in Mandarin, the overall interpretation for both the students and teachers' evaluation garnered the descriptive rating of "highly acceptable". Hence, this attests that there is no significant difference in the level of acceptability as perceived by the students and the teachers. This proves that both the learners and the teachers seemed that CALLS in Mandarin can be effectively utilized in teaching and learning Mandarin in Foreign Language subject.

Table 3. Comparison of the Students' and Teachers' Evaluation of CALLS in Mandarin

CRITERIA/DIMENSION	Level of Acceptability	
	Students	**Teachers**
1. Instructional Design	*Highly Acceptable*	*Very Highly Acceptable*
2. Program Instructions	*Highly Acceptable*	*Highly Acceptable*
3. Program Transition	*Highly Acceptable*	*Highly Acceptable*
4. User Interface	*Very Highly Acceptable*	*Very Highly Acceptable*
5. User Control	*Very Highly Acceptable*	*Highly Acceptable*
6. Phasing Control/ Branching	*Highly Acceptable*	*Highly Acceptable*
7. Error Handling	*Very Highly Acceptable*	*Very Highly Acceptable*
Overall	***Highly Acceptable***	***Highly Acceptable***

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CONCLUSIONS

Based on the findings of this study, several conclusions were drawn. Adopting the locally constructed evaluation instrument, Computer-assisted language learning software in Mandarin language is "highly acceptable" as perceived by the students as well as the teachers in the Bulacan State University. CALL software is generally rated, by both the students and the teachers as highly acceptable in terms of (1) instructional design, (2) program instructions, (3) program transition, (4) user interface, (5) user control, (6) phase control/branching and (7) error handling. The respondents also positively considered that CALLS can be used as teaching and learning supplement which primarily motivates learner through the effective use of graphics, animations and other interface elements.

In addition, both the students and the teachers expressed that the computer-assisted language learning software facilitated learning and that they desire to use CALLS for various Mandarin topics. Comparing the students' and teachers' evaluation of CALLS, the result proves that there is no significant difference on the level of acceptability of CALLS as perceived by the teachers and the students.

RECOMMENDATIONS

Recommendations are presented based on the conclusions and findings of the study. It is recommended that CALLS in Mandarin be used as teaching and learning supplement in foreign language classes. It is also recommended that the access for the software be available at the reading centers and library for reference purposes. Future researchers may use this study as reference for conducting further researches regarding the effectiveness of the CALLS or develop more interactive and well-enhanced CALLS which will take full advantage of the use of various multimedia elements. Hence, the current study is very limited for it only focused on the acceptance and satisfaction level of foreign language students and teachers in one college. The future researchers may conduct related studies which will cover a broader aspect to which the CALLS can be maximized in providing optimal language learning.

REFERENCES

[1] Bin Zou (Xi'an Jiaotong-Liverpool University, China), Minjie Xing (University of Manchester, UK), Yuping Wang (Griffith University, Australia), Mingyu Sun(University of Wisconsin - Milwaukee, USA) and Catherine H. Xiang (The London School of Economics and Political Science, UK). 2013. "Computer-Assisted Foreign Language Teaching and Learning: Technological Advances". http://www.igi-global.com/book/computer-assisted-foreign-language-teaching/69859

[2] Ellis, R The study of second language acquisition. Oxford applied linguistics. OUP 2004

[3] Godwin-Jones, Robert (2005). EMERGING TECHNOLOGIES Skype and Podcasting: Disruptive Technologies for Language Learning. Language Learning & Technology http://llt.msu.edu/vol9num3/emerging/

[4] Kawabata, Takako (2006). The Use of Computer-assisted Language Learning. Aichi Gakuin University

[5] Levy, M. (1997). CALL: Context and Conceptualisation. Oxford: Oxford University Press.

[6] McMurry, Benjamin L., "Evaluation in Computer-Assisted Language Learning" (2012). Brigham Young University. All Theses and Dissertations. Paper 3306

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Alu polymorphisms and Myocardial infarction in the Moroccan Population

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Abstract- Background: Myocardial infarction (MI) is one of the major causes of morbidity and mortality in developed countries. Currently, it becomes increasingly more common in developing countries as Morocco. The Alu family of short interspersed elements was widely used as a highly informative tool for studying genetic structure of human populations because of their unique mutational mechanism. In this study, we aim to investigate the association between four Alu polymorphisms located at the ACE, FXIII-B, PLAT TPA-25 and APOA1 genes and the risk of MI in Moroccan population.

Methods*:* A total sample of 413 unrelated subjects (210 patients with a history of MI and 203 healthy individuals) were enrolled in this study. Alu polymorphisms at the ACE, PLAT, FXIII-B and APOA1 genes were determined by simple assay based on polymerase chain reaction and direct electrophoresis of its products.

Results*:* Alu genotypes at ACE, PLAT and FXIII-B do not show any association with IM. The most interesting association was recorded with the APOA1 polymorphism, where the Del/Del genotype was significantly associated with a high risk of the MI.

Conclusion: Only the Alu/APOA1 insertion/deletion polymorphism between the four Alu polymorphisms studied shows a significant association with MI and can so constitute a good genetic marker of risk of developing MI in the Moroccan population.

Index Terms- MI, Alu, Polymophisms, ApoAI

I. INTRODUCTION

Myocardial infarction (MI) is a multifactorial Coronary Artery Disease (CAD) influenced by environmental and genetic factors. They constitute nowadays a major public health problem and remains the leading cause of death worldwide [1].

MI is a disease, prevalent predominantly in developed countries, and currently becomes increasingly more common in developing countries. Collecting extensive data about epidemiology and clinical findings becomes a necessity for a better comprehension and management of MI. In addition, studies on lifestyle and risk factors as smoking, alcohol consumption, hypertension, dyslipidemia and diabetes, must be controlled to prevent the MI disease in some developing countries [2].

Currently, one of the main researchers' objectives is to define new biomarkers for early diagnosis of MI for a better prevention of susceptible individuals and to provide validated clinical methods. Recently, several researches have been conducted to establish the association of functional variants on some candidate genes with the risk of developing MI.

The Y Alu family elements of short interspersed sequences are ~300 bp long and are commonly found in introns, 3′ untranslated regions of genes and intergenic genomic regions[3]. They represent a set of DNA markers that are unique for studying genetic structure of human populations, and becomes widely used as a highly informative tool in different domains. Their principal characteristics reside in their stability as polymorphisms identical by descent and that their ancestral state can be known, facilitating accurate rooting of population networks [4, 5;6]. In this study, their polymorphism is used to evaluate the genetic susceptibility to CAD and MI in the Moroccan population.

The markers were selected were for their involvement in one of the main roads leading to cardiovascular disease and particularly the MI and because of the presence of an Alu polymorphism within them or in their vicinity. The first one is the insertion/deletion (I/D) of a 288bp Alu repeat sequence within the intron 16 of the Angiotensin Converting Enzyme gene (ACE c.2306-117_404, rs4340). This polymorphism has been related to approximately 50% of the variability in the ACE levels in the bloodstream, with highest values within DD homozygotes [7], and this genotype was then widely considered as a CAD risk factor [8]. In contrast, the II genotype was indirectly associated with protection against myocardial infarction [9; 7].

The second polymorphism studied is the insertion/deletion (I/D) of a 310bp Alu repeat sequence within the intron 8 of the Tissular Plasminogen Activator gene (PLAT,OMIM 173370, 8p12). The ancestral state of this variation is an absence of the insertion, as reported on the evolutionary studies in Primates [4; 10]. Several studies have shown the importance of PLAT TPA-25 gene as a potential marker of susceptibility to the MI. However, the effect of this polymorphism is still uncertain.

Another important polymorphism Alu I/D studied in the genetic susceptibility to CAD and particularly to MI is located in intron 10 of FXIII-B gene, on chromosome 1 at position 1q31-q32.1. This gene encodes for the coagulation factor XIII B subunit and with subunit A it forms the Coagulation factor XIII that is the last zymogen to become activated in the blood coagulation cascade. Deficiency of this factor can result in a lifelong bleeding tendency, defective wound healing, and habitual abortion [11].

The fourth polymorphism is an insertion/deletion of an Alu sequence localized in the 5'UTR of *ApoA1* gene coding the

major protein component of high-density lipoprotein (HDL) in plasma [12].

The aim of the present study was to examine whether these four common Alu insertion/deletion are associated or not with the risk of myocardial infarction comparing results of a group of 210 MI patients with a control group of 203 apparently healthy individuals.

II. Subjects and methods

Subjects' recruitment

A total of 413 unrelated subjects were enrolled in this study, among them, 210 patients with a history of MI recruited at the Department of Cardiology of the University Hospital IbnRochd, Casablanca, Morocco, between January 2010 and June 2013. All patients were admitted with a coronary syndrome. Cardiologists established a MI diagnosis basically upon an abnormal ECG and elevated MI biomarkers. Patients' group included 129 men and 81 women, with an age ranging between 30 and 85 years old. Ethnicity, family history, cardiovascular risk factors (alcohol, tobacco, obesity) and other related data were obtained from each patient using a standard questionnaire. The study was approved by the Ethic's Committee of the University Hospital Center Ibn Rochd, and informed consent was obtained from all enrolled subjects. The medical case of each patient included anthropometric (Age, sex, BMI, Arterial Tension) and biochemical parameters (Diabetes mellitus, glycemic, cholesterol, TG, HDL, LDL).

The healthy control sample was constituted by two hundred and three healthy individuals (118 men and 85 women) with an age ranging between 28 and 80 years, matched for sex, age, and ethnic origin, were enrolled as a group of healthy controls.

Genotyping of ACE, PLAT, FXIII-B and APOA1 gene polymorphisms:

We carried out the analysis of the polymorphism of the four autosomal Alu insertions, mostly studied at four genes of susceptibility to MI (ACE, PLAT, FXIII-B and APOA1) on the total samples enrolled in the present study. DNA was extracted from peripheral venous blood sampled from MI patients and healthy controls. The extraction of genomic DNA from the leukocyte fraction of the blood samples was carried out using the Wizard Genomic DNA Purification kit according to the manufacturer's instructions (Promega Corporation, Madison, WI, USA). The extracted DNA was stored at -20°C. The four Alu insertions were typed by PCR amplification, using primers previously established as described below and using the Mytaq HS Mix, 2x for amplification, according to the manufacturer's instructions (Bioline Reagents Ltd). The separation was carried out by electrophoresis in 2% agarose gels and staining using ethidium bromide (0.5µl/ml).

The primers sequences used for the Alu_ACE polymorphism amplification are:
Forward (5'CTGGAGACCACTCCCATCCTTTCT3'),
Reverse (5'GATGTGGCCATCACATTCGTCAGAT3'),
PCR's mix composition and thermo-cycling conditions are that used by [7]. The PCR products were 490pb for the insertion (I) allele and 190 for the deletion (D) allele.

The TPA-25_Alu sequence of the PLAT gene was typed using the pair of primers :
Forward (5´ GTG AAA AGC AAG GTC TAC CAG 3'),
Reverse (5´ GAC ACC GAG TTC ATC TTG AC- 3'), using PCR conditions described by [10] . Allelic sizes were 570pb for the I allele and 260pb for the D one.

The Alu_FXIII-B sequence was amplified using the following primers:
Forward (5'TCAACTCCATGAGATTTTCAGAAGT3'),
Reverse (5'CTGGAAAAAATGTATTCAGGTGAGT3').
PCR reactions were performed using [5] conditions and the allelic sizes were 700pb for insertion allele and 410pb for deletion.

The amplification of ApoA1_Alu sequence was performed using the following primers :
Forward (5'-AAGTGCTGTAGGCCATTTAGATTAG-3'),
Reverse (5'AGTCTTCGATGACAGCGTATACAGA-3').
PCR reaction was performed using mix composition and cycling conditions used by [4], leading to PCR products of 510pb (I) and 210pb (D).

Statistical analysis

The four Alu polymorphisms were tested for Hardy-Weinberg equilibrium in the two main samples (patients MI and controls subjects) and the alleles frequencies were compared between them using comparisons $\chi 2$tests performed by Biosys-1 program.

Quantitative variables were expressed as mean ± standard deviation (SD), and qualitative variables were expressed as percentages. Multivariate association analyses with MI risk and genotype frequencies were assessed by comparison of variable means using $\chi 2$, odds ratios (ORs) and 95% confidence intervals (CIs) for the effect of polymorphisms on MI risk in association with age, sex, smoking, drinking, hypertension, diabetes and hyperlipidemia. These statistical analyses were performed using the SPSS software (version 21). A P value of less than 0.05 was used as the criterion of statistical significance.

III. Results

Samples characteristics of the study population

Anthropometric and laboratory analysis data of the studied population are shown in Table 1.

No statistically significant difference between cases and controls was observed in terms of age (p=0.054) and of sex ratio (p=0.547). There was a highly significant difference between MI patients and healthy controls with respect to BMI (p<0.001). When comparing lipid profiles, TG, total cholesterol and LDL were significantly higher in MI patients than in controls (P <0.001), whereas serum HDL levels were significantly higher among controls (P <0.001). In addition, the average of fasting plasma glucose (FPG) in MI cases was significantly higher than that of the controls (P < 0.001). The prevalence of smokers, and individuals with diabetes or hypertension was significantly higher among the MI patients. For alcohol intake data, 13,59% of MI cases present a history of alcohol intake. So far, these data demonstrated that smoking, alcohol intake, hypertension and diabetes were the important risk factors for CAD and MI development in Moroccan population.

Multivariate associations of studied Alu with the risk of MI

Alu Polymorphic insertions concerning four autosomal genes with a presumed role in the susceptibility of CAD and MI, were genotyped in 210 MI patients and 203 healthy controls. Genotypes and allele frequency distributions are presented in table 2. Except for FXIII-B Alu in MI patient's group, all the genotype and allele frequency distributions of the four polymorphisms followed Hardy-Weinberg equilibrium proportions (p>0.05).

The ACE_Alu deletion carrier ship was without effect on the risk of MI (Table 2), neither genotype nor allele distribution show significant differences between the two samples. In addition, no correlation between genotype distribution and independently associated variables has been encountered (Table 3-4). Similar results were obtained when comparing MI patients to healthy controls for the FXIII-B_Alu insertion carrier's. However, a trend without reaching significance was observed regarding the presence of FXIII-B Del/Del in the controls group compared to MI patients (64.5% vs 55.4%, p=0.0579).

Comparison of the allele distribution of PLAT TPA-25_Alu shows a trend of association of the deletion carrier's with the risk of MI without reaching significance (p=0.0755, OR=0.779, 95% CI [0.586-1.036]). Strikingly, we found that MI patients with high levels of cholesterol are frequently carriers of at least one deletion allele (genotype Ins/Del: p=0.010; Del/Del: p=0.039).

The most interesting results were recorded in association with the APOA1 polymorphism. Indeed, genotype distribution shows that there is a significant association of the Del/Del genotype with a high risk of MI (p<0.001; OR=0.396, 95% CI=[0.258-0.607]). The Ins/Ins genotype seems to be more protective (p=0.036; OR=0.369; 95% CI=[0.115-1.035]). Those results were confirmed when comparing allele distribution, showing that deletion is significantly associated to MI when comparing MI patients with healthy controls (84,3% vs 71,2% respectively; p<0.001; OR=0.46; 95% CI=[0.323- 0.655]). Correlation with BMI data shows that subjects with BMI <25 Kg/m^2 are more frequently carrying the deletion than subjects with BMI >30 Kg/m2 (80,3% vs 61,2%, respectively; p=0,026, OR=2,5, 95%CI [1,116-5,598]). Regarding hypertension profile, del/del genotype carriers are frequently hypertensive compared to ins/del genotype carriers (80,3% vs 19,7%, respectively; p=0,035; OR=0,49; 95% CI=[0,249-0,949]). Del/del genotype was correlated also with hyperglycemia (p=0,004, OR=3,37; 95% CI [1,466-7,727]), with hypertriglyceridemia (p=0,020, OR=2,14; 95% CI [1,125-4,073]), with cholesterol levels (p=0,003, OR=2,75 ; 95%CI [1,422-5,302]) and LDL levels (p=0,035, OR=2 ; 95% CI [1,050-3,810]).

IV. Discussion

Factors involved in atherosclerosis, thrombosis and vasoconstriction pathogenesis can contribute independently or together - depending of the genetic pools - in the development of coronary heart disease leading mostly to myocardial infarction. In this study we aim to investigate the association between polymorphic Alu insertions on four genes presenting a suspected and sometimes demonstrated susceptibility with the risk of MI (ACE, FXIII-B, PLATTPA-25 and APOA1 genes). The association between ACE I/D polymorphism and risk of myocardial infarction (MI) has been extensively studied [13]. It was reported that ACE I/D polymorphism could influence on the right ventricular myocardial performance index in patients with a first acute anterior myocardial infarction [14]. Our results showed the absence of any association of this polymorphism with the risk of MI in the Moroccan samples. Previous reports showed that DD genotype is associated with higher levels of circulating ACE and with high risk of MI [9; 15].

The FXIII-B gene encodes the B subunit of the factor XIII, which is a zymogen for a fibrinoligase interfering in the stabilization of blood clots. Considering its role in the formation of fibrin structure and in the regulation of fibrinolysis, its involvement in coronary artery disease, atherothrombotic, ischemic stroke, and peripheral artery disease are not surprising, and constitute a topic of intensive study [16]. However, little is known about the effect of FXIII-B I/D on coronary artery health. In this study, a trend without reaching significance was observed regarding the presence of FXIII-B Del/Del in the controls group compared to MI patients.

The most interesting results of this work were recorded in association with the APOA1 polymorphism. We found a significant association of the Del/Del genotype with a high risk of MI, when the Ins/Ins genotype seems to be more protector. Although the association of the Alu polymorphism in the APOA1 gene is associated with the risk of myocardial infarction (MI) remains unclear and related data are sparse [17; 18]. The apolipoprotein AI (*APOA1*) is known for its important role played in the metabolism of triglycerides (TG) and high-density lipoprotein (HDL) cholesterol.

Correlations of APOA1 deletion with a low BMI, hypertension, hyperglycemia cholesterol and LDL levels data suggest the important association of this polymorphism with the risk of MI.

V. Conclusion

In this study, we investigated the association between polymorphisms of four autosomal Alu insertions on ACE, PLAT TPA-25, FXIII-B and APOA1 genes and myocardial infarction. The association was searched in groups of MI patients, compared to a group of healthy controls. Our results suggest that subjects who carry the APOA1 del/del genotype and who have high total, LDL cholesterol levels, hyperglycemia and hypertriglyceridemia may be more predisposed to the development of MI. No association between the ACE, PLATTPA-25 and FXIII-B Alu polymorphisms and MI has been found in the Moroccan patients.

References

[1] Borzyszkowska, J.;Stanislawska-Sachadyn, A.;Wirtwein, M.;Sobiczewski, W.;Ciecwierz, D.;Targonski, R.;Gruchala, M.;Rynkiewicz, A. and Limon, J . (2012). Angiotensin converting enzyme gene polymorphism is associated with severity of coronary artery disease in men with high total cholesterol levels. J Appl Genet., 53: 175–182

[2] Mehri, S.;Mahjoub, S.;Finsterer, J.;Zaroui, A.;Mechmeche, R.;Baudin, B. and Hammami, M. (2011). The CC genotype of the angiotensin II type I receptor gene independently associates with acute myocardial infarction in a Tunisian population. J Renin Angiotensin Aldosterone Syst. System.,12, 595–600

[3] Batzer, M.A. and Deininger, P.L. (2002).Alu repeats and human genome diversity. Nat. Rev. Genet.,3, 370–379

[4] Batzer, M. A.;Stoneking, M.;Alegria-Hatman, M.;Bazan, H.;Kass, D.H.;Shaikh, T.H.;Novick, G.E.;Ioannou, P.A.;Scheer, W.; Herrera, RJ and Deninger, P.L. (1994). African origin of humain specific polymorphic Alu insertions. Pro. Natl.Acad.Sci.USA.,91, 12288-12292

[5] Batzer, M.A.;Arcot, S.;Phinney, J.M.;Alegria-Hartman, M.;Kass, D.H.; Milligan, S.M.;Kimpton, C.; Gill, P. et al. (1996). Genetic variation of recent Alu insertions in human populations. J Mol.Evol.,42, 22–29

[6] Watkins, W.S.;Rogers,A.R.;Ostler, C.T.; Wooding, S.;Bamshad, M.J.;Brassington, A.M.E.; Carroll, M.L.; Nguyen, S.V.; Walker, J.A.; Prasad ,B.V.R.; Reddy, P.G.; Das, P.K.;Batzer, M.A.and Jorde, L.M. (2003). Genetic Variation Among World Populations: Inferences From 100 AluInsertion Polymorphisms. Genome. Res., 13, 1607-1618

[7] Tiret, L.;Rigat, B.; Visvikis, S.; Breda, C.;Corvol, P.;Cambien, F and Soubrier, F.(1992). Evidence from combined segregation and linkage analysis that a vaiant of the angiotensin I-converting Enzyme (ACE) gene controls plasma ACE levels. Am J. Hum. Gent.,51, 197-205

[8] Agerholm-Larsen, B.;Nordestgaard, B.G and Tybjærg-Hansen, A. (2000). Atherosclerosis and Lipoproteins ACE Gene Polymorphism in Cardiovascular Disease. ArteriosclerThrombVasc Biol., 20, 484-492

[9] Cambien, F.; Poirier, O.; Lecerf, L.; Evans, A.; Cambou, J.P.; Arveiler, D.; Luc, D.; Bard, J.M.; Bara, L.; Ricard, S. et al. (1992). Deletion polymorphism in the gene for angiotensin –converting enzyme is a potent factor for myocardial infarction. Nature.,359, 588-589.

[10] Tishkoff, S.A.;Ruano, G.; Kidd, J.R and Kidd, K.K .(1996). Distribution and frequency of apolymorphicAlu insertion at the plasminogen activator locus in humains. Hum. Genet.,97, 759-764

[11] Hsieh, L. and Nugent, D.(2008). Factor XIII deficiency. Haemophilia.,14, 1190–1200

[12] Dodani, S.;Henkhaus,R.; Dong, L. and Butler, M.G.(2012). Apo lipoprotein A1 gene polymorphisms predict cardio-metabolic risk in South Asian immigrants. Dis. Markers., 32: 9–19

[13] Chen, Y.; Dong, S.; He, M.; Qi, T. and Zhu, W.(2013). Angiotensin-converting enzyme insertion/deletion polymorphism and risk of myocardial infarction in an updated meta-analysis based on 34993 participants. Gene., 15, 196-205.

[14] Ozturk, O.;Ulgen, MS.;Tekes, S.;Ozturk, U. and Toprak, N. (2005). Influence of angiotensin-converting enzyme I/D gene polymorphism on the right ventricular myocardial performance index in patients with a first acute anterior myocardial infarction. Circ J., 69, 211-5.

[15] Bohn, M.;Berge, KE.;Bakken,A.;Erikssen, J.and Berg, K. (1993). Insertion/deletion (I/D) polymorphism at the locus for angiotensin I-converting enzyme and parental history of myocardial infarction. Clin. Genet., 44, 298-301.

[16] Muszbek, L.;Bereczky, Z.; Bagoly, Z.;Shemirani, AH. and Katona, E. (2010). Factor XIII and atherothrombotic diseases. Semin.Thromb.Hemost., 36, 18-33.

[17] Breslow, J.L. (1988).Apolipoprotein genetic variation and human disease. Physiol Rev., 68: 85-132

[18] Genschel, J.; Haas, R.;Propsting, M.J and Schmidt, H.H. (1998).Apolipoprotein A-I induced amyloidosis . FEBSLett.,430, 145-149.

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Acknowlegements : This work was carried out with funds allocated by two PROTARS projects: PROTARS II (N°. P12 / 14) and PROTARS III (N°. D64 / 02).

Legend to tables

Variables		Controls	Cases (n =210)	P value
Age (Mean±SD)		57,66±10,24	59,84±11,44	0.054 NS
Sex ratio (M/F)		1,39 (118/85)	1,59 (129/81)	0.547 NS
BMI (Kg/m^2)		24,34 ± 2,14	27,49±3,93	<0.001***
Riskfactors				
	Smoking (%)	35 (17%)	73 (34,76%)	<0.001***
	Drinking (%)	NA	29 (13,59%)	-
	Diabetes (%)	18 (9%)	89 (42,58%)	<0.001***
	Hypertension (%)	68 (33,6%)	76 (36,19%)	<0.001***
FPG (g/L)		1,12±0,9	1,52±0,72	<0.001***
Triglycerides (g/L)		1,67±0,79	1,88±0,87	<0.001***
Total cholesterol (g/L)		1,64±0,86	1,82±0,48	<0.001***
LDL cholesterol (g/L)		1,2±0,2	1,45±0,39	<0.001***
HDL cholesterol (g/L)		0,45±0,4	0,37±0,1	<0.001***

*(NS: not significant differences; ***: very highly significant differences)*

Table 1: Anthropometric and laboratory analysis data

Alu polymorphisms	MCV	Healthy controls		p-value	OR
ACE					
Ins	96 (23,3%)	106 (26,1%)	Ins Vs Del	0,352 NS	0,86 [0,617-1,197]
Del	316 (76,7%)	300 (73,9%)			
Ins/Ins	12 (5,9%)	11 (5,4%)	Ins/Ins Vs Ins/Del+Del/Del	0,858 NS	1,079 [0,425-2,772]
Ins/Del	72 (34,9%)	84 (41,4%)	Ins/Ins+Ins/Del Vs Del/Del	0,219 NS	0,783 [0,519-1,179]
Del/Del	122 (59,2%)	108 (53,2%)			
FXIII-B					
Ins	98 (23,8%)	82 (20,2%)	Ins Vs Del	0.215 NS	1.233 [0.873-1.744]
Del	314 (76,2%)	324 (79,8%)			
Ins/Ins	6 (2,9%)	10 (5%)	Ins/Ins Vs Ins/Del+Del/Del	0.294 NS	0.579 [0.169-1.800]
Ins/Del	86 (41,7%)	62 (30,5%)	Ins/Ins+Ins/Del Vs Del/Del	0.056 NS	1.468 [0.968-2.229]
Del/Del	114 (55,4%)	131 (64,5%)			
TPA25					
Ins	174 (41,6%)	194 (47,8%)	Ins Vs Del	0.075 NS	0.779 [0.586-1.036]
Del	244 (58,4%)	212 (52,2%)			
Ins/Ins	41 (19,6%)	50 (24,6%)	Ins/Ins Vs Ins/Del+Del/Del	0.220 NS	0.747 [0.455-1.224]
Ins/Del	92 (44%)	94 (46,3%)	Ins/Ins+Ins/Del Vs Del/Del	0.115 NS	1,395 [0.922-2.109]
Del/Del	76 (36,4%)	59 (29,1%)			
APOAI					
Ins	66 (15,7%)	117 (28,8%)	Ins Vs Del	**0.000 *** **	0.461 [0.323- 0.655]
Del	354 (84,3%)	289 (71,2%)			
Ins/Ins	6 (2,8%)	15 (7,4%)	Ins/Ins Vs Ins/Del+Del/Del	0.036 *	0.369 [0.115-1.035]
Ins/Del	54 (28,7%)	87 (42,8%)	Ins/Ins+Ins/Del Vs Del/Del	**0.000 *** **	0.396 [0.258- .607]
Del/Del	150 (71,5%)	101 (49,8%)			

*(NS: not significant differences; *: significant differences; **: highly significant differences; ***: very highly significant differences)*

Table 2: Distribution of genotype and allele frequencies

	Sexe		OR IC p-value,	Age			OR IC p-value		
	H (%)	F (%)		(a):30-49 years (%)	(b):50-69 years (%)	(c):70-85 years (%)	(a) vs (b)	(a) vs (c)	(b) vs (c)
ACE									
II	8 (6,3)	4 (5,2)	1,233 [0,359;4,239] 0,739 NS	3 (7,8)	7 (6)	2 (4)	1,335 [0,327;5,440] 0,687 NS	2,143 [0,340;13,50] 0,417 NS	1,606 [0,322;8,006] 0,564 NS
ID	42 (32,8)	30 (38,4)	0,781 [0,435;1,405] 0,41 NS	14 (36,9)	42 (36,2)	16 (30,7)	1,028 [0,481;2,198] 0,944 NS	1,313 [0,542;3,177] 0,547 NS	1,277 [0,634;2,572] 0,494 NS
DD	78 (60,9)	44 (56,4)	1,205 [0,681;2,134] 0,521 NS	21 (55,3)	67 (57,8)	34 (65,3)	0,903 [0,432;1,890] 0,787 NS	0,654 [0,277;1,542] 0,332 NS	0,724 [0,367;1,429] 0,352 NS
FXIIIB									
II	4 (3,1)	2 (2,6)	1,226 [0,219;6,854} 0,817 NS	1 (2,7)	4 (3,4)	1 (2)	0,757 [0,082;6,986] 0,806 NS	1,378 [0,083;22,75] 0,823 NS	1,821 [0,199;16,70] 0,596 NS
ID	53 (41,4)	33 (42,3)	0,964 [0,545;1,705] 0,899 NS	13 (34,2)	56 (48,3)	17 (32,7)	0,557 [0,260;1,195] 0,133 NS	1,071 [0,441;2,596] 0,880 NS	1,922 [0,969;3,810] 0,061 NS
DD	71 (55,5)	43 (55,1)	1,014 [0,576;1,786] 0,962 NS	24 (63,1)	56 (48,3)	34 (65,3)	1,837 [0,865;3,900] 0,114 NS	0,908 [0,379;2,171] 0,827 NS	0,494 [0,251;0,973] **0,041 ***
TPA25									
II	22 (17,1)	19 (23,7)	0,66 [0,331;1,316] 0,238 NS	8 (21,1)	26 (22)	7 (13,2)	0,944 [0,386;2,305] 0,899 NS	1,752 [0,575;5,338] 0,324 NS	1,857 [0,750;4,598] 0,181 NS
ID	54 (41,9)	38 (47,5)	0,796 [0,454;1,395] 0,425 NS	18 (47,3)	50 (42,4)	24 (45,3)	1,224 [0,587;2,550] 0,589 NS	1,088 [0,472;2,508] ; 0,844 NS	0,888 [0,463;1,706] 0,722 NS
DD	53 (41,1)	23 (28,8)	1,728 [0,951;3,142] 0,073 NS	12 (31,6)	42 (35,6)	22 (41,5)	0,835 [0,382;1,824] 0,651 NS	0,650 [0,271;1,561] 0,335 NS	0,779 [0,401;1,512] 0,460 NS
APOAI									
II	4 (3,1)	2 (2,4)	1,264 [0,226;7,063] 0,790 NS	3 (7,8)	3 (2,6)	0 (0)	3,314 [0,640;17,16] 0,153 NS	not calculated	not calculated
ID	29 (22,5)	25 (31)	0,65 [0,347;1,216] 0,177 NS	8 (21,1)	33 (27,7)	13 (24,5)	0,695 [0,289;1,671] 0,416 NS	0,821 [0,302;2,230] 0,698 NS	1,181 [0,561;2,483] 0,661 NS
DD	96 (74,4)	54 (66,6)	1,455 [0,792;2,672] 0,227 NS	27 (71,1)	83 (69,7)	40 (75,5)	1,065 [0,477;2,376] 0,878 NS	0,798 [0,312;2,042] 0,637 NS	0,749 [0,358;1,567] 0,443 NS

*(NS: not significant differences; *: significant differences; **: highly significant differences; ***: very highly significant differences)*

Table 3: Correlation between genetic data and anthropometric parameters of MI patients

	Glycémie (g/l)		**OR ; IC ; p-value**	**Cholestérol** (g/l)		**OR IC p-value**	**Triglycérides (g/l)**		**OR IC p-value**
	(a) : < 1,10	(b) : > 1,10	(a) vs (b)	(c) : < 2	(d) : > 2	(c) vs (d)	(e) : < 2	(f) : > 2	(e) vs (f)
ACE									
II	5 (8,9%)	7 (5,5%)	1,695 [0,514;5,589] 0,389 NS	7 (7,2%)	5 (5,7%)	1,277 ; [0,390;4,179] 0,686 NS	7 (6,7%)	5 (6,1%)	1,111 [0,339;3,638] 0,862 NS
ID	23 (41,1%)	43 (33,6%)	1,378 [0,722;2,630] 0,331 NS	40 (40,8%)	26 (29,5%)	1,645 ; [0,894;3,026] 0,110 NS	34 (32,7%)	32 (39%)	0,759 [0,415;1,388] 0,371 NS
DD	28 (50%)	78 (60,9%)	0,641 [0,340;1,207] 0,168 NS	51 (52%)	57 (64,8%)	0,590 ; [0,327;1,065] 0,080 NS	63 (60,6%)	45 (54,9%)	1,263 [0,703;2,271] 0,435 NS
FXIIIB									
II	1 (1,9%)	4 (3,1%)	0,564 [0,062;5,160] 0,612 NS	3 (3,1%)	2 (2,3%)	1,358 ; [0,222;8,321] 0,741 NS	3 (2,9%)	2 (2,5%)	1,188 [0,194;7,282] 0,852 NS
ID	24 (44,4%)	56 (43,1%)	1,070 [0,569;2,015] 0,833 NS	41 (41,8%)	39 (44,3%)	0,904 ; [0,505;1,616] 0,733 NS	44 (42,3%)	36 (43,9%)	0,937 [0,522;1,681] 0,827 NS
DD	29 (53,7%)	70 (53,8%)	0,987 [0,526;1,852] 0,967 NS	54 (55,1%)	47 (53,4%)	1,071 ; [0,601;1,908] 0,817 NS	57 (54,8%)	44 (53,6%)	1,047 [0,586;1,872] 0,876 NS
TPA25									
II	10 (18,5%)	30 (23,1%)	0,834 [0,383;1,817] 0,649 NS	19 (19,4%)	21 (23, 9%)	0,767 ; [0,381;1,546] 0,459 NS	21 (20,1%)	19 (23,2%)	0,839 [0,416;1,692] 0,624 NS
ID	23 (42,6%)	57 (43,8%)	0,868 [0,459;1,640] 0,663 NS	52 (53,1%)	30 (34,1%)	2,186 ; [1,208;3,955] **0,010***	47 (45,2%)	35 (42,7%)	1,107 [0,618;1,985] 0,732 NS
DD	21 (38,9%)	43 (33,1%)	1,325 [0,691;2,540] 0,397 NS	27 (27,5%)	37 (42%)	0,524 ; [0,284;0,967] **0,039***	36 (34,7%)	28 (34,1%)	1,021 [0,555;1,878] 0,947 NS
APOAI									
II	1 (1,8%)	5 (3,9%)	0,447 [0,051;3,919] 0,467 NS	2 (2,4%)	4 (4,5%)	0,438 ; [0,078;2,449] 0,347 NS	0 (0%)	6 (7,3%)	Not calculated
ID	7 (13%)	41 (31,5%)	0,303 [0,126;0,727] **0,007****	16 (16,7%)	31 (35,2%)	0,386 ; [0,195;0,763] **0,006****	23 (22,1%)	25 (30,5%)	0,647 [0,335;1,253] 0,197 NS
DD	46 (85,2%)	84 (64,6%)	3,366 [1,466;7,727] **0,004****	79 (80,9%)	53 (60,3%)	2,746 ; [1,422;5,302] **0,003****	81 (77,9%)	51 (62,2%)	2,141 [1,125;4,073] **0,020***

Table 4: Correlation between genetic data and biological status of MI patients

Land Suitability Characterization for Crop and Fruit Production of Some River Nile Terraces, Khartoum North, Sudan

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***Abstract*- The** aim of this study was to evaluate the land suitability of some Nile River terraces for crop and fruit production at Khartoum North, Sudan. Nine soil profiles from three river terraces were selected to cover the different physiographic positions. The land suitability evaluation for annual crops and fruit tress was carried out by matching site conditions with the crop requirement with respect to the characteristics such as: climate condition, topography, drainage, texture, $CaCO_3$, CEC, % O.C, salinity and alkalinity. The suitability for crops, vegetables and fruit were divided into excellent, good, moderate, weak and not suitable. The soils of the study area were classified into: Typic Torrifluvents (unit 1), Entic Haplocambid (unit 2) and Typic Haplocambid (unit 3). The study showed that the soils of the three units were moderately suitable (S2) due to limitations of inundation, fertility, wetness, erosion, and physical limitations. Results indicated that the suitability of units 2 and 3 were weak for *Arachis hypogeal* L, *Alluim cepa*, *Vitis* spp, *Citrus sinensis* and not suitable for *Phaseolus vulgaris.*

***Index Terms*-** Nile River terraces, Khartoum North, inundation, erosion.

I. INTRODUCTION

For the time being, the world population is increasing dramatically (Liu and Chen, 2006). However, the potential of the land for crop production to satisfy the demand of the ever increasing population is declining as the result of sever soil degradation (Lal, 1994).

The land suitability refers to the fitness of a given area of land for a defined kind of land use. Land suitability is usually assessed on the assumption that the defined land use will be sustained and the environmental quality must be preserved or even improved on the site and the surrounding area (FAO, 1976).

The FAO defined that 'The suitability is a function of crop requirements and land characteristics and it is a measure of how will the qualities of land unit matches the requirements of a particular form of land use. Crop land suitability analysis is a prerequisite to achieve optimum utilization of available land resource for agricultural production in a sustainable manner (FAO, 1976).

The land suitability for crops was calculated by matching site conditions with the crop requirement with respect to the following characteristics: topography, drainage, physical soil (texture, structure), calcium carbonate and gypsum, soil fertility (apparent CEC, base saturation and organic carbon), salinity and alkalinity, climatic condition. The methods used based on qualitative evaluation (*Sys et al.*, 1991).

The irrigated intensive crop farming areas for vegetables and fruits in Sudan are largely located within the flooding plains of the Blue, White and River Nile and this is attributed to their high quality soils and water. These soils are used for agricultural production to meet the demands of the densely population capital. However, the selection of crops cultivated is erratic and traditional. Therefore, there is a real need for scientific and sound strategy to put these soils in their optimal use to the best interest of the farmers as well as the population of the capital (Kevie and El-Tom, 2004).

These soils are highly demanded for agricultural production (fruits, vegetables). However, some fruits and vegetables are imported to the capital from other states such as: Gezira, River Nile, North State, Kordofan, Sennar and Blue Nile. This means a high cost of transportation. Therefore, the objective of this study was to evaluate the land suitability of some River Nile terraces for crop and fruit production at Khartoum North, Sudan.

II. MATERIALS AND METHODS

Study area and soil sampling:

The study area is located in the northeastern part of Khartoum North, Sudan between the River Nile at El Khogalab village and extending eastwards till the piedmont plain. The area extends 8.0 km (8,000 ha) along a southeast-northwest direction and extends 4 km (4,000 ha) east west and is located where the grid coordinate is at 451437 to 459503N and 1747982 to 1750070E (Fig. 1). According to Van der Kevie (1973), the study area falls within the semi arid climatic zone. The average annual rainfall varies from 100-225 mm. Mean maximum temperature of the hottest months (May and June) is 40 and 42˚C, respectively. Mean minimum temperature of the coldest month (January) is 13-16˚C. The mean annual relative humidity ranges between 26-21 % (January to February), 15-26 % (March to June) and 41- 48 % (July to September, the wettest three months).

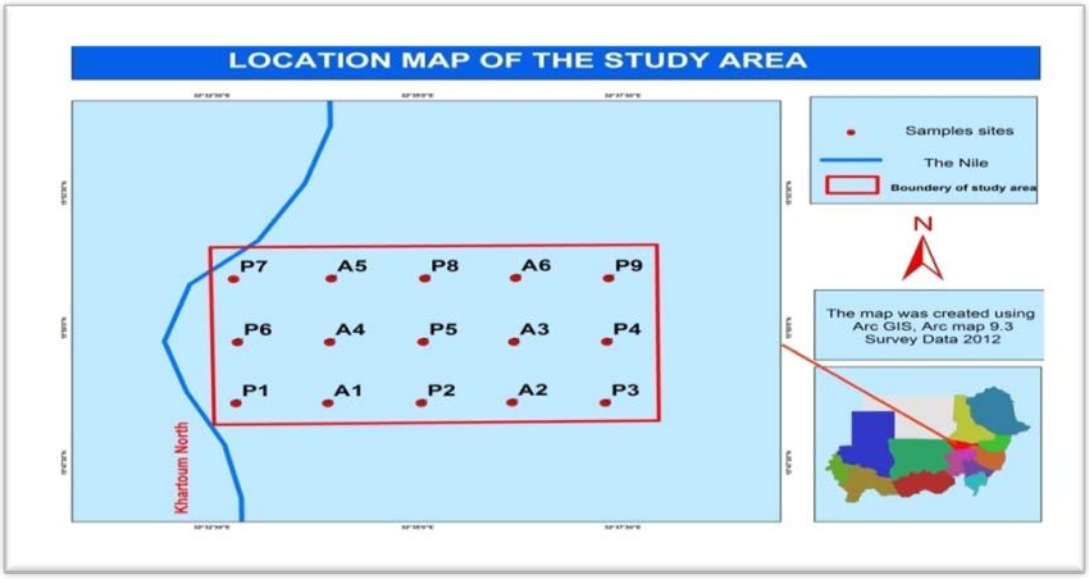

Figure (1): The study area and sites of the soil samples

Tundub (*Capparis decidua*), Seyal (*Acacia tortilis*), Usher, Musket (*Prosopis chilensis*), Heglig (*Balanites aegypiaca*) and Seder (*Zizyphus spina-christi*) are the predominant species among the natural vegetation. Table 1 presents the UTM coordinates of the sampling sites.

Table 1: Coordinates of the sampling sites within the study area.

Profile No.	Coordinates (UTM)	
	N	E
P1	451437	1747982
P2	453437	1747982
P3	455468	1747982
P4	459462	1747982
P5	457440	1747997
P6	451478	1750070
P7	453478	1750070
P8	455509	1750070
P9	459503	1750070

According to the Soil Taxonomy (2014), the calculated soil temperature regime is hyperthermic and soil moisture regime is variable from arridic/torric to ustic depending on local topographical conditions. Nine soil profiles located in different physiographic units were selected for soil sampling with a distance of 2 km in all direction (Fig. 1). Each horizon or layer was then fully described according to the FAO Guideline for Soil Profile Description (FAO, 2006).

III. METHODOLOY

Enhanced Thematic Mapper Plus (ETM+) Scene (173/49) was used as a base map. A preliminary reconnaissance soil survey was carried out in order to outline the soil distribution pattern in the study area. All soil profiles were fully described according the FAO Guideline for Soil profile Description (FAO, 2006). The land evaluation was determined based upon topography and soil characteristics include (Sys *et al.*, 1993). Soil properties such as pH, N%, P%, organic matter (%OM) and Cation Exchange Capacity (CEC) were considered in terms of soil fertility (Sys *et al.*, 1991). Particle size distribution was determined by the hydrometer method after removal of organic matter using H_2O_2 and stirring in a sodium hexametaphosphate solution (Soil Survey Staff, 2004). The soil pH was determined in the saturated soil paste using a Digital pH Meter Model (Jenway 3510). The electrical conductivity was determined in the saturated soil paste extract using a conductivity meter Model (Jenway 4510 U.S. Salinity Lab Staff, 1954). % CaCO3, %N and %P were determined according to Richards (1954). The exchangeable sodium percentage was calculated according to the formula: % ESP = {Exch Na^+}*100/CEC. Organic matter in the soils was determined using the Walkley and Black wet digestion method (Van Lagen, 1993). The CEC by the 1M NH_4OAC standard method (CEC_{SM}) was determined using continuous leaching of 5 g of soil with 100 ml of 1 M NH4OAC (at pH 7) and the concentrations of the exchangeable bases were

determined using the atomic absorption spectrophotometer. Requirements for each crop recommended by *Sys et al.,* (1993) were used.

IV. RESULTS AND DISCUSSION

Physical and chemical properties:

Table 2 presents some physical and chemical properties of selected soil profiles of the study area. Generally; the soils of the three units in the study area were alkaline with a pH value ranged between 7.6 to 8.18. The soils were non saline at all depth except at depth more than 70 cm in units 2 and 3 were slightly saline, non sodic with maximum value of SAR 7.58. The soils were moderately calcareous, low in nitrogen, organic carbon and available phosphorus. The CEC was low and ranged between 13.7 to 31.63 Cmol+/kg. The texture varied from sandy loam to clay.

Table 2: Some physical and chemical properties of selected soil profiles of the study area

Profile No.	Depth (cm)	pH	ECe (dS/m)	SAR [1]	CaCO3 (%)	N (%)	O.C (%)	P (mg/kg)	CEC[2] (Cmol+/kg)	Particle size distribution (%)			Textural class[3]
										Clay	Silt	Sand	
	Unit 1												
P 1	0-30	7.69	0.66	1.66	5.7	0.95	1.36	3.85	21.68	33.56	52.4	14.06	SiC
	30-80	7.6	0.45	1.78	5.04	0.89	1.28	3.64	20.16	38.32	33.3	28.34	SiC
	80-130	7.68	0.5	1.72	5.85	0.78	1.12	3.2	13.7	33.56	42.9	23.58	SiC
	Unit 2												
P 5	0-20	7.9	0.88	1.27	4.74	1.22	1.76	4.95	14.95	33.56	11.9	54.53	SC
	20-45	7.8	2.08	5.94	6.15	0.72	1.04	2.99	20.60	35.94	11.9	52.15	SC
	45-80	7.6	5.62	4.02	6.00	0.72	1.04	2.99	23.10	52.61	11.9	35.49	C
	80-120	7.6	7.03	6.28	6.67	1.00	1.44	4.07	22.34	40.7	9.52	49.77	C
	Unit 3												
P 9	0-15	7.97	0.38	2.09	3.93	0.72	0.64	1.91	20.82	16.9	33.3	49.77	SL
	15-40	8.18	0.97	2.40	4.30	0.11	1.04	2.99	31.63	26.42	59.5	14.06	SiC
	40-70	7.90	4.70	7.58	4.81	0.11	0.16	0.65	23.21	24.04	28.6	47.39	SL
	60-120	7.86	5.41	4.29	4.59	0.55	0.80	2.34	22.99	24.04	28.6	47.39	SL

Note: [1] Sodium adsorption ratio, [2] Cation exchangeable capacity, [3] SiC; Silty clay, SC; Sandy clay, C; Clay, Sl; Sandy loam

Soil classification:

Table 3 illustrates the classification of soils of the three units in the study area. According to the American system of soil classification (Soil Survey Staff, 1975), the soils of unit 1 (first terrace) belong to the order Entisols and classified as Typic Torrifluvents. This due to absence of pedogenic horizons. While the soils of units 2 and 3 (second and third terraces respectively) belong to the order Aridisols and classified as Entic Hplocabmids (unit 1) and Typic Haplocambids (unit 2), this due to lack available water of most time for plant growth and presence of cambic subsurface horizon

Table 3: Classification of soils of the study area

Unit No.	Profile No.	Classification	Area (ha)	(%)
1	1,6,7	Fine loamy, mixed, active (non calcareous), hyperthermic, Typic, Torrifluvents	400	25.00
2	2,5,8	Fine, mixed, active (non calcareous), hyperthermic, Entic, Haplocambids	700	43.75
3	3,4,9	Fine, mixed, superactive (non calcareous), hyperthermic, Typic, Haplocambids	500	31.25

Land Suitability for Agricultural Purpose:

The soils of the study area were classified with respect to their suitability after rating the different qualities (Kevie and Eltom, 2004) as shown on Table 4. The suitability classes of all units recognized were moderately suitable (S2), (land which is expected to be moderately productive for the defined use, yielding moderate benefits, with limitations which are moderately to reduce crop yields and/or increase recurrent inputs. The limitation includes; inundation (i), fertility (f), wetness (w), erosion (e) and physical limitations. The soil fertility of the area

was assessed using pH, %O.C, %N, available P and CEC. The soils of the area were non saline (EC_e less than 4 dS/m), non sodic (SAR 0-30 cm <8) and (SAR 30-120 cm <18 Rating 1). Erosion hazards of the study area were negligible because there were no evidences of sheet erosion. However some water erosion may be happened during high flood. The soils were non calcareous. The topography for gravity irrigation of the study area is smooth to promote uniform distribution of water and provide surface drainage to the all parts of the study area (Rating 1). The workability of the study area was loose to hard because it had silty clay loam, sub angular blocky structure, and coarse gravels (<3% of the surface coverage Rating 1) (Stori, 1964).

Table 4: Land suitability of different physiographic units

Land qualities	Unit 1	Unit 2	Unit 3
Soil moisture availability	1	2	2
Chemical soil fertility	3	3	3
Condition for seedling establishment	1	2	3
Drainage condition in grow season	1	2	2
Workability	1	2	3
Possibility of mechanization	1	2	2
Salinity	1	1	1
Alkalinity	1	1	1
Erosion hazards	2	2	2
Capability for maintain surface water	1	2	2
Topography for gravity irrigation	1	2	2
Soil drainability	3	2	1
Land cover	2	2	1
Suitability classes	S2	S2	S2
Suitability sub classes	S2iw (f)	S2fe	S2ef (p)
Kind of limitations	iwf	fe	ifp

Note: S2 = moderately suitable i = inundation; w = wetness; f = fertility; e = erosion; p = physical limitations

Land Suitability for Crops and Fruit Trees:

In applying systems of crops suitability to the soils of the study area, the ranking of the suitability of the different physiographic units of the study area was found as indicated in Table 5 bearing in mind that these ratings were based on the weighted average. The suitability of the land to different crops was determined for field and horticultural crops (vegetables and fruits) according to Sys (1993). The land suitability for crops was calculated by matching site conditions with the crop requirement with respect to the following characteristics: topography, drainage, physical soil (texture, structure), calcium carbonate and gypsum, soil fertility (apparent CEC, base saturation and organic carbon), salinity and alkalinity, climatic condition. The methods used were based on qualitative evaluation (Sys *et al.*, 1991 PART I, II, and III). The suitability for the field crops, vegetables and fruit were divided into excellent, good and moderate; For example the suitability of the unit 1 for Alfa alfa (*Medicago sativa)* was excellent for that crop; slope 0-2, moderate drainage, silty clay loam texture, with pH 7.4-8. ECe between 0-3 dS/m and SAR 0-8 and other requirements (Oluwatosin *et al.*, 2002).

Table 5: Land suitability for the common crops & fruits grown in the study area.

Crop type	Land unit		
	1 (Typic Torrifluvents)	**2 (Entic Haplocambids)**	**3 (Typic Haplocambids)**
Wheat	excellent	excellent	good
Barley	excellent	excellent	good
Maize	good	moderate	moderate
Sorghum	good	good	good
Alfa Alfa	excellent	good	moderate
Sunflower	good	good	good
Chick pea	excellent	moderate	moderate
Onion	good	weak	weak
Potato	moderate	weak	weak
Date palm	moderate	moderate	moderate
Grapes	good	weak	weak

Orange	moderate	weak	weak
Haricot beans	good	not suitable	not suitable

V. CONCLUSION

Acoording to the American system for soil classification the soils of the study area were belong within order Entisols (unit 1) and Aridisols (units 2 and 3). The study revealed that the suitability classes of the three units in the study area were moderately suitable for agricultural purpose, and the most important limitations include: inundation, wetness, low fertility, erosion and physical limitation such as soil moisture availability
.

ACKNOWLEDGMENT

The author is greatly indebted to Associate Prof. Mohammad Salih Dafallh, Department of Soil and environment sciences, University of Khartoum for his valuable suggestions and encouragement throughout the progress of this work. Thanks are also due to Assistant Prof. Mahtab Ahmad, Department of soil sciences, King Saud University for his kind advice and criticism in the preparation of this manuscript.

REFERENCES

[1] FAO, 1976. A frame work for land evaluation. Soil Bulletin 32, Soil resources development and conservation services, Land and Water Development Division (AGLS), FAO HQ. Rome.

[2] FAO, 2006. Guideline for Soil Profile Description. FAO, Rom. 70 pp.

[3] Lal, R. 1994. Sustainable land use systems and soil resilience. In Soil Resilience and Sustainable land use (ed. D.J. Greenland & I. Szabolcs), Wallingford, UK: CAB International, 41-67pp.

[4] Liu, Y & Chen, Y. 2006. Impact of population growth and land-use change on water resources and ecosystems of the arid Tarim River Basin in Western China International Journal of Sustainable Development & World Ecology. V.13, 295p.

[5] Oluwatosin, G.A., onileowo O.T. and Ojo-Atere J.O (2002). Characterization of soil in the continental grits of north western Nigeria. J Trop For. Ress (In Press)

[6] Soil Survey Laboratory Staff (2004). Soil survey laboratory methods manual. Soil Survey Investigations Report, vol. 42. USDA-SCS, Washington, DC

[7] Soil Survey Staff. 1975. Soil Taxonomy. U.S. Dept. Agr. Handbook 436. U. S. Govt. Printing Office, Washington.

[8] Stori, R. E. (1964). Handbook of soil evaluation, Associated studies bookstorie, Univ. of California, Berkeley, California.

[9] Sys, C., Van Ranst, E., Debaveye, Ir.J & Beernaert, F. 1993. Land evaluation, part III. Crop requirements. Agriculture publication, no.7, General Administration for Development Cooperation. Brussels, Belgium, 166p.

[10] Sys, I., Van Ranst E & Debaveye, J. 1991. Land evaluation, part II. Methods in land evaluation. Agriculture publications, no.7, General Administration for Development Cooperation, Brussels, Belgium, 70-76pp.

[11] U.S. Salinity Lab. Staff (1954). Diagnosis and Improvement of Saline and Alkali Soils. Agricultural Handbook No 60 USDA.

[12] Van der Kevie, W. (1973). Climate Zones in the Sudan. Soil Survey Department, Wad Medani.

[13] Van der Kevie, W. and O. A. M. El-Tom (2004). Manual for LandSuitability Classification for Agriculture with Particular Reference to Sudan. Ministry of Science and Technology, Agric. Research and technology Corporation. Land and Water Research Center, Wad-Medani, Sudan, 112-227.

[14] Van Lagen B (1993). Manual for Chemical Soil Analyses. Department of Soil Science and Geology, Wageningen University, the Netherlands.

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Blue Brain

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Abstract- Human brain is the most precious and typical creation of god. The man responds to the things just because of the brain. To preserve this typical thing a project named 'Blue Brain' which is also called the first virtual brain started in 2005. Scientists are in research to develop an artificial brain that can work, respond, contemplate and take decisions without any effort. The effort is to upload a human brain into machine. The aim is to preserve the human brain after death so that the data, intelligence, personalities, feelings, memories of that person should not be lost. This paper includes the complete research work explaining the functioning module of blue brain and the recent developments which are going through it.

Index Terms- Blue Brain, Artificial, Intelligence, Human Brain, Typical.

I. INTRODUCTION

It is very difficult to understand the complexity of human brain which is the most complex circuit than any other. But now it is possible to create a human brain. The project named Blue Brain is in under process for uploading human brain on computer which resides in the Super Computer. The project was founded in 2005, May by Henry Markram at EPFL in Lausanne Switzerland.

II. HISTORY OF BLUE BRAIN

The main objective of the project was founded in May 2005 by Brain and Mind Institute in Ecole Polytechnique Federal de Lausanne, Switzerland. Its aim is to analyze the brain's architecture and functioning principles. The project is being headed by Henry Markam, the director of the institution. For this they are using the Blue Gene super computer developed by IBM and Michael Hines, neuron software is running on this super computer. The simulation simply does not involve the artificial neural network but the biologically realistic model of neurons.

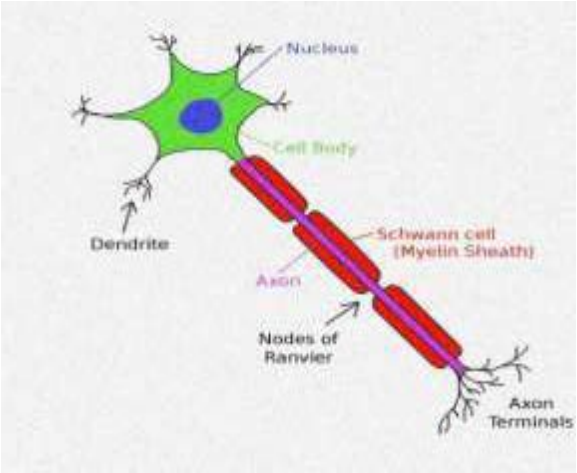

Fig. Neuron anatomical model

III. WHAT IS BLUE BRAIN?

Blue Brain is the name of the super computer developed by IBM. If possible, it would be the world's first virtual brain. Within years we would be able to scan our intelligence and knowledge into the computer. By this we can use this knowledge for the development of mankind even after the death of the person.It take decisions based on the past experiences of the person and apply it to the similar situation occurring in the present. With the help of blue brain we can upload our brain into a computer. Different activities and structure of our central nervous system can also be studied.

IV. NEED OF BLUE BRAIN

Intelligence is the quality through which all of us are different from each other. It is the inborn quality. There are some people having a very high level of intelligency. Sometimes they think upto such extent that other's cannot reach. Examples are Newton etc. But after the death the intelligence is lost. The solution to this is the Virtual Brain. Through this it can be preserved even after death. We all suffer from a problem of remembering history and important days etc. This all can be done by virtual brain.

V. SEVERAL GOALS OF PROJECT

NEUROCORTICAL COLUMN MODELLING

The initial phase completed in December 2006, was the simulation of the rat neocortical column which are the smallest functioning units of neocortex (responsible for conscious thoughts). It is about 2mm tall, having a diameter of 0.5mm and

contains 60,000 neurons in humans but rat neocortical column contain 10,000 neurons.

BRAIN SIMULATION

Henry Markam at TED conference said that, "It is not impossible to make the human brain and we will do it in 10 year". He said that if we would be able to implement it correctly, then it would be able to speak and have the intelligence similar to man.

PROGRESS

The first phase completed in November 2007. The first single cellular model was completed in 2005. The neurocortical column of 10,000 cells completed by 2008. Such 100 columns were built by 2011 human brain predicted to exist by 2023 which will be equivalent to 1000 rat brains.

VI. FUNCTIONING OF BLUE BRAIN

Firstly, it becomes quite important to understand how the person's brain can be uploaded into a computer. Raymond Kurgweil published a paper on this topic and provided that the use of small robots or nanobots is excellent. They are small enough to travel through our circulatory system. They would be able to monitor the activities of the nervous system. They will provide the interface with computer. By scanning our brain it will provide the clear information of the connections of neurons. They would record the current state of brain. All these information when entered into computer, it will work as us. All what is required is the super computer with large space and processing power.

VII. STEPS OF BUILDING A BLUE BRAIN

There are basically three steps of building a blue brain-

1. Collection of Data
2. Simulation of Data
3. Visualization

COLLECTION OF DATA: It involves in the collection of brain portion and analysing them under a microscope and understanding the electrical behaviour individually of the neurons. The observations are transformed into algorithm which are further ready for simulation.

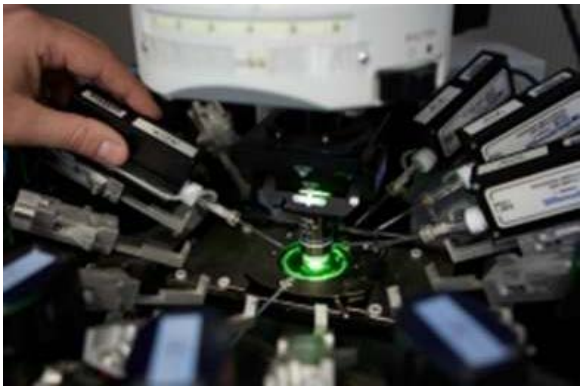

Fig. The 12 patch clamp, close view

SIMULATION OF DATA:

There are 2 aspects of simulation-

1. Speed of simulation
2. Simulation Workflow

Speed of Simulation: The speed of simulation of 1 neocortical column is two hundred times slower than the real one.

BBP-SDK

The software uses C, C++, FORTAN and is an open source software. It was developed in 1990's by Moore and Hines. The Blue Brain Project- SDK is a C++ wrapped in Java and Python.

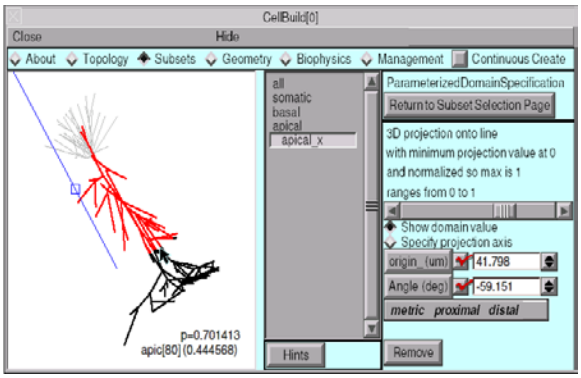

Fig. NEURON cell binder window

VISUALIZATION:

RTNEURON

RTNeuron is generally used for the visualisation of the neural simulations. This software is written in C++ and OpenGL. It is written basically for the neuron simulations. This gives the output in 3D.

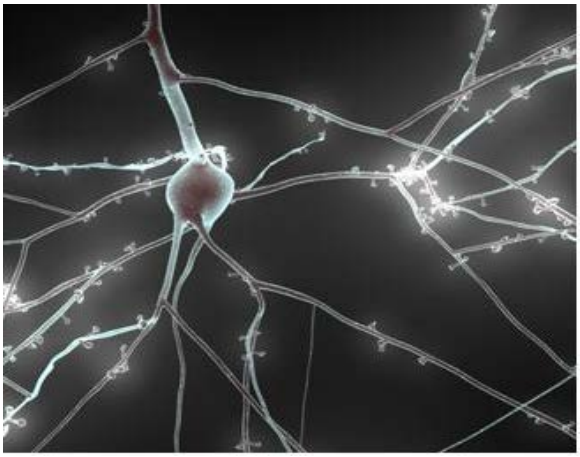

Fig. RTNeuron visualization of a neuron

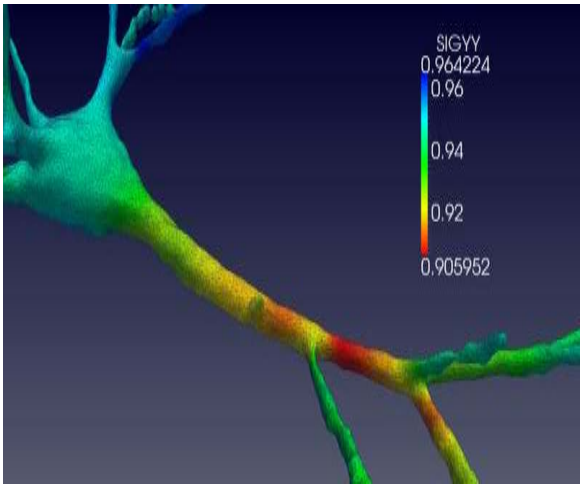

Fig. Visualization of neuron

VIII. HARDWARE/ COMPUTER USED

Blue Gene/P specifications:

1. 4,096 quad-core nodes.
2. Each core is a PowerPC of 4.5, 8.5 GHz
3. It consists of more than 6*1013flops
4. 15 terabytes memory
5. 1 PetaByte of disk space.
6. Operating system used is Linux SuSE SLES 10

This machine marked as 99th fastest supercomputer in the world in November 2009.

Fig. Blue Gene/P's processing system outer view

IX. MERITS

1. It can help deaf people to hear with the help of direct nerve stimulation.
2. The activity and thinking of different animals can be understood by interpretation of electric impulse from their brain.
3. Even after the death of a person his/her intelligence can be used for development of the society.

X. DEMERITS

1. Human will become dependent on machines.
2. Super computers use a large amount of power as much as 1MW.
3. If the neural schema of a particular person is hacked which is uploaded on blue brain can be misused.
4. Since we are providing a brain to machine, so thoughtfully it increases the risk of machine taking over the person.

XI. APPLICATIONS

1. Data of 100 years can be tested.
2. Neural Code can be cracked.
3. Information Processing of Neocortical can be understood.
4. Whole brain simulation can be studied.
5. A drug for the Brain Disorders.

.

XII. CONCLUSION

Human brain is complex than any circuitry in the world. And we are able to scan ourselves in the computer in near future. The only serious threats raised are also overcome as we note the combination of biological and digital technologies. Despite all the problems and complexity faced in the implementation of this project, it is predicted that the project will be capable by the year 2023. As said by Henry Markam, "As with Deep Blue, Blue Brain will allow us to challenge the foundations of our

understanding of intelligence and generate new theories of consciousness."

ACKNOWLEDGMENT

We would like to acknowledge the contribution of all the people who have helped me in completing this paper. We would also like to thank my family who supported me in the course of writing this paper.

REFERENCES

[1] Blue Brain - The Future Generation by Siva Kumar Avula in IJAIEM Volume 2, Issue 3, March 2013.

[2] http://www.ijaiem.org/Volume2 Issue3/IJAIEM-2013-03-28- 091.pdf

[3] Joha Johansson C & Lansner A.Towards cortex sized artificial neural systems. Neural Networks nsson C and Lansner A., Towards cortex sized artificial neural systems. Neural Networks, 2007

[4] Henry Markram builds a brain in supercomputer, TED conference July 2009

[5] Henry Markram, "The Blue Brain Project".

[6] http://bluebrainproject.epfl.ch.

[7] http://research.ibm.com/bluebrain.

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Current Status of Medicinal Plants in the Bokaro District of Jharkhand

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Abstract- Local inhabitants in rural areas of Jharkhand rely on traditional medicine as their primary form of health care, yet they are in danger of losing both their knowledge and the plants they have used as medicines for millennia. The study was conducted in the rural areas of Bokaro District. The aim of this study which included an ethnobotanical survey was to assess the current level of knowledge about medicinal plants and to analyze and catalogue such knowledge based on relative frequency citation (RFC) and use value (UV).

Index Terms- Ethnobotany, Medicinal Plants, Quantitative Analysis, Jharkhand

I. INTRODUCTION

Documentation of plants used for medicinal purpose is not new in India. There are many traces of this in ancient literature as they are essential for human survival [1,2]. The process has continued till date for various reasons. Botanists and local healers have preserved the knowledge about the local medicinal plants. There have been many surveys and documentation in different regions of India pertaining to existing status of medicinal plants. The state of Jharkhand lies in the eastern part of India spreading over an area of 7.97 million hectares, with a population of over 2,69,09428. Out of this total population, 28% belongs to the schedule tribes. The state is geographically known as Chhotanagpur Plateau, which forms the north eastern portion of peninsular plateau of India (Bhatt 2002). 29% of the total geographical area is occupied by forest. The huge forest cover signified the name Jharkhand which literally mean "the region of forest." A number of plants are used by the tribals in some form or other for the treatment of their various ailments. Haines (1925) in his book referred the local uses of plants. Hoffman (1950) in his "Encyclopedia Mundarica" and Bressers (1951) in his "Botany of Ranchi Districts" have mentioned the tribal uses of various plants of Chotanagpur. Ghosh (1971) in his floristic study of "Ranchi District" and Sahu (1986) in his "Ethnobotanical and ethnomedicobotanical studies of some plants of Santhal Pargana and Chotanagpur" have mentioned various uses of plants. A comprehensive investigation has been carried out in the area and the medicinal uses has been correlated with the uses in various parts of the country (Jain 1991;

Badoni 1995). More than 70% of the total population of the state is exclusively dependent on the herbs and traditional healers for maintaining a reasonable level of health (Tomar, 2002). The state is rich in biodiversity of medicinal plants and their traditional uses (Mairh et.al 2010, Lal and Singh, 2012)

The present study examined whether (i) local inhabitants are knowledgeable about the medicinal use of these plants (ii) the local inhabitants continue to practice herbal medicine in the treatment of sickness within their home (iii) names of the plants used for the treatment of various diseases (iv) the quantitative analysis of the knowledge of medicinal plants.

To our knowledge no ethnobotanical exploration had previously been conducted in this area. The information gained from this study may help in conducting further studies and projects aimed at documenting herbal knowledge in communities and supporting continued practice and sustainability of traditional herbal medicine in this area of Jharkhand and elsewhere.

II. STUDIED AREA

Bokaro district lies in the eastern portion of the state of Jharkhand in India (Plate 1 & 2). It is bounded by Giridih District in the North, West Bengal in the South, Dhanbad in the East, and Hazaribagh in the West. The total geographical area of the district is 2,861 sq. km. There are 9 blocks in the district.

Plate – I – Showing map of India

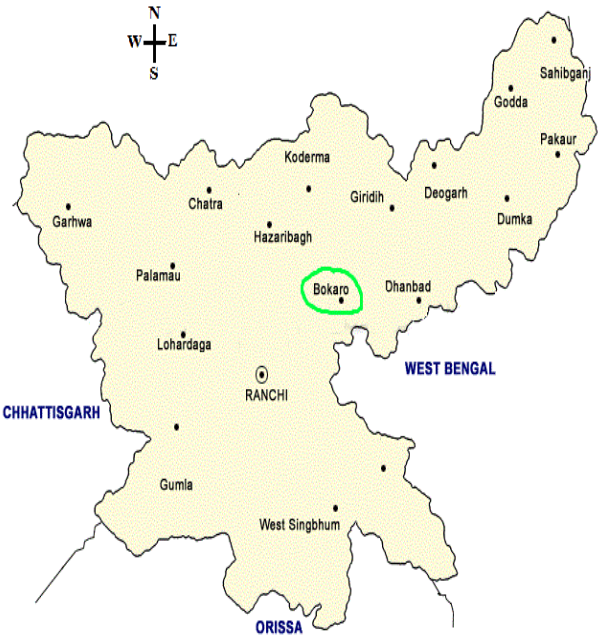

Plate – II – Showing map of Jharkhand (Bokaro District)

III. ETHNOMEDICINAL DATA COLLECTION AND ETHNOGRAPHIC COMPOSITION

The field data was collected during the period July 2013 to August 2014. It was started in rainy season and collections were repeated every two months of the year. Field work consisted of data documentation, plant collection and photography. A combination of focus group, individual interviews, field – walk / discussions and one local market survey was conducted with a tertiary educated translator present at each session. A total of 35 men 25 women and 5 vaidyas (traditional healers) were interviewed. Most of the informants belonged to an age between 50 and 70 years. The selection of informants was mainly based on their rich indigenous knowledge and long term experience of utilization of plants.

The informants were asked various questions about their traditional knowledge, plant use, disease treated, part used and the method of preparation and administration.

During the field visit the survey of data collection was made in different places i.e. waste lands, bare lands, play ground, road side, agricultural farms and near other localities. The collected samples of plants were brought to the department for identification. The serial number, vernacular name, botanical name, family, part used, life form and their medicinal uses were noted. The identification of plant material was carried out with the help of Hains, Flora (1925).

IV. SOCIO-ECONOMIC CONDITION OF THE DISTRICT

Some cities of the district have access to modern health facilities due to industrialization and the associated modern culture. They have access to hospitals. However the population of local inhabitants (tribals and non-tribals) uses traditional medicine due to the relatively low cost of traditional medicine, belief in their cultural practices and difficult access to modern health facilities. Even in cities/small towns where modern health services are more accessible and specialized, many people go to traditional healers showing the cultural acceptability of such practices.

V. QUANTITATIVE ETHNOMEDICINAL DATA ANALYSIS

Relative Frequency Citation (RFC)

The collected ethnomedicinal information was quantitatively analyzed using an index of relative frequency citation (RFC) as;

RFC = FC/N (0 < RFC < 1)

This index shows the local importance of each species and it is given by the frequency of citation (FC, the number of informants mentioning the use of the species) divided by the total number of informants participating in the survey (N), without considering the use-categories.

Use Value (UV)

The Use Value (UV) demonstrates the relative importance of plants known locally. It was calculated using the following formula

$$UV = \sum Ui/N$$

Where Ui is the number of uses mentioned by each informant for a given species and N is the total number of informants.

VI. RESULTS AND DISCUSSION

Medicinal plant diversity and part used

A total of 99 plant sps. belonging to 90 genera of 51 families were recorded with traditional uses as herbal medicine against various diseases. The most encountered medicinal plant families were Euphorbiaceae (8 sps.), Lamiaaceae (6 Sps.) Moraceae (5 sps.), Catharanthaceae (4 sps.), Caesalpinaceae (4 sps.), Rutaceae (4 sps.) and Fabaceae (4 sps.) each.

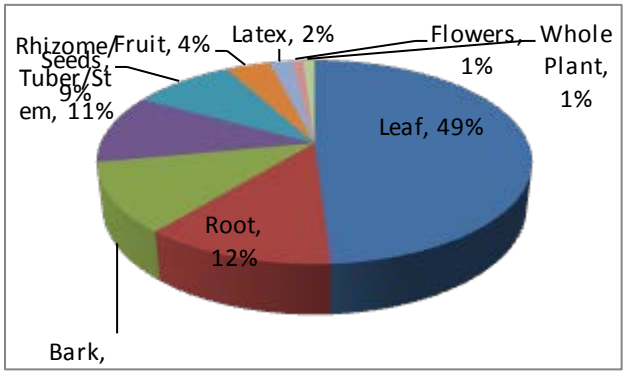

Fig-I : Showing % of plant parts used

The parts of the plant primarily used are the leaves (49%), Roots (12%), Bark (11%), Rhizome / tuber / stem (11%), Seeds (9%), Fruit (4%), Latex (2%), Flowers (1%) and whole plant (1%) are also frequently used. (Fig. I)

It was found that the highest number of plant species are used against stomach ache (12 sps.), followed by Rheumatism (11 sps.), Worins (10 sps.) for diarrhea and dysentery (8 sps.) for treatment of Jaundice (7 sps.), as a tonic and for skin diseases (6 sps.) each, for cold and fever, asthama and menstrual problems (5 sps. each) for teeth problems, snake bite and eye problems (3 sps. each) while for sore throat, pneumonia, epilepsy and brain disorders, typhoid, scorpion and insect sting as well as for hypertension (2 sps.) each are used.

The traditional healers diagnose ailments by their signs and symptoms rather than specific laboratory tests as this knowledge run through generations.

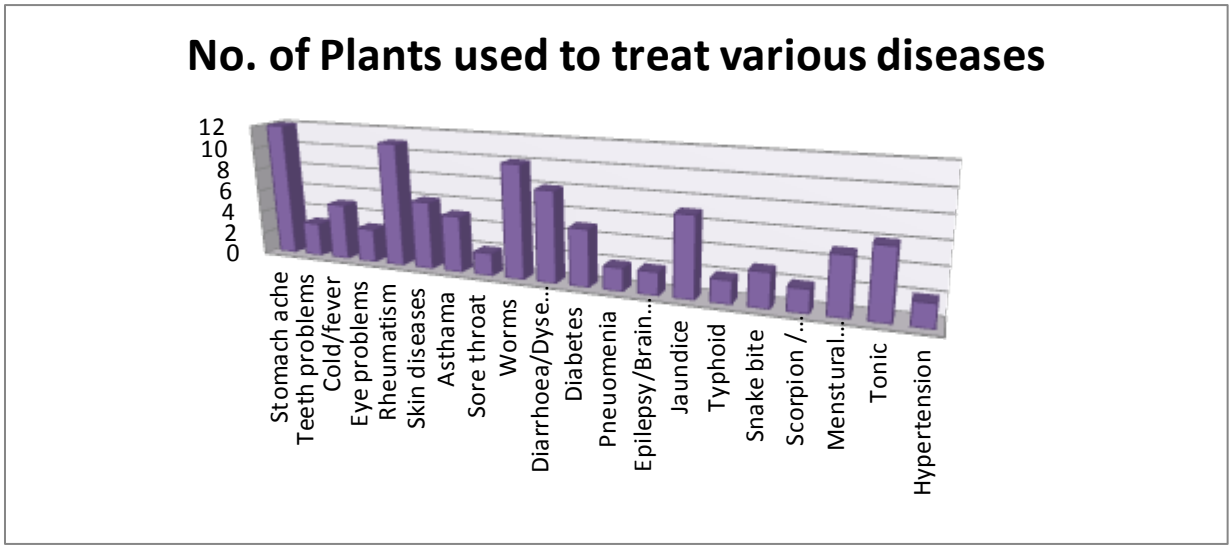

Fig-II : Showing number of plants used to treat various diseases

Data on Quantitative ethnomedicinal uses

Quantitative value indices were calculated in this study to analyse the ethnomedicinal information. There were 16 most cited plants known by a majority of the informants for medicinal uses *Emblica officinalis* ranked first (92.3%) in RFC, followed by *Ocimum sanctum*, *Maduca indica* (90.7%), *Terminalia chebula*, *T. behera* (89.2%) ranked third. These positions correspond to the fact that these plants were reported by highest number of informants mentioning the use of this plant. The value of RFC ranges from 30 percent to 92 percent in the medicinal use of these plants / herbs. The former is linked to *Butea monosperma from the family Fabaceae while the latter is associated with Emblica officinalis from family Euphorbiaceae.* However on overage the relative frequency of citation is 66%.

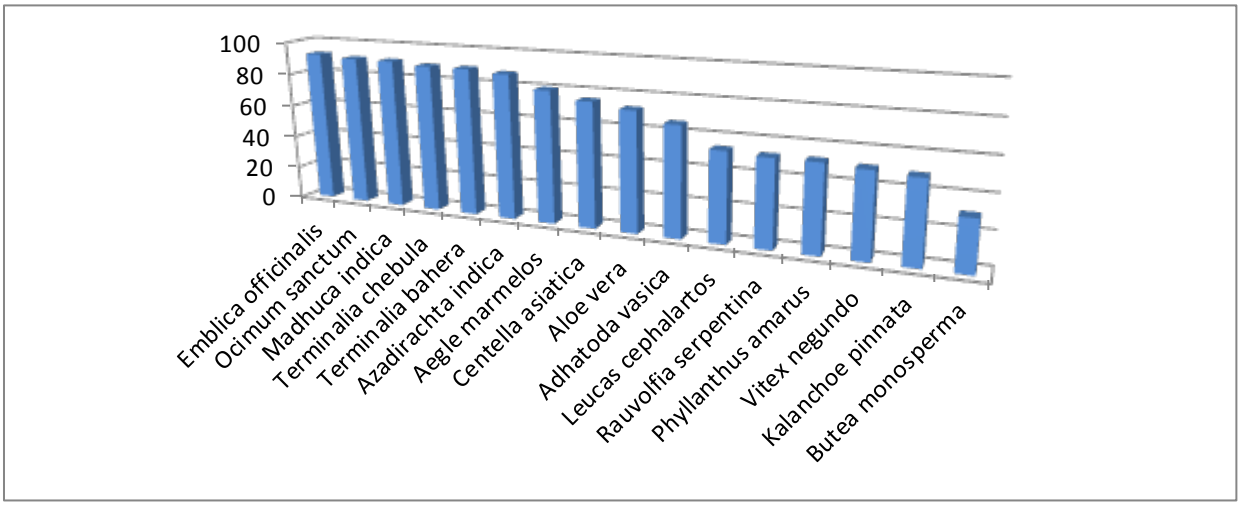

Fig-III : showing plant species with highest Relative Frequency of citation (RFC).

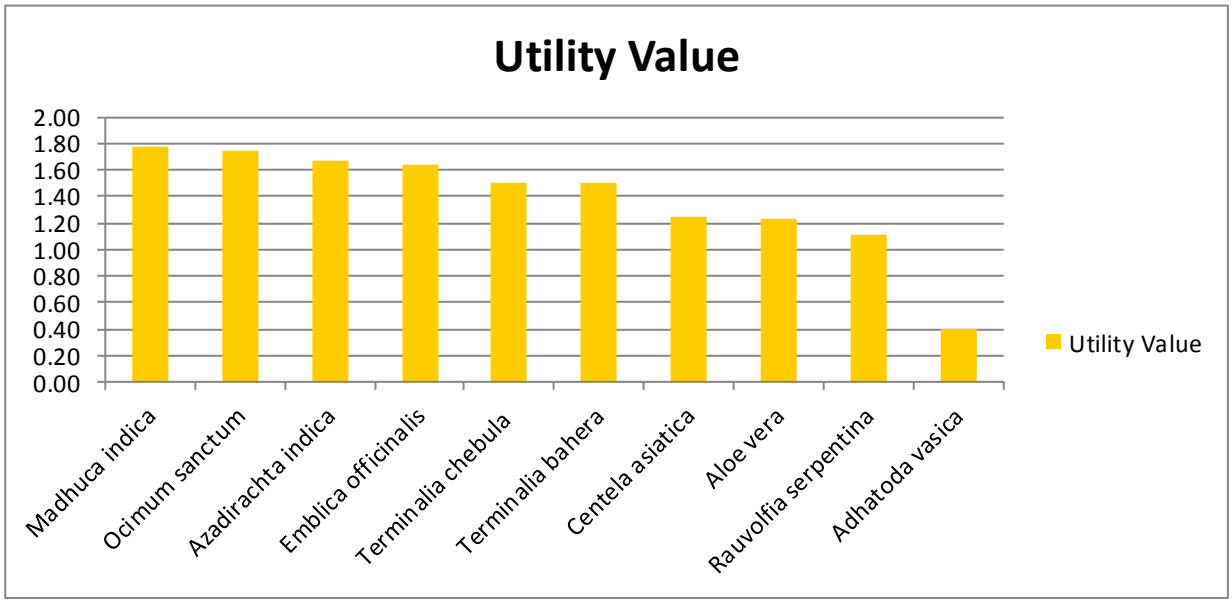

Fig-IV: showing utility value of different plants

Fig.(IV) shows 9 most popular medicinal plants with highest use value reported by the informants. It shows *Madhuca indica* and *Ocinum sanctum* has highest use value (1.76), followed by *Emblica officinalis* and *Azadirachta indica* (1.64) and *Terminalia Chebula* and *T. behera*. *Ocinum sanctum* is extensively used in the treatment of cold and cough, fever and in combination with other plants for the treatment of epilepsy, malaria, an poliomyelitis while *Madhuca indica* is used to control temperature, gas, chicken pox and dandruff besides making alcoholic beverage.

The UV of studied plants ranged from 0.46 to 1.76 which shows least relative importance of *Adhathoda vasica* from family Lamiace highest importance to *Ocimum sanctum* and *Madhuca indica* from families Lamiaceae and Sapotaceae respectively. These findings are consistent with that from RFC.

VII. CONCLUSION

This study reports the quantitative ethnomedicinal survey in some selected area of Bokaro District of Jharkhand. Among 99 plants species belonging to 51 families were reported. The families Euphorbiaceae, Lamiaceae and Fabaceae are the most used families in this area. The leaves are the favoured part of the plant. The most popular medicinal plants of this region known by local communities include *Emblica officinalis, Ocimum sanctum, Madhuca indica, Terminalia chedula, T. behera, Azadirachta indica, Aegle marmelos* and *Centella asiatica* based on their highest UV and RFC taken. In this way, we have compiled significant baseline data regarding indigenous knowledge about the native medicinal plants for treating common ailments is now ready to be further investigated phytochemically and

pharmacologically which may lead to natural drug discovery and development.

The medicinal plants of this area threatened by major factors such as by setting up of industries, habitat degradation, grazing and expansion of new agricultural lands.

ACKNOWLEDGEMENT

The present investigation was carried out under minor project UGC (E.RO Kolkata). The financial assistance in the form of Principal investigator is thankfully acknowledged.

REFERENCES

[1] Badoni, A. K. 1995 : Garhwal Himalaya Men Vaivilc Vividhta Sanrakshan avam state Vikas hetu Jari Booti Udhyog soc. Hin. Env Res. Charkrata Road, Vikas Nagar, Dehradun, U.P.

[2] Bhatt, S. C. 2002 The district Gazetteer of Jharkhand, Gyan Publishing House, New Delhi.

[3] Bressers, J. 1951. The Botany of Ranchi District. Bihar, India. –Ghosh->

[4] Jain S. K. 1991. Dictionary of Indian Folk Medicine and Ethnobotany, Deep Publications.

[5] Ghosh, T. K. 1971. Studies on flora of Ranchi District Ph.D. Thesis, Ranchi University, Ranchi.

[6] Haines, H. H. 1924, The Botany of Bihar and Orissa. Reprint 1961. Vol. 1-3 (Botanical Survey of India, Calcutta) PP. 1-1372.

[7] Hoffmann, J, 1950, Encyclopedia Mundarica Vol 1-13.

[8] Lal, H and Singh (2012) : in Medicinal Plants of Jharkhand. Biodiversity of Hazaribagh district.

[9] Mairh, Asutosh Kumar, Mishra, P. K. etc. at 2010, Traditional Botanical Wisdom of Birhor tribes of Jharkhand. Indian Journal of Traditional Knowledge. Vol. 9 (3) July PP 467-470.

[10] Sahu, S. C. 1986. Ethnobotany and Medicobotanical studies on some important plants of Santhal Parganas and Chotanagpur, Ph.D. Thesis R. U. Ranchi.

[11] Sastri, K, Chaturvedi, G.N. In Charak Samhita 22 revised, Sastri, R. Uppadhaya, Y., Pandey. G. S. editor C. Bharti Academy, Varanasi

[12] Tomar, J.B. 25-27, Dec.2002, Tribal Medicinal Plants of Jharkhand and their uses. Proc. Natl. Sem. PP 76-77.

[13] Topno, S. Mukherjees P., Ghosh, T. K. 1999 Exclusive Medicinal uses of some plants in Khunti subdivision of Chhotanagpur. “Damodar Basin” A most fragile part of India.

[14] Tulsidas, Rancharit manas P.63.

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Combined Real and Reactive Power Economic Dispatch using Multi-Objective Reinforced Learning with Optimized Losses

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Abstract- Most of the economic dispatch (ED) works so far deal with real power dispatch only. With the integration of renewable energy into the grid, reactive power dispatch cannot be ignored any longer due to its importance in providing security and reliability in power system planning, operation and control. This paper deals with the formulation of combined real and reactive economic dispatch (CRRED) subject to equality, inequality and stochastic constraints. An effective algorithm that uses a hybrid of distributed slack bus (DSB) formulated using combined participation factors (PF) and multi objective reinforcement learning (MORL) is proposed in this paper. The IEEE 14 Bus was used to validate the effectiveness of the proposed CRRED formulation and Hybrid method .The numerical results obtained show that combining real and reactive power results in a 0.95% decrease in the overall generation cost as compared to a case in which only real power is considered. Further, when the losses are distributed in the entire network using the DSB, then the overall generation cost is reduced by 29.6% due to the reduced losses in DSB model.

Index Terms- *Combined Real and Reactive Economic Dispatch (CRRED), Distributed Slack Bus (DSB), Participation Factors (PF), Reinforcement Learning (RL)*

I. INTRODUCTION

Reactive power production is highly dependent on the real power output. However, reactive power production by a generator reduces its capability to produce active power. Hence the production of reactive power by generator will result in reduction of its active power production. In addition Renewable power systems generate and absorb reactive power at the same time,leading to a stochastic reactive power scenario. Thus the place of reactive power in the modern power system cannot be ignored any longer. The objectives of reactive power (VAR) optimization, which include Reactive Power ED (RPED), are to improve the voltage profile, to minimize system active power losses, and to determine optimal VAR compensation placement under various operating conditions. To achieve these objectives, power system operators utilize control options such as adjusting generator excitation, transformer tap changing, shunt capacitors, and SVC. There has been a growing interest in VAR optimization problems over the last decade. Solving Optimal RPED (ORPED) is gaining more importance due to their effectiveness in handling the inequality constraints and discrete values using hybrid methods as compared to the deterministic and heuristic methods. Thus better method are needed to handle the more complex problems where stochastic reactive power from wind and solar generators are involved.

II. REVIEW OF REACTIVE POWER ECONOMIC DISPATCH (RPED)

Various aspects of reactive power have been considered in past researches. Deterministic methods have been used in past researches to handle problems related with reactive power optimal flow .These include Unified Method (UM) by Lee, K.Y, Park Y.M, and Ortiz, J. L, 1985 [1] ,Linear Programming (LP) and Quadratic Programming (QP) by Serrano, B. R. Vargas, 2001 [2],Mean-Variance Mapping Optimization (MVMO) by Worawat Nakawiro et al, 2011 [3],Superiority of Feasible solutions (SF), Self-adaptive Penalty (SP), εε-constraint (EC), Stochastic Ranking (SR), and the Ensemble of Constraint Handling Techniques (ECHT) by R. Mallipeddi et al,2012 [4] and Second Stochastic Chance-Constrained Model (SSCCM) by Lopez, J.C. et al, 2012 [5].Heuristic methods such as Adaptive Genetic Algorithm (AGA) has also been considered by Q.H. Wu, Y.J. Cao, J.Y. Wen, 1998 [6].In all these works, the Cost function for the reactive power economic dispatch not formulated and further only Static reactive power has been considered .Thus, there is need to formulate the reactive power cost function, determine the cost coefficients and finally come up with a method in which the real and reactive costs can be combined. It can also be noted that only pure methods have been employed in this problem. These methods are strong and weak at the same time, thus there is need to use a hybrid methods which exalts the strengths and suppresses the weaknesses.

In previous studies different techniques have been suggested to determine the reactive power pricing [15-23]. For example, Niknam et al., 2004[21], utilized various search techniques such as genetic algorithm (GA) and ant colony algorithms (ACO) for pricing and Chung et al. 2004[23] proposed a coupled market framework for energy and reactive power. Further, Bialek and Kattuman,2004 [22] developed an integrated method to calculate both real and reactive power spot price and to decompose them into the prices of selected ancillary services.

III. PROBLEM FORMULATION

In order to obtain a more accurate cost function, the reactive power cost is to be included in the active power cost function. The total cost is given by combining the active and reactive power cost by a weighting function,giving the active power more weight than the reactive power.

Real Power Dynamic Economic Dispatch

For real power,dynamic economic dispatch (DED) considers change-related costs. The DED takes the ramp rate limits, valve points and prohibited operating zone of the generating units into consideration. The general form of DED was formulated by **Yusuf Somez, 2013[7]** as is given by

$$\mathrm{F}(P_{ij}) = \left\{ a_{0,i} + \sum_{j=1}^{L=N_G} a_{ji} P_{t,i}^{j} + r_i \right\} + \left| e_i \sin f_i (P_i^{min} - P_i) \right| \qquad (1)$$

where $a_{0,i}, a_{j,i}, e_i$ and f_i are the cost coefficients of the i^{th} unit, P_i^{min} is the lower generation bound for the i^{th} unit and r_i is the error associated with the i^{th} equation. The problem is solved subject to the following constraints:

$$\sum_{i=1}^{NG} P_{gi} = P_D + P_L \qquad (2)$$

$$P_i^{min} \le P_i \le P_i^{max} \qquad (3)$$

$$P_{ij} - P_{ij-1} \le UR_i \qquad (4)$$

$$P_{ij-1} - P_{ij} \le DR_i \qquad (5)$$

$$-P_l^{max} \le P_{lj} \le P_l^{max} \; l = 1,2,3 \ldots \ldots L \qquad (6)$$

$$P_i \le P^{PZ,LOW} \qquad (7)$$

$$P_i \ge P^{PZ,HIGH} \qquad (8)$$

Reactive Power Economic Dispatch

According to Hasanpour, S., et al 2009[15] the fuel cost function for the reactive power output can be expressed as

$$\mathrm{F}(Q_{gi}) = a_{q,o} + \sum_{j=1}^{L=N_G} a_{qi} Q_{g,i}^{j} \qquad (9)$$

Where $a_{q,o}$ and a_{qi} are the reactive power cost coefficients calculated using a curve fitting method, Q_{gi} is the reactive power generated by generator i and n is the order of the fuel cost function . This equation has been extracted from the reactive power cost function of the generator.It is simple,realistic and can therefore provide realistic results in reactive power pricing[15]. The problem is solved subject to the following constraints:

Power balance constraints

$$P_i - V_i \sum_{j=1}^{N_B} V_j \left(G_{ij} \cos\theta_{ij} + B_{ij} \sin\theta_{ij}\right) = 0 \qquad (10)$$

$$i = 1,2,3 \ldots \ldots N_B - 1$$

$$Q_i - V_i \sum_{j=1}^{N_{PQ}} V_j \left(G_{ij} \sin\theta_{ij} - B_{ij} \cos\theta_{ij}\right) = 0 \quad (11)$$

$$i = 1,2,3 \ldots \ldots N_{PQ}$$

Continuous control variable (Generator Bus Voltage)

$$V_i^{min} \leq V_i \leq V_i^{max} \; i \in N_B \qquad (12)$$

Discrete control variable (Transformer Tap Settings)

$$t_k^{min} \leq t_k \leq t_k^{max} \; i \in N_T \qquad (13)$$

Where t_k is the tap setting of transformer at branch k

State variables

$$Q_{Ci}^{min} \leq Q_{Ci} \leq Q_{Ci}^{max} \; i \in N_C \qquad (14)$$

$$Q_{gi}^{min} \leq Q_{gi} \leq Q_{gi}^{max} \; i \in N_G \qquad (15)$$

$$|S_i| \leq S_i^{max} \qquad i \in N_i \qquad (16)$$

Reactive power balance

$$\sum_{i=1}^{N_G} Q_{Gi} + \sum_{j=1}^{N_G} Q_{cj} = \sum_{k=1}^{N_D} Q_{dk} + Q_L \qquad (17)$$

In these constraints, Q_{Ci} is the reactive power generated by the i^{th} capacitor bank, Q_{gi} is the reactive power generated at bus i, S_i is the apparent power flow through the ith branch, N_B is the total number of buses, $N_T is$ the number of tap setting transformer branches, N_C is the number of capacitor banks and N_g is the number of generator buses, Q_{Gi} Reactive power generated by generator i, Q_{cj} Reactive power generated and absorbed by VAR compensation device j such as capacitors,SVC,Wind Based Doubly Fed Induction Generators s(DFIGs), and PV generators, Q_{dk} Reactive power load at load bus k and Q_L Power system reactive power power loss and absorption .Further , V_i is the voltage magnitude at bus i , V_j is the voltage magnitude at bus j, P_i, Q_i is the real and reactive powers injected at bus i, G_{ij}, B_{ij} is the mutual conductance and suspectance between bus i and j , $N_B - 1$ is the total number of buses excluding the slack bus, N_{PQ} is the number of PQ buses and θ_{ij} is the voltage angle difference between bus i and bus j.

Combined Real and Reactive Economic Dispatch (CRRED)

In order to obtain a more accurate optimal cost, the reactive power cost is to be included in the active power cost function. The total cost is given by combining the active and reactive power cost, giving the active power more weight than the reactive power.The CRRED objective function for dynamic reactive power is formulated as

$$Minimize\ F_{Total} = \sum_{i=1}^{NG} WF(F_{gi}) + (1-W)F(Q_{gi}) \qquad (18)$$

Where W is the weight attached to the real power.

IV. MULTI OBJECTIVE REINFORCED LEARNING (MORL) WITH DISTRIBUTED SLACK BUS (DSB) [MORL-DSB]

In the past researches, heuristic and deterministic methods haven been widely used in the real power economic dispatch[1-6,15-23] due to their ability to solve such optimization problems with speed and accuracy. Musau et al,2015 [24] did a detailed review of the methods that have been used so far in solving the Multi Objective Dynamic Economic Dispatch (MODED). A more recent trend for solving MODED is the two-method and three-method hybrids formulation in which all the weaknesses of the base methods (that is, deterministic and heuristic methods) are suppressed and the strengths exalted. This leads to increased accuracy and speed in handling higher order cost functions with more objectives. However, hybrid methods have not been applied to CRRRED problems. This paper utilizes a hybrid of MORL and DSB for the first time.

a) Multi Objective Reinforced Learning[MORL]

The RL used in this case has been suggested by, E. A. Jasmin et al, 2011[13].The solution consists of two phases: *learning phase* and *retrieval phase*.To carry out the learning task, one issue is regarding how to select an action from the action space. The two commonly used action selection methods are **ε-greedy** and **pursuit**. In this paper, ε-greedy strategy of exploring action space is used.For solving this multi-stage multi-objective problem using RL, first step is fixing of state space χ and action space $\mathcal{A}$ precisely. The different units can be considered arbitrarily as corresponding to the different stages. The modification is that a MORL which can incorporate both real and reactive power is proposed. RL has the merits of faster computing speed and simplicity,it can effectively handle stochastic cost functions especially in RE environment .Also the method can also handle a great number of the Constraints. The flow chart of MORL is as shown in Figure 1.o

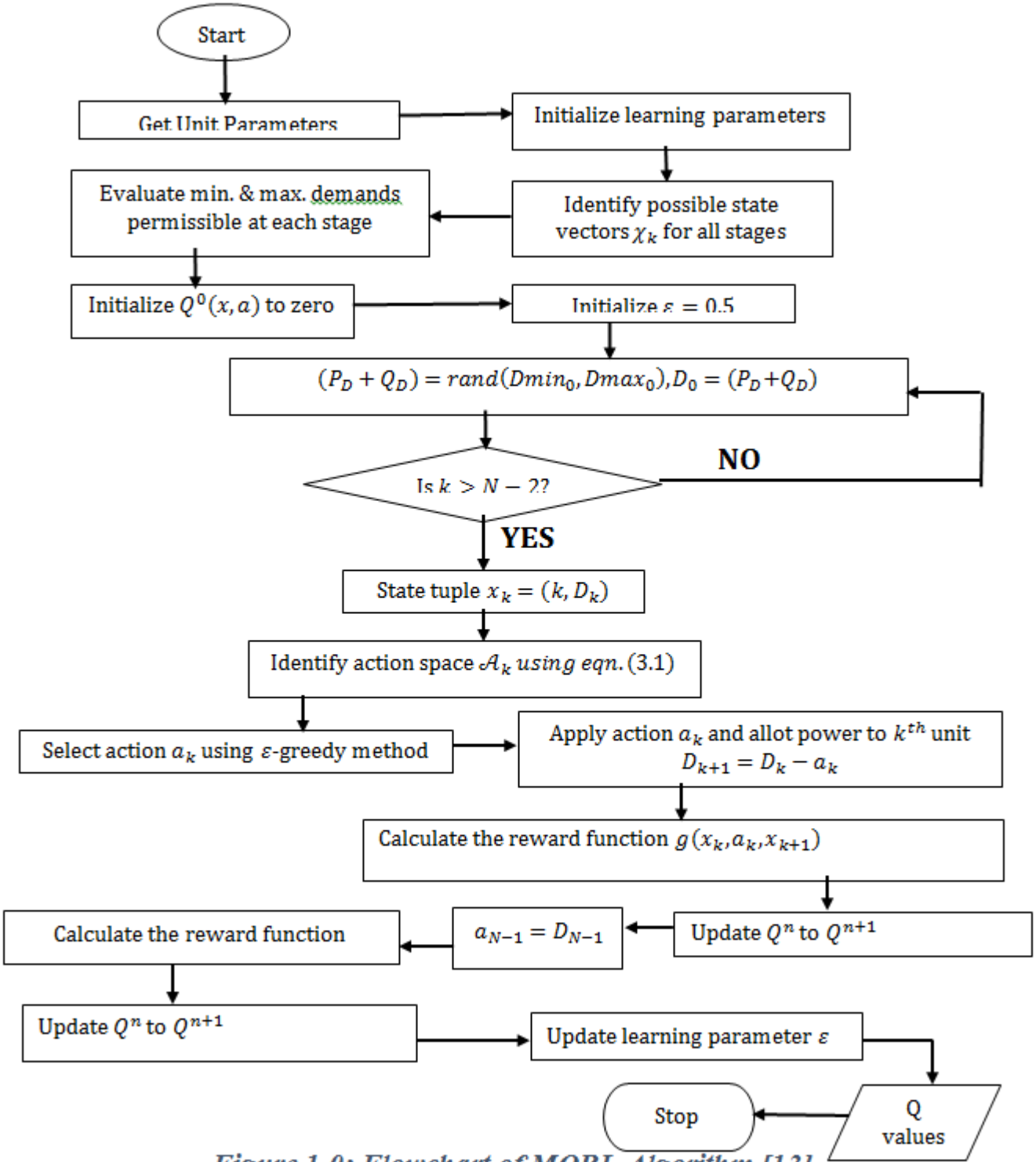

Figure 1.0: Flowchart of MORL Algorithm [13]

b)DSB with MORL (DSB-MORL)

Tong and K.Miu [8-11] formulated a real power DSB using the Newton Raphson Method. In this case real power participation factors (PF) were utilized to model the losses. Musau et al,**2012**[12] developed reactive power DSB then applied the results in [8-11] to come up with combined DSB which can handle both real and reactive power. In this paper, this combined DSB has been used to optimize the real and reactive losses, which is, compared to the Single Slack Bus (SSB) model. DSB results in reduced real and reactive power losses .MORL is then utilized to handle the CRRED in which the losses have been optimized by the DSB.

V. RESULTS AND ANALYSIS

Simulations were carried out on an Intel Core i3, 2.10 GHz, 4-GB RAM processor. The coding is written in MATLAB 2013a version. A hybrid of RL-DSB algorithm was used for solving the CRRED problem. The IEEE-14 bus system used to validate the method consists of 14 buses, 5 generators and 20 lines.The results consists of four parts,a load flow for the DSB and SSB,MORL, MORL-DSB and a comparison with other methods in the existing literature.

a) SSB and DSB Load flows

A load flow for the IEEE 14 Bus system was performed to illustrate the need for DSB,and the corresponding participation factors in CRRED problem. From tables 1.0-4.0,it is evident that DSB leads to reduced combined losses as compared to the SSB.The integration of the reactive power participation factor(RPPF) reduces the real losses to a great extent.

Table 1.0: Output Data with Single Slack Bus (SSB)

Bus No.	V (pu)	Angle	P_G	Q_G	P_L	Q_L	P_I	Q_I
1	1.0600	0.0000	232.593	-15.233	0.000	0.000	232.593	-15.233
2	1.0450	-4.989	40.000	47.928	21.700	12.700	18.300	35.228
3	1.0100	-12.7487	0.000	27.758	94.200	19.000	-94.200	8.758
4	1.0133	-10.2429	0.000	0.000	47.800	-3.900	-47.800	3.900
5	1.0166	-8.7606	0.000	0.000	7.600	1.600	-7.600	-1.600
6	1.0700	-14.447	0.000	0.000	11.200	7.500	-11.200	15.526
7	1.0457	-13.2375	0.000	23.026	0.000	0.000	0.000	0.000
8	1.0800	-13.2375	0.000	0.000	0.000	0.000	0.000	21.030
9	1.0306	-14.8207	0.000	21.030	29.500	16.600	-29.500	-16.600
10	1.0299	-15.0365	0.000	0.000	9.000	5.800	-9.000	-5.800
11	1.0461	-14.8584	0.000	0.000	3.500	1.800	-3.500	-1.800
12	1.0533	-15.2974	0.000	0.000	6.100	1.600	-6.100	-1.600
13	1.0466	-14.2814	0.000	0.000	13.500	5.800	-13.500	-5.800
14	1.0193	-16.0721	0.000	0.000	14.900	5.000	-14.900	-5.000
	TOTAL		**272.593**	**104.509**	**259.000**	**73.500**	**13.593**	**31.009**

Table 2. 0 :Line Flows and Losses with Single Slack Bus(SSB)

From-To	P(MW)	Q(Mvar)	From-To	P(MW)	Q(Mvar)	Loss (MW)	Loss(Mvars)
1-2	157.080	-17.484	2-1	-152.772	30.369	4.309	13.155
1-5	75.513	7.981	5-1	72.740	3.464	2.773	11.455
2-3	73.396	5.936	3-2	71.063	3.894	2.333	9.830
2-4	55.943	2.935	4-2	54.273	2.132	1.670	5.067
2-5	41.733	4.738	5-2	40.813	-1.929	0.920	2.890
3-4	-23.137	7.752	4-3	23.528	-6.753	0.391	0.998
4-5	-59.585	11.574	5-4	60.064	-10.063	0.479	1.511
4-7	27.066	-15.396	7-4	-27.066	17.372	0.000	1.932
4-9	15.464	-2.640	9-4	15.464	3.932	0.000	1.292
5-6	45.889	-20.843	6-5	-45.889	26.617	0.000	5.774
6-11	8.287	8.898	11-6	-8.165	-8.641	0.123	0.257
6-12	8.064	3.176	12-6	-7.9485	-3.008	0.081	0.168
6-13	18.337	9.981	13-6	-18.085	-9.485	0.252	0.496
7-8	0.000	-20.362	8-7	0.000	21.030	0.000	0.668
7-9	27.066	14.798	9-7	-27.066	-13.840	0.000	0.957
9-10	4.393	-0.904	10-9	-4.387	0.920	0.006	0.016

9-14	8.637	0.321	14-9	-8.547	-0.131	0.089	0.190
10-11	-4.613	-6.720	11-10	4.665	6.841	0.051	0.120
12-13	1.884	1.408	13-12	-1.873	-1.398	0.011	0.010
13-14	6.458	5.083	14-13	-6.353	-4.869	0.105	0.215
TOTAL LOSS						**13.593**	**56.910**

Table 3. 0: Output Data with Distributed Slack Bus (DSB) using Real Power PF

Bus No.	**V (pu)**	**Angle**	**P_G**	**Q_G**	**P_L**	**Q_L**	**P_I**	**Q_I**
1	1.0700	11.8713	232.408	6.325	0.000	0.000	232.408	6.325
2	1.0450	7.1139	40.001	27.802	21.700	12.700	18.301	15.102
3	1.0100	-0.6377	0.000	27.037	94.200	19.000	-94.200	8.037
4	1.0144	1.8474	0.000	0.000	47.800	-3.900	-47.800	3.900
5	1.0186	3.3143	0.000	0.000	7.600	1.600	-7.600	-1.600
6	1.0700	-2.3537	0.000	21.944	11.200	7.500	-11.200	14.444
7	1.0462	-1.1461	0.000	0.000	0.000	0.000	0.000	0.000
8	1.0800	--1.1461	0.000	20.695	0.000	0.000	0.000	20.695
9	1.0311	-2.7297	0.000	0.000	29.250	16.600	-29.500	-16.600
10	1.0304	-2.9452	0.000	0.000	9.000	5.800	-9.000	-5.800
11	1.0464	-2.7663	0.000	0.000	3.500	1.800	-3.500	-1.800
12	1.0533	-3.2039	0.000	0.000	6.100	1.600	-6.100	-1.600
13	1.0467	-3.2385	0.000	0.000	13.500	5.800	-13.500	-5.800
14	1.0196	-3.9797	0.000	0.000	14.900	5.000	-14.900	-5.000
	TOTAL		**272.409**	**103.803**	**259.000**	**73.500**	**13.409**	**30.303**

Table 4.0: Line Flows and Losses with Distributed Slack Bus(DSB) using Real Power PF

From-To	**P(MW)**	**P(MW)**	**From-To**	**P(MW)**	**P(MW)**	**Loss (MW)**	**Loss(Mvars)**
1~2	156.840	0.349	2~1	-152.677	12.364	4.164	12.713
2~3	75.567	11.815	3~2	-72.807	-0.419	2.761	11.397
2~4	73.320	5.944	4~2	-70.991	3.866	2.328	9.810
1~5	55.924	2.243	5~1	-54.257	2.815	1.667	5.058
2~5	41.735	3.572	5~2	-40.820	-0.778	0.915	2.794
3~4	-23.209	7.058	4~3	23.595	-6.071	0.387	0.987
4~5	-59.725	9.739	5~4	60.200	-8.241	0.475	1.499
5~6	27.100	-15.087	6~5	-27.100	16.999	0.000	1.912
4~7	15.487	-2.515	7~4	-15.487	3.804	0.000	1.289
7~8	45.827	-20.042	8~7	-45.827	25.706	0.000	5.664
4~9	8.253	8.793	9~4	-8.132	-8.541	0.121	0.253
7~9	8.057	3.163	9~7	-7.976	-2.996	0.080	0.167
9~10	18.317	9.927	10~9	-18.066	-9.433	0.251	0.494
6~11	0.000	-20.049	11~6	0.000	20.695	0.000	0.647
6~12	27.100	14.825	12~6	-27.100	-13.866	0.000	0.959
6~13	4.424	-0.807	13~6	-4.418	0.823	0.006	0.016
9~14	8.662	0.384	14~9	-8.572	-0.192	0.090	0.191
10~11	-4.582	-6.623	11~10	4.632	6.741	0.050	0.117
12~13	1.876	1.396	13~12	-1.865	-1.386	0.011	0.010
13~14	6.432	5.019	14~13	-6.328	-4.808	0.104	0.211
TOTAL LOSS					**13.409**	**56.187**	**56.188**

Table 5.0:Line Flows and Losses with Distributed Slack Bus using Reactive Power PF

Bus No.	V (pu)	Angle	P_G	Q_G	P_L	Q_L	P_I	Q_I
1	1.0500	12.0665	223.861	-35.774	0.000	0.000	223.861	-35.774
2	1.0450	7.0834	46.150	57.193	21.700	12.700	24.450	44.493
3	1.0200	-0.6686	2.287	37.215	94.200	19.000	-91.913	18.215
4	1.0142	1.8161	-1.790	-5.224	47.800	-3.900	-49.590	-1.324
5	1.0172	3.3072	2.114	-0.211	7.600	1.600	-5.486	-1.811
6	1.0800	-2.3425	7.030	40.454	11.200	7.500	-4.170	32.954
7	1.0503	-1.1766	-0.000	-5.963	0.000	0.000	-0.000	-5.963
8	1.1000	-1.1738	0.032	31.006	0.000	0.000	0.032	31.006
9	1.0337	-2.7573	-0.000	0.000	29.500	16.600	-29.500	-16.600
10	1.0326	-2.9662	-0.000	0.000	9.000	5.800	-9.000	-5.800
11	1.0475	-2.7727	-2.080	-4.273	3.500	1.800	-5.580	-6.073
12	1.0535	-3.1932	-1.657	-3.322	6.100	1.600	-7.757	-4.922
13	1.0471	-3.2329	-3.344	-6.339	13.500	5.800	-16.844	-12.139
14	1.0213	-3.9896	-0.000	0.000	14.900	5.000	-14.900	-5.000
	TOTAL		**272.603**	**104.762**	**259.000**	**73.500**	**13.603**	**31.262**

Table 6.0 :Line Flows and Losses with Distributed Slack Bus(DSB) for Combined PF

From-To	P(MW)	Q(Mvars)	From-To	P(MW)	Q(Mvars)	Loss (MW)	Loss(Mvars)
1~2	150.170	-33.304	2~1	-146.011	46.002	4.159	12.698
2~3	73.691	3.152	3~2	-71.025	7.853	2.666	11.006
2~4	72.822	0.832	4~2	-70.540	8.783	2.282	9.615
1~5	55.951	2.328	5~1	-54.282	2.736	1.669	5.063
2~5	41.689	4.351	5~2	-40.772	-1.554	0.916	2.797
3~4	-21.374	12.377	4~3	21.767	-11.374	0.393	1.003
4~5	-59.781	12.541	5~4	60.265	-11.014	0.484	1.527
5~6	27.194	-17.195	6~5	-27.194	19.253	0.000	2.058
4~7	15.512	-3.045	7~4	-15.512	4.354	-0.000	1.309
7~8	46.047	-24.905	8~7	-46.047	31.125	0.000	6.221
4~9	10.349	12.729	9~4	-10.130	-12.270	0.219	0.459
7~9	9.751	6.551	9~7	-9.606	-6.248	0.145	0.303
9~10	21.776	16.317	10~9	-21.356	-15.490	0.420	0.827
6~11	-0.032	-29.606	11~6	0.032	31.006	0.000	1.400
6~12	27.226	16.257	12~6	-27.226	-15.254	-0.000	1.003
6~13	4.501	-0.278	13~6	-4.495	0.294	0.006	0.016
9~14	8.737	0.724	14~9	-8.646	-0.529	0.091	0.194
10~11	-4.505	-6.094	11~10	4.550	6.197	0.044	0.103
12~13	1.849	1.327	13~12	-1.839	-1.317	0.010	0.009
13~14	6.351	4.668	14~13	-6.254	-4.471	0.097	0.197
TOTAL LOSS						**13.603**	**57.809**

From tables 4.0-6.0,it can be easily observed that ,the combined participation factors(CPF) leads to reduced losses as compared to the real power participation factors (RPF) hence the increased importance of reactive power in power loss reduction.

b) Multi Objective Reinforced Learning [MORL]

The **RL parameters** that were used in the algorithm are given in table 7.0:

Table 7.0:MORL Parameters

ε	0.5
α	0.1
γ	0.5

Power scheduling was done considering the three sets of real power and reactive power demands shown in table 8.0. The optimal generation of the five generating units and the optimal cost are also tabulated as shown in Table 8.0.CRRED problem formulation and solution led to reduced fuel cost as compared to the pure real power.

Table 8.0: Real and Reactive Power Scheduling for a 14-Bus System

	P_D = 800MW Q_D = 370MVAR	P_D = 900MW Q_D = 470MVAR	P_D = 1000MW Q_D = 570MVAR
P_{g1} (MW)	193.8187	193.3338	192.9860
P_{g2} (MW)	173.2834	202.5915	202.2780
P_{g3} (MW)	40.9645	54.9518	77.0050
P_{g4} (MW)	235.0919	243.9489	256.8600
P_{g5} (MW)	126.4889	164.1163	215.8620
P_{loss} (MW)	*30.3526*	*41.0577*	*55.0090*
Q_{g1} (MVAR)	195.7260	195.4648	195.0305
Q_{g2} (MVAR)	-2.5670	25.6773	74.5531
Q_{g3} (MVAR)	21.2810	25.4025	22.9167
Q_{g4} (MVAR)	150.9200	199.4408	219.0609
Q_{g5} (MVAR)	4.2270	21.6678	49.8217
Q_{loss} (MVAR)	*0.4130*	*2.3468*	*8.6171*
$F(P_{gi})$ ($)	**6,456.1**	**7,336.3**	**8,249.6**
$F(Q_{gi})$ ($)	1,276.7	1,617.8	1,962.0
F_T ($)	**5,420.2**	**6,192.6**	**6,992.1**

The cost of generation increased with increase in real power and reactive power demands. For low demands, the power flow will be within limits or deviates just slightly from the limits. As the power demand increases, the system resources continue being stretched and the power flow rises above the limits causing the cost to increase.

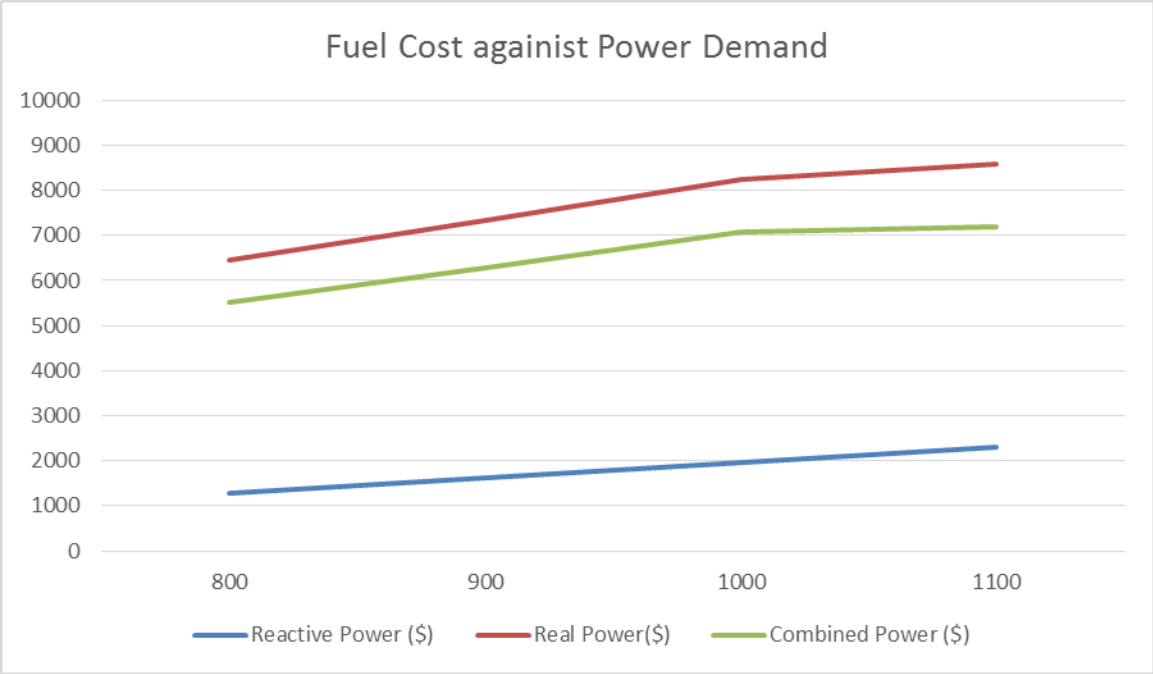

Figure 2.0: Fuel cost against Power Demand

From ***Figure 2.0,*** it is clear that the real power cost was higher than the reactive power cost. However, the combined real and reactive power cost was lower than the real power cost. This implies that the cost of generation reduces when combined real and reactive power cost is computed as compared to just considering real power generation that most economic dispatch problems involves. In ***Figure 2.0*** , a real power demand of 800MW corresponds to reactive power demand of 370MVAR, 900MW corresponds to 470MVAR, and 1000MW corresponds to 570MVAR (x axis).

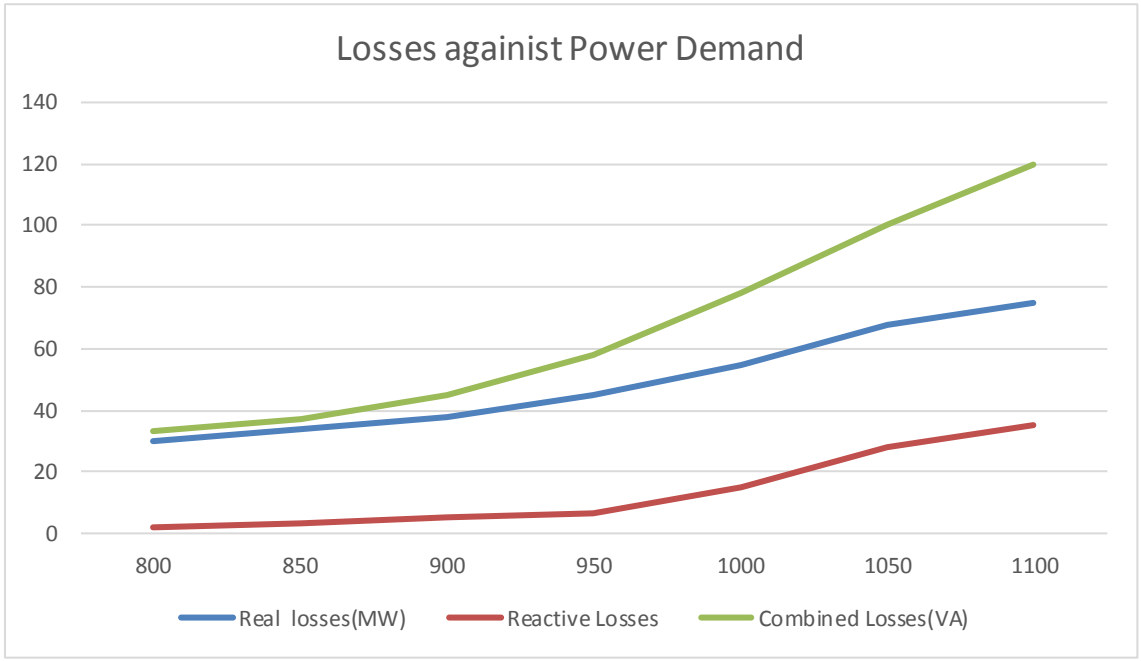

Figure 3.0: Power Losses against Power Demand

From ***Figure 3.0,*** the power losses increased with higher levels of power demanded. It is also clear that the real power losses were higher than the reactive power losses.The combined losses are a vector sum of the Real and reactive losses hence they are higher than both the two components considered separately.

c) MORL with DSB

As shown in table 9.0, use of MORL with Combined PF DSB led to lower system losses as compared to the real power DSB. This is because the inclusion of reactive power in DSB leads to improve voltage profile which translates to better reactive power management. The SSB –RL has the highest system losses. The generation cost are as tabulated in Table 10.0 for CRRED problem. From this table it is clear that which the generation cost are lowest in the DSB-MORL with combined PF compared to MORL with real power DSB and SSB. Further the inclusion of reactive power in ED formulation led to reduced cost as compared to a scenario in which only real power of the thermal units is considered. The algorithm with combined PF DSB provided a feasible solution with fewer iterations as compared to the other two scenarios.

Table 9.0: Comparison of Generated Power

		RL with SSB(MW)	**RL with DSB using Real PF (MW)**	**RL with DSB using Reactive PF(MW)**	**RL with DSB With Combined PF(MW)**
Generation:	Plant 1	232.593	232.408	223.861	**231.206**
	Plant 2	40.000	40.001	46.150	**40.0000**
Total System Losses		13.593	13.409	13.603	**13.301**

Table 10.0: Comparison of Generation Costs in MORL-DSB

	RL with SSB	**RL with DSB with Real Power PF**	**RL with DSB Reactive Power PF**	**RL with DSB Combined PF**
Generation Cost for Thermal Generators ($/Hr)	4814.131	4801.906	4808.3548	4800.2678
Generation Cost for CRRED ($/Hr)	**4781.009**	**4768.870**	**3966.6206**	**3378.6789**
Number of iterations	7	6	6	5

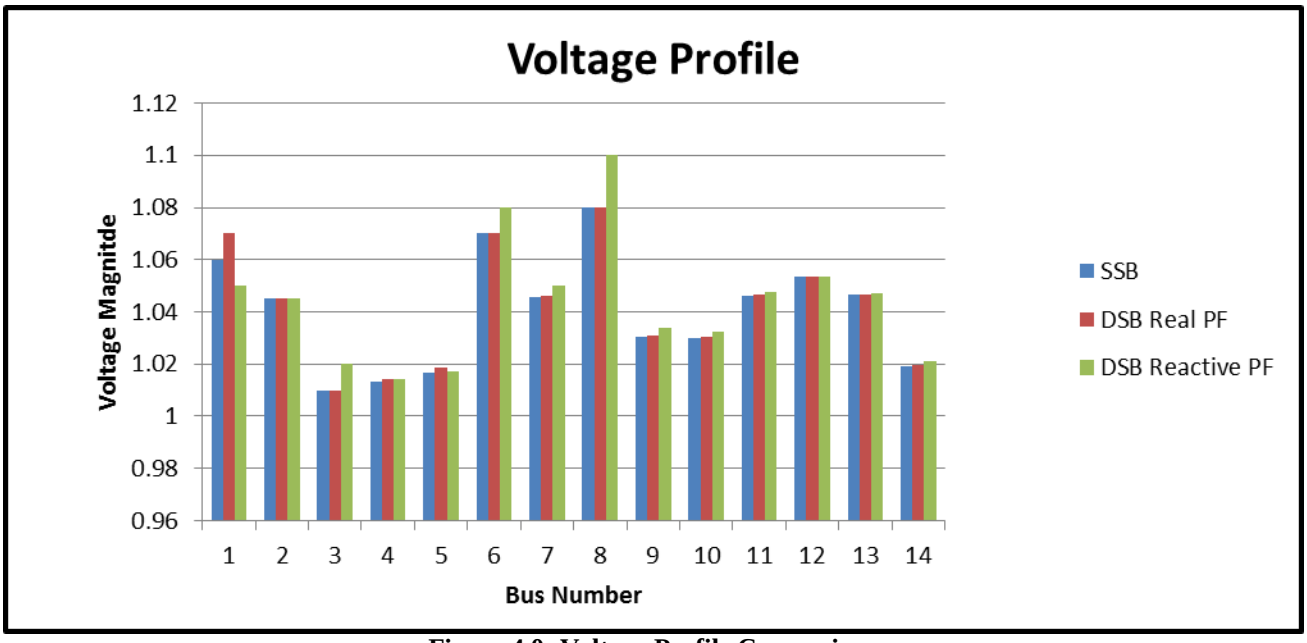

Figure 4.0 :Voltage Profile Comparison

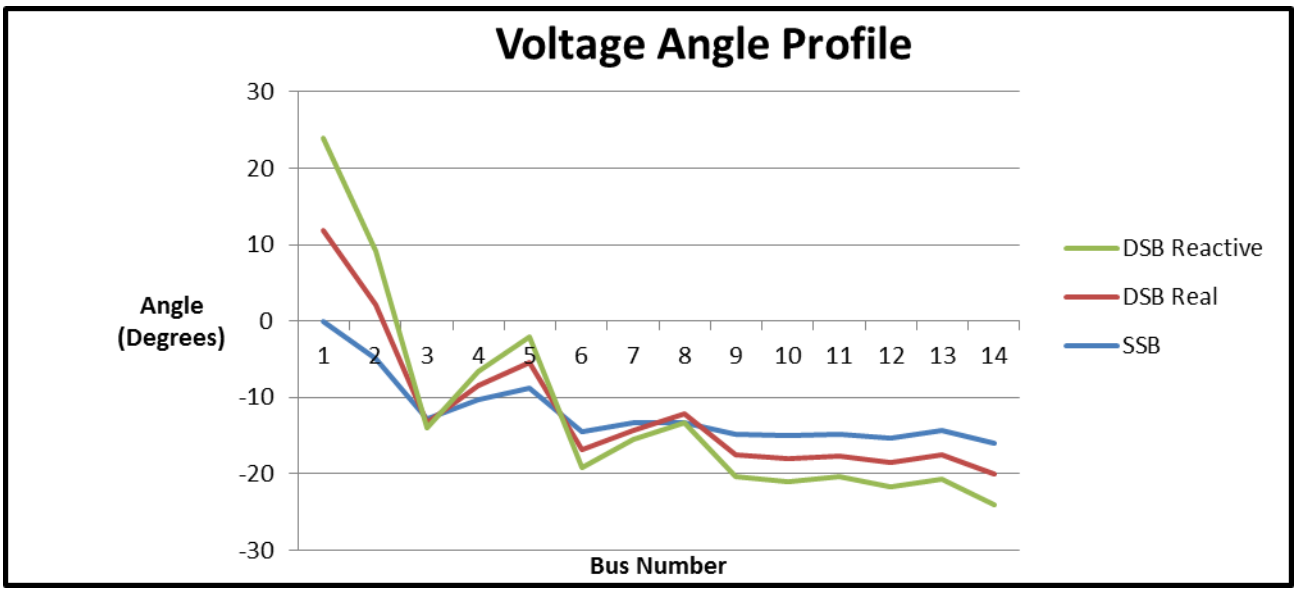

Figure 5. 0: Voltage Angle Comparison

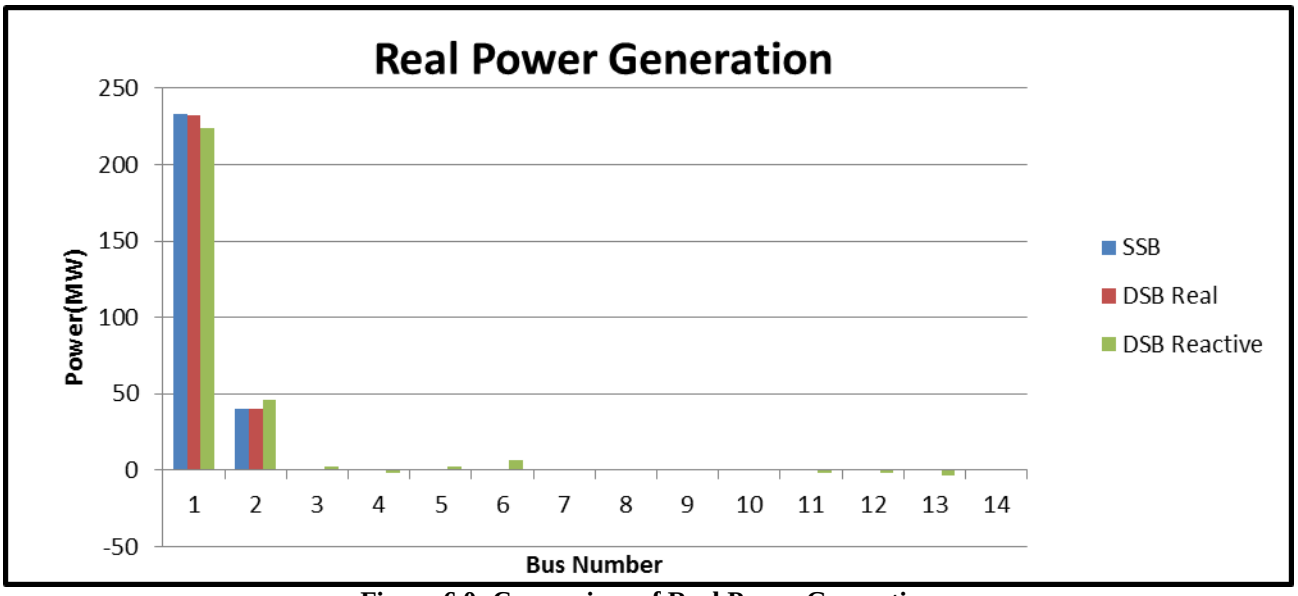

Figure 6.0: Comparison of Real Power Generation

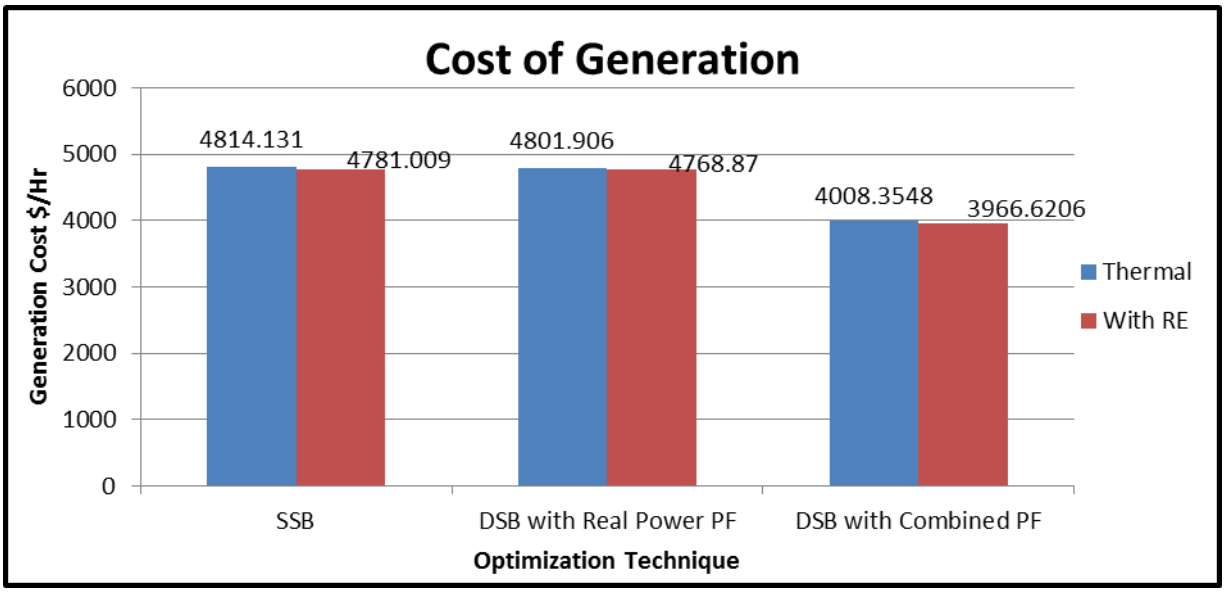

Figure 7.0: Comparison of Generation Costs

From figure 3.0, it is observed that the voltage magnitudes between buses are relatively similar. Voltage angles vary significantly in the two models as shown in figure 5.0. In the DSB-MORL, bus 1 was taken as the reference bus with a phase angle of 0.The DSB distributes system mismatches to all PV buses in the system through participation factors resulting in a change in phase angles. Power losses reduce by 0.184 MW in the DSB using real power participation factors compared to the SSB. However, the DSB using reactive power participation factors does not improve on the losses, this is because reactive power represents the power absorbed by the system. The generator real power outputs with a DSB are slightly less than the real power outputs with a single slack bus. This results in a lower generation cost in the DSB model as demonstrated in figure 6.0. The incorporation of renewable energy (CRRED) reduces the cost of generation in both the SSB and DSB as demonstrated in figure 7.0.

d) Comparison with other methods

To show the effectiveness of the proposed formulation and methodology, results are compared with related work carried out by researchers; Singh et al.2014 [14**]** and Hasanpour et al., 2009[15].Table 11.0 shows the comparison of results obtained under the IEEE 14 Bus System. Singh et al.2014 [14] used PSO which models the generators in terms of particles with respective velocities. The method ensures a complete search of the problem space, however it cannot be applied to a large practical network, Hasanpour et al., 2009[15] applied the Tracing Algorithm(TA) which is fair accurate ,realistic and easily formulated as compared to the deterministic methods. However the search space could not be exhausted leading to premature converge. The costs in [14] ($5460.5205) and

[15]($5690.6120) were found to be higher compared even to the DSB-MORL at minimum load($ 5420.2000**)** for the CRRED ,that is the MORL 15.24% 16.05 % better using the max and min approach respectively.The MORL with DSB Resulted into a far much reduced cost of $3378.6789 (29.6%) as compared to all other methods as losses involved have been optimized by DSB and further by MORL. The method provided an exhaustive search of the problem space with reduced number of iterations, reduced fuel cost and a better voltage profile.

Table 11.0: Comparison of proposed method with methods

Type of Cost ($)	**MORL(Max Demand)**	**MORL(Min Demand)**	**MORL With DSB Combined PF**	**Hasanpour, S et al.,2009[15]**	**Singh et al.,2014[14]**
Real power fuel cost, $F(P_{gi})$	8,249.6000	6456.1000	4800.2678	5998.8790	5678.5875
Combined fuel cost, F_T	6,992.1000	5420.2000	3378.6789	5690.6120	5460.5205
% cost Reduction	15.24	16.05	29.60	5.15	3.84

VI. CONCLUSION

DSB-MORL algorithm was successfully applied for the solution of CRRED. Power allocation was done among five generating units at optimum generating costs while taking into consideration the equality, inequality and the stochastic constraints. From the results and analysis done, CRRED of power was found to be cheaper by almost 0.95%(~$ 40/Hr)than when real dispatch of power only is considered. When network losses were optimized using the DSB and then RL applied for the CRRED, the cost was found to be even lower as compared to the pure RL. Reduced losses meant reduced cost due to the introduction of the renewable energy based reactive power. Dynamic reactive power results in improved reactive power management and improved voltage profile, hence reduced optimal cost. The DSB-MORL with Combined PF provided a feasible solution with fewer iterations as compared to the real power PF, reactive power PF and SSB. However, a better optimal cost can be achieved if more accurate cubic cost functions are used in modelling the CRRED. Lastly, increased practical application of the proposed DSB-MORL can be realized by showing the test results on IEEE 57 bus and IEEE 118 bus systems which are larger and more realistic.

ACKNOWLEDGEMENT

The authors gratefully acknowledge The Deans Committee Research Grant (DCRG) The University of Nairobi, for funding this research and the Department of Electrical and Information Engineering for providing facilities to carry out this research Work.

REFERENCES

[1] Lee, K.Y.; Park, Y.M.; Ortiz, J. L., "A United Approach to Optimal Real and Reactive Power Dispatch," Power Apparatus and Systems, IEEE Transactions on , Vol.PAS-104, No.5, pp.1147,1153, May 1985.

[2] Serrano, B. R.; Vargas, A., "Active-reactive power economic dispatch of very short term in competitive electric markets," Power Technology Proceedings, 2001 IEEE Porto, Vol.1, No.10 pp.6-8, 2001.

[3] Worawat Nakawiro et al "A Novel Optimization Algorithm for Optimal Reactive Power Dispatch: A Comparative Study" IEEE Transactions on Power Systems, Vol.1 pp. 1155-1161, 2011.

[4] R. Mallipeddi et al "Efficient constraint handling for optimal reactive power dispatch problems" Swarm and Evolutionary Computation Vol. 5, Pages 28-36, August 2012.

[5] Lopez, J.C.; Munoz, J.I.; Contreras, J.; Mantovani, J. R S, "Optimal reactive power dispatch using stochastic chance-constrained programming," Transmission and Distribution: Latin America Conference and Exposition (T&D-LA), 2012 Sixth IEEE/PES , Vol.3, pp.1-7, 3-5 Sept. 2012

[6] Q.H. Wu, Y.J. Cao, J.Y. Wen "Optimal reactive power dispatch using an adaptive genetic algorithm" International Journal of Electrical power and energy systems Vol.20, Issue 8, Pages 563–569, November 1998.

[7] Yusuf Sonmez "Estimation of Fuel cost curve parameters for thermal power plants using the ABC Algorithm" ,Turkish Journal Of Electrical Engineering and Computer Science ,Vol .21 pp. 1827-1841,2013

[8] K.M.S.Tong andM.Kleinberg, "A distributed slack bus model and its impact on distribution system application techniques," in Proc. IEEE Int.Symp.CircuitsSyst. (ISCAS),vol.5, pp.4743–4746,May2005.

[9] S.TongandK.Miu, "A network-based distributed slack bus model for DGs in unbalanced power how studies, IEEETrans.PowerSyst" vol.20, no. 2, pp. 835–842, May 2005

[10] K. M. S. Tong, "Participation factor studies for distributed slack bus Models in three-phase distribution power flow analysis,"inProc.IEEE PESTransm.Distrib.Conf.Exhib.,2005/2006, pp.92–96,May 2006.

[11] S. Tong and K. Miu, "Slack bus modeling and cost analysis of distributed generator installations," J. Energy Eng., vol. 133, no. 3, pp.111–120, 2007.

[12] Peter Musau Moses and Nicodemus Abungu Odero "Distributed Slack Bus Model for a Wind Based Distributed Generation using Combined Participation Factors" International Journal of Emerging Technology and Advanced Engineering(IJETAE),Volume 2, Issue 10, ,PP 459-469, October 2012.

[13] E. A. Jasmin et al "Reinforcement Learning Approaches to Economic Dispatch Problem," Electrical Power and Energy Systems, Vol 33 ,pp 836-845, 2011

[14] Singh, H. P., Brar, Y. S., & Kothari, D. P., "Combined active and reactive power dispatch using Particle Swarm Optimization" Proceedings of Informing Science & IT Education Conference (InSITE) 295-304, 2014.

[15] Hasanpour, S., Ghazi, R., & Javidi, M. H. "A new approach for cost allocation and reactive power pricing in a deregulated environment". Electrical Engg.,91 (1), 27-34,2009

[16] Deksnys, R., & Staniulis, R., "Pricing of reactive power services". Oil Shale Estonian Acad. Publ.,24, 363–376,2007.

[17] Baughman, M. L., & Siddiqi, S. N. "Real time pricing of reactive power: Theory and case study results". IEEE Trans. Power Sys.,6, 23-29,1993.

[18] Kahn, E., & Baldick, R. " Reactive power is a cheap constraint". The Energy Journal, 15, 191-201,1994.

[19] Muchayi. M., &. El-Hawary, M. E. "A summary of algorithms in reactive power pricing". Electric Power and System Research, 21, 119-124,1999.

[20] Hogan, W.(1993). "Markets in real electric networks require reactive prices". The Energy Journal, 14(3), 171-200,1993.

[21] Niknam, T., Arabian, H., & Mirjafari, M. "Reactive power pricing in deregulated environments using novel search methods". IEEE Proceedings of Third International Conference on Machine Learning and Cybemetics, Shanghai, pp. 4234–4240,2004

[22] Bialek, J.W.,&Kattuman, P.A. "Proportional sharing assumption in tracing methodology". IEE Proceedings Generation Transmission and Distribution, 151(4), 526-532,2004.

[23] Chung, C.Y., Chung, T. S., Yu, C.W., & Lin, X.J. "Cost-based reactive power pricing with voltage security consideration in restructured power systems". Electr Power Syst Res.,70, 85–92,2004.

[24] Moses Peter Musau, Nicodemus Odero Abungu, Cyrus Wabuge Wekesa. "Multi Objective Dynamic Economic Dispatch with Cubic Cost Functions". International Journal of Energy and Power Engineering. Vol. 4, No. 3, pp. 153-167,2015

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Queue System Improvement of Certificate Checking For Increasing Public Service in Bogor District Land Registry Office

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Abstract- Land Registry Office is an government institution that engaged in service field. In this sector, the increase of people satisfaction is the most important thing that needs to be maintained. However, the limited service resources make it not comparable to the rate of service request. Therefore, it will cause queue. One of the services in Bogor District Land Registry Office which has a high intensity of service request every day is certificate checking. This study aims to analyze the performance of queue service system of certificate checking and to develop a model of service that is improved and can meet the needs of the service. The development of queue model is done by making a simulation using the software Arena 14.00.00. Arena simulation results were tested by t-test to verify that the simulation model has been represented of certificate checking service in Bogor District Land Registry Office. Analyses of the simulation include the analysis of waiting time and queue length, utility analysis, and bottleneck analysis. From the analysis, there are inefficiencies that result in long waiting periods and a large number of files that have not been processed. the percentage of files that can be completed in every day at the existing condition is only 57.40% of the incoming beam. Scenario improvements were made to cope with the jam on phase experiencing a bottleneck. The improvement scenario can increase number of output to 96.20%, and boost the waiting time to become 0.278 hours from the previous of 1.56 hours.

Index Terms- Queue, Arena Simulation, Scenario Improvement

I. INTRODUCTION

Checking service is one type of duties and functions of the Land Registry Office. Checking service activities are intended to provide certainty about the authenticity of the certificate and that the certificate being checked is not being involved in the conflict and dispute. As is known, certificate has significant proof of ownership of a parcel of land. The authority to inspect and certify the authenticity of the certificate is on the District Land Registry Office/City where the certificate is issued.

Bogor District Land Registry Office is one of the Land Registry Offices in West Java that is classified as an A Class Land Registry Office pursuant to *Peraturan Kepala Badan Pertanahan Nasional* RI (PERKABAN) No. 1 of 2013. The Land Registry Office is included in Class A is the Land Registry Office which has great volume of services.

Land Registry Office is an office engaged in the service sector. The service sector deals with the increase in people's satisfaction as the most important thing that needs to be improved

The main factor in the quality of services is the easy access to service facilities that include location, time of service operations and minimum waiting time to get the services (Sridhar, 2013).

The high needs of communities to their land lead to the high intensity of land certificate checking service request. This phenomenon causes long queues in Land Registry Office.

The high society needs result in the high volume of applications that are not comparable with the Land Registry Office service capacity. This triggers to inefficiency and ineffectiveness in service system. As the consequence, congestion (bottlenecks) emerges and the waiting time becomes longer. This results in a decrease in public satisfaction with the service. A study by Noor Azizah in 2008 in Bogor District Land Registry Office shows that the dimensions of service quality give positive and significant impact on the improvement of people's satisfaction in terms of the dimensions of reliability and empathy.

The key operating characteristics for a system are shown to be (1) utilization rate, (2) percent idle time, (3) average time spent waiting in the system and in the queue, (4) average number of customers in the system and in the queue, and (5) probabilities of various numbers of customers in the system. (Chowdury,Rahman and Kabir. 2013)

A consumer experience in the long waiting time at a facility service significantly affects the overall perception of the services provided (Maister, 2005). Although customers have been served efficiently and politely, bad experiences may still appear in the waiting time and can affect the overall assessment of the quality of service. Analytical approach in this service issue is a matter that concerns the speed of queuing service performance to the applicants. The queue in question here is queuing service which checks the application for land titles.

In the queue situation, perception plays an important role. An unpleasant experience in waiting affect the perception of entire service (Nuryani, 2013). Process wait or queue containing the element of time. Unpleasant feeling when queuing one of which relates to how people make sense of time in the queue

Norman (2008) there are eight design principlefor waiting line, ie: 1) emotion dominate, 2) eliminate confusion, 3) the wait must be appropriate, 4) set expectations, 5) keep People occupied, 6) be fair, 7) end strong, start strong, 8) memory of an event is more important than the experience.

Queuing problems are associated with management's decision to cope with the demand for service capacity in various services. At the time of application for high service, the service facility is very busy, causing long queues and taking quite a long time. Conversely, when the demand is low, the facility becomes idle and inefficient. Management needs to provide optimal care and facilities so as to serve consumer demand that is varying. In addition, the service must always be optimized so that the satisfaction increases. Additionally, high utility services also affect the performance of employees who may be saturated and there would be a decline in the performance and quality of service of employees.

Performance of the queue is also affected by the arrival rate and speed of service. The arrival rate generally cannot be controlled by the Land Registry Office, while improving speed of service is difficult because it is tied with the applicable standard operating procedures. In addition to the high number of applications for land registration services, the number of steps that must be passed also adds to the high risk of the queue and the length of time needed for completion.

At a production process (a process which one will support the others as a whole), inefficiencies toward a stage will affect the other stages that have impact on the resulting output. This will not only disrupt the production process but also the quality of production (Astuti, 2002). It requires a simulation of the production line to optimize the number of service facilities.

The purpose of this study is to:

1. describe the existing condition of the certificate checking service operations in Bogor District Land Registry Office;
2. analyze the performance of the queuing system checking service of land titles;
3. develop queue repairs needed to improve productivity checks of certificate services in accordance with the level of the request.

The study was conducted using a case study approach to service certificate checking Bogor District Land Registry Office. This study was conducted to examine the performance of the queuing system for the land certificate checking service improvement that can be done to optimize the performance of services. This effort is expected to increase community satisfaction.

II. Research Methods

The types of data used in this study are primary direct observation in the form of: number of arrivals, arrival time, service time, the service process flow and in-depth interviews

The steps done in this study were:

1. Test the adequacy of the data
   The first step was the collection of observational data. Observational data were taken with care and had a sufficient number of quantitative reprensentatif . The required number of data observations is expressed in the following equation: (Barus, 2005)

$$N' = \left(\frac{k/s \sqrt{N \sum X_i^2 - (\sum X_i)^2}}{\sum X_i} \right)^2 , N > N'$$

   Where:
   N' = the number of observation that should be done
   k = level of confidence in observation
   s = the degree of accuracy in observation
   N = the number of observation made
   Xi = observational data
2. Testing Distribution
   If a distribution of the population is not known, it must be estimated . Empirical distribution functions estimate the true function of the underlying distribution . Testing distribution is done by using the Kolmogorov - Smirnov test . Kolmogorov - Smirnov test is an alternative test of Chi -square test to test the hypothesis that the distribution of observed variables differ from the expected variable distribution (Nazir, 1988) .
3. Simulate the model
   Land certificate checking service flow was simulated using the software Arena. Ward (2012) used the software of Arena to compare the efficiency of existing conditions with the proposed conditions. The number of stages and varying arrival distribution and service in the process of checking the certificate of service cause complexity and are quite difficult to be calculated analytically. Therefore, simulation software of Arena was applied in accordance with the existing conditions of service of checking certificates. Simulation is the process to mimic the real system to evaluate and improve system performance.
4. Validation Test T - Test
   Data simulation results need to be compared with the data obtained from the observation of reality. It is necessary to validate that the simulation model has represented a real condition. Hypothesis testing using t-test comparisons in this study was carried out by using the following hypotheses: (Sumarwoto&Marwani, 2012)
   H0 = There is no difference between simulations and the existing.
   H1 = There is a real difference between simulations with the existing.
5. Analysis of Simulation Results
   From the simulation results by using the software of Arena, there will be analysis of the level of utility services , the analysis of bottleneck , the waiting time, and queue length of service. Then, improvements on queue will be conducted by creating an improved service based scenario by reducing the waiting time and the comparison between the situation of the queue that is running with the condition of queue which is expected.

III. Results and Discussion

A. Land Certificate Checking System

Land certificate checking service activities are required to check the validity and authenticity of the certificate of land proposed by the applicants. The land certificate is a means of proof of ownership of a parcel of land.

Conditions of the application for a land certificate checking service based on the flow are given below:

1. The applicant who comes to the Land Registry Office goes into service. He then heads into the service counter for checking the certificates, submits a request file consisting of: application form (provided by the Land Registry Office), land

certificate, copy of ID, and the power of attorney (if authorized).

2. Officers in the counter (1 person) will receive the file and check the documents. If the file is incomplete, the clerk will inform the documents that need to be completed.
3. The applicant files a complete document and submits it to the officers and then they will search the location based on land book data in the archives. The time needed from the counter to the archives is 30 seconds.
4. Archive room officers (2 people) find a book that land is in accordance with the certificate applicant HAT sorted by village name, type and number of Rights. Land book that has been found and then inserted in the Certificate HAT and placed in the archive to be taken by the counter clerk for certificate testing.
5. Officers learn and observe the certificate (1), take the certificate and land book records available in the counter to check the compatibility between the land book and certificate. The points examined are namely the village name, type of rights, certificate number, number GU Land History and Notes. if there is a discrepancy, the certificate will be returned to the archivist to check back and match it with the data in the land book. Additionally, Cap officers also check whether the certificate is already plotting Figure Measure (GU); if not, the certificate will be returned to the clerk to be given back to the applicant in order to get to the counter plotting on floor 2. Once checked, HAT certificates and land book then are stamped stamp and handed over to the officer of Warrant Issuance of Deposit (SPS).
6. Officers SPS (1) receive the Certificate and Land Book and they are then collected on behalf of the applicant to make SPS. SPS contains information about the applicant's name, file number being requested, the amount of the requested file as well as the nominal amount of costs to be paid. SPS is printed and handed to the clerk, while the certificate and the land book are handed over to the data input clerk.
7. Data input officers (1) record the data of the applicant, the certificate number and the type of certificate to the internal applications as well as noting the time and date for checking.
8. The certificate and the land book are handed over to officials of verification (1) to re-examine the authenticity of the certificate in the form of paper certificates, certificates history, officials who signed the certificate to be matched with the land book. After the certificates and books mention the land, they are then sent to the clerk to be submitted to the applicant.

There are six (6) steps required in the certificate checking service activities , namely: 1) File reception counter ; 2) land book archive search; 3) The testing certificate ; 4) Issuance of SPS ; 5) Data Entry ; 6) Verification of officers certificate. It can be concluded that the structure of certificate checking service activities is a multi -channel multi- phase.

B. Adequacy Test Data

The data taken are considered fairly representative of the population if N>N' (Barus 2005). Data assessed for adequacy are service time data at each phase of the service

Table 1. Results of testing of adequacy of observational data

Activity	(N)	(N')	Explanation	Average time (Second)
Phase 1 (Counter Officer)	82	64	Sufficient	14,44 (0:0:14,44)
Phase 2 (archivist)	137	33,21	Sufficient	163,04 (0:02:43)
Phase 3 (Stamp Officer)	212	181	Sufficient	40.18 (0:0:40.18)
Phase 4 (SPS Officer)	181	176	Sufficient	178,55 (0:02:59)
Phase 5 Data Entry	199	103	sufficient	46,23 (00:00:46,23)
Phase 6 (Verification Officer)	212	191,8	sufficient	110.47 (00:01:21,48)

From Table.1 above, it is obtained N > N' at each stage of the service so that it can be concluded that, theoretically suggested, the observational data have been qualified.

C. Simulation Model

With the help of software of Arena 14:00, the simulation model was built as in Figure 1.

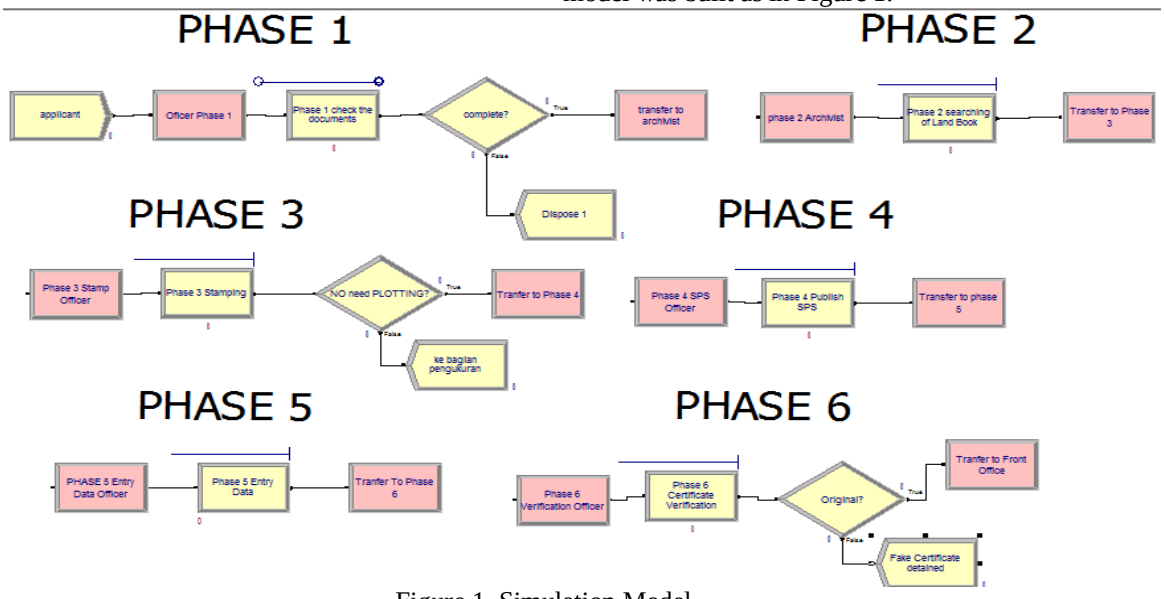

Figure 1. Simulation Model

Queue performance results of the simulation of the number of entry and exit form then were tested using T-test to prove that the simulation model has represented the existing condition of certificate service checking by Bogor District Land Registry Office (Sumarwoto & Marwani, 2012). T-test results can be seen in Table 2.

Table 2. T-test Results

	Input		Output	
	Simulation	Observation	Simulation	Observation
Mean	320.95	321.60	190.40	198.20
Variance	2238.68	16661.52	131.52	1021.96
Observations	20.00	20.00	20.00	20.00
Pearson Correlation	0.14		-0.15	
Hypothesized Mean Difference	0.00		0.00	
Df	19.00		19.00	
t Stat	-0.02		-0.98	
P(T<=t) one-tail	0.49		0.17	
t Critical one-tail	1.73		1.73	
P(T<=t) two-tail	0.98		0.34	
t Critical two-tail	2.09		2.09	

Calculation of the t-test for input data was done by value t-stat = -0.022 and t-table = 2,093. The test results show that the t-stat is between the value of (-2.093; 2,093). Then there is no difference between the data file and the existing entry simulation. From the output data, it was obtained that t-stat = -0.98 and the t-table = 2,093. The test results show that the t-stat is between the value of -2.093 and 2,093. From the output data, also there is no difference between the simulation data and the existing one. It can be concluded at the 95% confidence, interval on simulation models has to represent the existing condition of the certificate of service checks

From the simulation results with replication during the 20 days, measure performance of the queue was obtained as shown in Table 3.

Table 3. Results of simulation performance in certificate checking service queue

Performance	Minimum	average	maximum
Number of input	273 file	324 file	430 file
Number of output	169 file	186 file	217 file
in Process (WIP)	49 file	72 file	229 file
Waiting Time (minute)	60,138	83,784	253,938
Service Time (minute)	8,154	8,634	18,786
Transfer Time (minute	1,092	1,158	1,38
Total Time (minute)	69,594	93,756	263,454

From Table 3, it is shown that the number of incoming file is still greater than the number of out files that can be completed each day; the percentage of files that can be completed every day is 57.40 % of the incoming application. This results in a buildup of files on the following day. According to Iksan (2006), if the number of customers who come in is greater than the amount that comes out, the system cannot be said to be optimal.

D. Analysis of Waiting Time

At each stage, the service waiting time to do and the number of files existing queues can be seen in Table 4.

Table 4. The waiting time and the number of queues in each entity file at every stage of the simulation results service

Phase	Average Waiting time (hour)	Maximum Waiting time (hour)	Average Number of queue	Maximum Number of queue
Phase 1	0:00:40	0:13:28	0,409	31
Phase 2	0:46:08	2:45:47	33.34	156
Phase 3	0:00:04	0:01:19	0.03	1
Phase 4	1:07:40	2:46:17	33,58	88
Phase 5	0:00:11	0:00:32	0	1
Phase 6	0:00:20	0:07:13	0.11	3

From Table 5, we can see that the phases with the longest waiting time are Phase 4 and Phase 2. The highest number of the queues of files occurs in Phase 2, namely 33 files with maximum piles of 156 files. In Phase 4, the number of stacks of file queues is also quite a lot, that is, 34 files and maximum of 88 files. This may indicate that at Stage 4 and Stage 2, there is inefficiency in services that need to be reduced.

Bottleneck analysis

The capacity of the process is determined by the slowest series of activities in the process. Bottleneck is a situation where the performance or capacity of a system is limited by a component or resource (Khalafi & Raissi, 2014). Figure 3 illustrates a graph of queue length, waiting time, and utility workers.

E. Analysis of Utility Officer

Utility rates/resource use is also an important factor in the efficiency of a service. The utility rates show the value of the power to the server in a system. In Figure 2, we can see the level of utility of busiest workers.

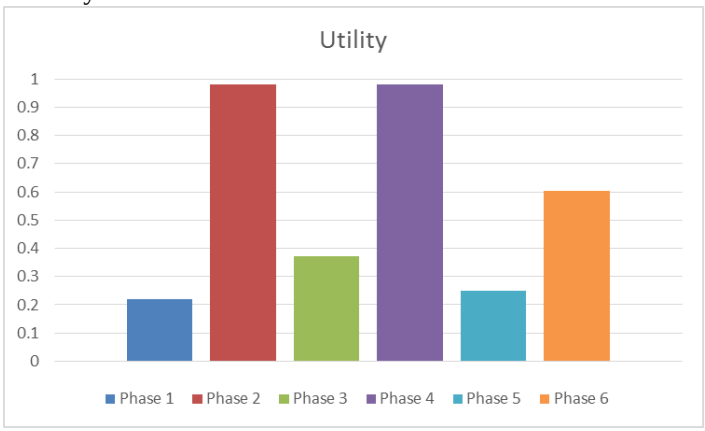

Figure 2. Utility level of workers

From the graph, it can be seen that the highest level of activity that officers have happens in Phase 4 at the utility level of 0.9814, or 98.14 % , and in Phase 2 that is equal to 98.11 % .

Determination of the tolerant limit of flurry refers to Ma'Arif and Hendri (2003) that for the best services, it is better to operate slightly below full capacity (50 < p < = 70 %). Therefore, the levels of utility workers who need to get improvement the most are Phase 2 and Phase 4.

F. Bottleneck analysis

The capacity of the process is determined by the slowest series of activities in the process. Bottleneck is a situation where the performance or capacity of a system is limited by a

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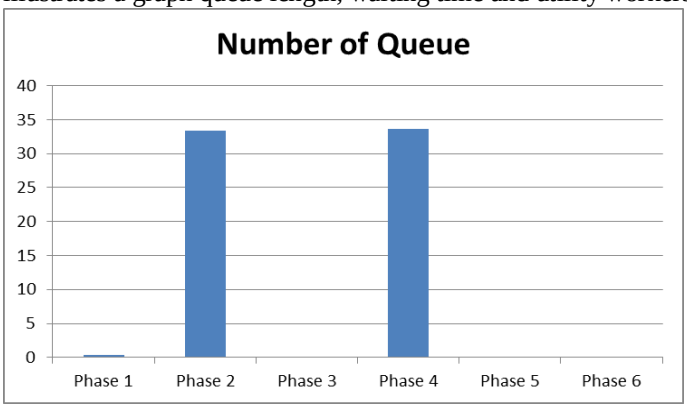

Figure 3. Number of queue

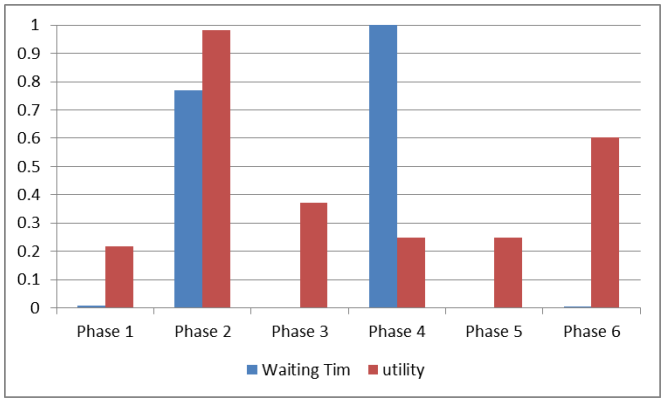

Figure 4. The Graph of the waiting time and the level of utility

From Figure 2 and 3, it can be concluded that the bottleneck on the certificate checking service activities are in Phase 2 of the land book search and Stage 4 is publishing SPS. The problem-solving approach of the production line is to fix the bottleneck at each station one by one starting with the station having the smallest output and longest service time (Abed, 2008).

F. Queue System Improvement

From the analysis of the waiting time, utility analysis, and bottleneck analysis, we concluded that the stages that need improvement are Phase 2 of the land book search and Phase 4 of the publication of SPS. Customers need excellent service that can generate loyal customers and improve customer satisfaction. One of the efforts is increasing satisfaction with the efficiency of the waiting time associated with a queue system that includes the speed of service and the number of applicants that can be served (Joni, Suryani, 2012).

Afrane and Appah 2014 the length of time patients wait an impact on patient satisfaction with care. hence the smaller the waiting time increased patient satisfaction. In line with Garcia D, Archer T, S Moradi, Ghiabi B (2012), the waiting time plays an important role in customer satisfaction.

Cernea (2010), queuing models play a major role in improving operational effectiveness. In general, in order to fix the used queue service time improvement approach it is possible to use one or both of the following solutions, namely by increasing the average service rate by redesigning queuing system or by adding new service channels so that customers can be served quickly.

There are five (5) scenarios developed in order to improve the queuing system. Scenarios are made to identify and determine the best system of proposals that could be applied. (Astuti, 2002). Model repair scenarios are presented in Table 5.

In Phase 2 of the archive search phase that requires hard skill in searching for archives, the improvements that can be done is to increase the number of officers. In Phase 4, namely the publication of SPS, the constraints due to length of time of service are slow Internet connection; therefore, the improvement made is to increase Internet speed in Phase 4.

After repairing in Phase 2 and Phase 4 as previously mentioned, there is congestion in Phase 6. Repairs are to be conducted on Stage 6. Stage 6 is an official verification of the implementation requires officers' soft skill ability to distinguish genuine or fake certificate. That is why, the necessary improvements in Phase 6 are providing an additional number of officers who have expertise and thoroughness in examining the authenticity of the certificate.

Table 5. Scenario improvement

Scenario	Phase in Services		
	Phase 2*	Phase 4**	Phase 6*
Existing	2	1	1
Scenario 1	2	2	1
Scenario 2	3	2	1
Scenario 3	3	3	2
Scenario 4	4	3	2
Scenario 5	4	4	2

Description:
*) Increasing the number of officers
**) Increasing internet speed

Explanation of each scenario are as follows:

1) The existing condition of service of checking certificates District Land Registry Office which consisted of 2 archivist, 1 official verification and 1 officer verifying the issuance of SPS. Internet speed in phase 4 is considered 1 (one) with an average service speed is 179 seconds.
2) Scenario 1 is the scenario improvement with the formation: 2 archivists; 1 official verification and increase the speed of the internet in Phase 4 to 2-fold. Which means that the speed of service at phase 4 increased to 89.5 sec/file.
3) Scenario 2 is the scenario where the number of archivist increased to 3, official verification remains 1 and the speed of service at the stage 4 is 2 times than the existing condition.
4) The improvement Scenario 3 is the scenario where the number of archivist is 3; verification officer increased to 2 people and the internet speed in Phase 4 increased to 3 times, which means that the speed of service at Phase 4 to 59.67 seconds.
5) Scenario 4 is the scenario where the number of archivist expanded to 4 people; official verification becomes 2 and the speed of the internet in Phase 4 is three-fold, with the speed of service at the phase 4 is 59.67 sec/file.
6) Scenario 5 is a repair scenario where the number of archivist expanded to 4 people; official verification becomes 2 and the speed of the internet in Phase 4 is 4-fold, with the speed of service at the stage of 4 to 44.75 sec / file.

The results of scenario repair for checking service activities are shown in Table 6 and Figure 5.

Table 6. Simulation performance results of each file of improvement scenario

Scenario	input	ouput	Service time (hour/file)	Total Time (hour/file)	Waiting Time (hour/file)	Number of WIP
existing	324	186.55	0.144	1.56	1.396	72.575
Scenario 1	324.5	252.75	0.15	0.892	0.721	38.899
Scenario 2	328.9	267.6	0.15	0.756	0.586	35.251
Scenario 3	325.9	308.95	0.152	0.346	0.174	15.798
Scenario 4	333.1	320.45	0.151	0.266	0.094	12.07
Scenario 5	346.8	331.9	0.153	0.278	0.105	13.556

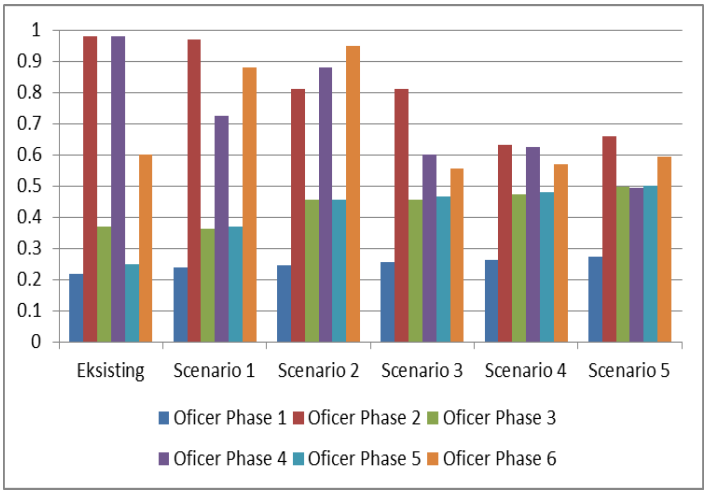

Figure 5. Graph utility level officer in each scenario

Based on simulation results, the best scenario is where the output file is in the optimal amount, the total time is less and the level of utility services officer does not exceed 70%; this occurs in the Scenario 4. Formations of officers in Scenario 4 are: the number of workers filing by 4 people, verification officials as much as 2 and increasing internet speed by 3 (three) times from the current speed.

For official verification, incidental increase in the number of servers is adjusted to the number of applications. Given the importance of the responsibility of the officer, the officer's verification certificate can be a verification officer from BPN employees who already have the skills to identify and separate the original certificate and the fake ones, especially for the old certificates that require more rigor in checking authenticity. Thus, it should be provided trained reserve officers with accuracy and expertise in checking certificates in Bogor District Land Registry Office to help examine the certificates.

IV. CONCLUSION

The existing condition of service of checking land titles in Bogor District Land Registry Office is already effective but still inefficient. The current service system of research still cannot meet the high public request for certificate checking service. The use of the queue number has not been optimal. It can lead to a decreased level of community satisfaction with services provided by Bogor District Land Registry Office.

From the simulation using Arena 14.00, the percentage of files that can be completed in every day at the existing condition is only 57.40% of the incoming beam. Of the six stages of the service, those which undergo stages bottleneck are Phase 2 of the archive search and Phase 4, which is publishing SPS.

Of the five development scenarios for service repair system, the best scenario would be Scenario 4, with the addition of the archivist to 4 people; increased internet speed to 3-fold and provide two officers of the internal certificate verification. This improvement scenario can boost the waiting time to become 0.278 hours from the previous of 1.56 hours. The amount of output increased to 96,20%. Yet, the wait In Process (WIP) file was still decreasing, from originally 73-209 files into 13 files. In addition archivist utility rates decreased from 98.11% to 63.2%. Utilities publisher officers SPS decreased from 98.11% to 62.6%. In conclusion, utility workers are expected to maintain service quality in checking of certificates.

ACKNOWLEDGMENT

On this occasion first author would like to thank to the Head of Bogor District Land Registry Office and my supervisors for the help so that this research can be accomplished. Also big grateful to my parents, my beloved husband and childrens for their countinuous encouragement and support.

REFERENCES

[1] Abed SY, "A Simulation Study to Increase The Capacity of a Rusk Production Line". *Journal Wseas Transaction on Information Science & Application*, 2008. Issue 9 Volume 5: 1395-1404.

[2] Afrane S, Appah A. 2014. Queuing Theory and the Managemenent of Waiting Time in Hospital: The Case of Anglo Gold Ashanti Hospital in Ghana. *Jurnal HRMARS Vol 4 No 2*: 34-44

[3] Astuti M, Mas'udin I. "Determination of Total Employment by Using Queue Simulation in the Production Department at PT Surya Tubal Indonesi". *Jurnal Optimumm*. 2002. Vol.3 No. 2: 115-120

[4] Azizah N. Customer satisfaction Analysis of Land Registering Services" [Thesis]. 2008. Bogor [ID]: Magister Manajemen and Bisnis. IPB

[5] Barus D. "Analysis Queue and Scheduling System Logging Load Transport in the Sugar Cane Sei Semayang PTPN II - Sumatera Utara". [Tesis]. 2005. Bogor [ID]: Magister Manajemen dan Bisnis. IPB

[6] Cernea SO, Jaradat M, Jaradat M. 2010.Characteristic of waiting Line Models-The Indicators of the Cutomers flow Management System Efficiency.*JournalAnnales Universitatis Apulensis Series Oeconomica*, Vol. 12 No. 2: 616-622

[7] Chowdury MSR, Rahman MT, Kabir MR. 2013. "Solving of Waiting Lines Models in The Bank Using Queuing Theory Model The Practice Case: Islami Bank Bangladesh Limited, Chawkbazar Branch, Chittagong". *IOSR Journal Of Business And Management. Volume 10, Issue 1 (May. - Jun. 2013), PP 22-29*

[8] GarciaD. Archer T, Moradi S, Ghiabi B. "Waiting in Vain: Managing Time and Customer Satisfaction at Call Center". *Journal Scientific Research.* 2012. *Vol. 3 No. 2: 213-216.*

[9] Iksan. "Additional recommendations III Branch Pier Port of Tanjung Perak Surabaya Queuing System Simulation Analysis Cargo Ship". *Jurnal Sistem Teknik Industri*. 2006. Vol. 7(2): 33-42

[10] Joni IDMAB, Suryani E. "Efficiency Analysis of Banking Services to improve service performance by Using Discrete Simulation Approach". *Jurnal Sistem Informasi SISF*. 2012. hal. 1-7

[11] Khalafi S, Raissi S. "Industrial Valves Production Line Bottleneck Analysis: A Computer Based Simulation Approach". *International Journal of Scientific & Technology Research*. 2014. Vol. 3: 9-14

[12] Ma'arif S, Hendri T. "*Quantitative Techniques for Management*". Jakarta [ID]: PT Grasindo. 2003.

[13] Maister DH. "*The* Psychology of Waiting Lines". http://www.columbia.edu/~ww2040/4615S13/Psychology_of_Waiting_Lines.pdf. 2005.

[14] *Nazir* M. "*Research methods"*. Jakarta [ID]. Ghalia Indonesia. 1988.

[15] Norman D. “The Psychology of Waiting Lines”. www.jnd.org. 2008

[16] Nuryani D, Gumelar G, Maulana H. 2013. “Wait Time Perception: Application of Occupy and Certainty in Psychological of Queuing”. *Jurnal Psikologi: Vol. 9, No. 1.*

[17] Sridhar, MS. “Waiting Lines and Customer Satisfaction” .http://eprints.rclis.org/9261/1/J43_Waiting_lines.pdf. 2013.

[18] Sumarwoto, Marwani S. “Application Statistics in Research”. Jakarta [ID]:Ufuk Press. 2012.

[19] Wardhani AR. “Simulation Queue at Borobudur Indomaret Malang”. *Jurnal Widya Teknika* Vol. 20 No. 2: 18-25. 2012.

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Formulation and Nutritional Appraisal of Low Cost Enteral Formula

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Abstract- Enteral feeding formula has shown to be beneficial in cancer patients, where otherwise the gut is efficacious in digestion and absorption of food but oral intake is not possible due to anorexia, tumor burden, and side effects of treatments. Long term enteral feeding programmed with extreme use of commercially available expensive enteral formula all pose a requirement of development of an Low Cost Enteral Formula (LCEF). Aim: to formulate low cost enteral formula and analyze its nutritional composition in comparison to other commercial formulae available in market. Material and Methods used: the low cost enteral formula using indigenous grains was developed by undergoing to different procedures. The formula obtained was then standardized along with commonly used commercial nutraceutical products. Both these were evaluated for nutritional value and cost. A study was conducted wherein LCEF was supplemented to post surgery head and neck cases in comparison to control group who were fed a commercially available nutraceutical supplement. A pre and post intervention comparative study was conducted including various parameters-weight, MUAC, BMI, Serum Protein, Serum Albumin and hemoglobin. Results: the low cost enteral formula developed, provided similar macro and micronutrients with low cost as compared to commercially available formulas. The results as indicated by various parameters showed that the experimental and control group had similar results. Patients also had good tolerance for the feed. Conclusion: LCEF can be used as an enteral formula in exchange to other commercial nutraceutical supplements available because of its cost effectiveness, similar nutritional content, easy to prepare at home, with nutrients in natural food form, making adaptation to normal foods easy and thus providing emotional comfort to patients.

Index Terms- Cancer, Enteral formula, Low cost, Nutrition.

I. INTRODUCTION

Cancer has become one of the leading causes of death in India. Caring for patients with cancer has become increasingly complex as there is no single case for the disease (Jain, 2003). Doctors and dieticians should be constantly aware of the diagnostic significance of loss of weight, anorexia, food aversions as early signs of malignant disease; when the diagnosis has been made and program of ablative surgery, radiation or treatment with cytotoxic drugs are laid down, a supportive diet should be carefully drawn up (Bloch AS, 1990). While the patient is being treated in the hospital, use of commercial formula makes it easier for the provision of energy, protein and all essential micronutrients. As many patients are from low socio-economic group, it may not be possible for all the patients to use ready to use, disease specific, and expensive nutrition products especially after obtaining discharge from the hospital. Thus it was important to formulate complete nutrition for cancer patients at home level developing appropriate low cost enteral feed formula as compared to commercially available expensive formulae in market.

II. REVIEW OF LITERATURE

The word 'Cancer' is derived from Latin word meaning Crab. Later, the term neoplasm was coined by scientist named Galen. He defined cancer as new growths contrary to nature. The ability of the neoplasm to migrate to other tissue or organ and form additional tumor is called metastasis. There are two categories of tumor; benign, which are slow in growth, encapsulation, and noninvasiveness and there is microscopic similarity to surrounding tissue. Whereas malignant tumors exhibit rapid growth, are invasive in nature and are large and abnormal in shape.

Table 1: Types of Cancer

Four most common cancers	Breast, Colon, Lung, Prostrate, Head and Neck, esophageal
Hematolymphoid Cancer	Hodgkin's Disease, Leukemia, Multiple Myeloma
Skin Cancer	Malignant Melanoma
Gastrointestinal Cancer	Head and Neck, Esophageal, Stomach, Pancreas, Liver, Colon, Rectal, Anal
Urinary Cancer	Kidney, Bladder, Testis, Prostrate
Cancers in Women	Breast, Ovarian, Gynecological, Choriocarcinoma
Miscellaneous Cancers	Brain tumor, Bone tumor, Carcinoid tumor, Nasopharyngeal cancer, Retropertoneal sarcomas, soft tissue tumors, thyroid cancer, cancers of unknown primary site

Head and Neck Cancer:

5-10% of all the cancers involve head and neck site. The term head and neck cancer refers to all those which affects the human body above the collarbone, excluding the brain and central nervous system.

Table 2: Types of Head and Neck Cancers

Types of Head and Neck Cancers:	Cancer of Lip
	Cancer of Tongue
	Cancer of Floor of the Mouth
	Cancer of Buccal Mucosa
	Cancer of Gingival (Gums)
	Cancer of Oropharynx
	Cancer of Hypopharynx
	Cancer of Larynx
	Cancer of Nasopharynx

Diagnosis:

Cancer at early stages has no symptoms. As the oral cancer progresses, the patient can often feel a lump in the mouth, ulceration in the lip or tongue, sore spot. In case of advanced cancer pain, bleeding, loss of teeth or change in speech may develop. Diagnosis includes: physical examination, routine laboratory tests, X-ray, CT scan, and Biopsy. Staging of cancer is the process of finding out how far the cancer has spread. The prognosis largely depends upon the cancer stage. Staging information is obtained from physical examination, endoscopies, and imaging studies (CT scan, MRI, X-Ray, Nuclear Medicine scans). The most common system used to describe the extent of oral cavity and oropharyngeal cancer is TNM system of American Joint Committee on Cancer (AJCC). TNM stands for Tumor, Nodes and Metastases respectively.

Treatment:

Treatment option includes surgery, radiation a combination of both and occasionally chemotherapy. The aim is to eradicate the cancer with the best cosmetic result.

Surgery- surgery involves removal of the tumor and a portion of healthy tissue. Since these tumors spread to cervical lymph nodes in the neck, a radical neck dissection is frequently performed. Surgical resection of the head and neck areas has the potential to severely restrict or eliminate oral intake. Complications post-operatively such as infection, development of fistulae, sepsis, will increase nutritional requirements (Northern Cancer Network, Head and Neck Cancer Nutritional Guidelines)

Radiation- radiation is used both alone and in combination with surgery for treatment. Radiation therapy uses ionizing radiation to kill cancer cells and shrink tumors. It damages both cancer cells and normal cells, though normal cells can recover from the effect of radiation and function properly.

Table 3: Effects of Radiation

Acute effects of Radiation Therapy on Head and Neck Cancers	Late effects of Radiation Therapy on Head and Neck Cancers (> after 90 days of treatment)
Xerostomia, sore mouth and throat, dysphagia, odynophagia, mucositis, alterations in taste and smell, fatigue, loss of apettite.	Mucosal atrophy and dryness, ulceration, salivary gland xerostomia, fibrosis, osteoradionecrosis, alterations in taste and smell.

Chemotherapy- chemotherapy uses anticancer drugs that are given intravenously or orally. Chemotherapy is sometimes given to shrink the tumor before surgery or radiation therapy, which is called neoadjuvant chemotherapy.

Nutritional effects of cancer:

Cancer Cachexia- the term describes a group of symptoms and signs that encompasses initiation, anorexia, anemia, weakness, tissue wasting and organ dysfunction.

Table 4: Metabolic effects during cancer

Metabolic Components	Parameters	Effects
Energy	Energy expenditure	Increases
	Energy Balance	Negative
	Energy Store	Decreases
Carbohydrate	Body Glucose Composition	Increases
Lipid	Lipoprotein lipase activity	Decreases
	Fat synthesis	Decreases
	Fat breakdown	Increases
	Serum triglyceride levels	Increases
	Serum lipid levels	Increases
Protein	Body muscle mass	Decreases
	Skeletal protein synthesis	Decreases
	Skeletal protein breakdown	Increases
	Liver protein synthesis	Increases
	Whole body protein synthesis	Increases
	Nitrogen balance	Decreases
	Plasma Branched chain amino acid	
Water	Total body water	Increases

(Soube WW *et al*, 1985)

Nutrition care of the patients with Cancer:

A common secondary diagnosis in patients with advanced neoplastic disease is protein energy malnutrition. Weight loss and altered nutritional status are evident in 50% of cancer patients at the time of diagnosis (Langstein and Norton, 1991).

Even small amount of weight loss pror to therapy (less than 5% of body weight) may worsen prognosis significantly (De Wys *et al*, 1980).

Goals of nutrition care:

1. Prevent or correct nutritional deficiencies
2. Minimize weight loss

Early intervention is essential and screening for risk of nutritional problems should occur at diagnosis and continue throughout treatment. Nutrition assessment and intervention must be timely and anticipate nutritional needs.

Enteral feeding:

By definition enteral means "within the or by the way of gastrointestinal tract"(Srilakshmi, 2002). Efforts to encourage oral intake sometimes fail or are inappropriate, and more aggressive feeding methods are requires. If the gut is functional, enteral tube feeding is utilized. Nasogastric or nasoenteric tubes are used for short term support. The selection of enteral formulas is determined by several factors, including the functional capacity of the gut, the intubations site, the patient's metabolic status, and considerations of cost and convenience especially in home use.

Table 5: Indications for Enteral Feeding

Physiological Problem	Clinical Problem
Inability to ingest food	Carcinoma of esophagus or stomach, dental or oral surgery, inflammatory disease of esophagus, coma
Inability to digest food	Pancreatitis, biliary tract disease
Decreased ability to handle colonic residue	Radiation therapy, sprue, inflammatory bowel disease
Inability to handle colonic residue	Inflammatory bowel disease, presurgical preparation, ileostomy, colostomy, draining fistula
Inability to meet nutritional requirement fully with normal food	Major surgery, burns, trauma, extended fever, anorexia of chronic illness, anorexia nervosa

Factors to consider when choosing a feeding formula:

Feeding formulas should be evaluated using following characteristics

1. Osmolarity
2. Viscosity
3. Appropriate macronutrient ratio to meet assessed needs
4. Suitability for contribution of fluid and electrolyte
5. Cost effectiveness (Krause and Mahan, 1996)

Contraindications of Enteral Feeding (American Society of Parenteral and Enteral Nutrition- ASPEN)- diffused peritonitis, intestinal obstruction that prohibits use of bowel, intractable vomiting, paralytic ileus, severe diarrhea, severe pancreatitis, enterocutaneous fistulae, gastrointestinal ischemia.

Feeding formulas

Enteral formulas can be categorized in three major groups:

1. Standard formulas- which is the largest group and includes concentrated formulas, high protein formulas, calorie dense formulas.
2. Pre-digested formulas- for patients with some degree of gastrointestinal dysfunction and are more easily absorbed than intact nutrients.
3. Disease specific formulas- in which nutrient profiles have been altered for specific disease state or immune enhancement.

Feeding methods

After it has been decided that which tube feed the patient will be receiving, the method of feeding has to be selected.

There are three types:

1. Continuous feeding- either by gravity or by using feeding pump, patient is feed 24 hours, drip by drip.
2. Intermittent feeding- feeding is given per bottle e.g.500ml, over a period of about an hour or a particular number of times a day.
3. Bolus feeding- is delivery of feeding multiple portions of 200-250ml.

III. METHODOLOGY

Low Cost Enteral Formula (LCEF) is a high calorie high protein enteral formula, designed originally by the dietician in a tertiary care cancer center in exchange to other commercial supplements available in the market.

Why is there a need for Low Cost Enteral Formula?

- The commercially available enteral formulae are usually polymeric or elemental defined formula diets.
- They have high osmolarity and can lead to partial gastric and ileac discomfort because none or very little digestion is required.
- Moreover, since nutrients are mostly in pure form, later adaptation of normal food intake takes time.
- Also they are expensive and not affordable by many patients.
- It has been observed that enteral food akin to normal diet but of improved digestibility and texture perform better nutritional support to patients with than elemental diet.
- The uses of familiar food bring about emotional comfort to the patient.
- Higher amount of dietary fiber, which helps to relive constipation unlike commercial formula.
- Commercial formula also provide with a fixed profile of nutrients which is not modifiable, whereas formulated feeds can be modified. Formulated feeds can be modified by addition or removal of certain ingredients.

The methodology followed 5 phases, as follows:

PHASE 1:

Table 6: Development of Low Cost Enteral Formula

Ingredients	Quantity
Whole Wheat	300g
Rice milled	100g
Ragi	100g
Green gram whole	300g
Soya beans	100g
Til	100g
Flax seed	100g
Sugar	200g
Skim milk powder	100g
Total	1400g

Nutritional importance of ingredients:

- Whole Wheat: good source of energy as 80 % of dry matter comprises of carbohydrates. It's a good source of various vitamins and minerals.
- Rice: it's a good source of carbohydrates and protein (rich in essential amino acid – lysine). Its gluten free and acts as a diuretic, therefore helps in digestion.
- Ragi: good source of calcium, also rich in sulphur containing amino acid – methionine, high in soluble and insoluble dietary fiber.
- Green gram whole: rich in arginine, branched chain amino acid. Germination helps in reducing flatulence and aids better and easy digestion.
- Soya beans: rich in linoleic and lenolenic fatty acids, rich in poly unsaturated fatty acids (PUFA), contains compunds which are thought to suppress carcinogenesis – Bowman dirk inhibitor, inositol hexa phosphate (phytic acid), phytosterol B, sitosteraol and isoflavones. Phytoestrogen as genstein and diadzecin.
- Provides antioxidants- vitamin A and E
- Fairly good source of mineral- Zinc and Calcium
- Rich in soya polysaccharide fiber (SPF) which are degraded by intestinal micro flora to provide short chain fatty acid (mainly butyrate) which are major fuel for intestinal villi.
- Till (Sesame/gingely seeds): very good source of manganese, copper, magnesium, calcium , iron, thiamine, zinc and dietary fiber with cholesterol lowering effect and prevent high blood pressure. Prevents oxidative damage.
- Flax seed: rich in alpha lenolenic acid (ALA), the essential fatty acid belonging to group of omega -3 fatty acid.
- Sugar: concentrated and instant source of energy, easily digestible and easily absorbed. Improves the acceptability of the products by improving the taste.
- Skim milk powder: it is used in improving protein quality as it contains all essential amino acids allowing reduction in total amounts of proteins which could have potential metabolic advantage and increases soluble vitamins. Skim milk powder is used as a saturating agent to block nonspecific binding sites on supports like blotting membrane (nitrocellulose) preventing binding of further detection reagents. The major protein component of milk- casein is responsible for most of the binding site saturation effect (Journal of Nutrition, 2008).

Preparation of LCEF

Preparing Enzyme Rich flour:-

Soaking: the required quantity of wheat, ragi, mung, soya beans were soaked in water over night, enabling the grain to swell up and thus help inactivation of the enzyme in the grain. Soaking helps in reducing oligosaccharide of the raffinose family and thus reduces the chances of flatulence. It also reduced the amount of phytic acid, which is an anti-nutrient factor which can affect the absorption of various nutrients.

Germination: the grains are drained, packed in muslin cloth and allowed to germinate. This allows maximum synthesis and activation of various beneficial enzymes. During germination the dormant enzymes like cystases and pectinases are released which breakdown the cell walls increasing the availability of protein and minerals. Germination brings about hydrolysis of protein into its immune modulatory compounds like glutamine and arginine. Starches and proteins are converted into simpler substance and availability of essential amino acid increases. Germination reduces or eliminates trypsin inhibiting factors and toxins. The amount of riboflavin, niacin, folic acid, choline content is increased.

Drying and roasting: the grains are then sun dried, which help in complete dehydration. Roasting imparts a flavor and also brings about dextrinization making it easy to digest, thus im[proving the quality and biological value of proteins.

Removal of rootlets: the rootlets that are developed in germination are removed which are non-caloric fiber portion, helps reducing the bulk and increasing the caloric content (CFTRI, Clinical Trials). This was all then grinded to form a powder.

PHASE 2:

Standardization: the formulated formula was then standardized to prepare a feed similar to other nutritional products, which could be fed to patients. 50gm of developed feed formula was developed in 190ml water (boiled+cocoled) to make 200ml feed.

PHASE 3:

Evaluation of nutritive value and cost: the standardized feed was then evaluated for its nutritive value (source of calculation- Nutritive value of Indian Foods, by C.Gopalan, BV Rama Sastri and SC Balasubramanian) and cost benefit analysis was carried (taking into consideration the then market price of the ingredients.)

PHASE 4:

Nutrition appraisal of LCEF/ Commercial feeds

A whole day's diet plan was formulated for patients with head and neck cancers using LCEF and commercial formula, which is more commonly used for patients at hospital. The nutritive values of both these products were analyzed. Two groups of subjects from head and neck unit underwent surgery with 8-10 days hospital stay. Experimental 30 samples were provided with LCEF feeds through Nasogastric Feeding. Control 30 sample were feed with commercial formula. Anthropometric measurements using weight, mid upper arm circumference (MUAC) and BMI were taken pre and post treatment using standardized method. The biochemical parameters using serum total proteins, serum albumin, and hemoglobin were taken pre and post treatment. The results obtained were evaluated to determine the efficacy of LCEF.

Table 7: Diet Content

	Experimental (sample size-30) LCEF powder in 190ml water	Control (sample size-30) Resource Plain in 190ml water
Calories (kcal)	1617	1668
Proteins (g)	56	55
Fats (g)	69	69.7
CHO (g)	244	244

PHASE 5:

The overall acceptability of this product was seen on 50 head and neck patients for five days undergoing radiation therapy at the hospital. These patients were randomly selected and feed before taking radiation dose.

RESULT AND DISCUSSION

A high calorie high protein enteral formula was designed in exchange with other commercial supplements available in market. This formula, with its similar nutritional contents, easy to prepare and cost effective could also bring emotional comfort to the patient.

Table 8: Low Cost Enteral Formula

Ingredients	Wheat (whole)	Rice (milled)	Ragi	Mung (whole)	Soya bean	Till	Flax seed	Sugar	Skim milk powder	Total	Per 100g
Amount (g)	300	100	100	300	100	100	100	200	100	1400	
Energy (kcal)	1038	345	328	1002	432	563	530	800	496	5534	395
Protein (g)	35.4	6.8	7.3	72	43.2	18.3	20.3	-	25.8	229.1g	16.4g
CHO(g)	213.6	78.2	72	170.1	26.9	25	28.9	200	38	846.7g	60.5g
Fats (g)	4.5	.5	1.3	3.9	19.5	43.3	37.1	-	26.7	136.8g	10g
Na (mg)	51.3	-	11	84	-	-	-	-	-	136.3mg	9.8mg
K (mg)	852	-	408	2529	-	-	-	-	-	3789mg	270mg
Ca (mg)	123	10	344	372	240	1450	170	-	95-	3659mg	261mg
P (mg)	918	160	283	978	690	570	370	-	730	4699mg	335mg
Iron (mg)	15.9	0.7	3.9	13.2	104	9.3	7.9	-	.6	61.6mg	4.42mg
Fiber (mg)	3.6	0.2	3.6	12.3	3.7	2.9	4.8	-	-	31.1mg	2.2mg
Zinc (mg)	8.1	1.4	2.3	9	3.4	12.2	-	-	-	36.4mg	2.6mg
Mg (mg)	414	90	137	381	170	-	-	-	-	119.7mg	85.5mg

Table 9: Cost Analyses

Name of Company	Products	Package/Quantity	Cost Rs.	Dilution	Cost per feed Rs.
Nestle	Resource (plain)	400gms in 1 tin	342	50gms/200ml water	42.75
	Resource HP	200gms in 1 tin	168	15gms/200ml water	12.6
	Resource (Diabetics)	200gms in 1 tin	220	22.4gms/200ml water	24.6
	Resource (Renal)	200gms in 1 tin	160	22gms/200ml water	17.6
	Resource (Hepatic)	200gms in 1 tin	215	26gms/200ml water	28

	Impact	1 box=61×4	320	1 sachet/206ml water	80
	Nevosource peptide	200gms in 1 tin	170	25gms/85ml water	21.3
Abbot	Ensure	400 gms in 1 tin	358	43gms/170ml water	34
Glaxo Smith	Actibase (Neutral)	200gms in 1 tin	255	18gms/200ml water	22.95
LCEF		100gms packet	18	6tsp(50gms) /200ml water	9.00

Table 10: Comparison of LCEF with other commercial products

	Units	Fit kid	Kid pro	Pedia sure	Resource High Protein	Resource plain	LCEF
Energy	Kcal	311	400	470	355	446	395
Protein	gms	33	24	14.1	41	15.71	16.4
Fats	gms	3	8	23.4	2	15.71	10
CHO	gms	38	58	50.05	48	61	60.5
Sodium	mg	-	500	181	500	357	98
Potassium	mg	-	900	512	800	660	270
Calcium	mg	200	800	386	500	223	261
Phosphate	mg	95	500	240	900	223	335
Magnesium	mg	160	180	78	-	89.3	85.5
Iron	mg	2.5	3	5.5	15	4	4.42
Zinc	mg	1	1.25	3.5	4.5	3.3	2.6

Diet Plans for experimental and control groups:
Experimental Group (Sample size -30)
6:30 am : 1 glass water + 6tsp LCEF powder
8:30 am : 1 glass milk + 3tsp sugar
10:30 am : 1 glass milk + 3tsp sugar
12.30 pm : 1 ½ glass Blended soup
3:30 pm : 1 glass water + 6tsp LCEF powder
5.30 pm : 1 glass milk + 3tsp sugar
7:30 pm : 1 ½ glass Blended soup
9:30 pm : 1 glass milk + 3tsp sugar
Control Group (Sample size -30)
6:30 am : 1 glass water + 6tsp Resource (plain)
8:30 am : 1 glass milk + 3tsp sugar
10:30 am : 1 glass milk + 3tsp sugar
12.30 pm : 1 ½ glass Blended soup
3:30 pm : 1 glass water + 6tsp Resource (plain)
5.30 pm : 1 glass milk + 3tsp sugar
7:30 pm : 1 ½ glass Blended soup
9:30 pm : 1 glass milk + 3tsp sugar

Table 11: Nutrition Appraisal of LCEF and Commercial Feeds

	Experimental group				**Control group**			
Time	Cals (kcal)	Pro (g)	Fat (g)	CHO (g)	Cals (kcal)	Pro (g)	Fat (g)	CHO (g)
6:30 am	197.5	8.2	5	30	223	7.3	7.3	30
8:30 am	199	6.6	12	24	199	6.6	12	24
10:30 am	199	6.6	12	24	199	6.6	8.2	24
12:30 pm	213	7	5.5	44.2	213	7	5.5	44.2
3:30 pm	197.5	8.2	5	30	223	7.3	7.3	30

5:30 pm	199	6.6	12	24	199	6.6	12	24
7:30 pm	213	7	5.5	44.2	213	7	5.5	44.2
9:30 pm	199	6.6	12	24	199	6.6	12	24
Total	**1617**	**56.8**	**69**	**244.4**	**1668**	**55**	**69.7**	**244.4**

The age of patient in the study ranged from 25-71 yrs. of age and their income level ranged from 200 rs per month to 2,500 rs per month.

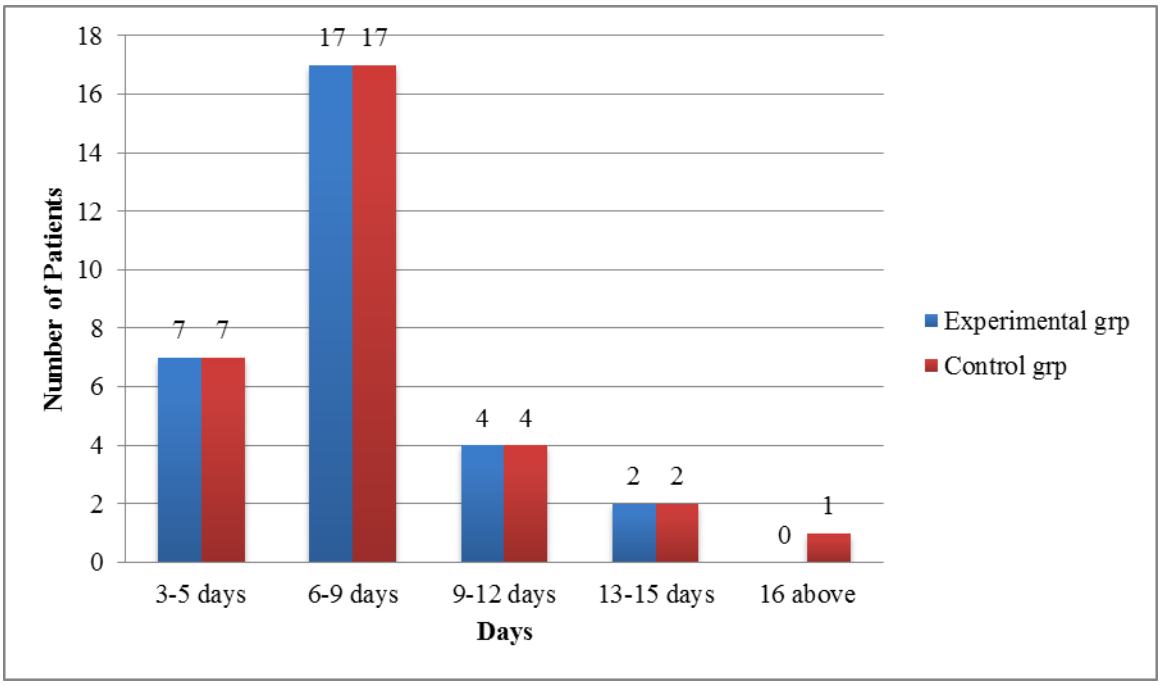

Figure 1: Hospital Stay of the Patient

As shown in the above figure, the mean hospital stay among the experimental group was around 7.63 and among control group was around 7.8 days. Therefore mean hospital stay for both the group was around 8 days. Thus, LCEF decreased the hospital stay of the experimental group.

Table 12: Baseline Biochemical Parameter

	Experimental grp	Control grp
Hemoglobin (g/dl)	10.25	10.53
Total Protein (g/dl)	5.91	5.94
Serum Protein (g/dl)	2.56	2.79

It was observed that in baseline biochemical parameters there was not much difference between the two groups.

Table 13: Baseline Anthropometric Characteristics

	Experimental grp	Control grp
Weight (kg)	48.4	55.2
MUAC (cm)	24.2	24.9
BMI (kg/m^2)	19.45	20.6

Baseline anthropometric characteristics were found to be similar in both the groups.

Table 14: BMI Classification

Below 17	Severely malnourished
17-18.5	Moderately malnourished
18.5-25	Well nourished
Above 25	Obese

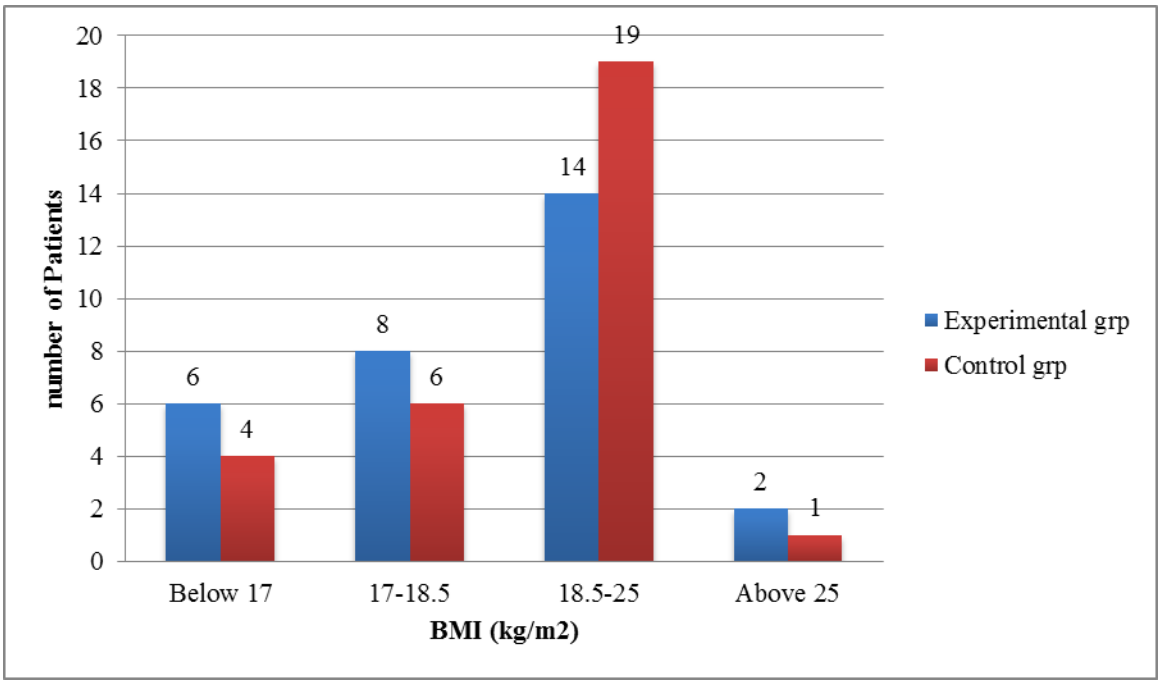

Figure 2: BMI of Patients

In the above figure, among the experimental group, out of 30 patients, 6 (20%) were severely malnourished, 8 patients (26.7%) were moderately malnourished, 14 patients were well nourished and only two were obese.

Among control group, out of 30 patients 4 were (13.3%) were severely malnourished, 6 were (20%) were moderately malnourished, 19 patients (63.3%) were well nourished and only 1 patient was obese.

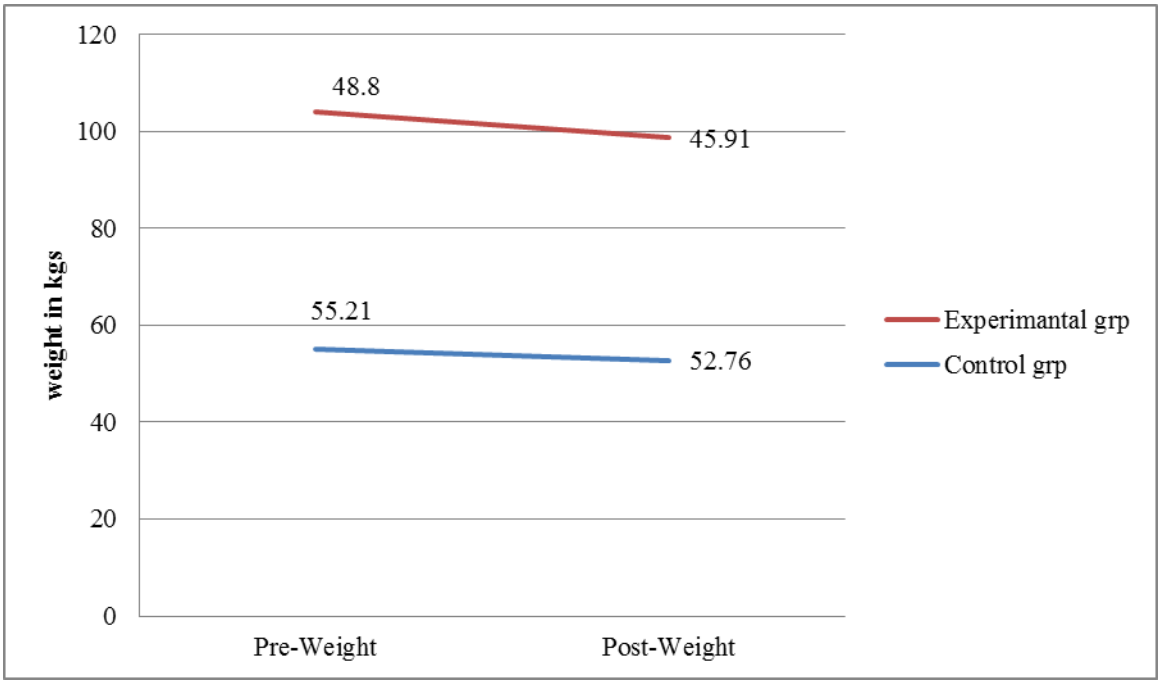

Figure 3: Weight among Patients

As seen in figure 6, the mean weight of the experimental group pre surgery was among 48.8 kgs which decreased to around 45.91 kgs post-surgery after the feeding period. Similarly among the control group, the mean weight of patients pre-surgery was 55.21 kgs, which decreased to around 52.76 kgs after the feeding period.

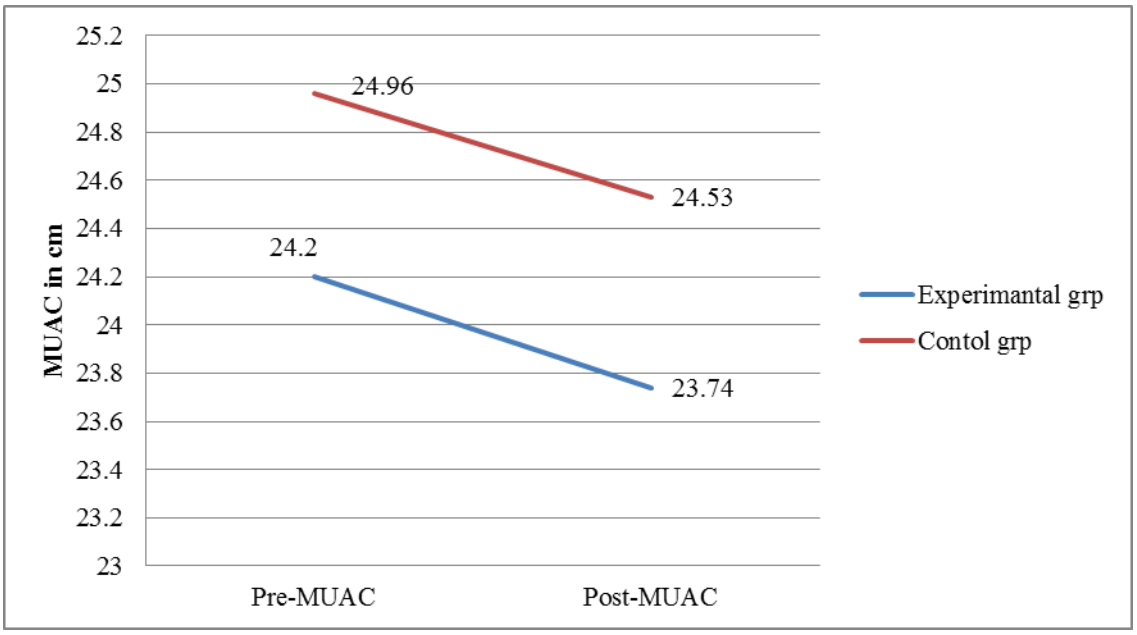

Figure 4: MUAC of Patients

As seen in the figure 4, the mean MUAC of 24.2cm among experimental group decreased to 23.74cm during hospital stay. Similarly the mean MUAC among the control group deceased from 24.96cm to 24.53cm.

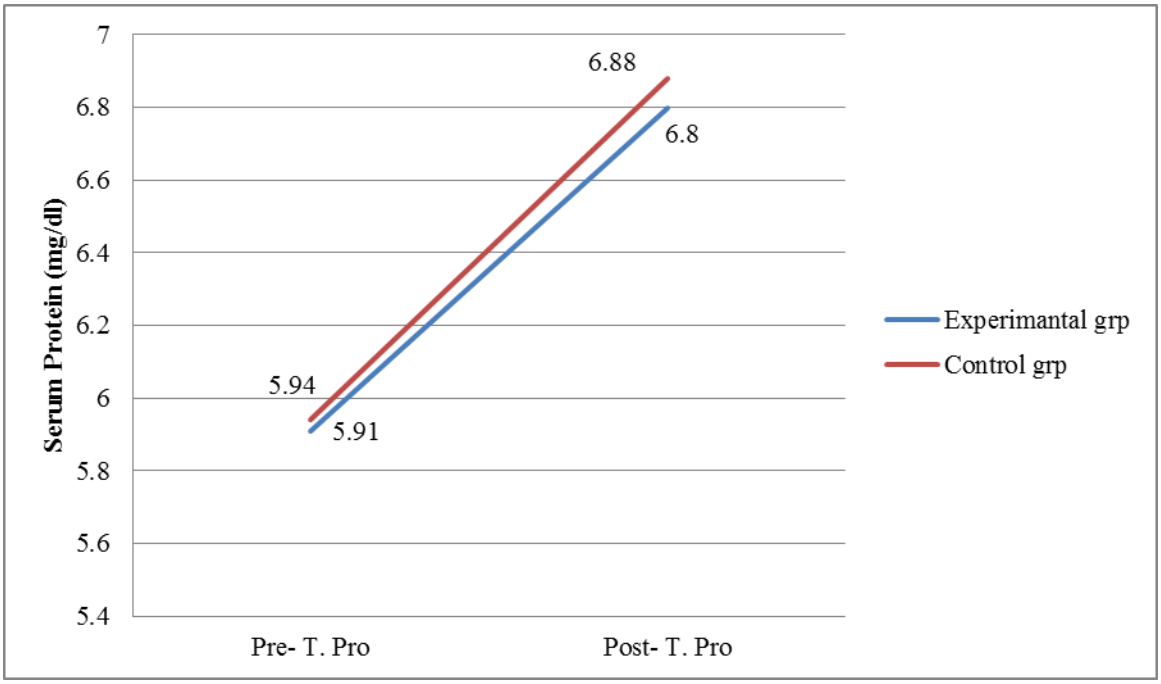

Figure 5: Serum Protein Levels among Patients

The mean serum total protein levels among the experimental and control group were 5.91g% and 5.94g% which increased to 6.8g% and 6.88g% respectively, as shown in figure 5.

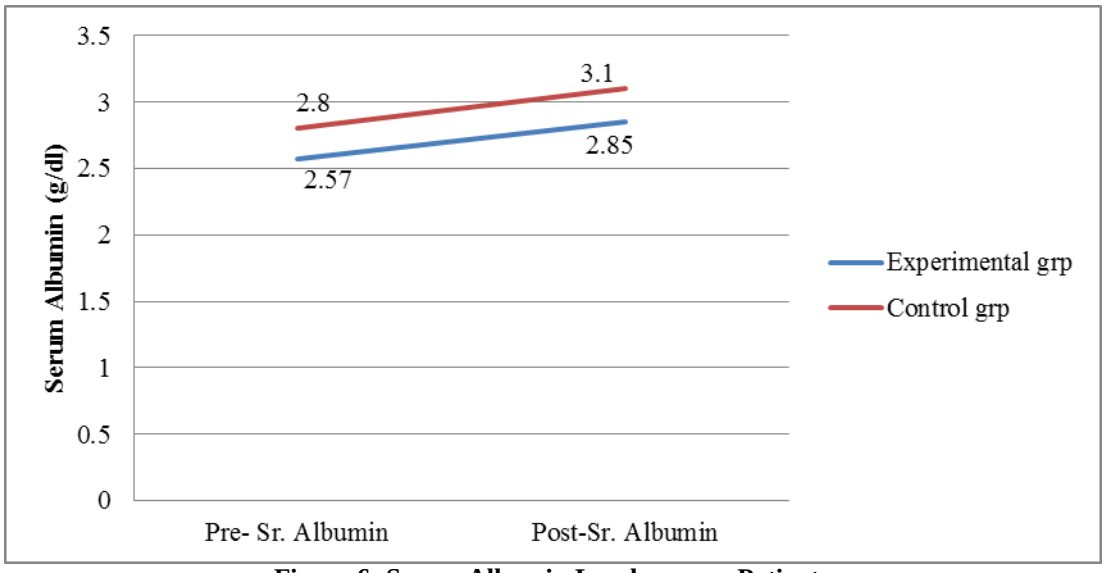

Figure 6: Serum Albumin Levels among Patients

As observed in figure 6, the mean increase in serum albumin levels among the patients of the experimental group was from 2.57 g% to 2.85g% and among the control group was from 2.8g% to 3.1 g%.

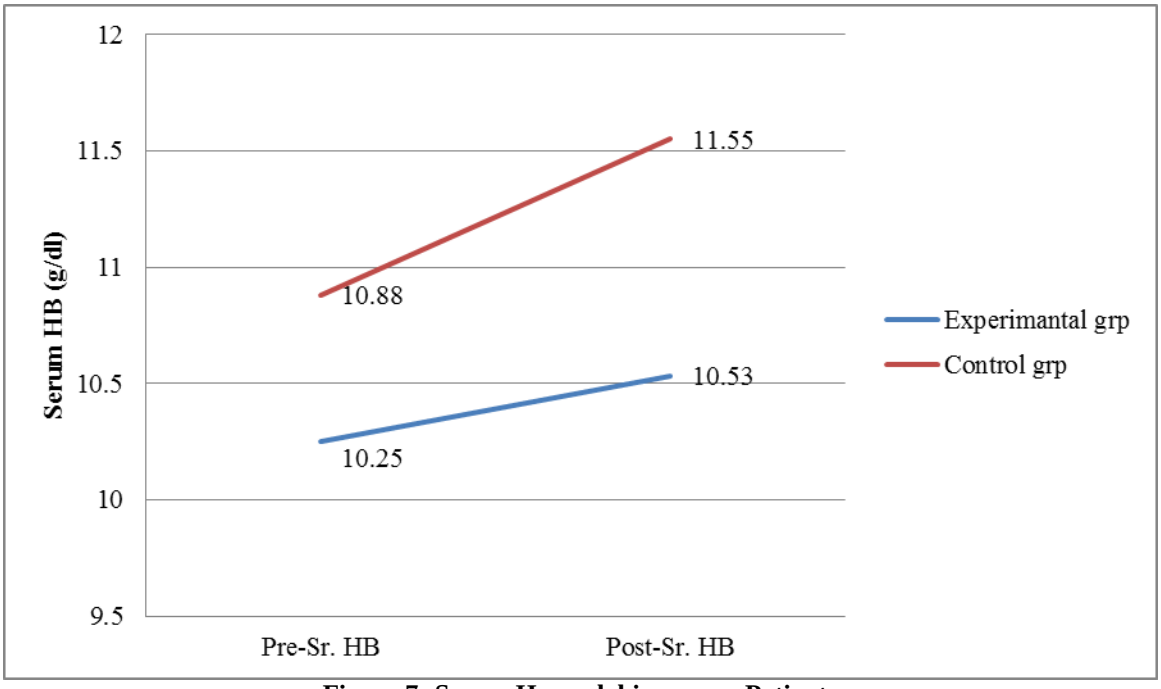

Figure 7: Serum Hemoglobin among Patients

There was increase in mean serum hemoglobin among both the groups as shown in figure 7.

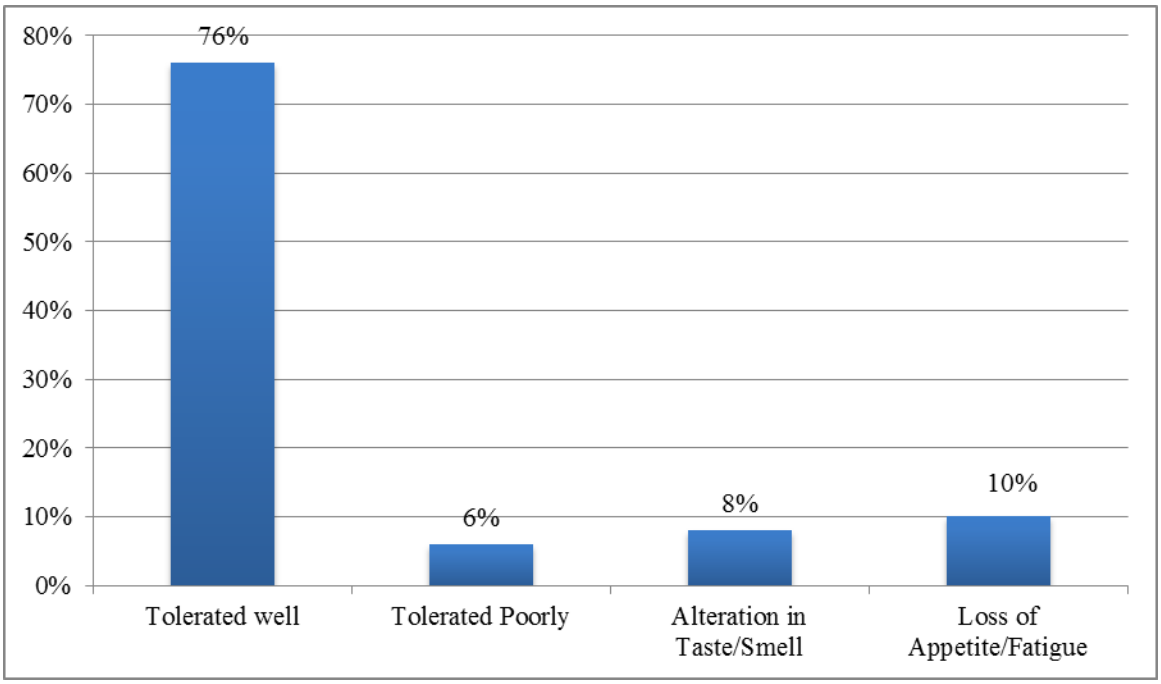

Figure 8: Patient's Tolerance to feed

76% (n=38) tolerated the feed well, 10% (n=5) experienced the feeling of fullness post feeding, 8% (n=4) observed gastrointestinal discomfort and only 6% (n=3) tolerated feed poorly as they felt dryness of mouth and throat.

IV. SUMMARY AND CONCLUSION

Commercial formulas are expensive; it may not be feasible to the patients to continue on commercial formulas. LCEF is cheaper, easy to prepare and provides comfort to the patient. As seen in the study the outcomes of LCEF feeds were similar to those obtained from commercial feeds, but at a cheaper rate. It can be easily prepared at home with nutrients in natural form. So that later adaptation to normal foods becomes easy. It has a consistency that would easily pass through the feeding tube. The overall acceptability and tolerance was good.

ACKNOWLEDGMENT

I would like to thank, the Divine Almighty and his presence with me throughout the study, which has pulled me out when I found myself in a heap of confusion and frustration. It was indeed strong in him, which enabled me to complete this work.

Since the year 2006, it was now the late Director of Tata Memorial Centre Dr. K.A. Dinshaw, encouraged to conduct this small study in the hospital. This in 2013 was accepted by the present Director R.A. Badwe, who encouraged putting up as IAEA-CRP Project, who permitted me to try further, on the patients. I am therefore thankful to both the Directors.

I am grateful to Dr. Jagmeet Madan, the principal of SVT College of Home Science and the President of Indian Dietetic Association, Mumbai Chapter, who in spite of her tight scheduled has been readily available to give me continuous guidance, support and help needed throughout the study.

It would not be right on my path, if I don't acknowledge Dr. Ganesh, HOD statistic and record department, Tata Memorial Hospital for analyzing the results. Also all the patients, the cornerstone of my study for their and co-ordination and trust which made my study a success should not be forgotten.

Last but not the least, my colleagues Mrs Purabi Mahajan and T.Y. Shivshankar and the Food service Department on the whole.

I would like to express my gratitude to my dear husband Mr. Bharat S Nair and my two sons and all other family members for providing all the help needed and being a source of inspiration and motivation throughout the project.

REFERENCES

[1] Jain, 2003, Nutritional parameters in children with malignancy. Indian Pediatrics 40:976-984.

[2] Bloch AS (ed) Nut Mgt. of Ca Patients, Rochvi ASPEN: A Cancer Guide, 1990.

[3] www.Trigan.com/catyps.htm, 2000.

[4] Northern Cancer Network, Head and Neck Cancer Nutritional Guidelines.

[5] Soube WW et al 1985, glutamine metabolism by intestinal tract J.Par.Ent.Nut. 9:608-617.

[6] Langstein and Norton, 1991.

[7] Dewys WD et all 1980, Prognostic effect of weight loss prior to chemotherapy in treatments. American J med 60:49.

[8] B. Srilakshmi, 2002, Food Science.

[9] Krause and Mahan, Food Nutrition and Dietetics, 1996

[10] Journal of Nutrition, 138, January 2008)

[11] Nutritive Value of Indian Foods, C. Gopalan, B.V. Rama Sastri, and Balasubramaniam, Rivised by and Updated by B.S Narasinga Rao, Y.G. Deosthala and K.C. Pant, ISBN:8123019789.

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Review on Management Information Systems (MIS) and its Role in Decision Making

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Abstract- This paper focuses on understanding the concept of MIS, the need for MIS, the advantages of MIS in an organization, the MIS model, decisions and the decision making system and majorly the role of MIS in decision making. It talks about MIS in brief considering the concept of MIS, the MIS model that is used by organizations, how MIS is beneficial, why is there a need of MIS in an organization. It then gives an overview of decisions and the decision making system which is necessary to understand the decision making process. Finally, the major focus of this paper is the role of MIS in decision making of an organization. How decisions are made in an organization using MIS, what challenges are faced by the organization in this process and a few recommendations to curb these challenges. It provides a brief understanding of why MIS improves decision making.

Index Terms- Benefits of MIS, Decision making, MIS, MIS model, MIS concept, Need for MIS.

I. INTRODUCTION

Management information systems(MIS) is an organized, diverse and automated information system that is concerned with the process of gathering ,storing and transferring relevant information to support the management operations in an organization. The data is distributed among the various departments in an organization. The processing of data takes place in various forms such as graphs, diagrams, charts, reports to generate accurate and relevant information for the management. MIS provides central storage of all the business information. MIS is used across all levels in an organization. There are different types of management information systems. This paper focuses on decision making information system.MIS plays a vital role in not only collecting and man-aging information, but also representing it in various formats useful for the management to make important organizational decisions.

MIS provides faster access to the required information which helps the organization to make effective and timely decisions regarding every aspect such as investments, employments, products, etc depending upon the organization. Decision making basically refers to choosing a certain line of action from among several alternatives. It is integral management that occurs in every level of management and in every function. The effectiveness of the organization depends upon the quality of decisions that informs its operation. Decision making is a major metric to determine the organizations success or failure. This paper focuses on understanding the need, benefits, types of MIS, the MIS model, decision making system and majorly the role of MIS in decision making of the organization.

II. NEED FOR MIS

Organizations found it difficult to manage the information as a whole, before computer technology bloomed. Developments in computer technology made it possible for the managers to easily gather, integrate, store and manage the information in the form they require depending upon their needs and timing. Information is used simultaneously by many people. The information needs to be current, accurate, concise, timely, complete, well presented and storable[1]. For organizational productivity, solely depending on personal computers is not reliable until it is used efficiently and effectively. Also, advanced technological systems for integrating and sorting the data can be costly unless the senior management provisions it to the staff. Thus, information systems came into picture.

Information system is a mechanism that ensures information is available to the managers as per their need and time. It provides relevant information for decision making. Management information is an important input at every level in the organization for decision making, planning, organizing ,implementing, and monitoring and controlling[5].

Managers have to assimilate masses of data, convert that data into information, form conclusions about that information and make decisions leading to the achievement of business objectives. For an organization, information is as important resource as money, machinery and manpower. It is essential for the survival of the enterprise. Hence management information system plays a major role in managing information and making it easy for the managers to collect, integrate and assign the information and ensures effective and efficient decision making.

III. CONCEPT OF MIS

Information is a set of classified and interpreted data used in decision making and it has also been defined as “some tangible or intangible entity which serves to reduce uncertainty about future state or events” [5]. There are different levels of decision making, for which information can be described as:

1) source

2) data
3) inferences and predictions drawn from data
4) value and choices
5) action which involves course of action.[5]

Management information system has a purpose to meet the general information needs of all the managers in an organization or in some subunits of the organization. A subunit can be based on functional areas or can be viewed at management levels.

Considering the definition for MIS, one of the popular definition describes management information system (MIS) as "an organizational method of providing past, present and projected information related to internal operations and external intelligence. It supports the planning, control and operation functions of an organization by furnishing uniform information in the proper time frame to assist the decision makers" [5]. The information in MIS describes the firm or one of its major systems in terms of what has happened in the past, what is happening now and what is likely to happen in the future. The information is provided in the form of reports and outputs of mathematical simulations. There are two types of reports namely, periodic and special report. All managers use the information output as they make decisions to solve the firm's problems.

A management information system has also been defined as "an integrated user machine system for providing information to support operations, management and decision making functions in an organization. The system utilizes computers, manual procedures, models for analysis, planning, control and decision making, and a database" [5]. All these definitions give a concise understanding of MIS as a whole.

IV. BENEFITS OF MIS

MIS makes a major difference for the business organizations. It provides several benefits such as :

1) effective and efficient coordination between Departments
2) quick and reliable referencing
3) access to relevant data and documents
4) use of less labor
5) improvement in organizational and departmental techniques
6) management of day-to-day activities
7) day-to-day assistance in a Department and closer contact with the rest of the world.
8) provides a valuable time-saving benefit to the workforce

For an organization the most important factor is to efficient and effective work in minimum amount of time. MIS supports this aspect of gaining profit and ensures that employees do not have to collect data manually for filing and analysis. Instead, that information can be entered quickly and easily into a computer program. As the data is growing, it is becoming difficult for business analysts to analyze the data, hence MIS provides a platform for building programs to access the data in response to the queries by management. With faster access to needed information, managers can make better decisions about procedures, future directions, and developments by competitors, and make them more quickly.

V. THE MIS MODEL

This section describes how does a MIS model actually look like. The components of the MIS model consist of :

1) Database
2) Organizational decision maker
3) Report writing software
4) Mathematical model

The organization of these components can be referred from Figure 1[5] given below.

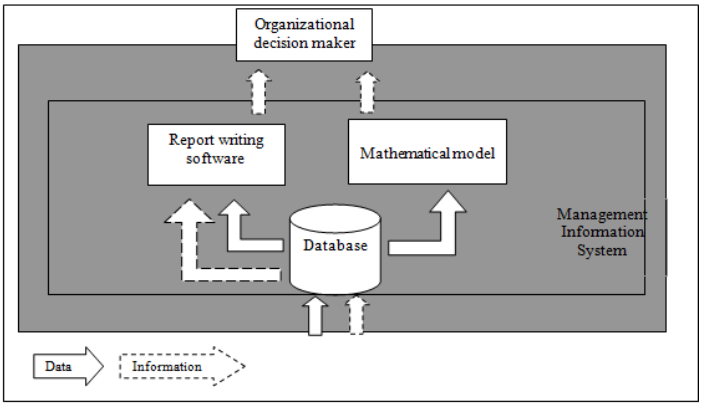

Figure 1 : MIS Model

The working of the MIS model starts with data and information coming from different sources. The data provided by accounting information system is stored in the database. The data and the information are entered from the environment. Data based information is sent to the report writing software for generating periodic and special reports , as well as to the mathematical model for simulation of the various aspects of the organization's operations. The output from the report writing software and the mathematical model is then sent to the people who are responsible for solving the problems. To solve the problem, effective decision making is required for productivity. There are decision makers which may or may not exist in the firm's environment. The environment might consist of other organizations to which the firm has collaborated such as suppliers, to from an Inter Organizational Information System(IOS). In such case, MIS supplies information to the other member of the IOS [5].

VI. DECISIONS AND THE DECISION MAKING SYSTEMS

Decision making systems :

This section talks about the decision making systems and its classification, and the types and nature of decisions. Decision making systems are based on the decision maker's or the

manager's knowledge about the environment. They can be classified into two types :

1) Closed Decision Making Systems If the decision maker operates in a known environment then it is called as closed decision making. The conditions for the same are as follows :
   a) The manager has a known set of decision alternatives with their outcomes fully in terms of values if implemented.
   b) The manager has a model, a method, rules where the decision alternatives can be generated, tested and ranked.
   c) The manager can choose one of the alternatives based on the goals and objectives. Example: Examination system to declare a pass and fail[4].
2) Open Decision Making Systems If the manager operates in an unknown environment then the decision-making is called as open decision making. The conditions for the same are as follows :
   a) The decision maker dosen't know all the decision alternatives.
   b) The outcome of the decision is also not known fully i.e. the knowledge of the outcome may be probabilistic one.
   c) No method, rule or model is available to study and finalize one decision among the set of decision alternative.
   d) It is difficult to decide objectives and goals. Therefore the decision maker reports to that decision where aspirations and desires meet. Example: Pricing a new product[4].

Decisions :

According to Haynes and Massie, a decision is a course of action which is consciously chosen for achieving a desired result.[4]. According to Trewatha and Newport, Decision making involves the selection of course of action from among two of more possible alternatives in order to arrive at a solution for a given problem.[4]. Considering the classification of decisions, there are classification based on the situation and their nature.

The types of decision on the basis of situation are based on the knowledge about the outcomes that are yet to take place. For a successful decision, the decision maker should be aware of the outcome that will take place once that decision is taken. In addition to that, if the decision maker has the full knowledge of the system then it is a situation of certainty. Contrastingly, if the decision maker has partial or incomplete knowledge of the system, then its a risk situation. Lastly, if the decision maker has no knowledge of the system then it is a situation under uncertainty.

On the basis of nature, decisions can be classified as programmed decisions and non-programmed decisions.

1) Programmed decision: - If a decision is based on rules, methods or some guidelines then it is called as programmed decision. The programmed decision making can be delegated to a lower level in the management. Eg: If a stock level of an item is 200 number then a decision to raise purchase requisition for extra items in few numbers[4].
2) Non- programmed decision: - A decision which cannot be made using a rule or method is called as non programmed decisions. This decision making is non-deterministic and is handled by top management Eg. Stock level is 200[4].

VI. ROLE OF MIS IN DECISION MAKING

Decision - making is the process by which organizational members choose specific course of action out of several alternatives in response to opportunities and threats . The outcome of the decision making process either results in a good or a bad decision. A Good decision results in successful productivity of the organization and in the courses of actions that help an individual, group or organization to be effective, while a bad decision results in ineffective and inefficient choice of course of action thereby leading to poor or no productivity and overall loss of time, effort, finance and labour. Every organization grows, prospers or fails as a result of decisions made by its members. The success of decision-making is highly dependent partly on available information, and partly on the components of the process which are known as functions. For example, if managerial objectives are absent or unclear, probably due to inadequate information, there is no basis for a search[1]. Without the information, the search has no meaning because there will be no alternatives to compare search results, which will thereby yield an undesired result due to random choice of a particular course of action. According to Alabi the search could be through[1] :

1) Undirected viewing : There is a general exposure to information where the viewer has no specific purpose in mind and is randomly searching for information from the entire information pool.
2) Conditioned viewing : There is a directed exposure to information. Yet it does not involve active search to a more or less clearly identified area or type of information.
3) Informal search : This is a relatively limited and unstructured effort to obtain specific information for a specific purpose. The information wanted is actively sought.
4) Formal search : This is a deliberate effort, usually following a pre-established plan, procedure or methodology to secure specific information relating to a specific issue.

Simon (1984), a leading authority in management decision-making considers that decision making comprises four princi-pal phases[2] :

1) Intelligence- searching the environment for conditions that calls for decision making.
2) Design- inventing, developing and analyzing possible courses of actions. This involves processes to understand the problem, to generate solutions and testing of solu-tions for feasibility.
3) Choice- selecting an alternative or course of action from those variables.

4) Review- assessing and analyzing all the past choices

MIS can be viewed in another way wherein it acts a means for transformation of data, which in the decision making process is used as information. The data is flooded in the MIS process which comes out in the form of information and this information is an input to the user processes. The data is processed into information for a specific purpose and it provides several alternatives of course of action for decision making, out of which one course of action is selected which is nothing but the decision taken.

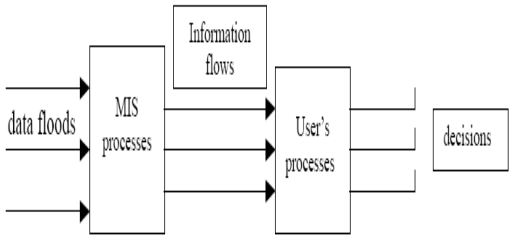

Figure 2 : MIS Decision Making Process

For improvement in decision making using MIS, a relevant MIS strategy should be chosen and it should be ensured that the choice made is fully compatible with the system. Thus, time and money will be saved and the probability of selecting a wrong choice will decrease. Also, the selected MIS strategy should be compatible with the decisions made. That means there should be a common point between the decisions and the MIS strategy to be used by the organization.

According to Obi (2003)[5], MIS can monitor any disturbances in the system and hence it is useful for decision making. MIS gets the system in control by taking a particular course of action. It is also relevant in nonprogrammer decisions as it provides support by supplying information for the search, the analysis, the evaluation and the choice and implementation process of decision making[5].

Considering the various aspects of how MIS helps in decision making, another key factor here is selecting the individuals for decision making. MIS is a highly complex process which requires lot of caution. Thus, organizations should carefully select the individuals who will be controlling the systems. The more professional a person, the better it can handle decision making which thereby increases the probability of correct decisions and positive outcomes for the organization.

On another level, decision making also depends on the past work or historic information. This is where record keeping comes into picture. MIS plays a major role in record keeping of databases that can easily keep confidential and invaluable information. Security of information in the databases is ensured by the managers of the organization. In addition to that, databases provide a platform from where information can be retrieved. Hence, record keeping and database tools of MIS ensures that the decisions are taken viably and at the same time the businesses run smoothly without any interruption.

From the operations perspective, the operations of MIS heavily rely on systematic methods. This indicates that the decisions made by the organization are pre-planned and in order which thus encourages objectivity during decision making[3]. Thus the systematic and orderly formula of operating is crucial and game changing for good decision making.

Jahangir [3] adds that the principles, strategies and modes of operation in MIS can be intelligently used by macroeconomists to draw a line between good and bad decisions. Once the line is drawn, good decisions are encouraged while the bad ones are sidelined and almost discarded. As a result, this ensures positivity in terms of decisions made by organizations which consequentially improves the decision making process.

From the fundamental perspective, a good number of MIS can perform multiple tasks simultaneously. Multitasking is directly proportional to efficiency since several operations are performed simultaneously thereby increasing the efficiency. In context of decision making, it is seen that multitasking ensures that decisions are made more speedily as compared to those systems that handle one task at a time.

Despite the various advantages of MIS in decision making , there are a few challenges which need to be curbed. MIS has a dynamic nature resulting in difficulty for some organizations to keep up with the principles, strategies or even ideas. Also, MIS is non adaptable, calling for different decisions in different situations which is challenging. MIS requires expertise and is costly for some organizations. Lastly, MIS is a more of a science-oriented field while business is art-oriented. Hence for some organizations it becomes difficult for collaborating and finding a middle ground for the two. Although these challenges are not common for all organizations, there is a need to curb the challenges mentioned above.

To overcome these challenges, one of the things that an organization can adapt is a well defined decision making system which will provide a viable environment for MIS. Considering the cost, the higher management of the organization should come up with plans to manage the cost of MIS. Good decision makers should be chosen that can handle diverse decisions and can think differently and intellectually. The organizations should arrange seminars and teach the diverse and dynamic nature f MIS for better understanding, thereby helping their employees to improve their performance.

VII. CONCLUSION

Management Information Systems provides accurate, timely, relevant and complete information necessary to facilitate decision making in an organization. It helps in planning, control and operational functions to be carried out effectively and efficiently. It provides a wide range of decision alternatives for the decision makers, enabling them to make their choice depending on the system and the situation. It ensures that the choice results in more often, a positive outcome. These are the major reasons why MIS is chosen by renowned organizations for decision making and for management of information.

MIS with all of its advantages has a few challenges that needs to be overcomed. Organizations should ensure top level

management involvement for smooth functioning of the organization when it comes to MIS. Decision making inn such organizations would be faster and in line with the modern and efficient business practices. Business owners must learn to cope up with the ever changing trends in MIS and decision making, without which it will be very challenging to make positive progress in decision making. Finally, it is vital to remember that improvement in decision making is fundamentally meant to ensure customer satisfaction while businesses continue to flourish in success [3]. The MIS strategies should be adopted as per the requirement and should aim to achieve the business goals.

ACKNOWLEDGMENT

We would sincerely like to thank our professors for the constant mentorship. We are grateful towards our peers for the encouragement and constructive criticism.

REFERENCES

[1] G.Satyanarayana Reddy, Rallabandi Srinivasu, Srikanth Reddy Rikkula,Vuda Sreenivasa Rao, "Management Information System to help managers for providing decision making inan organization," in International Journal of Reviews in Computing,2009.

[2] Gabriel, Justin Mgbechi Odinioha,Management Information Systems and Corporate Decision-Making : A literature Review,The International Journal of Management, Vol.2 Issue 3,July,2013.

[3] Srinivas Nowduri,"Manageent information systems and business decision making: review, analysis, and recommendations",Journal of Management and Marketing Research .

[4] http://archive.mu.ac.in/myweb_test/MCA%20study%20material/M.C.A.(Sem%20-%20III)%20-%20Management%20Information%20System.pdf. Pg 20-34.

[5] Predrag Ranisavljević, Tanja Spasić, Ivana Mladenović-Ranisavljević, "Management Information Systems and Decision Making Process in Enterprise" , Economics Management Information Technology,Vol. 1,No. 2, 2012.

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Effects of Strategic Public Relations on Organization Performance: A Case Study of Kenya Red Cross Society

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Abstract- Public relation is very relevant in organizations today since it has become the most powerful tool to express the image of an organization to the public. Public relations are often key strategic enablers in today's highly competitive business environment. Well-articulated Public relations strategies will always provide a good working strategy aimed at improving the company's image to the public. Public relations strategy is seen to be the outcome of a strategic thinking process by senior management mainly to improve on strategic management in order to have a better company's image communicated to the public. Strategic Public relations provide the top level management with vast means of communication to the public in order to be in touch with its clients.

This study was conducted through a case study of Red Cross Kenya. The main objective of the study is to examine the effects of strategic Public relations in organisation performance. The study used primary data obtained through questionnaires provided to employees of Red Cross Kenya.

Literature was reviewed from various sources on the effects of strategic public relations in organization performance. Data collected was analyzed using descriptive statistics to describe the population. The findings indicated that there is a significant effect of strategic public relations on organization performance.

Index Terms- Strategic Management, Public Relations, Strategic Public Relations

I. INTRODUCTION

Background to the Study

An indication of the growing importance of communication to the corporate world is that reputation is seen more and more as a sound asset that companies must preserve. Reputation, writes Rahul Jacob (1995) "defines a company and motivates its people." "In the knowledge economy, a company's reputation and the generally held sense of identity take on heightened value." Quality committed organizations need a bond between organization and individuals. It gives that extra energy that is necessary to do everyday tasks.

James (2006) defined public relations as the management of communication between an organization and its public.

" public relations" has become a catchphrase in the discipline of public relations (J. Grunig& L. Grunig, 2000). There is an increasing consensus among industry scholars and practitioners that public relations should move beyond its technician role to one that contributes to strategic management. What do these experts mean when they discuss strategic management? What role can public relations play in the strategic management of an organization thus organization performance? Organizations do not exist in a vacuum. They influence and are influenced by diverse factors within the environment. Specific problems and issues, along with different publics arise and recede around organizations. Large organizations, especially multinational corporations and NGOs face a variety of concerns and challenges all over the world.

Increasing globalization, alongside the rapid development of media and technology, has resulted in a situation that nobody could accurately predict. The internet has become a primary channel for publics to get together in cyberspace for communication; it has given the population opportunities to speak out. All the same, this electronic sounding-board has become a good place to detect problems and issues as soon as they arise. For example when clients have a problem, they may go to the organization's web site to complain or look for chartrooms and discussion groups to converse with other people who have similar complaints and issues. Advances in technology have brought the world closer together and hastened communication. Consequently, organizations need to communicate faster than ever with a growing number of audiences.

Organizations including Non-Governmental Organizations have been increasingly aware of the importance of understanding what is going on in their environment, among the sponsors and the communities. They employ various methods for gathering this information such as monitoring news media or conducting surveys. However, these forms of research are not comprehensive enough to fully understand the environment. More over a number of public relations scholars and professionals have maintained that organizations should make more efforts to discover problems in their initial stages, before they affect the organizations. Otherwise, these problems can evolve into issues, possibly crises, which may be critical to the organization's survival (J. Grunig, 2000). By carefully observing and scanning their environment, organizations can identify problems early so that they can be proactive in managing them.

Strategic Management

An overview of strategic management helps the researcher to have a deeper understanding of this research topic. Strategic management is the process by which an organization manages relationships with its external environment while following its organizational mission J. Grunig and Repper (2002) maintained that it was to keep the balance between internal activities and strategies to manage responses to external factors, or the environment.

Rowe et al 1994 also defines strategic management as the decision process that aligns the organization's internal capability with the opportunities and threats it faces in its environment. This therefore means Red Cross Society's management is left with the role of identifying the organizational capabilities with the opportunities and threats affecting its environment. With this, the management would be in position to identify what they are expected to do so as to ensure that they serve the community as required.

In this case, strategic decisions are basically concerned with the scope of the society's activities, matching of the society's activities to its environment, resource capability, the allocation and reallocation of major resources in an organization in order to improve on the performance of the organization.

In linking strategic management to public relations, it is advisable for the Red Cross Society to assign responsibilities to competent staff (Gray, 1998). Top management, key business executives and PR-oriented business managers play a highly influential role in shaping the public relations agenda of the organization. They understand the value of communicating key organizational objectives, environmental obligations and community outreach programs to diverse stakeholders. Top executives often offer key inputs and suggestions to fine-tune annual public relation plans and even allocate budgets for promotional campaigns to seek funding from donors. They are ready to take up speaking engagements and other external assignments that would boost the organization's image.

Public Relations

Broom & Tucker, (2008) defines public relations as the management process whose goal is to attain and maintain accord and positive behaviours among social groupings on which an organization depends to achieve its mission. Its fundamental responsibility is to build and maintain a hospitable environment for an organization.

Public relations and marketing may be done by the same or different people. However, success in one may be offset by failure in the other. Both need attention. Both deal with relationships that are prior to the survival of the organization: public relations builds and maintains a hospitable environment for an organization. Marketing builds and maintains a market for the organization's products and services. Nonprofit making organizations like Red Cross Society do have public relations but do not have marketing department.

Scenarios and Strategic Public Relations

To develop a method of scenario building, it is crucial to first understand the concept of strategic management in general and of the strategic management of public relations in particular. Using a situational theory of publics, public relations can help an organization identify and segment strategic publics that influence the organization's survival. Issues management and environmental scanning provide a framework for detecting problems and issues that will possibly need scenario-building approaches to be resolved. The scenario-building technique used in strategic management is another important concept. Scenario-building is a process that helps an organization better understand its environment so that it can make strategic decisions based on that knowledge. During the process, the members of the scenario-planning team recognize environment drivers and their effects on the organization; patterns found from an organization's past are accumulated and become an organization's database and resources for future strategies (Schoemaker, 1995; Von Reibnitz, 1998). Scenario building from a public perspective allows an organization to take the behaviours and attitudes of its publics into account in its decision making.

Organization Profile

Kenya Red Cross Society is a humanitarian relief organization that was created through an act of parliament on 21st December 1965. Before its official launch as a Kenyan organization, it operated as a branch of the British Red Cross between 1939 and 1965. The international committee of the Red Cross (ICRC) recognized the Kenya Red Cross in 1966. Apart from being a member of the ICRC, the organization has also been formally recognized by the International Federation of Red Cross and Red Crescent Societies since 1967.

The Kenya Red Cross is an organization of volunteers and has about 69,000 members operating through a network of 58 national branches. Membership is open to all with no discrimination based on race, sex, creed, religion, class, political affiliation or nationality.

Kenya Red Cross vision is to be the most effective, most trusted and self-sustaining humanitarian organization in Kenya. Its mission is to work with vigor and compassion through its networks and with communities to prevent and alleviate human suffering and save lives of the most vulnerable.

Kenya Red Cross has had a positive influence on the lives of millions of vulnerable people affected by diseases, natural and man-made disasters countrywide. By choosing not to discriminate in its service provision and constantly in the media, the Kenya Red Cross brand has been able to endear itself to Kenyan from different socio-economic classes through its good public relations.

In 2005, Kenya Red Cross received the internationally recognized SGS Certification, the highest achievement of excellence for a Non-Governmental Organization. This certification placed the organization on a par with the best in the world at providing world-class services through transparency, accountability, integrity, good governance, leadership and management.

The Kenya Red Cross has developed a communication policy to improve the effectiveness of its communication strategy. With this policy in place, the body has been able to maintain good media relations that have ensured an immense media coverage and thereby high visibility for the brand both locally and internationally.

The Kenya Red Cross has divided its humanitarian mission into three core products that are reflected in its organizational structure.

- Disaster Preparedness and Response- This caters for disaster preparedness, disaster response, tracing services and logistics.
- Health and Social Services – This includes first aid, blood donor, HIV/AIDS, water and sanitation (WatSan), disease prevention and control and social services.

- Organizational Development – This includes youth, branch development and the Lake Victoria Programme.

The Kenya Red Cross relies on external resources and its own local mobilization efforts to finance its programmes. Its total expenditure in 2005 was approximately Ksh. 300 million. Of these, external donors provided 74% while 26% came from local resources. This has been a great improvement from the days when the organization was fully dependent on external donors. The branches are moving closer towards being self-sustaining by meeting their own operational costs. This shall be possible by implementing income generating projects. One such project has been implemented at the organization's Nairobi headquarters. This was the construction of a Disaster Management Training Center.

The Kenya Red Cross does not use much of traditional communication methods such as advertising. Its greatest asset in keeping the brand on the national and international radar has been its superior public relations. Through highlighting its various humanitarian projects in the media, Red Cross Society brand has maintained a high level of visibility in both national and international media.

Problems Statement

Public relations is a powerful management tool if approached with strategic integrity, alignment and focus. An organizational performing with coherence and its energy focus on a specific goal is far more effective than one that allows confused and inconsistence messages to disseminate from management. A well-managed, sustainable and consistence public relations agenda or initiative can reap long term benefits for the organization (JounghwaChoia and Yoonhyeung Choi, 2009)

The problem prompting this study to be carried out is that at the time of this research proposal, Red Cross Society experienced calamities and disasters in Kenya. They ranged from droughts, IDPs and the recent Jomo Kenyatta International Airport (JKIA) fire tragedy. Red Cross Society was responsible in all these disasters through its public relations linking with the public.

How should the organization identify and detect those problems? What should they do with the results of those activities? Which internal function would be responsible for helping the organizations be prepared? This study attempts to provide answers to those questions by maintaining that public relations is the function responsible for these tasks. It is upon this that this research strives to find out the effectiveness of public relations on organization performance of Red Cross Society to enhance sustainability since there no prove of any written research has been done on the same. Hence this study aims to find out the effects of public relations on organization performance.

Specific Objectives of the study

However, the study specifically seeks to:

i. To identify the effects of organizational alignment in organization performance.
ii. To assess the effects of crisis management in organization performance.
iii. To find out the effect of media relations in organization performance.
iv. To identify the effects of donor relations in organization performance.

II. LITERATURE REVIEW

Theoretical Framework

Strategic public relations has become a popular among public relations practitioners (J. Grunig& L. Grunig, 2000). Although the concept does not have an explicit definition, most discussions of strategic public relations refer to the plans, objectives and evaluation of public relations programs that should be within the frame of organizational objectives (J. Grunig&Repper, 1992). From the strategic management prospective, effective public relations must be part of strategic management at the organizational level, while it manages its own program strategically. It seeks to balance internal activities with strategies that deal with the external environment to achieve an organization's mission and goals. Public relations contribute to organizational effectiveness as part of strategic management; it develops good relationship with stakeholders that can constrain or help the organization achieve its mission.

Some public relations scholars have pointed out that the role of public relations is not well recognized in strategic management. For instance, J. Grunig and L. Grunig (2000) maintained that only a few of these scholars have recognized or described the role of public relations, although writers on strategic management have discussed the environment and list important components. The authors argued that public relations plays a critical role in strategic management by helping the organization to identify the most important components of the environment and building good relationships with them through communication. In so doing, an organization can become effective and competitive. The organizational manages the interdependencies with its strategic constituencies that support or constrain it.

Strategic management theory differentiates between enterprises, corporate, business, functional and operational strategy. Based on these strategy levels, public relations strategy is conceptualized as a functional strategy, providing the vital link between the enterprise/corporate/business strategies and the public relations strategy. Public relations strategy is formulated in the redefined role of the "Public Relations Manager" and is mainly derived from/influenced by the organization's enterprise strategy and also delivers inputs into the enterprise strategy (Gray, 1998).

As a functional strategy, the public relations strategy provides focus and direction for an organization's communication with stakeholders, building symbolic and behavioural relationships with its strategic stakeholders. It is the thinking and logic behind the public relations function's actions—determining what should be communicated rather than how it should be communicated. It is therefore not the same as communication plans but provides the framework for the communication plans necessary to carry out the strategy.

Public relations strategy is developed within the context of the organization's vision, mission, corporate culture, policies and

strategies (the internal environment), but focuses on an assessment of the external environment (Charles, 1996).

Public Relations as a Strategic Function

Today, the public relations profession is focusing a great deal of attention on how public relations strategies can produce a positive *return on investment* (ROI) (Grunig, J. E., 2006). While it is difficult to place a monetary value on relationships with publics, in practice there are numerous examples of how good relationships have reduced the cost of litigation and negative publicity; gained from lobbying towards favourable regulation or legislation; or increased revenue through the sale of products and services to relevant stakeholders (Grunig, J. E., 2006). The extensive research currently being conducted on relationships may, in time, demonstrate relationships as the most important intangible asset to an organization, thus reinforcing the value, and ROI, public relations provides (Bayon& Bauer, 2002; Crosby &Johnson, 2004; Grunig, J. E., 2006). Relationships provide a means for evaluating for evaluating both the long- and short-term contributions of public relations programs and of the overall function to organizational effectiveness (Hon &Grunig, 1999; Huang, 2004; Ki & Hon, 2007) through the measurement of such factors as trust, control mutuality, satisfaction and commitment as key components of high quality relationships and the organization's reputation. Such factors are essential for organizations working within both favourable and unfavourable operating environments.

When features (political, social, regulatory, economic and competitive conditions) of an organization's operating environment are favourable, strong relationships with key stakeholders assist in further maximizing the organization's position within its industry. In a volatile operating environment, when social, political, regulatory or economic trends are working against the organization, or if competition increases; an organization looks to such relationships to survive in a turbulent, unpredictable or changing environment.

The time an organization benefits most from the contribution public relations makes through building relationships is when it is dealing with a volatile environment: when such outcomes as trust, satisfaction, commitment and the organization's reputation not only provide a return on investment, but are key components in safeguarding the investment itself.

Effectiveness of Public Relations.

Public relations professionals and scholars have long been searching for key concepts to assess the value of public relations. According to J. Grunig and Hung (2002), "Throughout the history of public relations, practitioners and scholars have attempted to identify and name a single concept that defines the value of public relations." Likewise, L. Grunig J. Grunig and Dozier (2002) also said: "For at least 25 years, public relations professionals and researchers have struggled to develop measures that would establish that public relations is effective or adds value."

Public relations professionals have attempted to measure public relations effectiveness as they increasingly have faced the challenge of demonstrating the value of public relations to their organizations (Hon, 1997). For example, Kim (2001) described practitioners' challenge from their organizations as follows: "CEOs' demands for accountability (of public relations) have become more tenacious than ever" because of recent budget cuts in the public relations industry. Ledingham and Bruning (1998) put it as follows: "Scholars have luxury to deliberate the nature of public relations but practitioners deal on a daily basis with the immediate problem of justifying the value of their programs."

However, despite the critical nature of demonstrating public relations value at the organizational level, a common belief is that the value of public relations is difficult to measure since most of its elements are intangible. Moreover, the function of public relations traditionally has been considered to be a means of reducing costs rather than as a means of generating organizational revenues.

L.Grunig, J. Grunig and Dozier (2002) describes the dilemma of assessing public relations value in detail: the question of the value of public relations has been of great concern to professional communicators for many years because of the perception among both communicators and other managers that public relations is an intangible management function in comparison with other functions whose value can be described, measured and evaluated through systematic approach. Because of this intangibility, public relations often has been believed to suffer at budget time and particularly during financial crises, because there is no way to demonstrate its worth.

Griffin (2002) and Hutton et al. (2001) have pointed out that public relations professional have widely embraced reputation management to demonstrate the economic viabilityof the public relations function. Specifically, Kim (2000, 2001) maintained that the accountability of public relations at the organizational level could be demonstrated well by showing the effect of reputation on financial performance of the organization.

Indeed, public relations practitioners advocate reputation management more than professionals in any other field. According to Hutton et al (2001), "… major international public relations agencies have embraced the concept of reputation management in varying degrees.

Public Relations in Organizational Alignment

Organizational alignment relates to the degree to which the components of an organization are arranged to optimally support the intent, objectives and goals of the organization. The components of the organization that must be aligned include: the work being completed (i.e. key business projects and work processes; the goals, skills and capabilities, and the hearts, minds and behaviours of both the people doing the work and the organizational leaders; and the plans (e.g. learning and development/human capital plans), tools and technologies and resources (including budget) that support the work being completed (Krone, 1987).

Without alignment, the best strategic plan will never be fully achieved because organizational alignment is the glue that makes strategy execution excellence happens. An aligned organization works together as a unit in a new way (i.e. more efficiently, effectively and dynamically) on the right things that deliver the greatest business value. An aligned organization gets things done faster, with less effort and with better results, and is more agile and responsive to changing business conditions (Aaker, 1991). Organizational alignment is both a process and an outcome. Building and ensuring organizational alignment

requires focused action and is an ongoing activity. In addition, the outcome of these organization alignment efforts- the degree of organizational alignment present- can be assessed in an organization at any point in time. Organizational alignment is critical when implementing changes or improvements geared towards maximizing shareholder value (Gray, 1998). Value is created by earning a return on invested capital greater than the opportunity cost of capital; the more an organization can invest at returns above the cost of capital, the more value it creates.

Understanding how the organization will measure value is the first step in creating organizational alignment. Creating value requires an organizational focus on long run cash flow returns, not quarter-to-quarter changes in earning per share. It requires a willingness to adopt a dispassionate, value-oriented view of corporate activities that recognizes organizations for what they are. Organization alignment starts with a thorough understanding of how an organization is measuring value.

The second step in organizational alignment involves implementing improvements or changes that unleash value trapped within the organization. This requires management to develop and institutionalize a managing value philosophy throughout the organization. This involves establishing priorities based on value creation; gearing planning, performance measurement and incentive compensation systems towards shareholder value; and communicating with all stakeholders in terms of value creation. This can be accomplished in a series of smaller steps to achieve higher levels of performance (Charles, 1996).

Define what the strategy is and what it looks like in action. Organizational alignment is built on business strategy so it must begin here. To be effective, the business strategy must clearly define the primary value proposition, future results destination, and the values and behaviours that will guide actions on the journey to business results achievement (Riel, 2007). While this content is important, it is also critical to describe the actions in the form of strategic objectives; the organization must focus on to get from the present to the future destination. A strategic plan that provides a specific but flexible roadmap for action serves as the guiding star for the organization and its alignment efforts moving forward.

Public relations Strategy. The organization/people can't align with the business strategy if they don't know what it is. Strategy public relations is critical, ongoing requirement in the drive to build organizational alignment. Communication must be frequent and two-way at all levels of the organization using multiple communication vehicles and a variety of targeted messages. It is important to remember that there is no such thing as over communication or too much business leader involvement when striving to create an aligned organization (Balmer, 1997).

Public Relation in Crisis Management

Coombs (2007) synthesized several definitions and perspectives of the term "crisis" and defined it as "the perception of an unpredictable event that threatens important expectancies of stakeholders and can seriously impact an organization's performance and generate negative outcomes." There are three key elements to this definition. First, a crisis is a perception. Even if an organization does not believe that a crisis exists, ultimately the public's perception is the reality of the situation, and if the stakeholders believe a crisis exists, then a crisis exists (Seeger, 2006; Coombs, 2007). Penrose (2000) studied the role of perception and concluded that the public's perception of the crisis is a critical element in crisis planning and will affect crisis outcomes. Second, while a crisis is unpredictable, it is not unexpected (Coombs, 2007; Cloudman and Hallahan, 2006). Organizations that effectively plan for crisis can better anticipate when a crisis hits, and therefore can lessen the damage of a crisis. Crisis management is public relations responsibility - that is, handling situations in which public awareness of a particular issue may dramatically and negatively impact the organization's ability to achieve its goals. For instance, when drought was rampant here in Kenya, Red Cross Society embarked on providing food items and clothing to the affected people. There was also a programme entitled "Kenyans for Kenya" whereby Kenyan donated money, food and clothing to the Red Cross. It was later discovered that maize that was imported from South Africa had aflatoxins and hence harmful for human consumption. The toxins were discovered after maize had been distributed to a large number of people. The general public tainted the society's name as corrupt and "not putting the poor people's interest at heart." The public relations team had to ensure that the general public did not thereafter automatically associate Red Cross Society with the infected maize. Other public relations activities include lobbying, advertising management about public issues and planning community events.

There have been countless public relations crises in the past and there are five steps that should be executed in order to properly manage a crisis. First, the organization in crisis should be prompt, addressing the public immediately following the discovery of the crisis. Second, the organization in question should maintain honesty because the public is more willing to forgive an honest mistake than a calculated lie. Third, it is important to be informative because the media as well as the public will create their own rumors if no information is given to them by the organization in crisis. Rumors can cause significantly more damage to the organization than the truth. Next, it is important to be concerned and show the public you care because people will be more forgiving if it is clear that the organization cares about the victims of the crisis. Finally, maintain two-way relationships. This is important because the organization can learn a lot about the status of public opinion by listening. These five steps are necessary in order to manage any crisis public relations. With that having been said, each crisis situation is unique and therefore, requires a tailored response. There are six types of responses and they range on a continuum from defensive to accommodative. First, organizations can attack the accuser attempting to eliminate the attacker's credibility. Second, organizations can us denial claiming that no crisis exists. The third response is justification where the organization claims no serious damage was done or that the victim was at fault. Fourth, the organization can use ingratiation to appease the public, such as giving away coupons. Next, organizations can use corrective action to right their wrongs. Finally, the organization can give a full apology asking for forgiveness for their mistake. All six responses have been used in the past with varying results. If chosen properly, one of the six responses can help mitigate damage.

Public Relations in Media

Integrated communication strategies are more likely to break through media coverage and make the organization's name or brand heard and remembered than ill-coordinated attempts would. Through consistent messages an organization is more likely to be known and looked upon favorably by key stakeholders/donors. Organizations have therefor increasingly put considerable effort into protecting their image by rigorously aligning and controlling all communication campaigns and all other contact points with stakeholders (Gray, 1998).

Organizations also realized that messages in various media can complement one another, leading to a greater communication impact than any one single message can achieve. Because of the increasing costs of traditional mass media advertising and the opportunities afforded by the internet, many organizations have therefore re-examined their media presence and how to control it. As a result of these developments, organizations now tend to look at media in a much broader sense and across the disciplines of marketing and public relations (Krone, 1987). Organizations have also become more creative in looking beyond corporate advertising to other media for communicating with stakeholders. Many organizations today use a range of media, including corporate blogs and internet communication such as websites, banners and sponsored online communities.

Two factors stemming from social media affect corporate communication policies. Social media has a significant democratizing effect which organizations find problematic to manage in the pursuit of corporate goals Aaker, 1991). The implications of democratization effect have not yet been investigated in the research literature. The second factor is the unpredictability of emergent situations arising from the complex communicative processes of the many different actors who form the social media participants. Similar to the democratization effect, organizations will find it problematic to harness these emergent situations to create business value unless they develop appropriate ways of designing the use of social media (Charles, 1996).

Public relations department determine the branding and advice on devising communication strategies. The role can extend to advising on corporate mission and strategy. NGOs invite the media whenever they are sponsoring a certain issues in the community to gain more trust from the public and donors. Kenya Red Cross Society is now a brand through media coverage and their involvement in humanitarian projects within the country.

The media and the public relations practitioners often must work with each other to meet their goals. Journalist want information to write articles about that the public will read and PR agents want their information told to the public. While these goals do not always coincide with each other, it is possible for a mutually beneficial relationship to exist between PR practitioners and the media.

There are however, many cases where one agent of the parties attempts to gain control over the other for their own benefit. One way this is done is known as access journalism, a term used to describe when journalists are coerced in altering their work by an article entity *(Access Journalism & Self-Censorship).* Journalist can be pressured by threats to withholdadvertising dollars, not receiving advanced copies of products to review, or simply withholding information. Access journalism is a method used to try and control the media.

Public Relations in Donor Relations

If we accept Grunig and Hunt's (1984) definition of public relations as, "the management of communication between an organization and its public," then we are led to conclude that the management of donor constituencies is a specialized form of public relations. The significance of this conclusion is that public relations is usually well integrated as a management function both at the branch level and the parent organization. Its practitioners tend to be well informed of the mission and the goals of the organization and operate consistently with the activities of the leadership. Fundraising professionals, in many instances, are not considered integral to the management team and as such may not be as knowledgeable about the mission and goals of the organization. This is especially true if the organization does not direct the fund-raising professionals on the fundraising campaign.

"All sources of donors – foundations, corporations and individuals – have the potential for infringing on the autonomy of charitable organizations through their gifts" (Kelly, 2001). Given this propensity for donors to influence the institution through their gifts, it places a greater responsibility on fundraising professionals to be cognizant of potential infringements on the autonomy of the organization receiving the gifts.

A more significant example of infringement on the donor autonomy or a distortion of organizational goals would be where a donor proposes funding for projects in a field dear to the heart of the donor, but a field in which there is no program to direct such an interest. Donors are the stakeholders in Non-Governmental Organizations and their characteristic is the linkage with the organization resulting from consequences, or "stakes" (Clarkson, 199); Coombs, 2000 and Daft, 2001) pointed out that stakeholders and an organization are linked because "they and the organization have consequences on each other." J. Grunig and L. Grunig (2000) defined stakeholders as those who are affected by the decisions of an organization or those who affect the organization by their decisions. Similarly, daft (2001) defined a stakeholder as any group within or outside an organization that has a stake in the organization's performance.
About the implications of donors for an organization's management, Coombs (2000) said as follows: "It is taken for granted in the management literature that organizations have donors and that the management of these donors affects the organization's viability."

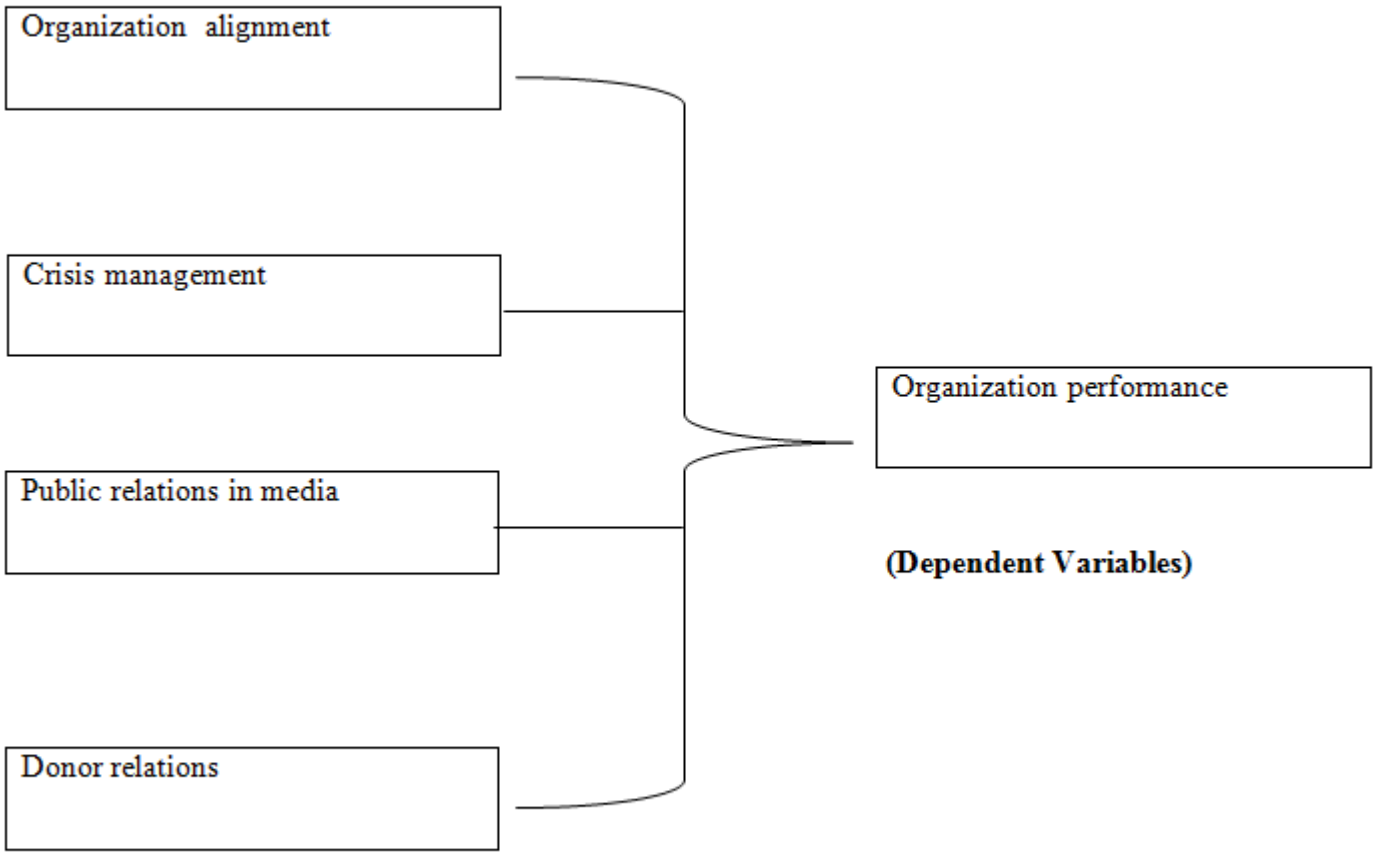
Conceptual Framework

The model of the study is determined in figure 2.1 below. It shows the independent variables; effects of public relations as a strategic function, effectiveness of public relations, public relations in organizational alignment, public relation in crisis management, public relations in media and public relations in donor relations.

The dependent variable is the effect on strategic management. If the public relations strategy is well implemented, it can result to enhanced reputation of the organization, competitive edge, employee motivation, stakeholders (donors and Government) trust in the organization among others. Also if

public relations is poorly implemented, it results to crisis, reduced donor funding, reduced performance, employee absenteeism and lack of cooperation among others.

Figure 2.1 Conceptual Framework



III. RESEARCH METHODOLOGY

Research Design

According to Michael S. Carriger (2000), Research Design is the strategy, the plan and the structure of conducting a research project. A research design is the plan and structure of investigation so conceived to obtain consumers to the research questions. Phillips (2002) noted that research design constitute the blue print for collection, measurement and analysis of data. According to De Vaus (2001), the function of the research design is to ensure that the evidence obtained enables us to answer the initial question as unambiguously as possible.

The research was descriptive survey research design. This is because the researcher took raw data and summarizes it in a useable form. This allowed the researcher to obtain information that describes phenomena as it exists by asking the individuals about their attitudes, behavior and values.

Sample Size and Sampling Procedures

Kerlinger (1967) defines sampling as taking of any portion of the population or universe as are preventative of that population or the Universe.

To identify the target population the researcher visited Ukunda, Mombasa and Kilifi branches of Red Cross Society and collect a list of employees in each branch to get the sample size. The researcher chose this sample size since these branches are accessible and fall in the coastal region. Other factors that led to this sample size are lack of enough time and money to facilitate a bigger size sample.

Stratified sampling was used to obtain a representative sample from each branch containing subjects with similar characteristics so as to get the sample population.

Table 3.1. Sample Size

Branch	Total Population	Sample Size	Percentage
Ukunda	28	10	25%
Mombasa	54	18	45%
Kilifi	36	12	30%
Total	**118**	**40**	**100%**

(Source: Researcher)

RESEARCH FINDINGS AND ANALYSIS

Response Rate

The table below shows demographics of the respondents` rate.

Table 4.1: Response Rate

Category	Questionnaires distributed	Questionnaires received	Percentage
Ukunda	10	8	20%
Mombasa	18	15	37.5%
Kilifi	12	7	17.5%
Total	**40**	**30**	**75%**

The researcher distributed 40 questionnaires to the respondents and received 30 of them back. This therefore indicates that the response is reliable since more than 50% of the feedback was received. Response rate was 75%.

Demographic Information of Gender

Table 4.2: Information about respondents' gender

Gender of respondents	Frequency	Percentage
Male	18	60%
Female	12	40%
Total	**30**	**100%**

The researcher received a total of 18 responses from the male and 12 from the female. This was a positive feedback since there was a fair representation of the gender. However, the ration of male to female as per the level of response indicates that there is no gender balance in Red Cross Society.

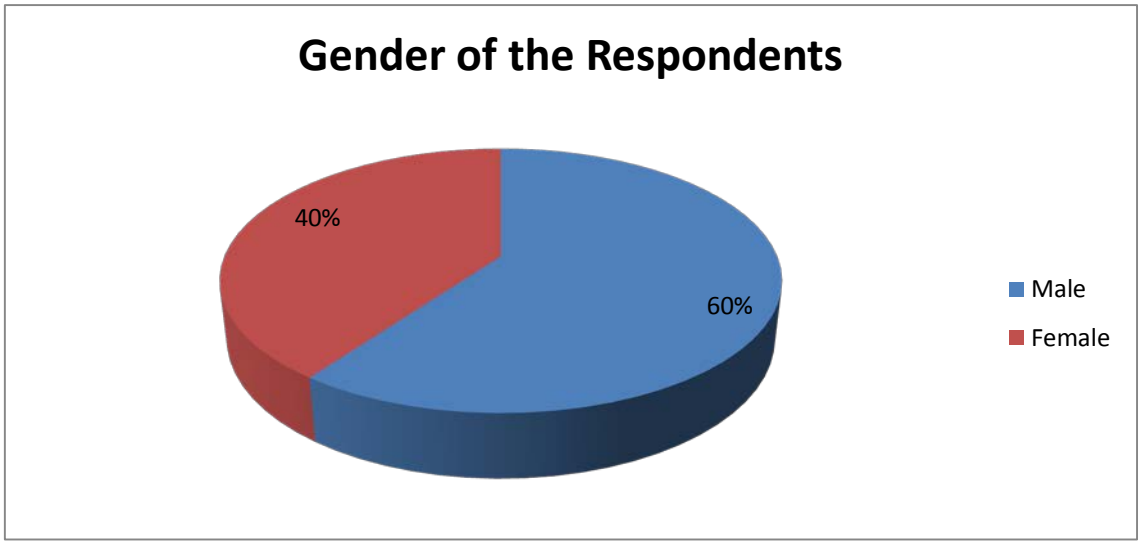


Figure 4.1 Demographic Information of gender

Demographic Distribution of respondents' level of education

The table below shows demographics of the respondents' level of education.

Table 4.3: Demographic Information about the respondents' level of education

Respondents' level of education	Frequency	Percentage
Secondary School	2	6.7%
College Diploma	5	16.7%
First Degree	11	36.7%
Master's Degree	12	40%
Total	**30**	**100%**

From the researcher's collected data, it is evident that Red Cross has approximately 76.7% of its employees as either degree or masters holders. Only 6.7% (N=2) were form four leavers. However, 5 respondents (16.7%) were diploma graduates.

This therefore means that Red Cross Society consists of elite staff hence offering better public relations to the citizens. The elite class is expected to impact their learned knowledge into practical use.

Demographic Distribution of Respondents' Marital Status

The table below shows demographic of the respondents' marital status.

Table 4.4 Demographic Information about the respondents' marital Status

Respondents' Marital Status	Frequency	Percentage
Married	12	40%
Single	13	43.3%
Divorced	3	10%
widowed	2	6.7%
Total	**30**	**100%**

Out of the data collected as shown in table 4.4 above, 40% (N=12) of the respondents were married, 43.3% (N=13) were single, 10% (N=3) were divorced and 6.7% (N=2) were widowed. The fact that most of the respondents were single seemed to make employee management quite easy as single staffs are believed to be flexible. The married group brought on board a mature way of thinking.

Demographic Distribution or Respondents Years of Service

The table below shows demographics of the respondents' years of service at Red Cross.

Duration of Working in the Organization	Frequency	Percentage
Less than 3 years	5	17%
3 – 5 years	13	43%
6 – 10 years	10	33%
Above 10 years	2	7%
Total	**30**	**100%**

On average, most of the staffs seemed to have been working with Red Cross Society for three to five years. This therefore means that there is job security in the institution. With regard to this research topic, it implies that the collected data is relatively accurate since the respondents have worked with the organization for quite some time.

Public Relations in Crisis Management

Public relations have positive effects in the organizational performance during a crisis. This therefore means that public relations help the management to resolve organizational disputes with stakeholders and donors. With regards to deep heat that was raised by general public as a result of criticisms of spoilt maize from South Africa. Public relations helped to contain the situation. The public were well informed about the crisis ranging from drought and calamities through public relations.

Public Relations in Organizational Alignment

Public relations play a very big role in organizational alignment. All the respondents agreed with some parameters that affects this topic that contributes to motivation by providing a coherent frame of reference by aligning strategic messages with those more closely related to the specifics of an individual's working environment, building a shared understanding among employees about organizational goals, improve job satisfaction throughout the organization, disseminate information about corporate activities, supports the culture of an organization, enables employees to understand the vision and direction of the organization while at the same time support management and HR initiatives in equipping personnel with the knowledge and motivation to perform their roles effectively.

Public Relations in Media Relations

From the gathered data, media relations is seen to have a very great impact on public relations. This therefore means that whatever is to be communicated in the media or whatever has been communicated by the media tends to frame the way the bank's management frame it communication messages.

With regards to the effects of public relations in media relations, respondents quoted that it enables organizations to send out press releases on news media wires to publicize organizations' strategic plans, leadership appointments and other company news. Respondents also said that it promoted the positive use of social media whilst managing its adverse effects, or more generally emergence, planned social media and to help achieve corporate strategy. By enabling the organization use a range of media, including corporate blogs and internet communication such as websites, banners and sponsored online communications as through consistent messages.

On the aspects of organization insights, 60% of the respondents agreed public relations enables media personnel to contact senior executives for interviews that offer insights into the latest trends in their industries while 40% felt that public relations enhances better communication with the donors. Therefore, from the gathered data, it is evident that public relations has a great effect on media relations in Red Cross Society.

Public Relations in Donor Relations

From the questionnaire, the respondents agreed that public relations has effects on donor relations. All respondents said that it enhances communications to donors through annual reports, quarterly updates, stock news, board meeting minutes and financial reporting. They also felt that it 100% enables organization send its donors industry updates, which can include media coverage the organization has received – negative or positive. This creates positive relationship with key financial donors and beneficiaries.

On the other aspects of public relations effect in donor relations 100% said that it enables organizations adapt to the growing demand for information and stakeholder insight through policies of consistency, that is, by formalizing all communications and pursuing uniformity in everything they say or do.

IV. SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

Research Summary of the Findings

1. Public Relations in Crisis Management

The findings of the study on crisis management indicated that the perception is that it prevents further damage to organizations image, enhances donor confidence and plays a critical part in building, maintaining and protecting organization reputations. This is due to role of crisis management of enhancing reputations of the organization, a tool used as overall assessments of organizations by their stakeholders and being aggregate perceptions by stakeholders of an organization's ability to fulfill their expectations. The study found out that, in crisis management, public relations enhances deliverance of customer service by responding to customer comments and complaints, minimizes discrepancies between the organization's desired identity and brand features and enhances building of trust with citizens, donors and beneficiaries with organization critics, through commitment to good results and societal reporting.

2. Public Relations in Organizational Alignment

The study found out that organizational alignment is enhanced in strategic management by providing a coherent frame of reference by aligning strategic messages with those more closely related to the specifics of an individual's working environment, a shared understanding among employees about corporate goals and improves job satisfaction throughout the organization through dissemination of information about corporate activities.

3. Public Relations in Media Relations

The study found out that media relations in organizational performance is mainly the message the organization intends to put through to the intended group as it enables organizations to send out press releases on news media wires to publicize company news and anything else that appertains to the public. The focus enables the organization use a range of media, including corporate blogs and internet communication such as websites, banners and sponsored online communications. The study found out that it enables media personnel to contact senior executives for interviews that offer insights into the latest trends in their organization and that media relations enhances effective content management of corporate websites and/or other external touch points.`

4. Public Relations in Donor Relations

The study found out that impact of donor relations in organizational performance is that it enhances communications to donors through annual reports, quarterly updates, board of trustees meeting minutes and financial reporting.

The study found out that the role of the organization in donor relation is to integrate the economic resources, political support and special knowledge each stakeholder offers, transforming it into financial and social wealth, not because it is socially responsible to do so, but because it offers better services to the beneficiaries.

Conclusion

The study aimed to discuss possible effects of the public relations on organizational performance with a focus of identifying the effects of crisis management, organizational alignment, media relations and donor relations.

Public Relations in Crisis Management

The study found out that, in crisis management, corporate communications enhances deliverance of customer service by responding to customer comments and complaints, minimizes discrepancies between the company's desired identity and brand features and enhances building of trust with stakeholders, employees, beneficiaries and organization critics, through commitment to good practice and societal reporting.

Public Relations in Organizational Alignment

The study found that public relations makes the communication function relevant in the strategic management process through its focus on communication with strategic stakeholders and aligning communication goals to the organizational mission, enhances mobilization of internal and external support for corporate and keeps employees informed about promotional opportunities, industry trends and best practices through its concern with learning, showing the corporation to itself and as a role model of organization for both external and internal environments and having a dominant role in achieving organizational growth.

Public Relations in Media Relations

The study found out that it enables organizations to send out press releases on news media wires to publicize organizational news both internal and external.

Public Relations in Donor Relations

The study found out that organization in donor relations integrates the economic resources, political support and special knowledge each stakeholder offers, transforming it into financial and social wealth.

Recommendations

To create effective public relations in crisis management and image management, an organization need to formulate a strategy. Public relations strategy that can be seen as a pro-active capability to adapt the organization changes in stakeholder expectations and opinions.

To have an effective impact of organizational alignment, a public relations strategy should be developed within the context of the organization's vision, mission, corporate culture, policies and strategies but focus on an assessment of the external environment. This enables the employees to understand the vision and direction of the organization.

Proper detailed enquiries should be done on media relations because it is the thinking, the logic behind the public relations function's actions in determining what should be communicated rather than how it should be communicated.

Due to the growing demand for information and stakeholder insight, the organization policies should be consistent by formalizing all communications and pursuing uniformity in everything they say and do. This enhances ability of organizations to recognize the need for an inclusive and balanced stakeholder management approach that involves actively communicating with all stakeholder groups upon which the organization depends and not just beneficiaries, thus leading to creation of well-managed, sustainable and consistent public relations agenda or initiative.

Suggestions for Further Research

Although the study had some limitations and constraints, the finding of the research has to be a subject to be discussed and applied in a profit making organization and business activities. For this point of view, new research has to be done using other sampling methods and on different organizations both profit making and nonprofit making. With these new researches it will be easier to compare and to discuss similar findings of studies with those provided in this study.

REFERENCES

[1] Aaker, D. A. and Myers, J. G. (1991) Advertising Management, New York; Prentice Hall

[2] Balmer, J.M.T. (1997) Corporate Identity: past, Present and Future, International Center for Corporate Identity Studies 1997.

[3] Bayon, T., Gutsche, J., & Bauer, H. (2002).Customer equity marketing: Touching the intangible. European Management Journal.

[4] Botan, C. H., & Hazleton, V., (Jr) (1989).Public Relations Theory, Lawrence Erlbaum Associates.

[5] Broom, G., & Dozier, D. (1990).Using Research in Public Relations: Applications to Program s Management.Englewood Cliffs, NJ: Prentice Hall.

[6] Bryman, A. (1988). Quantity and Quality in Social Research. London: Unwin Hyman

[7] Coombs, T. (2000).Crisis Management: Advantages of a relationship perspective. Public Relations as Relationship Management: Hillsdale, NJ: Lawrence Erlbaum.

[8] Dozier, D. M. (1990). The Innovation of Research in public relations practice: review of a program of studies. Public Relations Research Annual, 2,3

[9] Gray, E. R. and Balmer, J. M. T. (1998) Managing Corporate Image and Corporate Reputation, London: Long Range Planning.

[10] Grunig, J. E. (1992) Communication, Public Relations and effective organizations: an overview of the book. In J. E. Grunig (Ed), Excellence in Public Relations and Communication management. Hillsdale, NJ: Lawrence Erlbaum Associates, Inc.

[11] Grunig, J., Grunig, L. A., & Dozier, D. M. (2002).The Excellence Theory. In C. H. Botan& V. Hazleton (eds), Public Relations Theory II. New Jersey: Lawrence Erlbaum Associates

[12] Hon, L. C., &Grunig, J. E. (1999).Guidelines for Measuring Relationships in Public elations.Gainesville, FL: The Institute for Public Relations.

[13] Hutton, J.G. (1999).The Definition, Dimensions and Domain of Public Relations.Public Relations Review.

[14] Jackson, P. (1987) Public Relations for Managers, London: Pitman

[15] Jounghwa Choi, Yoonhyeung Choi, (2009) "Behavioral dimensions of public relations leadership in organizations", Journal of Communication Management, Vol. 13 Iss: 4, pp.292 – 309Retrieved November 23rd , 2013, from the emerald database http://www.emeraldinsight.com

[16] Krone, K., Jablin, F. M., and Putnam, L. L. (1987) Communication Theory and Organizational Communication: Multiple Perspectives, in F.M. Jablin et al (eds), Handbook of Organizational Communication, Newbury Park, CA: Sage Publications

[17] Riel, C.B.M. Van and Fombrun, C. (2007) Essentials of Public Relations, Abingdon: Routledge www.google.co.ke/kenyaredcross

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Influence of Integrated Marketing Communication and Sales Performance of Commercial Banks in Kenya

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Abstract- In order to keep up with the competition and changing consumer needs and wants in the competitive business environment, commercial banks are forced to adopt effective Integrated Marketing Communication strategies to promote their products/services beyond boarders thus creating awareness hence growth of their marketing share. ICM strategies enable Commercial Banks to attract and retain customers thus increased return on investments. The emergence of integrated marketing communications (IMC) has become one of the most significant examples of development in the marketing discipline. It has influenced thinking and acting among companies but also authorities, state owned companies and political parties, all facing the realities of competition in an open economy. This study addressed the following research questions; what was the influences of advertising, sales promotion, public relations, personal selling and direct marketing on the sales performance of Commercial Banks in Kenya? In methodology, the study adopted a descriptive survey. The target population for this study was the staff at the marketing department of Commercial Banks in Kenya. The study carried out a census of all the staff within the department of marketing at 43 Commercial Banks operating in Kenya. This study utilized a questionnaire as the data collection tool. Data collected was analyzed through descriptive statistics with the help of SPSS. Regression analysis was adopted to help determine the relationship between the independent and dependent variable. The study concluded that there was a positive relationship between independent variables (advertising, personal selling, sales promotion, public relations and direct marketing) and dependent variable (Sales Performance of Commercial Banks in Kenya).The study recommends that the Government should come up with policies to enhance Communication technology especially in the advent of recent interconnectivity through the undersea cables which has enabled faster internet services through fiber optic cable among major towns in Kenya and is perceived to be faster and could be of great benefit if connected with rural towns and markets for job creation like in Cyber cafes and consequently alleviate unemployment.

Index Terms- Integrated Marketing Communications, Search Engine Optimization, Commercial Banks in Kenya

I. INTRODUCTION

Background of the Study

In the twenty first century, when the variety of products and services reached a point beyond measure and companies face with fierce competition on national and international markets; day by day, it becomes more difficult for the companies to survive and grow (Harris, 1997). Differentiation of the products and services offered to the customers, increasing the varieties of service and taking the requirements and needs of the customers as the basis have become one of the most important methods for the companies to create competitive advantage.

Along with the effect of rapid and continuous evolution experienced in communication and information technology, intensity in the marketing activities of the companies has emerged (Haynes, Andy, Lackman, Conway, Guskey, Andrey, 1999). Disorganization brought along by this intensity can lead the consumers to experience confusion and become hesitant. Proctor and Kitchen (2002) point out that in twenty first century, the successful marketing strategies require successful communication strategies, and this in turn, necessitates all the communication activities to be gathered together within an integrated approach in a creative manner.

Integrated marketing communication (IMC) is being practiced worldwide at very large scale. Integrated marketing communication is consumer oriented approach rather than organizational oriented that focuses on organizational needs. IMC is performed in a manner of synergy rather than in isolation (Kitchen, Philip, Schultz, Don, 2003). IMC is associated with some positive results like brand awareness, customer satisfaction, brand loyalty, positive brand image, unique brand association, greater profitability, increased sales and cost savings.bIMC has major impact on organizational performance and brand equity. There are some barriers to successful implementation of IMC program (Jooyoung, Kim, Morris, John, 2003).

Integrated Marketing Communication

Communication is the process of conveying thoughts and sharing the meanings among individuals or organizations. Communication which can be described as the paste that keeps combined a channel of distribution. The function of communication within channel of marketing is an important issue from both a theoretical and managerial point of view (Kitchen, Philip, Schultz, Don, 2003). Communication in marketing channel can function as the process by which influential information is transmitted (Frazier and Summers, 1984).

Though the Marketing literature admits that communication plays a vigorous role in channel functioning (Grabner and Rosenberg, 1969; Stern and El-Ansary, 1988), it provides no integrated theory for channel communication. Communication has been connected conceptually to both behavioral issues (e.g. power and climate) and structural issues (e. g. the pattern of exchange relationship) in the channel, yet empirical research on

channel communication is scanty. Communication is a need which is being used to create network, spread ideas and promote the products or services. Effective communications done through well-known channel that transmits simply and exactly.

Marketing communications represent the accumulation of all components in a brand‘s marketing mix that promote exchanges by building shared meanings with the stakeholders of brand (Kotler and Philip, 2003). Businesses use different tools to promote their company, product or services which include; brochures, telemarketing and websites. Objectives of the marketing communication are to provide information to target audience and to boost the sales

(Odabaşı, Yavuz, Oyman and Mine, 2003).

Integrated Marketing Communication (IMC) is a term that emerged in the late 20th century regarding application of consistent brand messaging across myriad marketing channels.IMC was developed mainly to address the need for businesses to offer clients more than just standard advertising. The concept of Integrated Marketing Communications (IMC) makes definite sense so much so that trainee in the field may get amaze what all the confusion is about (Linton, Ion, Morley, and Kevin, 1995).

IMC recommends that marketers focus at the customer first his or her preferences, buying patterns, media exposure, and other factors and then customer is exposed to the products that fits its need through mix of communication methods which the customer find more attractive and credible. According to Jones (2008) it is revolutionary step because of a whole culture of agencies, in-house departments, and consultants had grown up around the notion of separation for advertising, direct marketing, sales promotion, and public relations efforts, rather than the harmonious, customer-centered planning process that IMC requires.

Integration has become an essential concept in marketing because technological advances have changed how business stakeholders interact. Marketing theory that was established during the discipline‘s formative years has been overtaken by the complexities of real-time, multimodal, multi directional communication (Odabaşı, Yavuz, Oyman and Mine, 2003). Reid and Mike (2002) defined IMC as concept of marketing communication planning that combine and evaluate strategic role of different communication discipline to get the clarity, consistency and greater impact.

According to Percy et al. (2001) planning and execution of all marketing communications are required in a same way to meet the objective. Process of producing and applying the different communication programs and the probability to have impact in future over time, overall IMC process starts with the customer and work to determine and define the methods and forms to develop the influential communications programs (Schreuer and Richard, 2000). IMC is also considered as a strategic business process which is used to plan, develop, execute and evaluate the coordinated and assessable influential marketing communication programs relevant to external and internal audience over time (Proctor, Tony, Kitchen and Philip, 2002).

Proctor, Tony, Kitchen and Philip (2002) defined the IMC in following words, an IMC program plans and executes various marketing activities with consistency so that its total impact exceeds the sum of each activity. It is a strategy in which different communication tools like advertising, public relations, sales promotion, direct marketing and personal selling work together to maximize the communication impact on target consumers (wikipedia.org). IMC is also defined as a management concept which is designed to make unified force of different aspects of marketing communication such as sales promotion, public relations, advertising and direct marketing rather than to work in isolation (marketing.about.com).

Each strategy has its own importance which can be assessed from the results and impact of that strategy. IMC is supposed as a key competitive advantage in many organizations (Weilbacher 2001, Smith, 2002) because sales and profit can be increased while saving the time, money and stress by applying IMC (Smith, 2002). This fact is also recognized by agency executives (Kitchen and Schultz, 1997). IMC has positive impact on communications, creativity and cause consistency in communications. Real contribution of integrated promotional mix can makes strategic tool for business.

IMC provides new dynamic model that facilitate the business to make marketing communication as consumer oriented (Kitchen, Brignell, Li and Jones, 2004). It makes easy availability and access of goods and services and makes message more efficient and reduces product related risks in the mind of consumers. (IMC). IMC emphasizes the value of coordinating marketing communications activities advertising, direct response, Web sites, sales promotion, and publicity. However, these IMC coordination efforts within marketing largely ignore the most significant marketing tool for communicating and influencing relationships with customers the company’s sales force (Odabaşı, Yavuz, Oyman and Mine, 2003).

Clearly, coordinating the sales and marketing functions can improve the effectiveness of activities undertaken by the functional areas. The Venn diagram in Figure 1 illustrates the need for interaction between sales and marketing (Pickton, David, Hartley and Ben, 1998).

The activities in the circle on the left are primarily undertaken by the marketing function with input from sales, and the activities in the circle on the right are primarily undertaken by the sales function with input from marketing. The activities in the intersection of the two circles can be performed effectively only through a coordinated effort between sales and marketing (Odabaşı, Yavuz, Oyman and Mine, 2003).

Managers recognize this need for greater coordination between marketing and sales. In international surveys of senior executives from a wide range of business-to-business industries, sales and marketing integration was mentioned as one of the organizational changes that would do the most to improve sales performance and as one of the most important issues facing sales and marketing managers (Miller and Gist 2002).

Commercial Banks in Kenya

There has been tremendous growth in the Kenyan banking industry. Changes in the Kenyan economy and Commercial Banks have not been spared from the impact of these changes. The banking sector in Kenya comprises 43 registered

Commercial Banks that are licensed by the Central Bank of Kenya. There are various banking laws in Kenya that govern and regulate the way banks are formed, operate and are managed in the country. Some of these laws include but not limited to the appropriation act, banking act, bankruptcy act, Barclays of Kenya limited act, capital markets, Central Bank of Kenya act, central depositories act, cheques act, general loans and stock act among other laws. The laws are divided and partitioned to cover the different aspects in the banking industry. It also enables the government to keep an eye in the way the banks are operated and managed. According to customer surveys that have been carried out on customer satisfaction, clearly indicate that quality service delivery to customers by Commercial Banks in Kenya still has remained a challenge due to inappropriate strategies adopted. Adoption of effective strategies by Commercial Banks in Kenya in managing service quality will enhance organizational performance and market competitiveness (www.cbk.co.ke).

Statement of the Problem

To survive in the competitive marketing environment, both small and large organizations need to adopt integrated marketing communication practices in order to attract and retain customer hence long term relationships and sales performance and overall productivity (Reid et al, 2005). Increased revenue, increased client-base and customer loyalty are measures of sales efforts of any competitive organization in the competitive market (Marquardt, 1994). Stiff completion, globalization, influence and emerging technology and changing consumer needs and wants are factors that are driving companies to change their communication practices in the local and international markets (Albers-Miller and Sraughan, 2000).

Integrated Marketing Communication practices adopted by commercial banks in Kenya remain an understudied area. Little has been done by researches with regard to IMC practices applied by Commercial Banks in Kenya. A study carried out by Kiptugen (2003) looked at the strategic marketing responses of medical companies to a changing competitive business environment established that proactive rather than reactive promotional mix strategies are the core drive of any competitive organization operating in the dynamic marketing environment.

Previous studies that have been carried out did not focus on commercial banks; other studies were carried out in developed countries compared to Kenya that is a developing country.

Arising from the findings of the above study, it is evident that, there are many areas about the influence of integrated marketing communication and sales performance of commercial banks that have not been investigated by previous research studies. It is for this reason that the study sought to establish the influence of integrated marketing communication and sales performance of commercial banks in Kenya.

Objectives of the Study

The research objectives were to:

i. Determine the influence of advertising on sales performance of Commercial Banks in Kenya.
ii. Determine the influence of sales promotion on sales performance of Commercial Banks in Kenya.
iii. Determine the influence of public relations on sales performance of Commercial Banks in Kenya.
iv. Determine the influence of personal selling on performance of Commercial Banks in Kenya.
v. Determine the influence of direct marketing on sales performance of Commercial Banks in Kenya.

II. LITERATURE REVIEW

The Concept of Integrated Marketing Communication

Today, corporate marketing budgets are allocated towards trade promotions, consumer promotions, branding, public relations, and advertising (Pickton, David, Hartley and Ben, 1998). The allocation of communication budgets away from mass media and traditional advertising has raised IMC's importance for effective marketing. Now, marketing is viewed more as a two-way conversation between marketers and consumers. This transition in the advertising and media industries can be summarized by the following market trends: a shift from mass media advertising to multiple forms of communication, the growing popularity of more specialized (niche) media, which considers individualized patterns of consumption and increased segmentation of consumer tastes and preferences.

The move from a manufacturer dominated market to a retailer-dominated, consumer-controlled market, the growing use of data-based marketing versus general-focus advertising and marketing, greater business accountability, particularly in advertising, performance-based compensation within organizations, which helps increase sales and benefits in companies, unlimited internet access and greater availability of online goods and services, a larger focus on developing marketing communications activities that produce value for target audiences, while raising benefits and reducing costs (Proctor, Tony, Kitchen and Philip, 2002).

Competition intensifying with the rapidly changing environment necessitates the companies to be more effective in their performance and makes it inevitable for them to support the effectiveness of the performance with integrated marketing communication components (Jooyoung, Kim, Morris, John, 2003). Integrated marketing communications (IMC) is an approach used by organizations to brand and coordinate their communication efforts. The American Association of Advertising Agencies defines IMC as "a concept that recognizes the added value of a comprehensive plan that evaluates the strategic roles of a variety of communication disciplines, and combines these disciplines to provide clarity, consistency and maximum communication impact."

The primary idea behind an IMC strategy is to create a seamless experience for consumers across different aspects of the marketing mix. The brand's core image and messaging are reinforced as each marketing communication channel works together in unity, rather than in isolation. Integration" of communication activities has become a basic field from the point of companies and marketing communication since early 1990s, and the concept of integrated marketing communication, which was developed by the advertising agencies initially, was later on

approved by marketing communication, public relations and the brand new field of company identity management circles (Jooyoung, Kim, Morris, John, 2003).

Fam (2000) also indicated that the integrated marketing communication is an important promotion concept, both the advertising industry and marketer had to face with in recent years, and emphasized that the integrated marketing communication, which had been considered just as a gossip during the initial periods when it was first brought up, observed as being adopted by many marketer and advertising agencies according to the results of researches being carried out in recent years, and suggest that the producers and retailers shall also want to gain the advantages provided by this integration by integrating their marketing communication activities in the near future.

Reid (2002) indicates that the integrated marketing communication is developed both as a communication philosophy gradually gaining importance and also as a strategic management process for the creation and management of powerful brands. Pickton and Hartley (1998) indicate that although the practitioners of marketing communication always claim of being positive about different marketing communication mixed disciplines can be implemented as a consistent and coherent whole or by customization, the integrated marketing communication concept is developed by advertising agencies in late 1980s to meet the increasing demands of new market environment of 1990s.

Under fierce competition conditions of present day, the integrated marketing communication plays an important role in strategic harmonization (coordination) of brand and company messages intended for the apprehension of value expectations of consumers (Reid, 2002). Jooyoung and Morris (2003) indicate that since the integrated marketing communication has become the focal point of the communication efforts of the companies; the companies began to comprehend that the consumers are not the groups making up the target audience.

According to the leading advocates of the concept, integration of the communication activities ensures the organizational performance to increase by guaranteeing high level of loyalty, by preventing imitation of entrepreneurship and products, by ensuring generation of income with the implementation of the plans made; and also the communication activities, being strategically planned as visually matching with each other, take the lead to create a greater effect on viewers and audiences identified as a targets (Kitchen, Philip, Schultz, Don, 2003).

Kotler (2003) also emphasize that a successful integrated marketing communication creates a sales impact affecting the whole company through better communication, consistency and coordination. Kitchen and Schultz (2003) emphasize that nowadays the companies should be consumer, profit and public focused; and that one of the important points in creating mutual relations with consumers and customers is comprehension of social responsibilities of the company", and that this new kind of social marketing means companies should pay attention to establish a balance between company profitability and fulfilment and satisfaction of customer requirements and public benefit and that these three elements in question can be performed through integrated communication and integrated marketing communication.

According to (Linton, Ion, Morley, and Kevin, 1995), the concept of integrated marketing communication is a concept based on maximizing effectiveness in creation and presentation of messages oriented towards customers by developing databases based on understanding even a single customer and mutual relations, and is an advance form of the basic communication model. The synergy created by coordination shall be reflected as productivity in operational sense, saving in terms of costs and efficiency from the point of messages (Odabaşı and Oyman, 2003). Also Linton and Morley (1995) emphasize that this synergy created by the integrated marketing communication activities can increase the marketing performance by creating positive effect on market share, sales and profitability of the company.

Integrated Marketing Communication Foundation

Various theories have been suggested by different authors in relation to IMC. Some of these theories include; AIDA theory, hierarchy of effects theory**,** and relationship marketing theory.

a. AIDA Theory

The AIDA model produces a detailed illustration about the entire procedure of how advertising effects consumer behaviour and the purchase decisions. It is an acronym, which consists of the factors of attention, interest, desire and action, all of them relevant to the relationship between consumer behaviour and advertising. AIDA model is initiatory and simplest (Aaker and Joachimsthaler, 2000). It explains how personal selling works and shows a set of stair-step stages which describe the process leading a potential customer to purchase.

The first element, that is attention, describes the stage in which the brand manages to gain the attention of the consumer through the advertisement that he/she has come into contact with. It could be either positive or negative attention or sometimes, in a worse case, no attention at all. From the advertiser's standpoint, only the first case is a favourable one where the consumer pays positive attention to the advertisement and eventually the brand (Kotler, 2007). Organizations creating attention, interest, desire, and attraction of their products in the market using appropriate channels of communication to reach the mass market thus stimulating demand of existing and new products in the market. Therefore, adoption of the theory by firms promotes tremendous growth of the companies in terms of client base and revenue (Aaker and Joachimsthaler, 2000). They all have three general stages in common, even though the amount or names of sub-stages might differ: cognitive stage (what the receiver knows or perceives), affective stage (receiver's feelings or affective level), behavioural stage (consumer's action) (Aaker and Joachimsthaler, 2000).

b. Hierarchy of Effects Theory

The Hierarchy of Effects Model was created in 1961 by Lavidge and Gary. This marketing communication model, suggests that there are six steps from viewing a product advertisement (advert) to product purchase. The job of the advertiser is to encourage the customer to go through the six steps and purchase the product which include; awareness, knowledge, liking, preference and purchase. Customers see many adverts each day but will only remember the brand of a tiny

fraction of products. Knowledge of the customer begins when the product is advertised using various communication channels which include; the internet, retail advisors and product packaging. In today's digital world this step has become more important as consumers expect to gather product knowledge at the click of a button.

Consumers will quickly move to competitor brands if they do not get the information they want. The advertiser's job is to ensure product information is easily available (Belch and Belch, 2003). Liking of the product involves customer willingness to buy a product after information search in the market concerning the product on offer. Preference involves consumers being loyal to a particular brand compared to competitor brands. At this stage advertisers will want the consumer to disconnect from rival products and focus on their particular product. Advertisers will want to highlight their brand's benefits and unique selling points so that the consumer can differentiate it from competitor brands. Conviction to a product is a stage of creating the customer's desire to purchase the product in the market. Advertisers may encourage conviction by allowing consumers to test or sample the product (Buzzell, 2004).

Purchase involves is the final stage that consumers experience in the buying process. The advertiser may want the customer to purchase their product by emphasizing on the benefits of the product to the consumer (Belch and Belch, 2003). This stage needs to be simple and easy, otherwise the customer will get fed up and walk away without a purchase. For example a variety of payment options encourages purchase whilst a complicated and slow website discourages purchases. Companies should identify new ways of increasing purchase habits among consumers. Modern technologies like online purchase and mobile phone technologies should drive competitive companies thus minimizing costs of operation (Alexander and Schouten, 2002).

a. Relationship marketing theory

Relationship marketing theory is a form of marketing developed from direct response marketing campaigns which emphasizes customer retention and satisfaction, rather than a dominant focus on sales transactions (Alexander and Schouten, 2002). As a practice, relationship marketing differs from other forms of marketing in that it recognizes the long term value of customer relationships and extends communication beyond intrusive advertising and sales promotional messages (Aaker and Joachimsthaler, 2000). With the growth of the internet and mobile platforms, relationship marketing has continued to evolve and move forward as technology opens more collaborative and social communication channels (Berglof & Bolton, 2002).

Relationship marketing involves a short-term arrangement where both the buyer and seller have an interest in providing a more satisfying exchange (Adebsi, 2006). This theory tries to disambiguiously transcend the simple post purchase-exchange process with a customer to make more truthful and richer contact by providing a more holistic, personalized purchase, and uses the experience to create stronger ties (Aaker and Joachimsthaler, 2000).

Relationship marketing relies upon the communication and acquisition of consumer requirements solely from existing customers in a mutually beneficial exchange usually involving permission for contact by the customer through an "opt-in" system (Adebsi, 2006).With particular relevance to customer satisfaction the relative price and quality of goods and services produced or sold through a company alongside customer service generally determine the amount of sales relative to that of competing companies (Berglof & Bolton, 2002).

A key principle of relationship marketing is the retention of customers through varying means and practices to ensure repeated trade from preexisting customers by satisfying requirements above those of competing companies through a mutually beneficial relationship (Albers & Straughan, 2000). Extensive classic marketing theories center on means of attracting customers and creating transactions rather than maintaining them, the majority usage of direct marketing used in the past is now gradually being used more alongside relationship marketing as its importance becomes more recognizable. Increased profitability associated with customer retention efforts occurs because of several factors that occur once a relationship has been established with a customer (Berglof & Bolton, 2002).

The Integrated Marketing Communication Strategies

According to Brassington and Pettitt (2000), promotion strategy is the direct way in which an organization communicates the product or service to its target audiences. Within the healthcare industry, promotion is used in many different ways (Meidan, 1996). Brassington and Pettitt (2000) has categorized the promotional tools into five main elements; Advertising, Sales promotion, Public relations, Personnel selling, and Direct Marketing.

a. Advertising

Brassington and Pettit (2000) define advertising strategy as any paid form of non-personal communication directed towards target audiences and transmitted through various mass media in order to promote and present a product, services or idea. The key difference between advertising and other promotional tools is that it is impersonal and communicates with large numbers of people through paid media channels. Meidan (1996) states that services organization can use its advertising for either its short-term or its long term objectives. Healthcare organizations attempting to create a long-term relationship, should build up of its name by using institutional advertising, while a laboratory services organizations interested in promoting its brand name and its differentiated services would use a brand advertising policy.

The institutional advertising consists of promotion of the firms' image as a whole and promotion of the products offered, with extra emphasis on the specific firm's name organization. The organization seeks through its marketing communications to build awareness and to impress customers looking for the best range of healthcare services, due to the former impression of laboratory services organizations as impersonal institutions with no interest in their customers as people, and of healthcare services as abstract and quite similar the institutional advertising has become more and more important (Meidan, 1996).

Brand advertising follows closely in the footsteps of institutional advertising. Its purpose is to create awareness of the laboratory services organizations' name and to advertise the different services it is offering. Since healthcare firms are serving a mass of people, the problems of brand advertising are to know who to advertise to, and how to advertise (Pettit, 2000). While

institutional advertising is directed towards the whole population, the brand advertising of particular products has to be much more selective since it has to show that the consumer will benefit from the service.

Furthermore, all the individual campaigns of brand advertising have to be compatible in tone and presentation and match the image the laboratory services organizations has created through its institutional advertising (Mortimer, 2001). Mortimer (2001) states that an important part of advertising is to make the service tangible in the mind of the consumer in order to reduce perceived risk and provide a clear idea of what the service comprises. Furthermore she considers it important to advertise consistently, with clear brand image in order to achieve differentiation and encourage word-of-mouth communication.

Meidan (1996) suggests that there are two types of advertising channels appropriate for advertising. That is "above-the-line" and under-the-line" advertising. Above-the-line advertising contains different channels of communication such as television, radio, posters, magazines and newspapers. Under-the-line advertising constitutes a huge part of organizational advertising activities. It is the invisible advertising of the organization services including leaflets, pamphlets, explanatory guides and manuals that can be used to support selling of a specific service.

a. Sales Promotion

According to Brassington and Pettit (2000) sales promotion is tactical marketing techniques with mostly short- term incentives, which are to add value to the product or service, in order to achieve specific sales or marketing objectives. Furthermore, Meidan (1996) states that it has two distinctive qualities. Firstly, it provides a "bargain chance" since many sales promotion tools have an attention gaining quality that communicates an offer that although they appeal to a wide range of buyers, many customers tend to be less brand loyal in the long run. Secondly, if sales promotions are used too frequently and carelessly, it could lead to insecure customers, wondering whether the services are reliable or reasonably priced.

Meidan (1996) indicates that due to conflicting ideas concerning the benefits of sales promotions, healthcare organization must base its decision upon relevance and usefulness of sales promotion as well as cost effectiveness. Petit (1994) claim that normally, coupons, special offers and other forms of price manipulation are the dominant forms of sales promotion.

Price based promotions are difficult and probably dangerous to use for organization service markets. This is due to the fact that the price setting of healthcare service is already a difficult process, and that consumers often see lower prices as a result of lower quality. However, Meidan (1996) states that sales promotion with healthcare services appear to be most effectively used in combination with advertising. The primary objectives with sales promotion within organization services are to attract new customers; to increase market share in selected market segments; and to lower the cost of acquiring new customers by seeking to avoid direct price competition with other healthcare organizations.

a. Public Relation

According to Brassington and Pettit (2000) the essence of public relations (PR) is to look after the nature and quality of the relationship between the organization and its different publics, and to create a mutual understanding. Public relations cover a range of activities, for example the creation and maintenance of corporate identity and image; charitable involvement, such as sponsorship, and community initiatives; media relation for the spreading of good news as well as for crisis management, such as damage limitation.

Moreover, an organization can attend trade exhibitions to create stronger relationships with key suppliers and customers as well as enhancing the organization's presence and reputation within the market (Brassington, 2000). Meidan, (1996) states that another part of public relations is the publicity gained through magazines. Organizational services obtain considerable publicity in so called quality press, such as different healthcare journals. In popular newspaper the publicity is, in contrary to the quality press, often negative from the healthcare firm's point of view.

a. Personal Selling

Brassington and Pettit (2000) argue that, personal selling is a two way communication tools between a representative of an organization and an individual or group, with the intention to form, persuade or remind them, or sometimes serve them to take appropriate actions. Furthermore, personal selling is a crucial element in ensuring customers' post- purchase satisfaction, and in building profitable long-term buyer-seller relationship built on trust and understanding.

Verhallen *et al* (1997) states that the increased competition within the fast changing environment of organizational services has led to many organizations developing and maintaining comprehensive relationship with their customers. Furthermore, Julian and Ramaseshan (1994) state that the long term person to person relationship is an important factor for a retail firms to achieve a competitive advantage. Meidan (1996) points out that once customer has chosen its laboratory services organizations, he is unlikely to switch to another.

Further, personal selling is probably the most important element in the communication press within the financial services industry. Lee (2002) state that personal selling can be performed either face to face or through technological aids such as the internet. According to Julian and Ramaseshan (1994) the relationship between the salesperson and customer is perceived as being of great importance for the marketing of healthcare organizations.

In addition, the sales force within the organization service industry needs not only to be trained in the art of selling but also to be aware of all the services available and be able to clearly explain what each services offers. Since customers' needs and motivation are likely to be complex, and their ability to assess alternative courses of action without professional assistance is likely to be limited, it is of great significance for the sales force engages and cooperates toward the customer, trying to find a solution to the customer's problem, rather than only persuading him to purchase the products or services (Meidan, 1996).

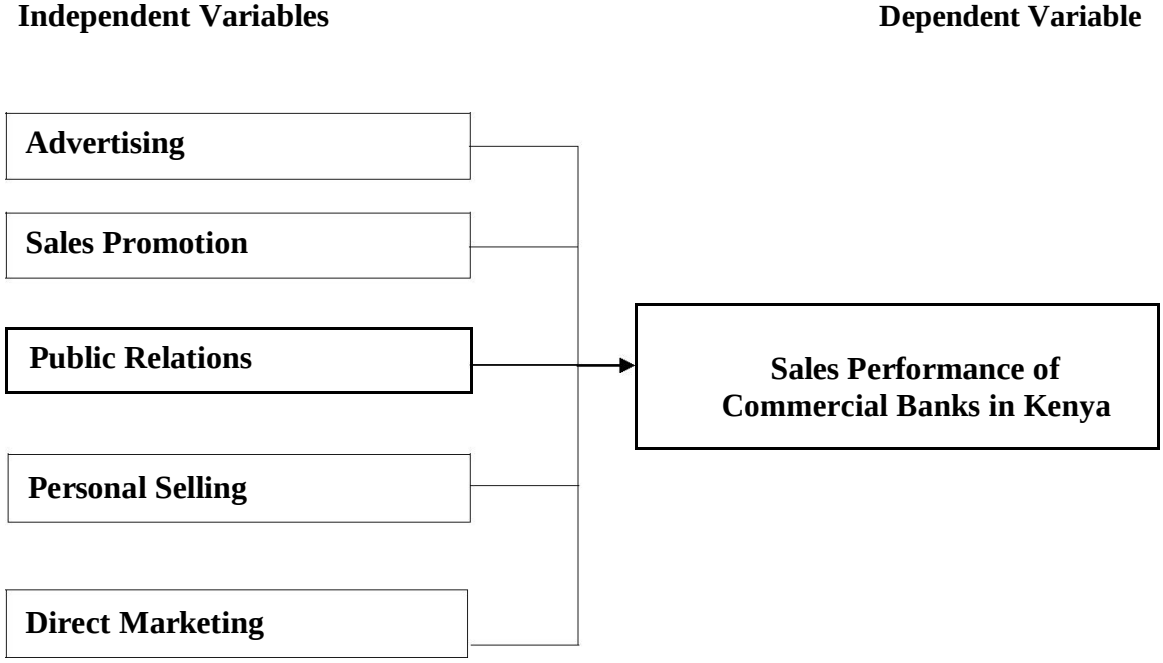
a. Direct Marketing

According to Brassington & Pettit (2000) direct marketing is an interactive system of marketing, using one or more advertising

media to achieve measurable response anywhere, forming a basis for creating and further developing an on-going direct relationship between an organization and its customers, to be able to create and sustain quality relationship with sometimes hundreds or even thousands of individual customers, an organization needs to have as much information as possible about each one, and needs to be able to access, manipulate and analyze that information, thus, the database is crucial to the process of building the relationship. Lee (2000) states that the fast advances in technology over the past 30 years have reshaped how consumers today interact with their financial institutions.

The financial sector has extended its face to face selling towards direct marketing of products and services in the form of phone, mail or computer transactions. Moles (2000) claim that as computer literacy and the availability of computers increase and the costs decrease. Through the internet, financial service organizations can identify their customer interests. Furthermore, the Internet technology also makes it possible to follow individual customer usage. With the information gathered in an integrated database it is possible to read the customers' needs and satisfy them. This knowledge can be used for different kinds of direct marketing (Lee, 2000).

Fig: 2.1Conceptual Framework



(Source: Author, 2015)

Benefits of Integrated Marketing Communications

The IMC process generally begins with an integrated marketing communications plan describing the different types of marketing, advertising, and sales tools to be used during campaigns (Knapp, 2000). These are largely promotional tools, which include everything from search engine optimization (SEO) tactics and banner advertisements, to webinars and blogs. Traditional marketing communication elements such as newspapers, billboards, and magazines may also be used to inform and persuade consumers. Marketers must also decide on the appropriate combination of traditional and digital communications for their target audience to build a strong brand-consumer relationship (Lee, 2000).

Regardless of the brand's promotional mix, it is important that marketers ensure their messaging is consistent and credible across all communication channels. With so many products and services to choose from, consumers are often overwhelmed by the vast number of advertisements flooding both online and offline communication channels. Marketing messages run the risk of being overlooked and ignored if they are not relevant to consumer needs and wants. Integrated marketing communications clearly and effectively communicate brand's story and messaging across several communication channels to create brand awareness (Meidan, 1996).

IMC is also viewed as more cost-effective than mass media, since consumers are likely to interact with brands across various mediums and digital interfaces. As consumers spend more time on computers and mobile devices, marketers seek to weave together multiple exposures to their brands using different touch points. Companies can then view the performance of their communication tactics as a whole instead of as fragmented pieces (Knapp, 2000).

Integrated marketing communications creates a competitive advantage for companies looking to boost their sales and profits. This is especially useful for small- or mid-sized firms that have limited people resources and marketing budgets. IMC wraps communications around customers and helps them move through the various stages of the buying process. The organization simultaneously consolidates its image, develops a dialogue, and nurtures its relationship with customers throughout the exchange. Furthermore, IMC can be instrumental to creating a seamless

purchasing experience that spurs customers to become loyal, and lifelong customers (Knapp, 2000).

Sales Performance Management

Effective sales performance management is a critical initiative which aims to drive sales transformation or reduce operational costs. Sales performance management is the discipline of marrying performance data with business improvement processes to drive sales effectiveness. At its core is incentive compensation management. The business impact of sales performance management grows when other critical processes are added, such as territory and quota management, analytics and dash boarding, and coaching (Kotler, 1999).

Proving the value of the integrated marketing communication (IMC) process in its relation to brand outcomes, such as brand awareness, brand loyalty, and sales, is critical issues. To make a position in the global market it becomes necessary for every organization to concentrate on its sales aspects, and it's important to take proper steps to keep up the performance in order to be in the competition, which can be done through appropriate planning and strategizing sales, timely execution of initiatives regarding sales, simultaneously ensuring both front-line sales people and decision-makers have visibility in performance compensation, which is initiated and completed by the seller, the owner of the goods (Kotler, 1999).

The first step is of the agreement to an acquisition followed by the passing of title and settlement of prices, the sales completes prior to payment and makes the payment obligatory.

Sales department contributes majorly in any organization's growth; the goal is to increase the number of interactions between potential customers and company using promotional techniques such as advertising techniques, sales promotion, publicity and public relations, creating new sales channels, or creating new products, among other things. It deals with the interaction between the customer and sales facility and sales person. In order to do this, the sales management would break down selling process and then increase the effectiveness of the discrete processes as well as the interaction between different processes (Knapp, 2000).

It is suggested that by effectively bringing more customers and enticing them to contact, sales organization can improve their efficiency, profitability, allowing sales people to provide a higher level of customer service and satisfaction. It secures income to drive the rest of the business. Aims at persuading customers to buy products or services and it involve coordinating travelling representatives, telephone sales, and preparing mail shots (Knapp, 2000).

It also involves interaction with the marketing function and complaints, orders, monitoring Sales, profitability, expenses, setting targets, preparation for catalogues among others, customer accounts, chasing up orders and dealing with special requests. For an organization to improve its productivity, it's important that its work force is well trained and equipped with resources, which largely depends upon the ability of sales person's interactive communication with the customers. Beside communication skills there are other crucial personality factors which influence sales performance (Spring, 1993).

Sales Task	**Functions to be Performed**	**Performance Indicators**
Sales planning, forecasting And budgeting	Predicting demand for the product and sales assets, availability of sales assets and additional opportunities of sales, react quickly when the demand decreases; it improves efficiency and decreases unfocused and uncoordinated activities within the sales process, consumer's taste, competitive conditions, industry trends, strategies needed to obtain projected sales revenues	- Extent to which sales representative sells the company. - Knowledge of business
Sales associate development	It includes sales goals and sales tracking, encouraging the sales process along with end results, task carried out by each sales representative should be studied, and out bound phone sales done, tracking the sales activity.	-Amount of time spent in office -Number of calls made on existing account. -Volume of sales in currency. -Extent to which sales representative sells the company
Designing the sales territory	Weather the sales representative has the opportunity of reaching potential customers in that territory over a given period of time, structured routing system used by the sales person for contacting customers in	-Number of new accounts opened -Planning and routing of calls

	that territory in with minimum selling time and cost	
Training the sales force	Sales force should regularly receive information regarding selling skills and Knowledge of: customers, product/services, company, industries and competitors and plans to be implemented in future.	Completeness and accuracy of sales - order - Knowledge of business. - Accuracy in quoting prices and deliveries. - Sales persons presentation -Number of new accounts opened
Motivating and leading sales force	Maintaining a high level of self-motivation in the sales staff, enhance the existing talent by giving additional skills training and work around the traits which cannot be changed, atmosphere of respect, trust and common	-Number of new accounts opened. -Number of sales made on existing accounts

Table : 2.2 Sales Performances

	vision within the team should be maintained in order to move towards the company's vision and goal.	
Compensating the sales force	Facilitate the sales people with incentives along with basic salary and develop compensation packages to keep up their motivation.	- Completeness and accuracy of sales orders - Productivity of the company
Evaluating sales force performance	Customer's relations, adherence to expense guidelines, job skills and company relations, criterion and expectation should be discussed with each sales person and incentive packages should be attached to each criterion.	Promptness in submitting reports. - Expenses made in entertaining customers - Completeness and accuracy of sales order - Extent to which sales representative sells company
Sales report	Whether or not sales process is being Operated effectively and achieves the goal as set forth in sales planning and to take corrective actions, allows senior management to evaluate sales manager, finally to satisfy the need of different stakeholders.	Volume of sales in currency - Promptness in submitting report.

Source: (Proctor, Tony, Kitchen, Philip, 2002).

Empirical Studies

Studies by Boorom, Goolsby and Ramsey (2008) on relational communication traits and their effect on addictiveness and sales performance, found that communication apprehension strongly influences interaction involvement, which is supposed to be an integral part of addictiveness and sales performance. The study revealed that as the communication apprehension increases salespersons effectiveness is lessened, ultimately effecting the growth of the organization. To overcome communication apprehension the sales persons can undergo intensive skills training programmed, visualization and cognitive modification techniques.

According to Jeremy Miller, organization has to recognize and recruit candidates who possess those specific skills required to gain success in sales and then evolve sales processes and management system to form a learning organization in order to adapt to the market. Spring (1993) did a study named as Four dimensions of sales productivity, whereby he specified four dimensions to keep up the sales productivity, in the first dimension of market strategy and focus, he mentioned that by developing and communicating organizational missions and sales

strategies and strategizing proper customer satisfaction, through appropriate distribution channel, and encouraging innovative ideas and business ventures the productivity can be improved.

III. METHODOLOGY

Research Design

Saunders, Lewis & Thornhill (2009) defines a research design as the arrangement of conditions for collection and analysis of data in a manner that aims to combine relevance to the research purpose with economy in procedure. The descriptive research process would help in collecting data in order to answer questions concerning the current status of the subjects that were under investigation. A descriptive study was concerned with finding out the what, where and how of a phenomenon and a cross-sectional survey design was chosen since data was collected at one point in time from sample selected to represent a larger population. This study adopted descriptive cross sectional survey that established the influence of Influence of Integrated Marketing Communication and Sales Performance of Commercial Banks in Kenya.

Population of the Study

The study population consisted of 43 Commercial Banks operating in Kenya. The study was be a census where all the 43 Commercial Banks operating in Kenya and licensed by Central Bank of Kenya were used to determine Influence of Integrated Marketing Communication and Sales Performance of Commercial Banks in Kenya.

Data Analysis

The data collected in the research was edited, coded and entries made into made into statistical software (Statistical Package for Social Sciences, SPSS version 20). This involved converting quantitative (nominal and ordinal data) into numerical codes. Descriptive statistics was then run which consisted of frequencies, percentages, means and standard deviation to summarize the data. The study also adopted multiple linear regression and Pearson correlation analysis to establish the relationship between variables of interest. Specifically, multiple linear regression analysis was used to determine the joint relationship between independent and dependent variables.

The regression model was:

$$\mathbf{Y= \beta 0 + \beta 1X1 + \beta 2X2 + \beta 3X3 + \beta 4X4 + \beta 5X5 + \varepsilon}$$

Y= Sales Performance of Commercial Banks in Kenya

β0= Y intercept

β1 to β5 = regression coefficients X1 = Advertising

X2 = Sales Promotion

X3 = Public Relations

X4 = Personal Selling X5 = Direct marketing

ε = error term

Pearson correlation analysis was determined if there is a relationship between the promotion mix strategies and growth. This included the nature, magnitude and significance of such relationship. Pearson Correlation analysis was conducted at 95% confidence level ($\alpha = 0.05$).

IV. RESEARCH FINDINGS AND DISCUSSION

Demographic Characteristics of Respondents

The respondents were asked to indicate their position in their companies. The findings are summarized in the Table 4.1:

The respondents were asked to indicate their age. The findings were summarized in the Table 4.1:

Table 4.1 Age of the Respondents.

Age (Years)	**Frequency**	**Percentage (%)**
Below 20 years	9	21
21-30 years	15	35
31-40 years	10	23
41-50 years	3	7
51 and above years	6	14
Total	**43**	**100**

Source: Research data

As indicated from the Table 4.2.1, 21% of respondents are aged below 20 years. 21-30 years were only 35 %. The other

23% were in the age bracket of 31-40 years, 7% were between 41-50% and above 51years were 14% respectively.

The respondents were asked to indicate their education level. The findings are summarized in the Table 4.2:

Table 4.2 Academic Level of Respondents

Academic Level	Frequency	Percentage (%)
Degree	18	42
A-Level	5	12
Diploma	9	21
O-Level	5	12
Post-graduate	6	13
Total	**43**	**100**

Source: Research data.

As shown in Table 4.2, it was evident that 42% of the respondents were degree holders while 8% of the respondents had attained the A-level of education. 21% of the respondents were diplomas holders. 12% of the respondents were O- Level and A-level holders and 13 % had post-graduate qualifications.
The respondents were asked to indicate their banks had operated in Kenya. The findings are summarized in the Table 4.3:

Table 4.3 Period of Operation

Period of Operating	Frequency	Percentage (%)
0-1 year	0	0
2-5 years	13	30
6-10 years	6	14
11-15 years	13	31
16-19 years	6	14
20 and above years	5	12
Total	**43**	**100**

Source: Research data.

As shown in Table 4.3, 30% of the banks indicated that they had been operating in Kenya for a period of between 2-5 years due to good image of the organization. 31% of them indicated that had been operating in Kenya for a period of between 11-15 years due to quality services. 14% of them had been operating in Kenya for a period of between 16-19 years due to customized services and accommodative loyalty programs. And finally, 12% of them had been operating in Kenya for a period above 20 years.

Integrated Marketing Communication

The respondents were asked to indicate the integrated marketing communication applied by their Banks in the market. The findings are summarized in the Table 4.9, 4.10, 4.11, 4.12 and 4.13 as shown below:

Advertising

The respondents were asked to indicate the advertising medium used by their firms. The findings are summarized in the Table 4.4:

Table 4.4 Advertising

Extent of Using Promotional Strategies	**N**	**Very great extent [5]**	**Great extent [4]**	**Moderate extent [3]**	**Little extent [2]**	**No extent at all [1]**	**Mean Score**
Promotion through website	43	72.1	28.4	0.00	0.00	0.00	3.41
Promotion through Telephone handling	43	72.1	28.4	0.00	0.00	0.00	3.41
Promotion through flyer and brochure	43	72.1	28.4	0.00	0.00	0.00	3.41
Promotion through Office setting	43	72.1	28.4	0.00	0.00	0.00	3.41
Promotion through radio	43	0.00	0.00	0.00	0.00	99.5	2.11
Promotion through television	43	0.00	0.00	0.00	0.00	99.8	2.11
Promotion through newspapers	43	0.00	0.00	0.00	0.00	99.9.	2.11
Promotion through Billboards	43	0.00	0.00	0.00	8.00	92.3	2.11
Promotion through sponsorships	43	0.00	0.00	0.00	9.00	90.9	2.11
	43	0.00	0.00	0.00	0.00	99.8	2.11

Source: Research data.

As shown in Table 4.4, majority of the respondents indicated that they used website, telemarketing and flyer as promotional strategies with a mean of (3.41) in order to minimize costs. While the majority of them said they did not Promotion their services through Office setting, radio, television, newspapers, Billboards and sponsorships with a mean of (2.11) due to high costs associated.

Sales Promotional

The respondents were asked to indicate the sales promotional activities carried out by their banks in the industry to stimulate sales. The findings were summarized in the Table 4.5:

Table 4.5 Sales Promotional Activities

Sales Promotional Activities	**Frequency**	**Percentage (%)**
Discounting	18	42
Price cuts	15	34

Free samples	5	12
Personal selling	5	12
Total	**43**	**100**

Source: Research data

As shown in Table 4.5, 42% of the respondents indicated that their firms carried out promotional activities by giving discounts to their customers hence attraction and retention. 34% of them indicated that they carried out promotional activities by reducing their prices hence attracting more customers. 12% of the customers indicated they carried out promotional activities through free samples and personal selling thus retention of their customers in the long term.

Public Relations

The respondents were asked to indicate the purpose of Public Relations activities to their banks in the industry. The findings are summarized in the Table 4.6:

Table 4.6 Public Relationship

Public Relationship	**Frequency**	**Percentage (%)**
Collecting market information on consumer needs	4	9
Adequate marketing budget	13	31
Enter new markets	2	5
Opening new branches	2	5
Have good/attractive premises	2	5
Strategic location /store layout	2	5
Bargaining power on prices	2	5
Low cost of operation	4	9
Investment in new products/services	6	14
Coping with competition	2	5
Clear vision and goals	3	7
Total	**43**	**100**

Source: Research data

As shown in Table 4.6, 31% of the respondents indicated that adequate funds should be allocated to carry out customer relations programs to enhance their image. 14% of them indicated that investment in new products/services would lead to enhanced customer relations due to satisfaction. 9% of the respondents indicated that customer relations can be enhanced through collecting market information on consumer needs, and through minimal low costs of operation. 5% of the respondents indicated that customer relations can be promoted by entering new markets, opening new branches, having good/attractive premises, strategic location /store layout, having bargaining power on prices, having low cost of operation, investment in new products/services, coping with competition and by having clear vision and goals.

Personal Selling Means

The respondents were asked to indicate the purpose of Personal Selling activities to their banks in the industry. The findings are summarized in the Table 4.7:

Table 4.7 Personal Selling Means

Personal Selling Means	**Frequency**	**Percentage (%)**
Personal contact with customers	17	38
The influence of sales people	5	12
Close relationship	5	12
Positive word of mouth	16	38
Total	**43**	**100**

Source: Research data

As shown in Figure 4.7, 38% of the respondents indicated that positive word of mouth from loyal customers was a strong mean of personal selling that influenced others to purchase their service. 38% indicated that personal contact was an effective mean of personal selling. 12% indicated that close relations promoted customer loyalty. While 12% indicated that the influence of sales people was an effective method of personal selling that determined the end user decision on the purchase of a service.

Direct Marketing

The respondents were asked to indicate the direct marketing activities that were used by their firms in the industry. The findings are summarized in the Table 4.8:

Table 4.8 Direct Marketing

Distribution Strategies	**N**	**Min**	**Max**	**Mean**	**Std. Deviation**
Personal contact with customers	43	1	5	4.50	1.063
By email	43	1	5	4.33	1.063
By telemarketing	43	1	5	4.12	1.103
Total	43				

Source: Research data

The most commonly used direct marketing strategy was personal selling which have the highest mean (4.50) to discourage competitors. Distribution through mail order is the second strategy used with a mean of (4.33) due to cost efficiency. Thus direct marketing through telemarketing is another strategy that was used with a mean of (4.12) which is key in maintaining close contact with customers.

Performance Measurement

The respondents were asked to indicate the performance measurement indicators used by their banks in the industry. The findings are summarized in the Table 4.9:

Table 4.9 Performance Measurement

Performance Measurement	**N**	**To a Very Large**	**To a Large Extent**	**To a moderate Extent**	**To a small Extent**	**Not At all**			

Indicators		**Extent** **5]**	**[4]**	**[3]**	**[2]**	**[1]**	**Total (%)**	**Mean Score**	**S.E**
Increased market share	40	**60.3**	22.0	17.9	0.00	0.00	100	3.13	.109
Increased profitability	40	**40.2**	22.0	27.7	0.00	0.00	100	3.11	.109
Reduced costs of production	40	**48.0**	22.0	29.9	0.00	0.00	100	2.80	.194
Increased customer satisfaction	40	**45.3**	22.0	32.5	0.00	0.00	100	2.80	.194
Introduction of new products	40	**62.4**	48.8	0.00	0.00	0.00	100	2.11	.105
Improved employee performance	40	**80.4**	12.0	0.8	0.00	0.00	100	2.10	.109
Expansion into new markets	40	**72.3**	22.0	5.5	0.00	0.00	100	2.10	.109
ICT integration in customer service delivery	40	**45.7**	45.2	10.2	0.00	0.00	100	2.06	107
Minimal customer complaints	40	**35.1**	33.3	21.8	0.00	0.00	100	2.06	106

Source: Research data

As shown in Table 4.9, 60% of the respondents indicated that their firms used the market share to measure their growth and performance in the industry with a mean of 3.13. 40% of them used profits generated with a mean of 3.11. 48% of them used reduced costs of production and customer satisfaction with a mean of 2.80 as a measure of performance. 62% indicated that development of new products was used as a measure of performance with a mean of 2.11. 80% of them indicated that improved employee performance and expansion to new markets were used as measures of performance by their firms with a mean of 2.10. 45% of them indicated that ICT integration in customer service delivery was used as an indicator of performance with a mean of 2.06. Finally, 35% of them indicated that minimal customer complaints were used as indicators of performance with a mean of 2.06.

Relationship between Independent and Dependent Variables

The respondents were asked to indicate the relationship between the independent and dependent variables. The findings are summarized in the Table 4.10:

Table 4.10: Coefficient of Determination

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	**(Constant)**	1.139	1.2235		1.615	0.367
	Advertising	0.887	0.1032	0.152	4.223	.0142
	Sales Promotion	0. 752	0.3425	0.054	3.724	.0169
	Public Relations	0.645	0.2178	0.116	3.936	.0191
	Personal Selling	0.539	0.1937	0.263	3.247	.0254
	Direct marketing	0.597	0.1834	0.0634	3.233	.0482

Source: Author (2014)

As shown in Table 4.10, coefficient of determination explains the extent to which changes in the dependent variable can be explained by the change in the independent variables or the percentage of variation in the dependent variable (Sales Performance of Commercial Banks) that is explained by all the five independent variables (Advertising, Sales Promotion, Public Relations, Personal Selling and Direct marketing).

Multiple regression analysis was conducted to determine the relationship between Sales Performance of Commercial Banks and the five variables. As per the SPSS generated table above, the equation ($Y = \beta 0 + \beta 1X1 + \beta 2X2 + \beta 3X3 + \beta 4X4 + \beta 5X5 + \varepsilon$) becomes:

$Y= 1.139+ 0.887X1+ 0.752X2+ 0.465X3+ 0.539X4+ 0.498 X5$

According to the regression equation established, taking all factors into account (Advertising, Sales Promotion, Public Relations, Personal Selling and Direct marketing) constant at zero, sustainable competitiveness will be 1.139. The data findings analyzed also shows that taking all other independent variables at zero, a unit increase in Advertising will lead to a 0.887 Sales Performance of Commercial Banks in Kenya; a unit increase in personal selling will lead to a 0.752 Sales Performance of Commercial Banks in Kenya, a unit increase in sales promotion will lead to a 0.465 Sales Performance of Commercial Banks in Kenya; a unit increase in public relations will lead to a 0.539 Sales Performance of Commercial Banks in Kenya and a unit increase in direct marketing will lead to 0.597 Sales Performance of Commercial Banks in Kenya. This infers that Advertising contribute most to effective Sales Performance of Commercial Banks in Kenya. At 5% level of significance and 95% level of confidence, Advertising had a 0.0142 level of significance, sales promotion showed a 0.0169 level of significance, Public relations showed a 0.0191 level of significance and personal selling showed a 0.0254 and direct marketing showed a 0.0482 level of significance.

After regression analysis, it can be concluded that there is a positive relationship between independent variables (Advertising, Personal Selling, Sales Promotion, Public Relations and Direct marketing) and dependent variable (Sales Performance of Commercial Banks).

Relationship between Variables of the Study

This section sought to determine the relationship between independent variables and dependent variable. The findings are summarized in the Table 4.8:

Table 4.11 : Pearson's Correlation analysis

	1	2	3	4	5	6
Sales Performance of Commercial Banks In Kenya	1					
Public Relations	0.217*	1				
Personal Selling	0.301**	0.502*	1			
Sales Promotion	0.294**	0.091*	0.291**	1		
Advertising	0.338*	0.447**	0.411**	0.094**	1	
Direct marketing	0.276**	0.389**	0.299**	0.179**	6 0.266**	1

** σ=0.01 (correlation is significant at 0.01 level (2-tailed)
* σ=0.05 (Correlation is significant at 0.05 level (2-tailed)

The correlation table presents the relationship between dimensions of sales performance measured by advertising, personal selling, sales promotion, public relations and direct marketing. The results show that all the dimensions relate positively. Specifically, sales promotion, advertising, personal selling, public relations and direct marketing ($r = 0.294$, $p < 0.01$; $r = 0.338$, $p < 0.01$; $r = 0.276$, $p < 0.01$) relates positively with sales performance of Commercial Banks respectively. These suggest that the independent variables (sales promotion, advertising, personal selling, public relations and direct marketing) relate positively with sales performance.

Discussion

The study established that majority of the banks advertised their services through their websites in order to cut down costs of operation. This is supported by Mortimer (2001) who states that an important part of advertising is to make the service tangible in the mind of the consumer in order to reduce perceived risk and provide a clear idea of what the service comprises. Furthermore she considers it important to advertise consistently, with clear brand image in order to achieve differentiation and encourage word-of-mouth communication.

The study established that discounts on was a tactic used by banks to increase profits for a short term period. This is supported by Meidan (1996) who argue that sales promotion provides a "bargain chance" since many sales promotion tools have an attention gaining quality that communicates an offer that although they appeal to a wide range of buyers, many customers tend to be less brand loyal in the long run.

The study identified that public relations activities carried out by the banks were intended to enhance positive publicity and image in the market. According to Brassington and Pettit (2000) the essence of public relations (PR) is to look after the nature and quality of the relationship between the organization and its different publics, and to create a mutual understanding. Public relations cover a range of activities, for example the creation and maintenance of corporate identity and image; charitable involvement, such as sponsorship, and community initiatives; media relation for the spreading of good news as well as for crisis management, such as damage limitation.

It was established by the study that personal selling was used as a mean of increasing sales. This is supported by Julian and Ramaseshan (1994) who argue that the long term person to person relationship is an important factor for a retail firms to achieve a competitive advantage. Meidan (1996) points out that once customer has chosen its laboratory services organizations, he is unlikely to switch to another. Further, personal selling is probably the most important element in the communication press within the financial services industry.

The study established that direct marketing was technic used by banks to improve close relation. This is supported by Lee (2000) who argue that the fast advances in technology over the past 30 years have reshaped how consumers today interact with their financial institutions. The financial sector has extended its face to face selling towards direct marketing of products and services in the form of phone, mail or computer transactions. Through the internet, firms can identify their customer interests. Furthermore, the Internet technology also makes it possible to follow individual customer usage.

The study established that there was a positive relationship between integrated marketing communication and sales performance. This is supported by Mols (2000) who argue that organizational performance encompasses accumulated end results of all the organization's work processes and activities. Performance measures can be financial or non-financial. Financial measures of organizational performance include; return on assets, return on sales, return on equity, return on investment, return on capital employed and sales growth. Non-financial organizational performance measures include; web-performance

track variations in traffic-page views, advertising impressions served and unique users

V. CONCLUSIONS AND RECOMMENDATIONS

Conclusions

The findings indicate that commercial banks in Kenya strive to adopt at least most of the integrated communication practices in their endeavor to achieve some competitive advantage over their competitors in such a stormy environment despite the stiff competitions and costs of operation. It is concluded that the level of adoption of the integrated communication practices amongst commercial banks in Kenya still remains an uphill task despite the importance of strategic marketing practices in any business; these practices have not yet been embraced amongst the commercial banks in Kenya due to high costs associated with marketing communication practices.

Many are the factors that have led to such a low levels of adoption of the integrated marketing communication practices were inadequate financial backup that is deemed as a major source of drawback to adoption of integrated communication by commercial banks in Kenya.

Technological challenges serve as a drawback to commercial banks in Kenya in effective adoption of integrated marketing communication practices. Due to fewer efforts of the Government policies to support E-business, commercial banks in Kenya have been performing relatively poor.

It is concluded that if a proper mechanism is put in place in regard to capital advancement and in reasonable terms, good business operating environment and good infrastructure will go a long way in enhancing the adoption integrated marketing communication in Kenya. It is concluded that commercial banks in Kenya to be competitive in terms of product/service quality, they should adopt modern technology in communication to promote their services cost effectively to the target market.

Recommendations and Policies

It was established that due to good image of some organization, most customers were loyal to commercial banks in Kenya even though they needed to put more effort in promoting their services. It is recommended that print media advertisements to be used by to promote their products and services to the target customers.

It was evident that majority of commercial banks in Kenya did not advertise using newspapers, television, journals, magazines and billboards due to high costs associated with the media. Therefore, the study recommends Government intervention initiatives through the Ministry of Communication to endorse commercial banks in Kenya through the implementation of the fiber optic cable to enable small and large firms to promote their products through online.

The study established that the banking industry was extremely competitive due to competition from well establishes firms in the global market. Therefore, this study recommended that the Government of Kenya to intervene and support commercial banks through stimulating declining firms in order to promote social –economic development.

It was witnessed that public relations was enhanced through collecting market information on consumer needs, low costs of operation, entering new markets, opening new branches, having good and attractive premises, strategic location, having bargaining power on prices, investment in new products and services, coping with competition and by having clear vision and goals. It was witnessed that telemarketing, email and personal contact were the common practices used by commercial banks in Kenya to promote their products.

This study recommends that commercial banks in Kenya should embrace the importance of promoting their products and services in order to survive in the dynamic business environment. It is recommended that the government recognizes the importance of this sub-sector and initiates legislation that promote their marketing programs. It is important that the government also puts in place legislation that enables commercial banks to promote their services. The Government should come up with policies to enhance Communication technology especially in the advent of recent interconnectivity through the undersea cables which has enabled faster internet services through fiber optic cable among major towns in Kenya and is perceived to be faster and could be of great benefit if connected with rural towns and markets for job creation like in Cyber cafes and consequently alleviate unemployment.

The study also established that advertising free samples and personal selling were used at a minimal extent due to costs that were associated with the medium. Therefore, this study recommends that management of commercial banks in Kenya to form strategic partnerships that will enhance their marketing practices in the industry.

The study established that the purpose of public relations activities to their firms in the industry was to market products and services that were produced by their firms and introduce new products in new markets. Therefore, this study recommends that commercial banks in Kenya to forms a joint marketing board that will market their products and services in the global market.

Suggestions for Further Research

Future studies should explore the reasons behind the promotion strategies in the Commercial Banks. Researchers should go ahead and establish the reasons behind the failure of integrated marketing communication strategies among Commercial Banks in Kenya hence establish long term solutions in the industry in terms of new product development and quality customer delivery. Future studies will minimize promotional challenges experienced by the Commercial Banks in Kenya hence competitive edge in the local and global market.

REFERENCES

[1] Albers-Millers N.D & Straughan R.D (2000). Financial Services Advertising in Eight non English Speaking Countries international journal of bank marketing vol. 18 no 7,347-348

[2] Arnold, S, Chadraba, P. & Springer. (2001). Marketing Strategies for Central and Eastern Europe. Aldershiot: ashgate publishing, ltd.

[3] Aaker, D.A., Joachimsthaler, E. (2000), Brand Leadership, The Free Press, New York, NY, pp. 13, 27, 40, 48,

[4] Adebsi, Y. (2006), Essential of Marketing Management, 1st Edition, Lagos:Cilgal Publication.

[5] Alexander, J.H., Schouten, J.W., Koenig, H.F. (2002), "Building Brand Community", Journal of Marketing, Vol. 66 No.January, pp.38-54

[6] Belch, G., and Belch, M.A. (2003), Measuring the Effectiveness of Promotional Programs, Advertising and Promotion – An Integrated Marketing Communication Perspective, Tata McGraw Hill, New Delhi, 6th edition.

[7] Boulding, William, Richard Staelin, Michael Ehret, and Wesley J. Johnston. (2005) "A CRM Roadmap: What We Know, Potential Pitfalls, and Where to Go." Journal of Marketing, 69 (4), 155–166.

[8] Buzzell, R.D, (2004), The PIMS Program of Strategy Research: A Retrospective Appraisal, Journal of Business Research, 57 (May), 478-83.

[9] Berglof, E. & Bolton. (2002) The Great Divine and Beyond: Financial Architecture in Transition. Transition Newsletter vol.13, no 6. 8-12

[10] Bokros,L., Fleming A .& Votava ,c.(2001) Financial Transition in Europe and central Asia challenges of a new decade, the International Bank for Reconstruction and Development a World free of poverty series Report no.23251. Vol .1, Washington D.C the World Bank

[11] Bossone B (2000) what makes banks special? A study of Banking, Finance and Economic Development the World Bank financial sector Strategy and Policy Department, policy Working Research Paper, pp. 3-9

[12] Brassington, F. & Pettitt S. (2000) Principles of Marketing 2nd Edition, Harlow Pearson Education Limited

[13] Cavuisgil S. T. Zou, S., & Naidou G.M. (1993) Product and Promotion Adaption in Export Ventures: An Empirical Investigation., Journal of International Business Studies,Vol.24, no 3

[14] Claessens S & Jasen M (2000) Internalization of Financial Services. Forthcoming Kluwer Academic press WTO & World Bank

[15] Czinkota M.R & Ronkainen, I.A (2004). International Marketing, 7th Edition, Ohio: Harcourt. Inc

[16] Duncan Thomas, Moriarty Sandra (1998), "A Communication-based Marketing Model for Managing Relationships", Journal of Marketing, 56(2): 1-13.

[17] Daniels, J.D. & Radebaugh, L.H.(2001), International Business: Environments and Operations 9th Edition New Jersey: Prentice Hall Inc

[18] Dawes, J. & Brown, and R.B (2000) Postmodern Marketing: Research Issues for Retail Financial Services. Qualitative Market Research An International Journal Volume 3, number 2, 90-98

[19] De Mooij, M. (1994) Advertising Worldwide 2nd Edition, Trowbridge: Prentice hall Exportradet. Http://swedishtrade.se(2004-03-30)

[20] Fill Chris (1995), Marketing Communications, Wiltshire, Second Edition. Prentice Hall

[21] Fleming, A., Chu, L. & Bakker, m-r (1997) Banking Crises in the Baltics Policy Research Working Paper No. 1647, Washington: World Bank

[22] Flohr-Nielsen,J.(2002) Internet Technology and Customer Linking in Nordic BankingInternational Journal of Service Industry Management, vol. 13 no 5. 475-495

[23] Flohr-Nilsen, J.host, V., Jaesson J. E., Kock, S.& Selnes F.(2003) Market Orientation in Nordic Banks: Does Nationality matter?., European Journal of Marketing vol 37 no. 11/12 1818-1841

[24] Ghauri. P, N & Holstius, K. (1996) the Role of Matching in the Foreign Market Entry Process in the Baltic States, European Journal of Marketing

[25] Gummesson E.2000. Qualitative Methods in Management Research 2nd Edition Thousand oaks': Sage Publications, Inc.

[26] Gale, B.T. and B.S. Branch (1982), Concentration Versus Market Share: Which Determines Performance and Why Does it Matter? The Antitrust Bulletin, 27 (Spring), 83-103.

[27] Graham,R.C., and Frankenberger, K.D. (2000), "The Contribution of Changes in Advertising Expenditures to Earnings and Market values", Journal of Business Research, 50, 149 155.

[28] Gronroos, Christian. (1990) Service Management and Marketing: Managing the Moments of Truth in Service Competition Free Press/ Lexington Books, Lexington, MA. 27

[29] Hall, M. and L. Weiss (1967), Firm Size and Profitability, Review of Economics and Statistics, 49 (August), 319-330.

[30] Harris, L. (1997). "A Study of Organizational Culture Factors Associated with Market Orientation", Unpublished Ph.D Thesis, Cardif Business School, University of Wale

[31] Haynes, Andy; Lackman, Conway; ve Guskey, Andrey. (1999). Comprehensive Brand Presentation: Ensuring Consistent Brand Image", The Journal Of Product And Brand Management, Vol. 8, No.4: 286300

[32] Holme, I.M & Solvang, B.K (1997), Forsknigsmetodik-Om Kvalitativa Och Kvantititiva Metoder. Lund: Student literature.

[33] Joseph, B., Joseph, M & McClure, C.(1999), Service Quality in the Banking sector: the Impact of technology on Service Delivery c. International Journal of Bank Marketing, vol. 17no. 4,182-193

[34] Julian C.C. & Ramaseshan, B (1994), The Role of Customer-contact Personnel in the Marketing of Retail Banks Services. International Journal and Retail &Distribution Management, vol 22 no 5, 29-34

[35] Jooyoung, Kim ve Morris, John D. (2003). "The Effect Of Advertising On The Market Value Of Firms: Empirical Evidence From The SuperBowl Ads", Journal Of Targeting, Measurement And Analysis ForMarketing, Vol. 12, No. 1: 5364

[36] Jacobson, R. and D.A. Aaker (1985), Is Market Share All that it's Cracked up to be? Journal of Marketing, vol. 49 (Fall), 11-22.

[37] Kazmi, S.H.,and S.K. Batra. (2008), Introduction to Advertising and a Brief History, Advertising and Sales Promotion, Excel Books, New Delhi, 3rd edition

[38] Keller, K.L. (2000), "The brand report card", Harvard Business Review, No.January-February, pp.147-57.

[39] Keller, K.L. (2003a), "Brand synthesis: The Multidimensionality of Brand Knowledge", Journal of Consumer Research, Vol. 29 No.4.

[40] Keller, K.L. (2003b), Strategic Brand Management: Building, Measuring, and Managing Brand Equity, 2nd Ed., Pearson Education, Harlow, pp.351.

[41] Kitchen, Philip J., Schultz, D.E. (1997), "IMC: What it is and why companies are working that way?" New Ways for Optimizing Integrated Communications, ESOMAR, The Netherlands pp.1-24

[42] Knapp, D.E. (2000), The Brand Mindset, McGraw-Hill, New York, NY, pp. 33, 36, 103, Kotler, P.(1999), Managing Integrated Marketing Communications, Marketing Management, Prentice Hall of India, New Delhi, 10th edition.

[43] Kiptugen E.J (2003), Strategic Responses to a Changing Competitive Environment. A Case Study of KCB, Unpublished MBA project, University of Nairobi.

[44] Kamakura, Wagner A. ve Russell, G. J. (1991). "Measuring Consumer Perceptions Of Brand Quality With Scanner Data:Implications For Brand Equity", Marketing Science Institute Report,No. 91: 122

[45] Kitchen, Philip J. ve Schultz, Don E. (2003). "Integrated Corporate And Product Brand Communication (1)", Advances In Competitiveness Research, Vol. 11, No. 1: 6680

[46] Kotler, Philip. (2003). Marketing Management New Jersey: Prentica Hall, International Eleventh Edition Lassar, Walfried; Mittal, Banwari; ve Sharma, Arun. (1995). "Measuring Customer Based Brand Equity", Journal Of Consumer Marketing, Vol. 12, No. 4: 1119

[47] Linton, Ion ve Morley, Kevin. (1995). Integrated Marketing Communication, Oxford: ButterworthHeinemann Nunnally, J. (1967). Pschometric Theory, McGrawHill

[48] Lee, J. (2002), A Key to Marketing Financial Services: the Right Mix of Products Services, Channels and Customers. Journal of Services Marketing vol. 16 no 3, 238-258

[49] Lindstrom J. (2003), Konkurrenssitation Paden Svenska Bankmarknaden Bachelors Thesis Lulea Lulea Tekniska Unversitet

[50] Lundahl, U. & Skarvad P-H (1992), Utredningsmotodik for Sahallsvetare och Ekonomer 2nd Edition Lund: Student Literature.

[51] Leventhal Richard C. (2005), "The Importance of Marketing", Strategic Direction, 21(6): 3-4Mancke, R.B. (1974), Causes of Inter-firm Profitability Differences: A New Interpretation of the Evidence, The Quarterly Journal of Economics, 88 (May), 181- 193.

[52] Linton, Ion ve Morley, Kevin. (1995). Integrated Marketing Communication, Oxford: Butterworth Heinemann Nunnally, J. (1967). Pschometric Theory, McGrawHill Morgan Robert E. (1996), "Conceptual Foundations of Marketing and Marketing Theory",

[53] Marquadt R (1994), Banketableringar I Frammande Lander, Doctoral Thesis, Uppsala Uppsala University

[54] McLaughlin C.P. & Fitzsimmons, J.A. (1996), Strategies for Globalizing Service Operation .International Journal of Service Industry Management, vol. 7 no 4, 43-57

[55] Meidan, A (1996), Marketing Financial Services: Hampshire and London: Macmillan Press Ltd

[56] Miles M.B & Huber man, M.A (1994), Qualitative Data Analysis 2nd Edition London Sage Publication

[57] Mols N.P (2000), The Internet and Services Marketing - The Cease of Danks Retail Banking.

[58] Internet Research: Electronic Networking Application and Policy, vol. 10 no 1, 7-1

[59] Mortimer, K. (2001), Services Advertising: The Agency Viewpoint Journal of Services Marketing vol. 15no 2 131-146

[60] Mugenda, O.M., & Mugenda A.G. (2003), Research Methods: Quantitative and Qualitative Approaches, African Centre Of Technology Studies, Nairobi

[61] Nicoulaud, B (1989), Problems and Strategies in the International Marketing of Services European Journal of marketing vol 23 no 6 55-66 Nordea, http://ww.nordea.com,

[62] http://ww.nordea.ee, http://ww.nordea.se,(2004-04-20)

[63] Odabaşı, Yavuz ve Oyman, Mine. (2003). Pazarlama İletişimi Yönetimi, İstanbul: Media Cat Kitapları, 2.Baskı

[64] O'Donnell, S. & Jeong, L (2000), Marketing Standardization within Global Industries International Marketing Review, vol. 17, no 1, 9-33

[65] Papavassiliou, N. & Stathakopoulus, V. (1997), Standardization vs. Adaption of International Advertising Strategies: Towards a Framework. European Journal of Marketing, vol. 32 no 7, 504-527

[66] Peatti S. & peatti, K. (1994), Promoting Financial Services with Glittering Prizes

[67] International Journal of Bank marketing Vol. 12 no. 6, 19-29

[68] Pickton David, Broderick Amanda (2001), Integrated Marketing Communications, Essex, Pearson Educated Limited

[69] Pickton, David ve Hartley, Ben (1998). "Measuring Integration: An Assesment of The Quality Of Integrated Marketing

[70] Pitta, Dennis A. ve Katsanis, Lea Prevel. (1995). "Understanding Brand Equity for Successful Brand Extension", Journal of Consumer Marketing, Vol. 12, No. 4: 5164

[71] Proctor, Tony, ve Kitchen, Philip J. (2002). "Communication in Postmodern Integrated Marketing", Corporate Communications Vol. 7, No. 3: 144154

[72] Quintana, M (2003), The Different Dimensions of Europeanization in the Banking Sector: Implications for EWCs Warwick papers in industrial relations no 72, Industrial

[73] Relations Research Unit, University of Warwick, C Reid et al, (2005), Approaches to small firm marketing: A critique."European Journal of Marketing, Vol .32, no .1/2, pp no 40-60.30

[74] Reid, Mike (2002). "Building Strong Brands through the Management of Integrated Marketing Communications, International Journal of Wine Marketing, Vol. 14, No. 3: 3753

[75] Sanchez E. and Peinado Y (2003), Strategic Marketing. (8th Ed.). McGraw-Hill.

[76] Saunders, M., Lewis, P., & Thornhill, A. (2009). Research Methods for Business Students, 5th Ed. New Jersey: Prentice Hall.

[77] Sekaran, U. (2003). Research Methods for Business: A Skill Building Approach, 4th Ed. New York: John Wiley & Son

[78] Schreuer, Richard. (2000). "To Build Brand Equity Marketing Alone Is Not Enough", Strategy&Leadership, 1620

[79] Verhallen et al (1997), Is the Marketing Concept Always Necessary? The Effectiveness of Customer, Competitors and Societal Strategies in Business Environment Types', European Journal of Marketing, 42 (1/2), pp. 222–37.

[80] Yates, D.S., Moore, D.S., & Starnes, D.S. (2008), The Practice of Statistics, 3rd Ed. Freeman

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The Effects of Deployment Practices on Employee Performance among the Public Banking Institutions in Kenya

A Survey of Post Bank Coast Region

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Abstract- The achievement of high levels of performance from the human resources in an organization has been a very emotive issue both in the public and private sector organizations. However there was a near unanimity that all the human resources disciplines ranging from employee relations, to deployment and which have an effect on organizational performance attribute. The human resources discipline that has generated a lot of problem is the human resources deployment which has been proved to have serious effects on productivity, innovation and motivation as well as quality, effectiveness and efficiency in the banking sector and other sector. This study seeks to establish the effects of deployment programs on employee performance. It has taken into consideration such performance factors as employee productivity, employee motivation and employee innovation and take in depth analysis of whether they are affected by human resources programs of deployment. The study was conducted at post bank coast Region. The study adopted explanatory approach design to research. The population of the study was seventy (72) employees of Post bank Coast Region. The study took a sample of forty nine (49) employees as its unit of analysis; a stratified random sampling method was used in selecting the sample of study. The data was obtained from secondary and primary sources. The data instrument that was used in collecting data include the structured questionnaires, and the participant observation methods processes, a company has the pedigree to increase employee's performance in more positive ways than negative ways.

The purpose of the study determined the effects of deployment practices on employee performance among the public banking institutions in Kenya (Post Bank). Descriptive and inferential statistical test were carried out and the following were the findings:

On the employee's performance, inter location deployment, redesigning deployment and inter departmental deployment was established that the general employee performance of the studied population was fairly good; In this case, the employee performance is above average but there is need for improvement. This study specifically concludes that through carefully addressing of the deployment practices and processes, a company has the pedigree to increase employee's performance in more positive ways than negative ways. The study further concludes that of all the deployment practices, re-designation has proved to have negative effects on employee performance and therefore should be accomplished in a very careful way

Index Terms- Deployment, Inter-location Deployment, Inter-departmental Deployment, Performance Appraisal, Selection, Training, Job Definition

I. INTRODUCTION

Deployment practices are aimed at supporting employee's engagement, employee motivation and increased productivity and leadership development across all level of employees across all levels of employees within the organization. Deployment is defined as the movement of staff from ones' current assignment to another to meet operational needs. We have different types of Deployment, mainly: Inter-location Deployment, Inter-departmental Deployment and Re-designation Deployment.

According to Mullins (2004) argues that performance as an indicator of an organization success is affected by many factors which include the human resources management program in an organization. He mentions such programs as including the training and development, reward system, performance evaluation programs and employee assistance programs and the employee deployment programs. He however notes the employee deployment programs and practices as the factor highly affecting the performance of employees in any organization. He notes that deployment practices affect the level of productivity, motivation, innovation quality, relations, and participation and communication patterns among other core human resources activities.

(Glinow, 2008) suggest that to achieve high performance standards and sustaining high performance levels happens to the dominant topic in almost all organization both private, public, or profit and non- profit organizations. He notes that high performance levels with positive indicators makes the organization more stable with conceding high profitability, quality, and productivity, motivation and innovation standards and efficiency levels. On the other hand he declares that low performance portends negative and dysfunctional consequences for the firm. He contends that where there are cases of low performance indicators, there are corresponding circumstances

associated with high employee turnover, poor customer relations, low productivity, innovation and quality among the employees.

Tubman, (2005), describes deployment as that organization practice or activity of moving their human resources to new work stations either within new departments, new stations and providing them with enhanced responsibilities and duties (re-designation). He gives the types of deployments as interdepartmental deployments; inter location deployments, and re-designation deployments. He explains that whatever the type deployment has major effects on employee performance in an organization. Its great impacts on employee innovation, creativity, developments, attitude, quality, productivity, communication, relationships patterns, satisfaction, loyalty and commitments, he adds. He notes that when handled well and in accordance with the employees' circumstances, deployment increase employee performance through increased innovation, creativity, quality, productivity, profitability, loyalty flexibility, efficiency, effectiveness, and low levels of discontents, dysfunctional conflicts.

Nonetheless he notes that when poorly handled deployment has the potential to negatively affect employee performance. He explains that this state of affairs make the employees less effective, innovative, productive, flexible, loyal and to develop negative behavioral attributes and tendencies such as high wastes and redundancies, negative viewing of the organization, more conflicts and complaints and low quality.

In the views of (Mondy, 2009) the discipline of employee deployment and its twin subject of deployment. Here lishes that although these disciples have been as old as the function of human resources management itself, they have been haphazardly considered and relegated to the lower levels among other human resources functions training and development, employee relation, and recruitment and selection, despite their great significance in the improvements of performance in all organization. Their relegation has however brought more dysfunctional circumstances leading to business declines, more customer withdrawals and poor employee relations. This study therefore seeks to establish the effects of deployment employee performance among the public institutions in Kenya.

Lucy (2007) admits that employee performances is very important to organizations operations and constitute the core variable in determining the survival and competitiveness. Employee performance equally plays an import function in determining the rewards offered in an organization. He admits that performance attributed to such actions associated with productivity, innovation, flexibility, level of production, commitment, absenteeism rate and the possible overall organizations image. He explains that performance may be categorized into levels as high levels of performance, moderate level of performance and low levels of performance. He describes low performance as the most undesirable state of affairs in any organization. He advocates for high performance levels associated with high productivity, innovation, quality, efficiency, commitments and relishes that this is a kin to high better prospects for an organization

Background of Post Bank

The Kenya post office saving bank was established in 1910, similar saving services were offered across the east Africa region. When the East Africa community broke up in 1977, the Kenya government established its own saving bank. Post bank is primarily engaged in mobilization of savings for the national department and operates under the Kenya post office savings bank Act cap 493B. In addition, the bank offers local and international credit cards under the sponsorship of a commercial bank, local and international money transfer services, collection and disbursement services.

The recent past has seen the company engaging in adoption of a number of deployment practices thus they are effective strategies on how to overcome effects to employees performance leading to sharpened efficiency and heightened competitiveness through implementation.

Statement of the Problem

A number of organizations in Kenya employ the use of deployment practices. Banks and their operation have been characterized with fluctuating performance levels, and many have collapsed. There have been continuous report cases of high customer withdrawals, high labor turnover rate, low quality services and low profitability index of various banks in Kenya. Furthermore, the bank has not been able to compete efficiently and effectively and has been overtaken by even newly established banks and deposit taking microfinance firms. The lack of competitiveness, poor performance, collapse of major investments and expansion programs have made the bank more vulnerable and could cause the collapse of the whole operations of the bank (the bank's performance assessment, report January 2012)

According to (Kamau, 2012) the problems facing post bank currently remains ever and capable of keeping it off business. He adds that the problems could be attributed to number of factors, including the human resources management programs in respect of employee deployment, employee rewards systems and employee training and development programs, the business culture being practiced and lack of focus on its strategic decisions. However, he claims, the net weight of the problems lies with the human resources deployment practices and program which has severely come heavy criticism. In respect of the above background this study seeks to determine the effects of deployment employee performance in the bank. Finally with proper use of inter location deployment, inter departmental deployment and re designation in post bank , there will be effective strategies on how to overcome effects affecting employees performance in an organization leading to sharpened efficiency and heightened competitiveness through implementation.

1.3 Objectives of the Study

To investigate the effects of deployment practices on employee performance among the public banking institutions in Kenya (Post Bank)

II. LITERATURE REVIEW

Conceptual framework

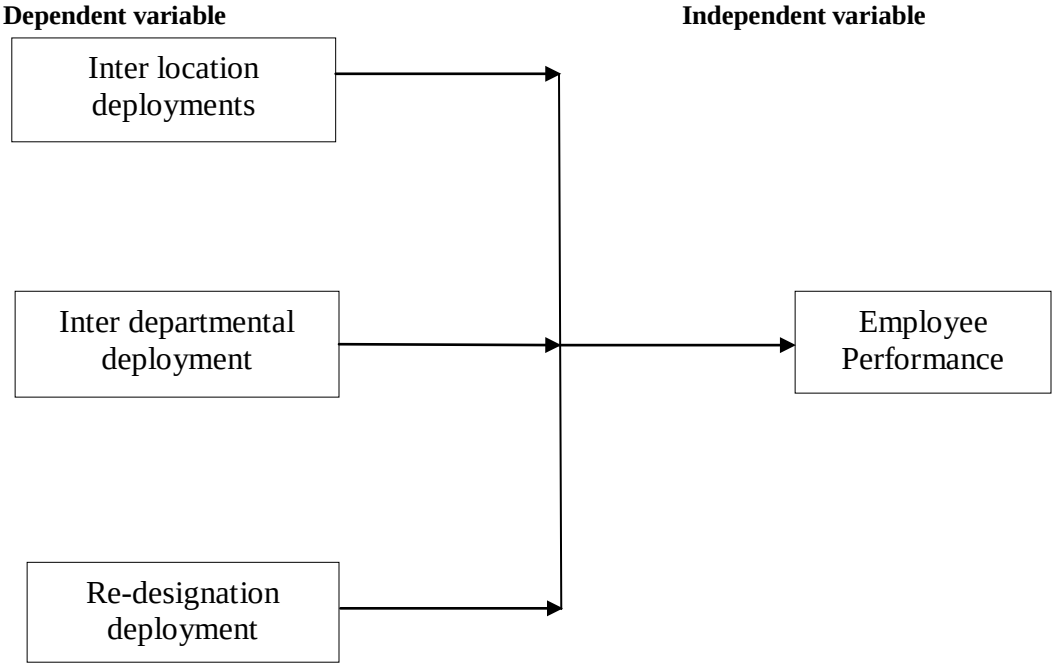

Fig 2.3 Relationship between variables

III. REVIEW OF VARIABLES

Inter-Location deployment

According to (Goss, 2009) accepts that inter-location deployments makes employees more performance oriented through the increment of their competences.

He notes that change of environments may mean new and invested initiatives, personal development programs and other important performance indicators. He agrees that interlocation deployment practices cause dysfunctional behavioral patterns in employees if not conducted according to the employee's desires. He concurs that interlocation deployment practices have more benefits to the employee performance programs and actually works to increase employee performance through increased innovation, creativity, initiative and flexibility. He admits that the movement to a new location creates an extra demand on the employee to exhibit the signs of high motivation, morale design and redesign and positive viewing of the organization so as to be successful. Graham et al 2008, inter location deployment practice is concerned with the movement of employees from the main branches of organization to the relocation. It is particularly suitable for those organization having branches in different location within the same country or outside the country and particularly relevant for large organizations, they explain. They further explains that inter location deployments works best when an organization has organized specialized areas and branches spread over boundaries. They examine the merits of moving employees to new geographical areas as their work stations. While applauding the practice as difficult and very demanding they note that it gives the employees the chances to explore, learn and adapt to the environments. It also makes it mandatory for employees to develop innovative and creative ways of survival, development and growth through constant design and redesign, they claim.

Tichy (2004) agree that interlocation deployment has an effect on employee performance He agrees that it has both negative and positive effects and goes head to provide both the positive and negative consequences. They said moving to a new location from the original location of the employee increases a sense of new perspectives, circumstances and environment that he notes needs the employee to be more motivated, creative innovative, loyal and be committed to the ideals of the new location requirements. He asserts that the movement may present the employee with the opportunity for more personal developments, creative ways of thinking, innovative work efforts and high levels of motivation. They reason that these practices will in the long turn lead to more tangible benefits associated with high productivity, quality, profitability, efficiency, effectiveness and sound cost control systems. It has further effects on the employee mobility and highly works to increase the mobile characteristic in the employees. They add that the movement to a new location may have serious consequences on the employee.

He states that this requires personal adjustments, design and redesign, and high levels of employee effort which may interfere with the employees thus negatively affecting employee performance leading to reductions in effort, innovation and creativity (Koontz, 2009) supports the views of expressed by Tichy that interlocation employee deployment portends both positive and negative consequences for an organization. He decrees that trend of deployment in organization that has no regard for employee input. He agrees that when carefully handled interlocation deployment system works to improve employee

performance and has positive repercussions for productivity, innovation, quality and creativity. He emphasized more on the performance attributes of creativity, and innovation saying that the employee must poses the two attributes so as to fit in the new location. He is of the view that high levels of employee flexibility can be achieved through interlocation deployment practices and goes ahead to advocate for the same efforts for all organization irrespective of their sizes and nature.

Interdepartmental deployment

In the views of (Robbins, 2003) concurs that interdepartmental deployment offers the employees the chances to become productive, innovative, and exhibit high chances of commitment, loyalty and satisfaction in order to achieve. He further notes that employees tends to develop positive attitude in an attempt to learn new cultures and work formats. He admits that interdepartmental deployments offer the employee the chances to learn more of the organization, its programs, activities and operations thus increasing the flexibility, developmental ability, learning prospect thus becoming more productive, effective, and efficient and customers friendly. He however notes that interdepartmental deployment is sometimes more disruptive to the employee and may reduce the performance. He explains that employee become frustrated, stressed and fatigued at learning new things, perspectives. Additionally adopting a new culture may take some time, need psychological social and physical adjustments and on more occasion leads to more strains on employees thus reducing the overall performance of the employees. (Hullington, 2009) moving an employee from one department to another has more effects on the performance. They assert that new departments offer new challenges to the employee in terms of learning new ways of work, social behaviors and psychological orientations and cultural orientations. He describes interdepartmental deployments as the kind of redeployment taking place in an organization where an employee is taken from one department to another, for instance from human resources to administration or marketing to production. He notes that the challenges offered to the employee by the new environment work format, social arrangements and other work demands makes the employee eager, curious and develop interest in the knowing them.

He explains that in trying to understands the new requirements the employee must be more motivated innovative, creative and have all sense of personal initiative to learn and be proactive efficient and effective in order assimilate the developments. He concludes that the new mindset of high innovation, creativity, initiative, motivation and positive motivation increases employee performance. Otieno (2010) examines the contributions and benefits associated with interdepartmental deployment to the employees in particular an organization in general. He reasons that an interdepartmental deployment practice has more positive benefits to the employee and organization than the negative consequences associated with it. He asserts that through interdepartmental deployments employees tend to have knowledge of the entire organization, the departments and the units within in addition to the other employees, the work procedures and the technology used in the entire organization. He contends that employee become more productive, innovative, creative, and flexible and develops high sense of initiative, loyalty and commitments, factors he agrees are the indicators of good performance. He further criticizes the interdepartmental deployment systems saying that it does not portend well of long term employee focus and has the potential to increase the strikes or other dysfunctional employee behaviors Dressler(2005) contends interdepartmental deployment has both positive and negative effects on employee performance. However he quickly adds that interdepartmental deployment portends to have more positive effects to an organization in general and employees in particular. It creates a sense of innovative, creative initiative and learning behavior in an employee. It also calls for more commitments, loyalty, positive viewing and collaborations as well as cooperation on the part of the employee. He explain that by exhibiting these behavioral and performance characteristics the employee will be include to be more productive , profitable, customer focus and possess the general ability to learn train and develop more. The new development arising from new requirements will also force the employee to undertake personal redesign, changes in social arrangements, psychological orientations and physical circumstances, in the process becoming highly mobile and flexile in the work and in relating with the peers and other stakeholders.

He regrets that sometimes the new demand is placed on the employee by the new arrangements will work to weaken the employees social life developed overtime and lead to more emotional, psychological and physical instability in the employees thereby reducing their effort and initiative as well as the production levels. (Tubman, 2007) declares that deployment along the departmental basis force the employees to design new work format, social behaviors, and psychological make ups. He stresses that, interdepartmental deployment forces employees to show high senses of innovation, creativity, quality, commitment, initiative, flexibility and loyalty so as to fit and in the process exhibiting high levels of performance. He however relishes that sometimes if no conducted properly and appropriately, interdepartmental deployments would be counter productive and result in negative performance attributes. It may cause intra personal conflicts, more grievances, complaints and satisfaction problems. This may work to increase their impel us to leave the organization resulting in more sabotage, turnover absenteeism among other poor performances indicators.

Re-designation deployment

According to (Holbeche,2009) new duties equally require new cultural mindset, work ethics and may also demand fundamental shift in social arrangements and psychological makeup and physical setting creating an alert state in an individual employee. He suggest that aligning to the new requirements in there designed status and jobs may require high levels of innovation, creativity, initiative, change mindset, flexibility, motivation and morale and conformance behaviors from the employee. The learning process to understand and assume the new roles, task structures, responsibilities will force the employee store design the operations to suit the new work arrangements. He stresses that deployment through re-designation has more positive benefits to an employee through more creativity, innovation, motivation, mobility, morale and high levels of flexibility and personal and development efforts

there by increasing their productive quality efficiency, and effectiveness status as organizational resources.

She, however, admits that re-designation sometimes affects negatively the employee's rate and position of performance arguing that more but uncontrolled work structure creates emotional instability, role conflict, role ambiguity and emotional stress which portend negatively toward the performance of the employee. There has been acrimonious debate among the human resources experts on the role of re-designation on employee performance inparticular and organizational performance generally, with the results being more divided opinion on the issue than has generally been believed to be. Majority of the human resources experts however believe that this kind or type of deployment increases employee performance and has similar results for the overall business performance. It results in more positive effort, energy and positive contributions towards the business goals, strategies and objectives while at the same time re energizing their motivation and morale efforts towards the organization. On the negative side re-designation provides the employee with more duties, assignments, responsibilities, and tasks which may wear down the employee's contributions toward the organization. More work duties, responsibilities may create a condition stress, frustration, and fatigue (Mcshane,2008).

Mullins(2004) agrees that re-designation has more benefits to the employee than to the organization and reasons that it offers the employee the changes to wade off conditions of boredom, stress and frustration of narrowness in the duties, and responsibilities. He notes that deployment through the addition of more duties, roles and responsibilities, with enhanced status work to motivate the employee, make them more empowered. He contends that new duties need new skills, knowledge, abilities, experiences attitude, capabilities and capacities which must be learnt by the employees.

(Schuler, 2003) reasons that re-designation mare result in enhanced status for the employee with more recognition, achievements, growth, and development prospects. Thus, Re-designation deployment increases employee performance through increased flexibility, initiative, dependability, innovation, creativity, effectiveness, quality productivity, growth, commitment, loyalty and efficacy. When handled carelessly, re-designation deployment decreases employee performance through decreased effort, motivation, innovation, morale, identification and increased wastages, absenteeism, turnover, negative reactions.

Empirical Framework

Although the three approaches to understanding HR in deployment under the Michigan and Harvard models have gained considerable attention from researchers, they have produced conflicting results. Referred to as the hard and soft HRM, they form the basis for the empirical framework in this study.

Women's career opportunities are influenced by the deployment approach practiced by an organization. The chances that are open for career progress are improved with deployment. The three main deployment influences of careers offered to prospective employees are categorized under interlocation, interdepartmental and redesignation deployment. These factors were also found to influence the nature of HRM approach engaged by an organization. Gooderham, Nordhaug and Ringdal (1999) tested the impact of micro level variables on HR practices and discovered that while institutional determinants like size of the organization have a strong influence on the use of both the collaborative and calculative HRM approaches, managerial sovereignty with less pressure from institutional laws was linked more with the hard/calculative approach than the soft/collaborative approach. They came to a conclusion that the stronger of the management autonomy in organizations the more they will take on the control/calculative approach towards HRM in deployment practices. Similarly, strong institutional laws tend to favour the commitment based approaches as management has less control to initiate organizational changes to fit the organizational strategy. These findings generally support the HR deployment practices described in the prescriptive literature in this study. Morris, Wilkinson and Munday (2000) in contrasting Japanese personnel designs and the hard and soft HRM models, found that the Japanese personnel system is different from the calculative-collaborative HRM model. While the Japanese design is linked to production, the calculative and collaborative HR models are linked to corporate strategy, both of which depict elements of tight control, specific training and unitarist values. The degree to which organizations depict calculative and collaborative orientations to HR in relation to overall HR performance was studied by Kane and Crawford (1999). They drew their conclusions asserting that deployment HR must align with the criteria of both developmental and strategic options and be integrated with the overall corporate strategy and objectives. Their findings on the conflict or incompatibility between the two theoretical perspectives differ from other findings. They found little evidence of conflict between these three deployment practices. While determining the obstacles to implementing an effective HR system, their results of a factor analysis revealed management attitudes, incompetence of HR staff and the current state of HR. The researchers concluded that effective HR system becomes attainable through both calculative and collaborative approaches provided they are both related to organizational strategy and objectives (the calculative orientation) and employee motivation and development (the collaborative orientation) Taking on one of our independent variables, compensation and relating it with the findings of Heery (1997). It was discovered that performance-based compensation is applied both where interdepartmental, interlocation and redesignation deployment to HR are practiced. A distilling factor however that has implications for industrial relations practice was revealed in that where performance-based compensation formed part of collaborative HR, trade unions were more likely to gain a representative role than under a deployment approach. Majority of previous research has verified significant relationship between deployment practices and Employee Outcomes (Sels, 2006). Collins (2005) in a research of similar nature targeting small business have found that effective HR practices impact employee outcomes significantly (employee outcomes used by them were different than ours). A research was conducted by Qureshi (2006) regarding Impact of deployment practices on corporate performance in Pakistan . His findings were supportive of our assumption that HR practice system effect Corporate performance through employee outcome

IV. RESEARCH METHODOLOGY

Research design

This research is descriptive research design. It suits this study because, as a scientific method which it involves observing and describing the behavior of a subject without influencing it in any way. It enabled the research to generalize the findings of a fairly large population. The research attempts to describe such things as possible behavior, attitudes, values and characteristics (Mugenda & Mugenda, 2003). It also serves as a foundation to more research design and quantitative research experimentations. Ghauri & Gronhaug (2005) reiterated that population, not only includes people, but also firms, product and other parameters.

Target Population

According to Cooper & Schinder (2003), a population is the total collection of elements about which researcher will wish to make some inferences. Target population refers to the entire group of individuals or objects to which researchers are interested in generalizing the conclusions. The target population usually has varying characteristics; and therefore, at times referred to as the theoretical population (Cooper & Schinder, 2003). The population targeted by the study is seventy two (72) employees of post bank. The 72 employees comprise of 13 Managers, 13 technical staff, 4 supervisors, 20 clerical staff and 22 tellers. **(** Post bank journal, Wilson kariuki (2012)

Sampling size, sampling method and techniques

Ghauri & Gronhaug (2005) defined a sample as the segment of population that is selected for investigation. It is a subset of population. Kothari (2004) described a sample size as the number of items to be selected from the universe to constitute a sample. He argued that an optimum sample is one which fulfills the requirement of efficiency, representativeness and flexibility. Gay asserted that in a descriptive research, 10% of the population forms a representative sample, Mburu, (2009). Conducting a study of these organizations requires ample time and finance among other things. The study took a sample of (49) employees from the said population of seventy two (72) as its unit of analysis. This sample size of (49) employees represented a sample ratio of 68.1% of the total population targeted for the study.

Table 3.1 – Sample size

DEPARTMENTS	**NO. OF EMPLOYEES per department**	**SAMPLE STAFF**
Managers	13	5
Technical staff	13	10
Supervisors	4	4
Clerical staff	20	15
Tellers	22	15
TOTAL	72	49

Source: Post bank journal, Wilson kariuki (2012)

Data collection instrument, procedure and analysis

The researcher collected primary data from the source using questionnaires while secondary data was collected from published reference materials such as reports and journals. Data collection method is through the use of questioning. To enhance reliability and validity of the data collection instruments a pilot study was undertaken. The data collected was analyzed with the goal of highlighting useful information, suggested conclusions and for purposes of supporting decisions making with regards to issues of internal auditing.

V. DATA PRESENTATION, ANALYSIS AND INTERPRETATION

Response rate

The researcher issued 72 questionnaires out of which a total of 55 respondents answered the questions to the researchers satisfaction, 17 respondents did not return questionnaires. Therefore, the data analysis is based on 55 instruments, giving a response rate of 76.4%, and 9.72 did not respond as shown in the figure below.

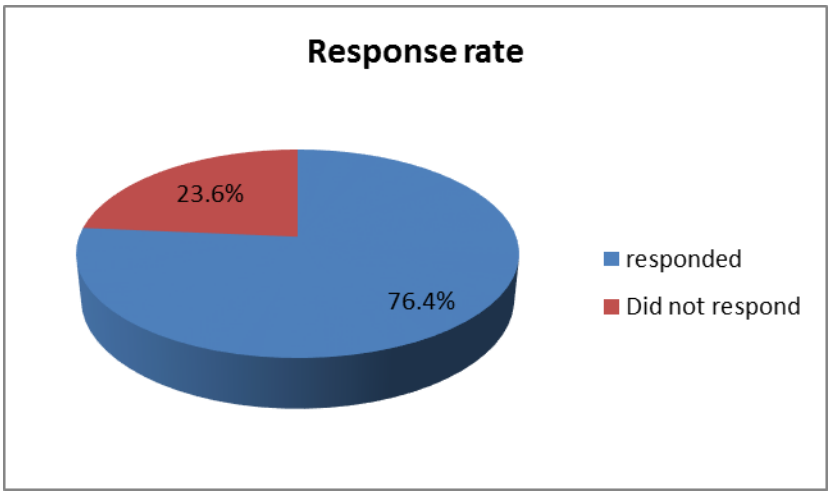

FIG 4.2 Response Rate

Gender

Population under study was composed of 52.7% male and 47.3% female as illustrated in figure 4.1 below. This indicates that the researcher was gender sensitive by ensuring that there is equal gender representation in the population. This enabled the researcher obtain information from both genders, hence more appropriate and reliable information.

Table 4.3: Gender

Gender	Frequency	Percentage
Female	25	45.5%
Males	30	54.5%
Total	**55**	**100%**

Age and work experience

The respondents were asked to give their age. From table 4.4below, majority of the respondents, are between the age of 30 and 35 years, between 42 and 47 years; between 48-55 years and few were age of 24 -29 years as shown below.

Table 4.4.1 Age bracket

Age bracket	Frequency	Percentage
24-29 yrs	9	16.4
30-35 yrs	19	34.5
36-40 yrs	8	14.5
42-47 yrs	10	18.2
48-55 yrs	9	16.4
Total	55	100

Table 4.4.2 Years served in the Firm

Period	frequency	Percentage
Below 10 years	35	63.6%
11-20 years	15	27.3%
20-30 years	5	9.1%
Total	**55**	**100%**

The analyses from the responses received as shown above (Table 4.4) indicated that 63.6% of the respondents had served in the organizations for a period below 10 years while 27.3% had served up to 20 years and 9.1% respondent had served for more than 20 years in the organizations.

EMPLOYEES PERFORMANCE

Post Bank Employee Performance	**A**	**B**	**C**	**N**
Our bank's current performance level is favorably high	2	40	13	55
Our banks performance levels have been on the rise	1	50	4	55
Our bank's has a policy guiding employees performance management practices	2	26	27	55
Our banks performance levels is affected by the nature of deployment patterns	-	36	19	55
I always participate in our banks performance assessment sessions.	2	17	36	55
Productivity, quality and flexibility are the core indices used in the determination of employees performance levels in our bank	3	45	7	55
MEAN	1.7	35.7	17.7	55

Figure 4.5 – employee performance

Respondents were asked to rate the level of their performance in the organization. From the findings, it was asserted that the current performance level had low extent of a mean of 1.7 moderately high, (Mean = 35.7) and high extent level with average mean = 17.7. Thus it can be noted that post bank performance level, policy guiding the employees, employee's performance assessment is moderately influencing the performance of the employees in the organization.

Deployment factors and their effects on employee performance

Deployment is a process of to moving or allocating an individual a different position, use or a function within the organization structure. It may allows staff to be moved from activities which are of lesser priority, or which have been rationalized, reconfigured, or restructured, to areas of greater need. This section of the study provides findings on deployment factors and how they impact on employee performance.

Interdepartmental deployment practice

In the views of (Robbins, 2003) concurs that interdepartmental deployment offers the employees the chances to become productive, innovative, and exhibit high chances of commitment, loyalty and satisfaction in order to achieve. He further notes that employees tends to develop positive attitude in an attempt to learn new cultures and work formats. He admits that interdepartmental deployments offer the employee the chances to learn more of the organization, its programs, activities and operations thus increasing the flexibility, developmental ability, learning prospect thus becoming more productive, effective, and efficient and customers friendly

Table 4.6.1 – Interdepartmental deployment factors

	A	B	C	N
Our bank often practices interdepartmental, deployment for employees	-	51	4	55
Our banks interdepartmental deployment practices allow for employee participation	3	47	5	55
Our banks interdepartmental deployment practice affects employees performance levels	-	49	6	55
Our banks interdepartmental deployment practices increase employees productivity levels	2	44	9	55
Our banks interdepartmental deployment practice is flexible and adaptable to the employees	-	35	20	55
I prefer the interdepartmental deployment practices being undertaken by the bank	1	51	3	55
MEAN	1	46.2	7.83	55

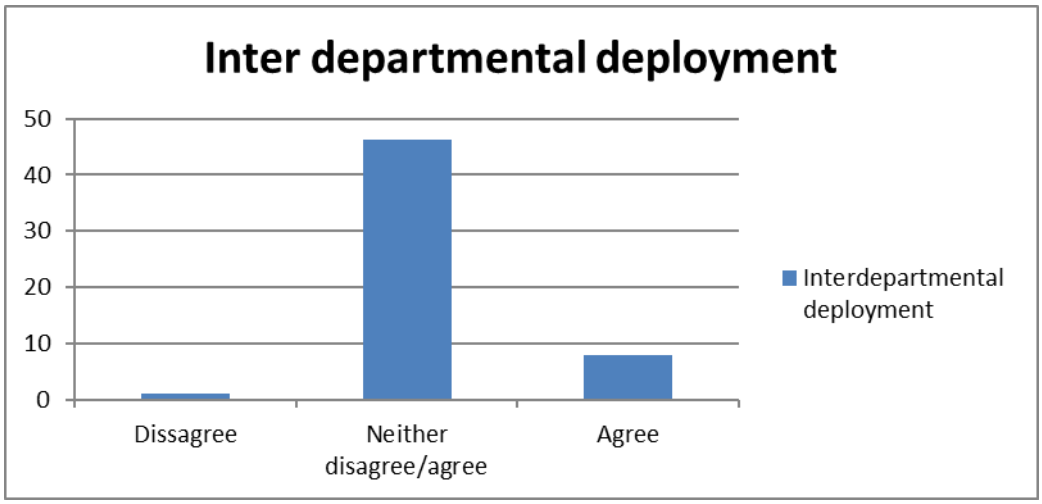

Figure 4.6.1 – Inter departmental deployment

The study sought to establish whether the bank practice interdepartmental deployment. . From the findings, it was asserted that the current performance level had a disagree level of a mean of 1, neither agree/agree level of, (Mean = 46.2) and agree level with average mean = 7.83. Thus it can be noted that post bank performance level, policy guiding the employees, employee's performance assessment is neither disagree/agree level that is influencing inter departmental deployment in the performance of the employees in the organization.

Inter location deployment

According to (Goss, 2009) accepts that inter-location deployments makes employees more performance oriented through the increment of their competences.

He notes that change of environments may mean new and invested initiatives, personal development programs and other important performance indicators. He agrees that inter location deployment practices cause dysfunctional behavioral patterns in employees if not conducted according to the employee's desires. He concurs that inter location deployment practices have more benefits to the employee performance programs and actually works to increase employee performance through increased innovation, creativity, initiative and flexibility.

Table 4.6.2 – inter location deployment factors

Inter location deployment factors	A	B	C	N
Our bank has a more viable inter location deployment policy	1	40	14	55
Our bank's inter location deployment policy guides on employee redeployment practices	3	50	2	55
Our bank's inter location deployment practices affects employees performance	7	33	15	55
The inter location deployment practice in the bank increases employees quality of operations	4	46	5	55
The inter location deployment practice in our bank is conducted periodically	1	45	9	55
Our bank's inter location deployment practice is conducted through consensus with the stakeholders.	-	46	9	55
I always participate in the design of the employee inter location deployment programs at our bank.	4	46	5	55
Our banks Inter location deployment practice is technical cumbersome and expensive.	1	54	-	55
MEAN	2.8	45.7	6.4	55

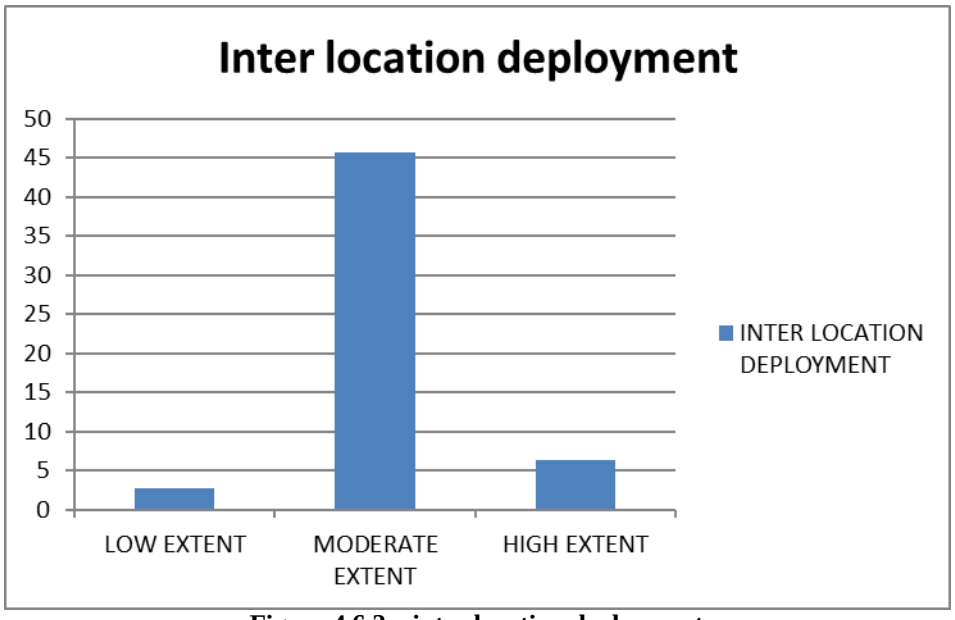

Figure 4.6.2 – inter location deployment

On inter location deployment, it was found that Post bank practice relocation deployment, From the findings, it was asserted that the current performance level had low extent of a mean of 2.8 moderately high, (Mean = 45.7) and high extent level with average mean = 6.4. Thus it can be noted that post bank performance level, policy guiding the employees, employee's performance assessment is moderately influencing the performance of the employees in the organization.

According to (Holbeche,2009) new duties equally require new cultural mindset, work ethics and may also demand fundamental shift in social arrangements and psychological makeup and physical setting creating an alert state in an individual employee. He suggest that aligning to the new requirements in there designed status and jobs may require high levels of innovation, creativity, initiative, change mindset, flexibility, motivation and morale and conformance behaviors from the employee.

Re-designation Deployment

Table 4.6.3 –Re-designation Deployment factors

Re-designation Deployment factors	A	B	C	N
Our bank always conducts re designation deployment for employees	-	46	9	55
Our bank's Re designation deployment Practice allows for employee participation	1	47	7	55
Our bank's Re designation deployment Practice is favorable to the stakeholders	-	37	18	55
Our bank's Re designation deployment Practice affects employees performance levels	-	50	5	55
I always participate in the banks Re designation Redeployment policy formulation	3	28	24	55
Our banks re designation deployment practice is friendly to the employee circumstances	2	50	3	55
Our banks re designation deployment program motivates the employee toward superior performance	-	48	7	55
MEAN	0.9	43.7	10.4	55

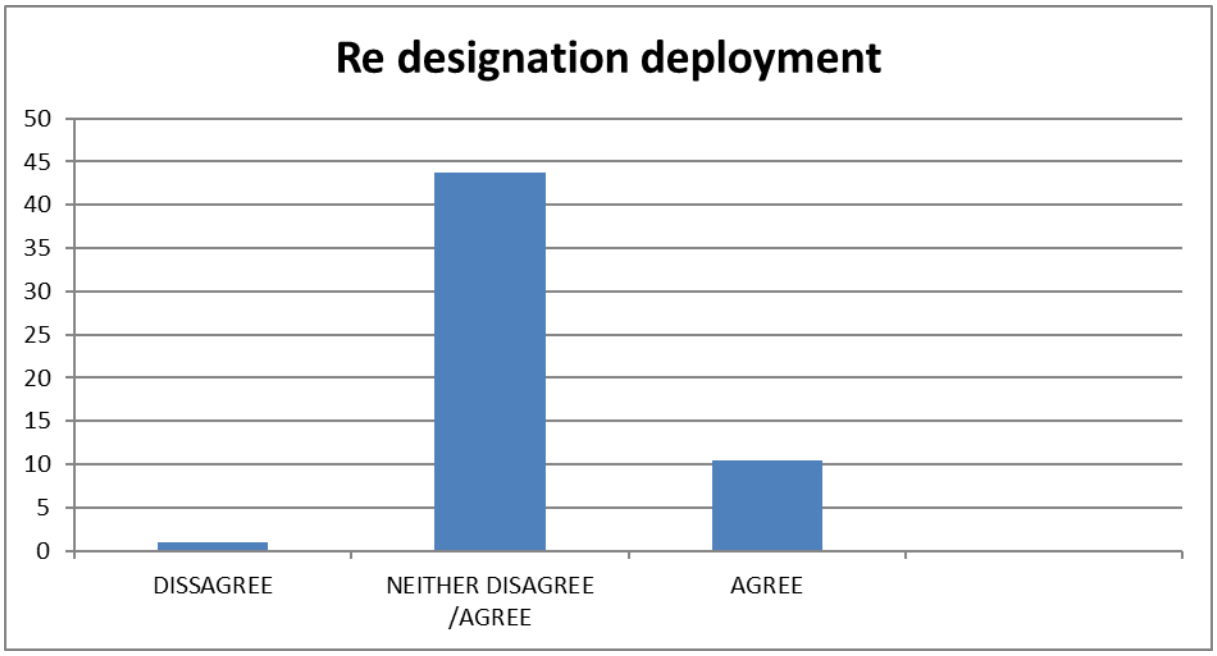

Figure 4.6.3 Redesignation deployment

The study sought to establish whether the bank practice re-designation deployment and its effect on employee performance. It was found that post bank rarely conducts re-designation deployment for its employees, (Mean = 43.7 and that it is not favorable to its stakeholders, (It was also disagreed that employees always participate in the banks re designation deployment policy formulation, (Mean = 0.9)

However, employees were neutral that to the fact that re-designation deployment program motivates the employee toward superior performance, (Mean = 10.4). Generally, re designation deployment factors have effects on the employees' performance

VI. CONCLUSION AND RECOMMENDATIONS

Conclusion

The study sought to establish the effects of each deployment practices on employee performance at Post bank. The objectives of the study were adequate and comprehensively assessed and covered. The findings of the study as provided in the above section this report concludes that deployment practices have significant impacts on employee performance.

Deployment practices should be carefully and objectively pursued according to organizational values and objectives. This study specifically concludes that through carefully addressing of the deployment practices and processes, a company has the pedigree to increase employee's performance in more positive ways than negative ways. All the deployment practices, inter location, interdepartmental and re-designation have effects on employee performance. The study further concludes that of all the deployment practices, re-designation has proved to have negative effects on employee performance and therefore should be accomplished in a very careful way.

Recommendation

- The relevance of deployment practices in organizations cannot be over-emphasized since it constitutes the organizational climate for the internal activities. For a successful deployment exercise in a company, the following are recommendation emanating from this study.
- There must be clear stipulated policies, procedures and guidelines covering deployment practices in organizations. This will always help to provide mechanism for instituting deployment practices as part of organization's practices and culture.
- Always establishing a positive deployment culture, any negative or conflicting communications should be avoided because it may kill employees' morale.
- Employees are a critical part of your deployment plan if you sustain your business while deployed. To ensure your employees are prepared, a special employee deployment manual can become an important part of the overall deployment plan. It is particularly critical to have on hand for each employee while you are deployed. It will reinforce how to perform certain functions and procedures, it will clarify the tasks for which each employee is responsible, and it spell out your policies and procedures

Areas of further research

From the result of this study, the researcher recommends that the same kind of study to be done on sample group of organizations to widen the scope and more probably a comparative study to be pursued on the same. Again, further research should be conducted to establish ways to curb challenges affecting employee's performance in both public and private sector organizations.

REFERENCES

[1] Armstrong, M. (2005). Human Resources Management. New York: Mc Graw Hill.

[2] Bennet, R. & Graham, H. T. (2008), Lucy, (2006), Human Resources Management, New York: Prentice Hall Publisher.

[3] Dessler, G. (2005). Employee Performance Management Principles And Practice. State University, USA: San Diego.

[4] Galliers, E. W. & Pinnk, R. S. (2008). Managing for Information Productivity and Profitability. New York: Mc Graw Hill.

[5] Glinow, M. (2008). Organizational Behavior, Emerging Knowledge and Practice For The Real World. (5th ed). Boston: McGraw Hill.

[6] Goss. S. (2009). Human Resources Management In The Hospitality Industry, An Introductory Guide. Washington DC: Heinemann Education, Publishers.

[7] Heinz, E. D. (2010). Organization Design through Effective Human Resources Management Practices New York: San Francisco publishing co ltd.

[8] Hullington, K. H. (2009). Performance Management Practices. Portsmouth: Prentice Hall.

[9] Kamau. N. (2012). The Problems Facing the Banking Institutions In Kenya, The Human Resources Side, Nairobi: Longman Publishers.

[10] Kenya Association Of Bankers (2009). The Operations Of Individual Banks, Case Of Post Bank Limited, Nairobi: Uzima Publisher.

[11] Kothari, C. R. (2009). Research Methodology. New Delhi: Oxford,

[12] Mathis, P. M. (1972). The Human Side of the Enterprise. New York: Mc Graw Hill.

[13] Mondy, M. W. (2009). Human Resources Management, Organization Improvement Series, (8th ed). New Jersey: McGraw Hill International.

[14] Mullins, L. J. (2004). Management And Organization Behavoiur (7th ed). Harlow: Pearson Education Limited Edinburgh Gate.

[15] Nzuve, W. K. (2006). Human Resources Management, Kenya Perspective, Nairobi: East African Publishers.

[16] Post Bank Kenya (2012). The Bank's Performance Assessment, Report, Nairobi: Government Printers.

[17] Robbins, S. P. (2003). Organization Behavior. New Jersey: Prentice Hall International Education.

[18] Tichy, K. L. (2004). Strategic Human Resources Management (3rd ed). New York: San Francisco Publishing Co Ltd .

[19] Torrington, D., Hall, L. & Taylor, S. (2008). Human Resources Management 7th Edition. New Jersey: Prentice Hall

[20] Tubman, D. (2007). Effective Organization Management Systems. New York: Harcourt College Publishers.

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The Effects of Motivation on Job Performance

A Case Study of KCB Coast Region

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Abstract- The study investigates the effect of Employee Motivation on Organizational Performance of selected 7 KCB branches Mombasa county. KCB is making numerous efforts towards the motivation of its workers but the challenge facing the implementation of these measures continues to persist. The motivated employees under no circumstance will churn out decreased performance. The study therefore concluded that great strides be made to motivate all staff to enhance performance. The researcher recommends that management attaches more importance to issues of employee motivation to make the institution survive amongst its competitors.

Index Terms- Employee motivation, Remuneration, Job satisfaction, Rewards, Recognition

I. INTRODUCTION

Background of Kenya Commercial Bank

Kenya Commercial Bank is a public organization operating in East Africa. Its history dates back to 1896 when its predecessor, the National Bank of India opened an outlet in Mombasa. Eight years later in 1904, the Bank extended its operations to Nairobi, which had become the Headquarters of the expanding railway line to Uganda. Currently, It has six branches in Mombasa namely; Kengeleni, Kilindini, Mtwapa, Mvita, Treasury Square and Town Centre.

KCB Mombasa intends to serve all its customers through coordinated service delivery focusing on customer satisfaction. However, it has been a hustle for KBC to pursue the above goal because it has been registering poor performance from employee.

Statement of the problem

There are two measures of motivation that is, Monetary and Non monetary incentives which can be offered by to employees by the management .Monetary incentive for all the championing of alternative motivators, money still occupies a major place in the mix of motivators. The sharing of a company's profits gives incentive to employees to produce a quality product, perform a quality service, or improve the quality of a process within the company. What benefits the company directly benefits the employee and their performance in an organization. Monetary and other rewards are being given to employees for generating cost-savings or process-improving ideas, to boost productivity and reduce absenteeism. Money is effective when it is directly tied to an employee's ideas or accomplishments. Nevertheless, if not coupled with other, nonmonetary motivators, its motivating effects are short-lived. Further, monetary incentives can prove counterproductive if not made available to all members of the organization. Chad Daw (2009)

Study after study has found that the most effective motivators of workers are nonmonetary. Monetary systems are insufficient motivators, in part because expectations often exceed results and because disparity between salaried individuals may divide rather than unite employees. According to (Torrington hall 2008) proven nonmonetary positive motivators foster team spirit and include recognition, responsibility, and advancement. Managers, who recognize the "small wins" of employees, promote participatory environments, and treat employees with fairness and respect will find their employees to be more highly motivated. One company's managers brainstormed to come up with 30 powerful rewards that cost little or nothing to implement. The most effective rewards, such as letters of recommendation and time off from work, enhanced personal fulfillment and self-respect. Over the longer term, sincere praise and personal gestures are far more effective and more economical than awards of money alone. In the end, a program that combines monetary reward systems and satisfies intrinsic, self-actualizing needs may be the most potent employee motivator.

These motivation factors help the organization to avoid clashes and non cooperation, avoid wastage of resources, reduce industrial accidents and also reduce the rate of labour turnover and absenteeism .motivation brings harmony, unity and cooperative and outlook among employees.

This study is therefore aimed at assessing the effects of motivation on organizational performance-a case of KCB branches in Mombasa.

Objectives of the study.

i. To find out how the financial rewards affects job performance in KCB

ii. To determine how non-financial rewards affects job performance

iii. To establish the extent to which training affect job performance

II. RELATED LITERATURE

Employee performance

Coulter (2006) describes employee performance as the total or aggregate output of an employee activities and actions in an organization. She goes further to declare that the level of employee performance may be characterized as low performance

levels, moderate performance levels and low performance levels. she agrees that the employee performance in an organization is normally measured using such attributes as effectiveness, efficiency, quality, innovation, creativity, commitments, satisfaction, cohesiveness, flexibility, customer relations, communication patterns and employee efforts towards the goals of an organization.(Robbins, 2003) concurs that redeployment has both positive and negative effects on employee performance. He states the kind of developments to be realized from redeployments' practice whether positive or negative view developments depends on, among other factors, the manner in which redeployment is carried out in an organization.

Conceptual framework

Dependant variable **Independent variable**

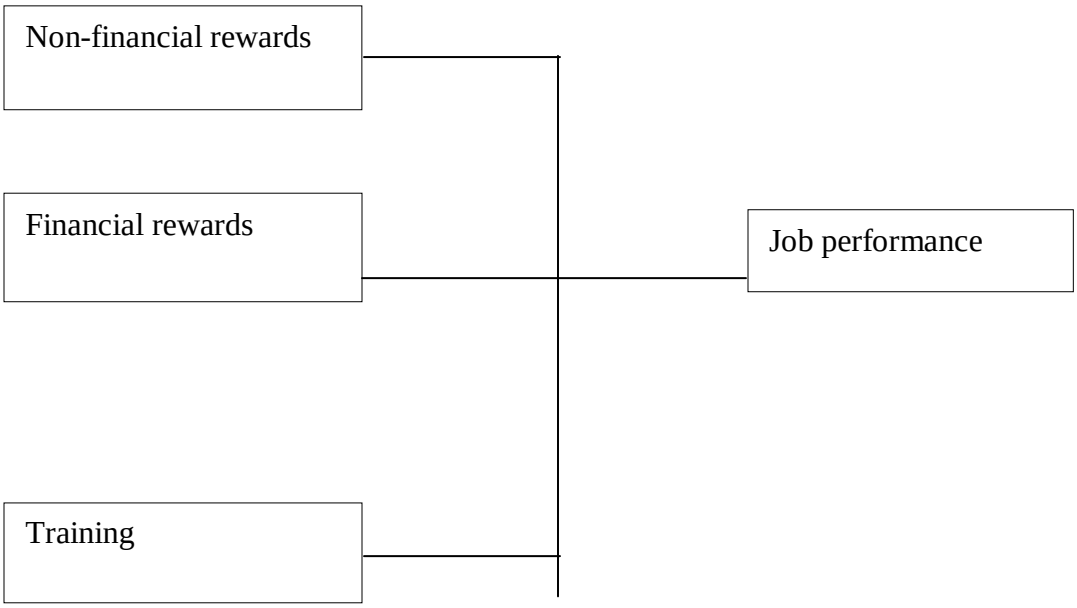


Fig 2.3 Relationship between variables

METHODOLOGY

Research design

This research is descriptive research design. It suits this study because, as a scientific method which it involves observing and describing the behavior of a subject without influencing it in any way. It will enable the research to generalize the findings of a fairly large population. The research attempts to describe such things as possible behavior, attitudes, values and characteristics (Mugenda & Mugenda, 2003). It also serves as a foundation to more research design and quantitative research experimentations. Ghauri & Gronhaug (2005) reiterated that population, not only includes people, but also firms, product and other parameters.

III. DATA PRESENTATION, ANALYSIS AND INTERPRETATION

Descriptive Statistics

The results are presented according to the responses sought from the participant employees at KCB. The responses are in tabulated and graphical forms. The results are structured according to the questions asked in the survey questionnaire. The following descriptive statistical sets of responses are as following.

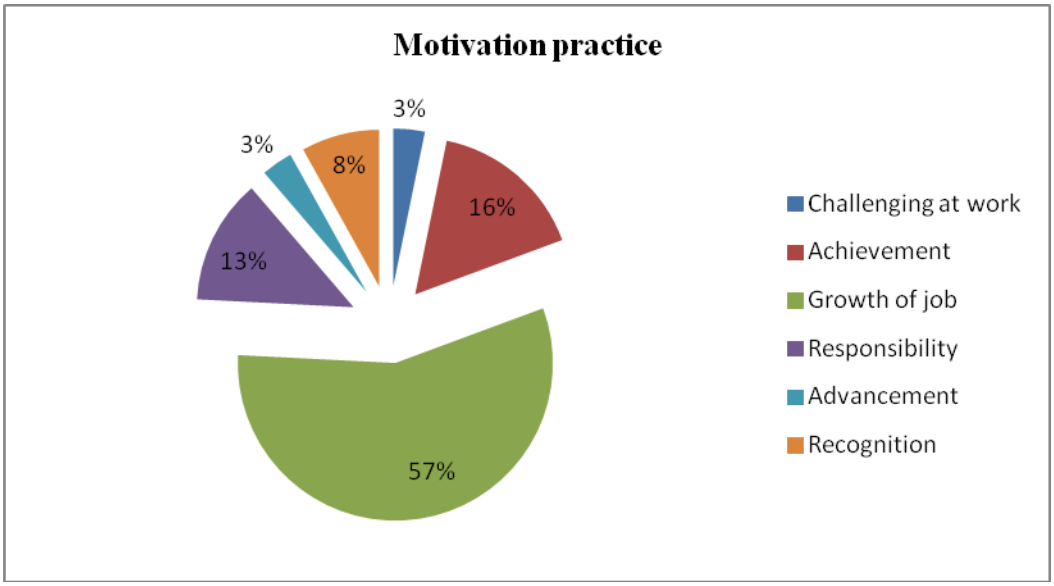
4.3.1. How motivated you feel with your immediate supervisors?

Scale	No. of respondent	%age of respondents

Highly motivated	5	8.3%
Motivated	15	25%
Neutral	38	63.3%
Demotivated	2	3.3%
Highly demotivated	0	0%
Total	**60**	**100%**

A total of 63.3% of the respondents at KCB find the behavior of their supervisors as Neutral, 25% as motivating, 8.3 % as highly motivating, whereas remaining 3.3% think demotivated. This leaves a scope for improvement and even the demotivated employees can be motivated leading to improvement in results.

4.3.2. How satisfied you are with the motivation management in practice at your organization?



In the figure above, motivation management practice shows that 57% of the employees prefer growth of job, 16 % prefers achievement, 13% prefers responsibility, 8% prefers recognition, and advancement and challenging at work prefers equal percentage of 3%.

Which types of incentives motivate you in a more effective way?

Types of incentives	**No. of respondents**	**% of respondents**

Financial	30	50
Non- financial	5	8.3
Combination of both	25	41.7
Total	**60**	**100%**

A proper reward management framework exists in KCB as represented by the responses of the surveyed employees. As generally perceived, reward system is not only entirely dependent on financial rewards, but non-financial rewards. Still monetary rewards are highly rated towards improving motivational level. While 8.3% find non-monetary rewards as motivating, 50 % chose monetary rewards and the highest proportion, of the respondents (41.7%) find a combination of both financial and non-financial rewards based rewards program as most effective.

How effective, according to you is the reward management system at your organization

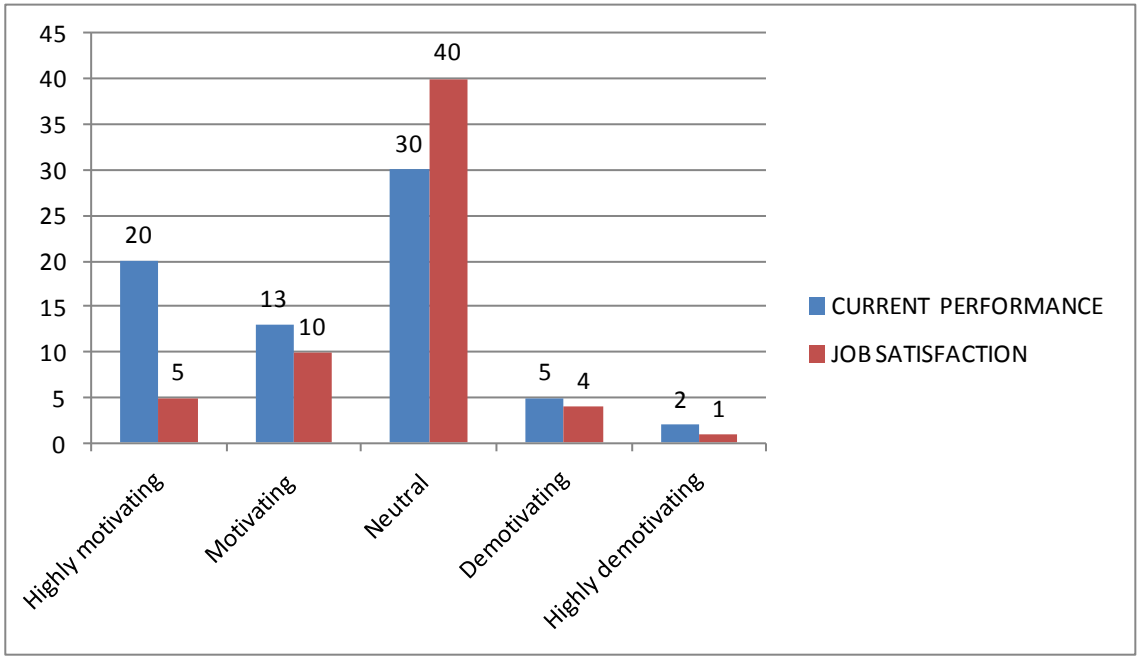
It is found that financial (tangible) incentives like suitable salary, additional fringe benefits and non-financial (intangible) incentives such as non-monetary rewards, recognitions, appreciation and promotions have equally important bearing on the motivation. Contrary to presumed, there may be situations where managers may need to cut down on incentives to initiate punitive action which may actually enhance performance because the employees may strive to get back on track and deliver better results. This may dispense the need for devising newer or improved incentive plan.

How important are the opportunities for promotions within the organization?

Scale	No. of respondents	%age
Very important	33	55%
Important	20	33.3%
Neutral	7	11.7%
Unimportant	0	0%
Not required	0	0%
Total	**60**	**100%**

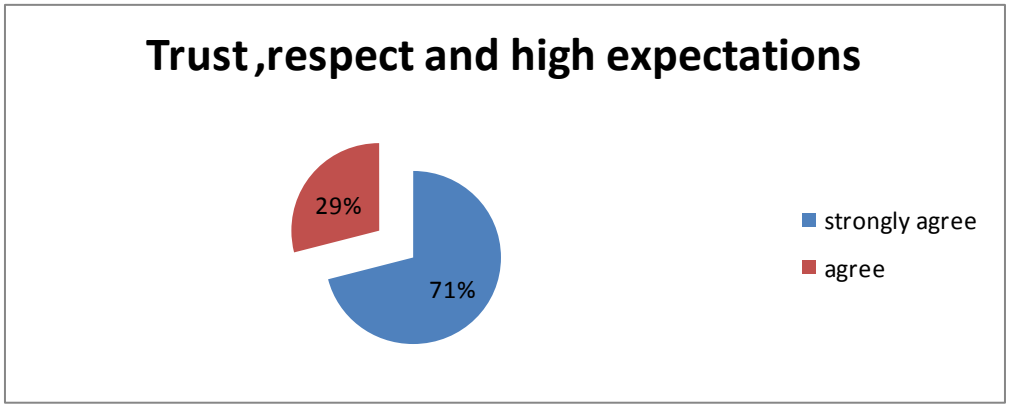
Promotion is the process of formally enhancing employees' performance. As found in the quantitative results, a large percentage of respondents attached importance to promotion as a motivating factor (55% respondents ranked it as the most motivating factor among the ten factors). Fair promotion is the key requirement to motivate the existing performance needs to be acknowledged, evaluated and rewarded in an unbiased manner in order to motivate the employees to the maximum extent. Promotion is given due importance because it is an effective management tool the execution of which is essential to increase the employee confidence and interest in job and improve the overall productivity of the organization.

How motivating is the current performance appraisal and job satisfaction at your organization?

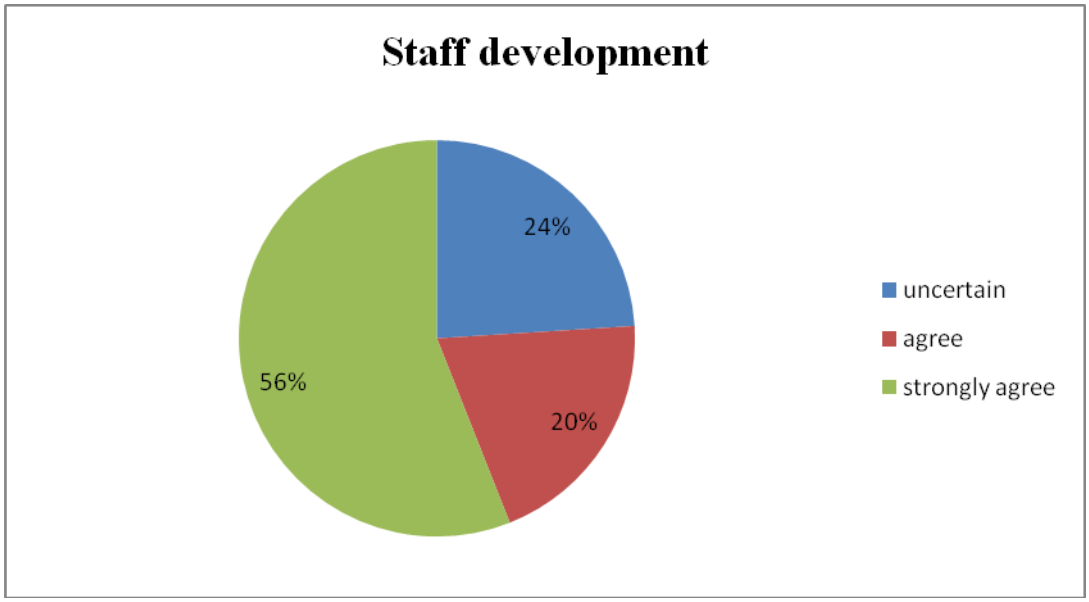


Forms of Motivation

Section C, had respondents being quizzed on what they perceived as forms of motivation. Using a Likert scale they were asked to tick whether they strongly agree, agree, uncertain, strongly disagree and disagree to issues raised.

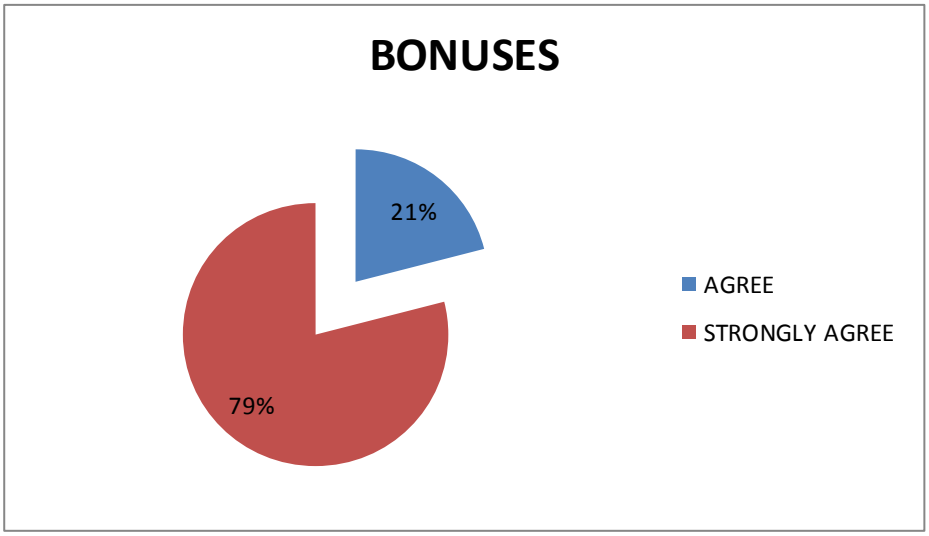


The views of respondents on the issue trust, respect and high expectation as a form of motivation saw 71% of the total respondents strongly agreeing to it, asserting that they desire self respect and self esteem and esteem for others. This is what Maslow put as Ego and Esteem needs. When externally focused these may include the desire for reputation, prestige, status, fame, glory, dominance, recognition, attention, importance, and appreciation. This implies respondents apart from the enticing and fat salaries and the numerous incentives packages at their disposal offered by management is not motivated to increase performance rather having management and colleagues repose some level of trust in them and according them the due respect alone is enough for them to maximize their performance. The remaining 29% threw their weight behind them.

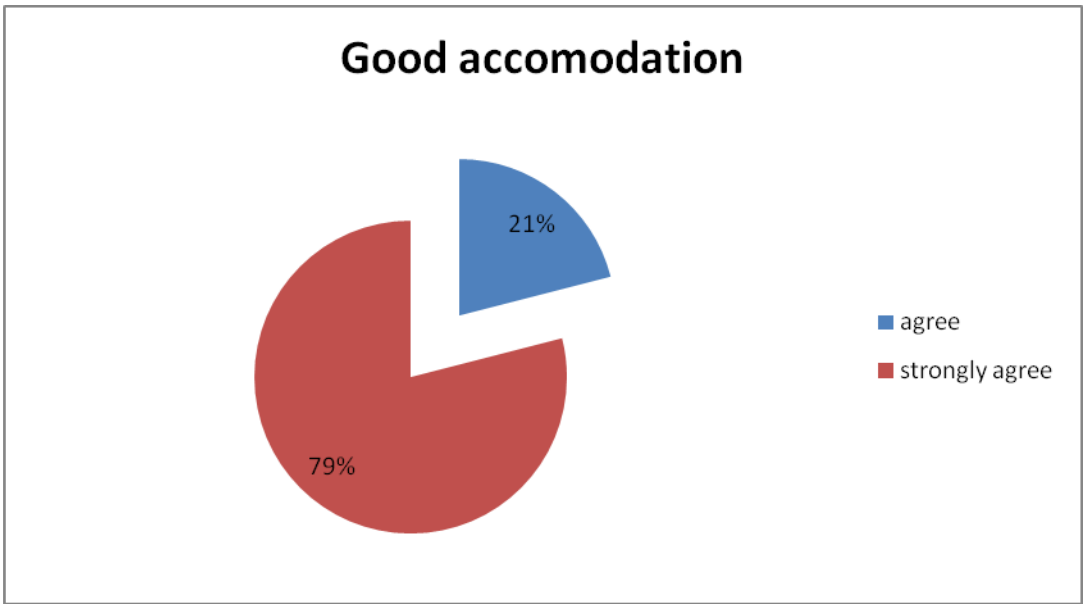


The analysis of data collected revealed that respondents see staff development as the next important form of motivation. A total of 56% of them strongly shared this opinion the reason being that every worker craves for this need thus, being able to self realizes objectives in life and continuous self –development to facilitate the process of becoming that entire person is capable of becoming. This in Maslow's opinion is what he termed self actualization. In support of this argument had 20% of the respondents agreeing to it and the remaining 24% very uncertain of the situation when quizzed. The views shared by the respondents implied that the employees of KCB Bank are not only enthused and enticed by juicy incentives and fat salaries given by management with the objective of coercing them to increase performance but their personal development for the future with respect to furthering their education and achieving their aim in life has now become one of the critical factors for them to perform at their maximum best. The picture painted in figure above gives a graphical description.

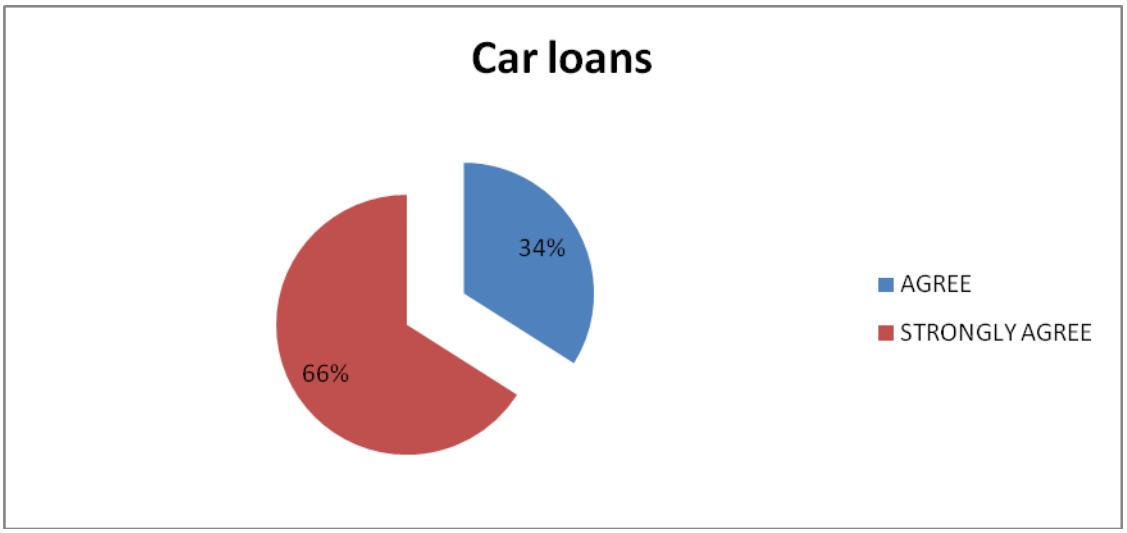
Majority of 79% of total respondents were of the opinion that bonuses motivate them to perform at work. In the survey they understood bonuses to mean extra payment to them over and above their usual salary given as incentive. Their reason was very simple it's due them as they have worked for it. The most of it all is that such monies come at times when things are hard so to speak, giving them a relief. Twenty-one per cent threw their weight behind them by agreeing to it.



As depicted in figure below, it is evident, that respondents believe having a good and decent accommodation motivates them to perform at their optimum best. In response to the question, an overwhelming majority of the respondents who participated in the survey, representing 79% made their intention known by strongly agreeing to the scenario. The reason was that having a place to house you gives the peace of mind to perform, than to wake up every morning very disorganized and thinking of where to sleep the next day. The remaining 21% were in support of that. It was not surprising when Maslow in his hierarchy of needs said, shelter and security is a vital motivator to human behavior. This implies notwithstanding how hard the situation may be, management should be able provide the workers with decent shelter to put them in the right frame of mind enhance their performance at work



Majority of 66% of the total respondents surveyed, were of the view that provision of car loans to employees of the bank will serve as a motivator to boost their performance. They cited the following reasons that most of them stay far away from town, and getting transport to work becomes very hectic. Others looking at it from another angle believed facilitating the means to work will give a sort of prestige and fame (esteem needs).The remaining 34% only added their voice to it by agreeing. This implies that management, if cannot give car loans or create that facility for the employees can provide transportation in any other form for the workers. Figure below has the graphical picture.



IV. INDIVIDUAL NEEDS

Section D of the questionnaire touched on individual needs of respondents. They were given five items comprising employee needs as established by Maslow's hierarchy of needs and asked to rank them in order of importance

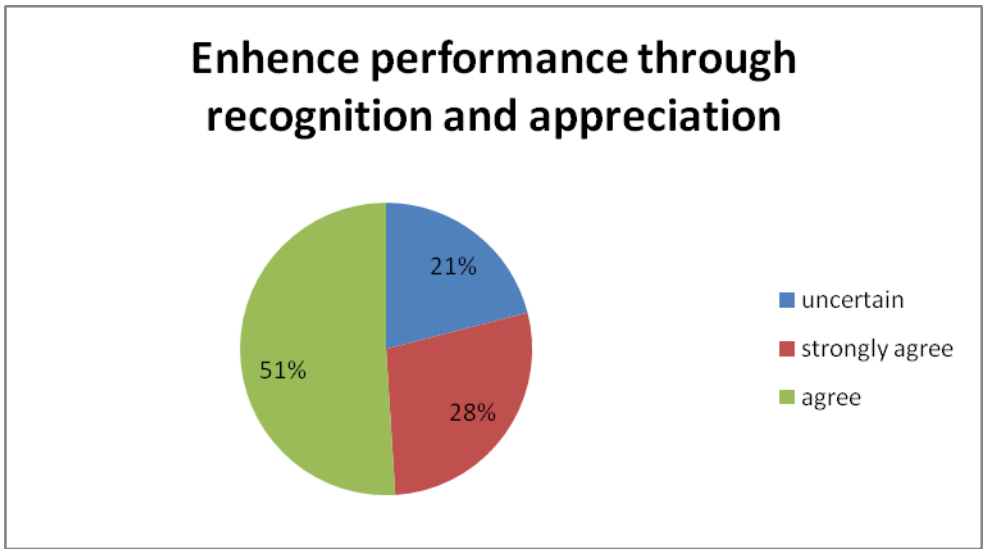
Table 4.5 Ranking of Individual Needs

ITEM	FREQUENCY	%
Self actualization	30	50
Self esteems	10	16.7
Safety	15	25
Social	2	3.3
Basic	3	45
Total	60	100

Most respondents when pushed to the wall on the issue of how they will rank their personal needs in the light of Maslow's hierarchy of needs, shared a different opinion and agreed more with Alderfer‟s ERG theory which sought to refute the claim that human needs are satisfied from lower rank needs to higher order of needs rather human needs cannot assume a rigid hierarchy. The argument was that the needs of KCB Bank workers cannot be automatically fixed as the survey revealed that there were gaps between the staffs needs and at a point in time some were overlapping. Individual workers at the bank also took exception to the fact that they do not graduate or progress along a particular line rather unconsciously may be obsessed by a higher need, that a lower need may go unnoticed. Finally, a tension or behavior may not be ignited by a single need but several of them. This implies that management should not perceive that all employees notwithstanding the fact that, they belong to the same organization and work towards the same goal, will have the same needs at the same time, rather understand employees from their individual perspectives and deal with them accordingly. Table Above is a practical confirmation, as most respondents placed self actualization needs first (5), self esteem needs second (4), safety needs third (2), social needs fourth (3) and physiological needs fifth (1)

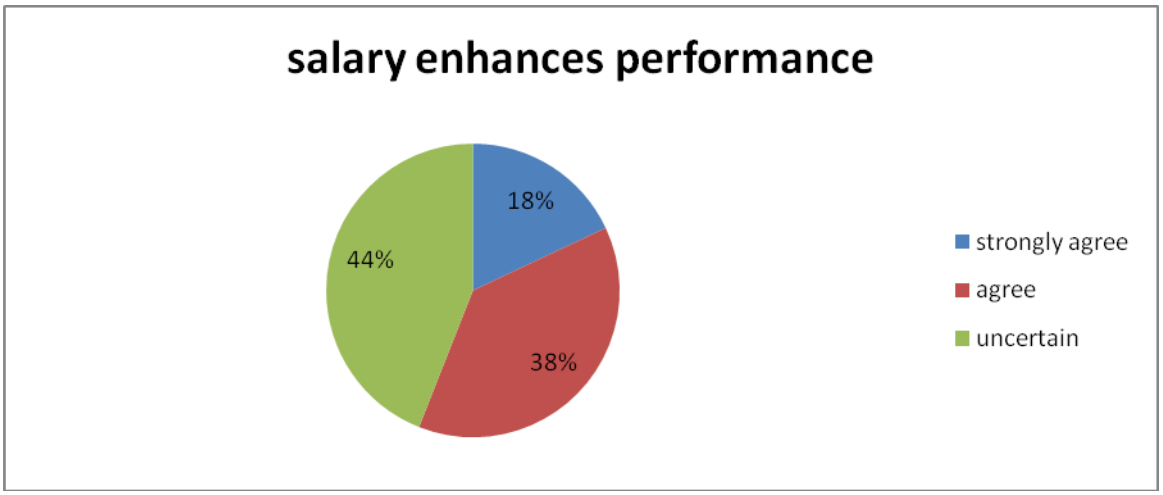
Respondents' Perception on Motivational Factors that Increase Performance

In section C Respondents were asked as to what their perceptions were about each of the seven scenarios in relation to the motivational factors that enhance employee performance. The object of this particular section found out if indeed workers when taken care of by management especially through motivation will perform at their optimum best, to answer the question is there a relationship between motivation and employee performance?

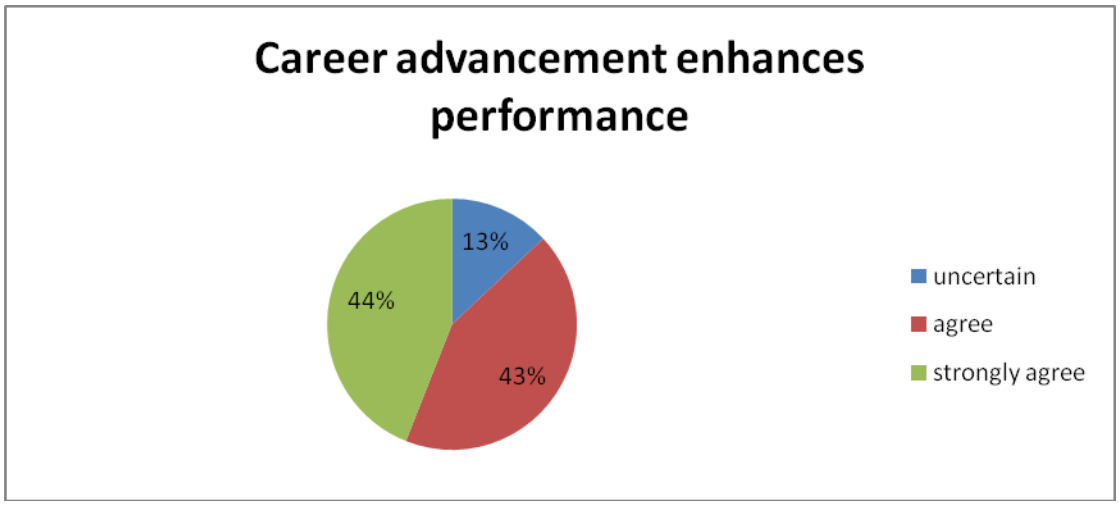


Respondents when quizzed on whether recognition and appreciation for a good work by management enhances performance, majority thus 51% agreed that after putting in much effort into their work, they expect that at least management if anything at all should say something or give a pat on the shoulder to show their satisfaction, as these little things go a long way to spur them on to do more. The perception was shared by 28% who in solidarity strongly agreed to it. On the other hand a minority of 21% were highly uncertain of the assertion made by their colleagues. Showing appreciation and recognition for good work done breeds healthy competition among employees and indirectly raises‟ the bar of excellence. It is natural in an organizational setting for co workers see a colleague being applauded for the good job done; they will also work hard to get the same reward. It should not be seen as a negative challenge rather a positive one that will enhance performance. Literature reviewed attested to this finding. Worman (2008),in his article motivating employees without raising their pay confirmed that, employees are not motivated by money alone but when they accomplish something they believe indeed they have accomplished something and recognition from management is appreciation for that achievement. He further added that management hardly gives recognition because they do not get enough. In a typical fashion participants revealed that they were uncertain as to whether salaries given them motivates them to perform, surprisingly 42% of the total respondents shared this perception. Close to this category were 38% of the total respondents who felt other wise and agreed that their salary commensurate with their performance. A minority of 18% strongly agreed to this scenario. It is the universal perception that every employee works for money in return but they also work because they have personal goals to achieve. There had been numerous studies sharing a contradictory opinion to this particular finding. Maslow (1943) claimed that employees work to survive and live through financial compensation, to make new friends, to have job security, for a sense of achievement and to feel important in society, to have a sense of identity, and most especially to have job satisfaction. Taylor (1911) siding with Maslow reiterated that the most important motivator of workers is salaries and wages when he claimed that non monetary rewards breeds low productivity. He continued by saying that if employees receive the same wage irrespective of their individual contribution to the goal, they will work less and that employees think working at a higher rate means fewer employees may be needed which discourages employees to work more.

This result has proven that the staff of KCB does not see fat salaries as motivating them to maximize their performance but rather agreed with Worman (2008) it is a costly mistake to get lost in the false theory that more money equals happy employees. He further asserted that cash will always be a major factor in motivating people and a solid compensation plan is critical to attracting and keeping employees. But the key additional cash is not always the only answer and in many cases not even the best answer.

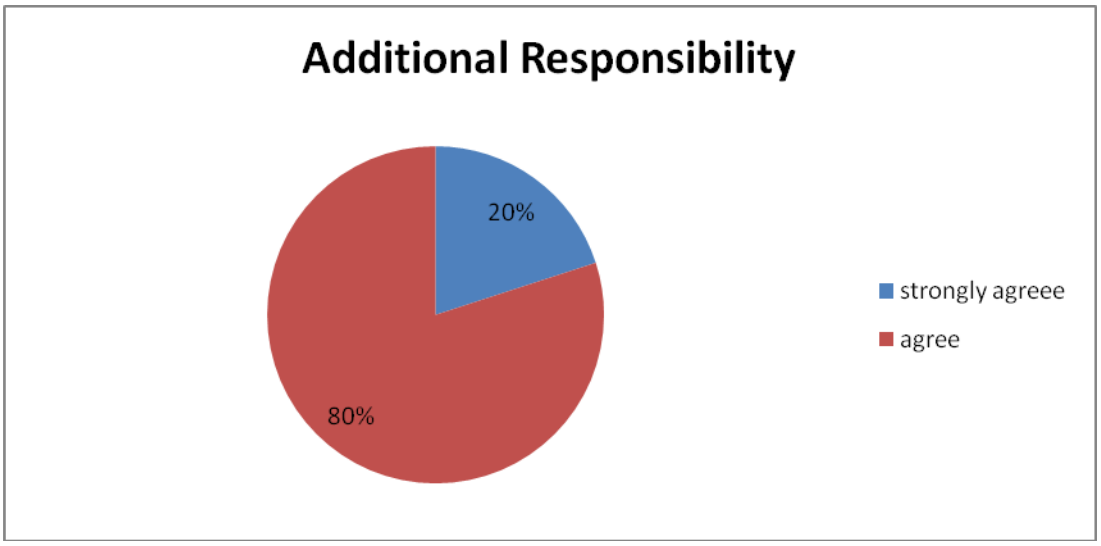


In this particular scenario it was too close to call, as 44% of total respondents" surveyed, believed that an opportunity for them to advance in their career and educational quest highly motivates them to perform in their field of endeavor, in solidarity 43% confirmed the perception by agreeing to the scenario, whilst 13% were not so sure it could. The statistics provided is displayed on fig 4.3, shows that respondents are happy about this policy of management giving them the opportunity to move up the career ladder, and hoped that management will honor their promise when the time is due. Employees as key as they are to bank needs to know what is potentially ahead of them, the opportunities there are for growth and development. This finding career development enhances performance in literature was emphasized by Worman(2008) human resources are key to the success of the organization and need to potentially know what is ahead of them, the avenues for career advancement and growth. He was of the opinion that the issue is sometimes a forgotten ingredient as to the importance it plays in the overall motivation of employees. Maslow(1970) termed this as esteem and selfactualisation and buttressed by Alderfer(1972) when he sought to replace it with growth thus the intrinsic personal desire for development. The researcher will like to urge management to set career paths within their organization thus promote from within. Specific circumstances may require that management look for talent outside, it is always appropriate to first consider internal personnel, for such actions sends positive signals to everyone that there are indeed further career opportunities within.



Additional Responsibility

Data collected during the field survey interpreted and analyzed discovered shockingly a majority 67 respondents representing 80% of the total population were of the opinion that given additional responsibility to handle aside their usual commitments and job description will boost their morale to give off their best which will inevitably lead to increased performance. The reason for such an opinion was that it informs management how committed and dedicated they are to their job and has the potential to take responsibility for their actions all in the interest of ensuring the growth of the business. The 20% left only joined the chorus by strongly agreeing to it. Figure below captured the trend for simple understanding.



The results obtained from the analysis shows that the staff of KCB believes in being responsible and circumspect in their field of endeavor to help the company achieve the feat or height it wants to attain. Support from literature reviewed emphasizes that in every organization there are responsible and exceptional employees who are begging and craving for and can competently handle additional responsibility (Worman, 2008). This shows a very impressive and positive attitude. The job of management in such circumstances is to wittingly identify who they are and if possible match responsibilities to their strengths and desires.

Relevance of motivation to employee performance

Section E of the questionnaire sought the general view of respondents on the importance of motivating employees.

Table 4.5: Respondents Perception on Importance of Motivation

NUMBER	Item
1.	High efficiency
2.	Reduce absenteeism
3.	Reduce employee turnover
4.	Improve corporate image
5.	Good relations
6.	Moral improvement
7.	Reduce wastage and breakages

V. SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

Summary of the findings

The study, effect of motivation on employee performance was undertaken by the researcher, with sole aim of establishing a relationship between motivation and employee performance at the workplace. The study was conducted with the workers of KCB constituting the population and a sample size of 70 drawn from it. The mixed methodology approach thus both quantitative and quantitative designs were employed in conducting the study. The two were considered because the merits of one compensate for the weaknesses of the other. Both types are valid and useful but not mutually exclusive. The bottom line is both methods ensured a greater understanding of a population. The data collection technique was the case study method alongside the questionnaire

Instruments were used in collecting data. Most of the literature reviewed by the study on motivation theory and practice concentrated on various theories regarding human nature in general and motivation in particular, failing to give anything concrete on the practical aspects of it in the workplace Respondents who participated in the survey were asked varied questions in relation to employee motivation; forms of motivation, individual needs of employees, employees perception about motivational factors that enhances performance and the relevance of employee motivation to an organization. Data collected and analyzed indicated that, employees when motivated very well are able give their optimum best. The results of the study and its interpretation revealed that; The participants in the survey had as many (25%) between the age range of 31-40, (58.3%) between the age range of bellow 30 and (16.7%) above 50 years this implied that to work at the bank one need to be relatively younger and no wonder they could sit behind staring at it for close more than 8 hours. Most of the respondents about (16.7%)had worked with the bank for a period of 1-5years,50% had worked between 5- 10 years, and 33.3 had worked between

10-15 years, which implied the research achieved its aim, as workers within that range were in the best position to articulate their views better concerning the issue of motivation at the bank. Trust, respect and high expectation was seen by most of the workers thus (71%) as a form of motivation indicating that as employees they desire self respect from management and colleagues and self esteem and esteem for others whiles (29%) supported it. Staff development was next on the scale as a total of (56%) opined that as employees craves for this need, thus being able to self realize objectives in life and continuous self development. facilitates the process becoming the entire they hope to become. The remaining (20%) and(24%) agreed and were very uncertain respectively. Employees disclosed that bonuses motivated them to increase their performance, declaring that the bonuses come at a time when things are hard so to speak, giving them a relief. Good accommodation was seen by (79%)of the respondents as very vital for optimum performance indicating that having a place to lay the head and house one's family gives the peace of mind to perform than to wake up every morning disorganized and not knowing where to sleep next. Employees view on ranking of individual need disclosed that human need are not rigid, refuting Maslow's hierarchy of needs and agreed with Alderfer‟s ERG theory indicating that there were gaps between the staffs needs and at a point in time some were overlapping. Individual workers at the bank also took exception to the fact that they do not graduate or progress along a particular line rather unconsciously may be obsessed by a higher need, that a lower need may go unnoticed. Employees performed the optimum level when they are recognized and appreciated for a good job done by management charging that a pat on the shoulder means more than money to them as they feel accepted. Fat salaries according to the employees does not motivate them to increase performance in that, they were not receiving as expected but were quick to add, money will always be a major motivator but once again cannot equal happiness. Career advancement enhances performance as (44%) of the total respondents believed that an opportunity to advance in their work and educational quest motivates them to maximize performance in their field of endeavour.Promotion and growth as motivational factor enhances performance as (69%)of the employees shared this opinion emphasizing that money is not the ultimate but promotion id reward for improved effort, indicating a direct relationship between reward and effort. Job security as a motivational factor enhances, with (69%) strongly agreeing to the assertion implying that stability, dependency, protection, freedom from fear and anxiety at the work place creates the platform to give off the optimum best. Interpersonal relationship also improves performance indicating that, as human beings are gregarious in nature, and as such have the need to belong. This implied at the work place to be able to interact with co workers, sharing problems with management create the rapport to be able collaborate with colleagues. Attending outside seminars or workshops was very key to employees as majority of them indicated it affords the platform to interact with colleagues from other banks, pick new ideas and initiatives from them and in turn share it with co workers for the common growth of the bank. Arguably the revelation of the study, it was overwhelmingly seen silent contributing factor to increased performance in the sense that (80%) of the total population rooted for it contending aside their commitments and job description begs and craves for that they can competently handle any additional responsibility handed them by management All these findings put together and reporting the view of employees of KCB shows that indeed there is a relationship between motivation and performance at the workplace as all the variables studied pointed to the fact the way employees feel about themselves, their work and treated by management goes a long waya to determine their output

Conclusion

Worman (2008), writing on 20 ways to motivate your employees without raising their pay asserted that "it is costly mistake to get lost in the false theory that money equals happy employees". Believe it or leave it cash will always be a major factor in motivating people and solid compensation plan is critical to attracting and keeping employees. But the issue is that additional cash is not always the answer to the problem, and in many cases not even the best option therefore the study concludes that; Most of the staff of KCB has served the bank for a substantial number of years giving them rich experience and the ability to deliberate on motivational issues concerning their work. The level of trust, respect and high expectation from management and colleagues is not encouraging. Staff development policies and strategies of the bank require review to suit individual worker needs. Bonuses as motivational factor for employees was in the right direction except it did not commensurate with work done and needs an upward adjustment. Good and decent accommodation for staff was encouraging as, staff believed it was the best management could under the circumstance. Car loan policies and progammes is the best as in a space of every two years there is a review and upward adjustment to cater for the current economic trend. The individual of the staff of Guaranty Trust Bank has undergone tremendous changes since the institution was established as their lot has improved in that sector. The seemingly loss of one of the most cherished and envied hallmarks of employees recognition and appreciation appeared to have affected employee performance as it was low and in some cases nonexistent. Salaries paid staff of KCB was highly inadequate considering the current economic conditions, having a negative impact on their total performance. Career advancement and promotion at KCB was very positive and encouraging as over the years consistent and hardworking employees have risen through the ranks to their current positions. Job security issues well catered for by management as the enabling environment has been created and employees who exhibit gross misconduct are fired based on that. Interpersonal relationship among management and staff was very excellent. Use of outside seminars as rewarding increased performance was nonexistent Additional responsibility to reward high performance is the nurturing stage and had not been that prominent.

Recommendations

The researcher recommended that;

1) Employers are continually challenged to develop pay policies and procedures that will enable them to attract, motivate, retain and satisfy their employees. The findings of this study can be handy tool which could be used to provide solutions to individual conflict that has

resulted from poor reward system. It is very pertinent at this juncture to suggest that more research should be conducted on the relationship and influence of rewards on workers performance using many private and public organizations. It is important for further studies to be carried out in order to do justice to all the factors that influence workers performance. With the limitations identified above, the ability to generalize the result of this study is restricted.

2) The employees should undergo training on how to come up with the changing needs of the economy since it is a challenge that is universal due to the fluctuation of exchange rates and rate of inflation and also go for training to advance their careers before they demand for salary increments.
3) The management should have clear chain of communication with the employees this will make it easy for them to know the various needs of the employees and make it easy for them to cater for their employees needs. It would also help foster an environment of trust.
4) The management should introduce new methods of motivating employees this will make the organization to increase its profit and reputation due to the increased morale of the employees
5) The management should try and ensure that employee recognition is timely and focused on individual achievements by making recognition a priority utilizing the formal and informal methods

REFERENCES

[1] Ahmad, M. Wasay, E. & Malik, S. (2012). Impact of Employee Motivation on Customer Satisfaction: Study of Airline Industry in Pakistan: Interdisciplinary Journal of Contemporary Research in Business, Institute of Interdisciplinary Business Research, Vol.4, No.6.3.

[2] Anyim, C. Chidi, O.& Badejo, A. (2012). Motivation and Employees' Performance in the Public and Private Sectors in Nigeria: International Journal of Business Administration Vol. 3, No. 1.4.

[3] Agwu, M. (2012). Impact of Employees Safety Culture on Organizational Performance in Shell Bonny Terminal integrated Project (BTIP): European Journal of Business and Social Sciences, Vol. 1, No. 5, pp 70-82.5.

[4] Agwu, M. (2013). Impact of Fair Reward System on Employees Job Performance in Nigerian Agip Oil Company Limited Port-Harcourt: British Journal of Education, Society & Behavioural Science 3(1): 47-6.6.

[5] Azar, M & Shafighi, A. (2013). The Effect of Work Motivation on Employees' Job Performance: International Journal of Academic Research in Business and Social Sciences, Vol. 3, No. 9 ISSN: 2222-6990.7.

[6] Baron, R.A. (1983). Behavior in organizations. New York: Allyn & Bacon, Inc.

[7] Bateman, T.S. & Snell, S.A (1996).Management: Building Competitive Advantage. 3rd ed. Chicago : Irwin. 575p.

[8] Cal bank Annual Report, 2006, 2010. Chen, J. and Silverthorne, C. (2008).The impact of locus of control on job stress, job performance and job satisfaction in Taiwan, Leadership and Organization Development Journal Vol. 29 No. 7, 2008, Emerald Group Publishing Limited pp. 572-582.

[9] Chaudhary, N & Sharma, B. (2012). Impact of Employee Motivation on Performance (Productivity) In Private Organization: International Journal of Business Trends and Technology, volume2, Issue 4.8.

[10] Prentice Hall. "Employee Motivation and Team Performance of the Banks in Ghana and China

[11] " Proceedings of the 7th International Conference on Innovation & Management.

[12] Iqbal, J. Yusaf, A. Munawar, R. Naheed, S. (2012). Employee Motivation in Modern Organization: Interdisciplinary Journal of Contemporary Research in Business, Vol.4, No.3.10.

[13] IBL Group, 2012. Mauritius. Available from: http://www.iblgroup.com/en/home

[14] [Accessed 15 March 2013]KAHYA, E., 2007. The effects of job characteristics and working conditions on job performance. International Journal of Industrial Ergonomics, 37, 515–523

[15] U.S, M. (2013). The Impact of Employee Motivation on Organizational Performance (A Study of Some Selected Firms in Anambra State Nigeria: The International Journal Of Engineering And Science (IJES), Volume 2, Issue 7, pp. 70-80

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Determinants of Implementation of Electronic Procurement in Procuring Entities at the County Level in Kenya.

(Case Study of Lamu County Service Delivery Coordinating Unit)

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Abstract- Despite the government initiative for procuring entities to implement e-procurement, the process has been slowly implemented. E-procurement is a practice if implemented might lead to efficiency, transparency and reduced cost. However, it's slowed implementation raises concern as to determinants of implementation of e procurement. Consequently the purpose of the study was to assess the determinants of e-procurement implementation in procuring entities, with specific reference to Lamu county service delivery coordinating unit. Specifically the study sought to determine the role of ICT infrastructure, level of employee competence in Information Technology, public procurement regulation and management commitment on implementation of e-procurement in procuring entities. Employees in the Lamu commissioner's office, treasury and prequalified contractors were the target population of the study. A purposive sample was selected based on the knowledge of the population and the purpose of the study. A sample size of thirty (33) individuals was drawn from the population and a questionnaire was used as data collection instrument. Descriptive statistics and inferential statistics were used to meet the objectives of the study. The study found dependent variables on implementation of e-procurement positively and significantly correlated with effective and efficient implementation of e-procurement. Regression analysis further revealed that ICT infrastructure, level of employee competence in Information Technology, and management commitment on implementation of e-procurement were significant determinants of successful implementation of e-procurement. The study therefore recommended that procuring entities need to create e-procurement platforms by investing in ICT infrastructure both in hardware and software linking all procurement stakeholders. Also the employees have to be motivated to learn, and train in e-procurement regulations and ICT skills for successful implementation of e-procurement. Therefore bodies like PPOA which is mandated with the responsibility of ensuring that procurement procedures established under the Act are complied with, need to, provide advice and assistance to procuring entities and employee. Finally managers should be able to adopt change management strategies towards making the transformation process from manual to e-procurement a success. On the basis of study limitations, the study recommended further research to be undertaken using larger sample size and also consider other factors like leadership style in both government and non-governmental organizations.

Index Terms- electronic procurement, E-Government, IT Infrastructure, Procuring entities, Procurement regulation, Employee level of ICT competence , implementation of electronic procurement

I. Introduction

E-procurement in the public sector is emerging internationally; hence, initiatives have been implemented in Singapore, United Kingdom, United States of America, Malaysia, Australia and European Union. E-procurement projects are often part of a country's larger e-government efforts to better serve its citizen and businesses in the digital economy. For instance, Singapore's GeBIZ was implemented as one of the programmes under its e-Government master plan. This field is populated by two types of vendors: big enterprise resource planning (ERP) provides which offer e-procurement as one of their services, and the more affordable services focused specifically of e-procurement according to Aberdeen 2001, an e-procurement system manages tenders through a web site. This can be accessed anywhere globally and has greatly improved the accessibility of tenders.

Wu, (2007) & Turban et al, (2006) contends that e-procurement application focus on creating efficiencies; their goal is to make the traditional purchasing procedures more effective as Larsen et al (2008) noted the development and implementation of electronic commerce business models such as a procurement portal in organizations is a challenge that goods beyond mere technological functionality.

In ICT development Kenya has not been left behind because several changes have taken place in Kenya concerning ICT though not properly through a legal framework over the first 10 years of inception. Notable changes have been formation of the Multi- Stakeholder Kenya ICT Action Network. Through the network, a policy process deemed to be inclusive has been

catalyzed, resulting in the country's first draft ICT policy document which was approved by Cabinet in February, 2006, (Republic on Kenya, 2006).

Though electronic commerce is viewed as involving many ministries, Communication Commission of Kenya (CCK) is responsible for revitalizing and transforming the economy into modern market oriented through e-commerce (Republic of Kenya, 2006). Many firms in Kenya and world over have registered dismal performance in terms of business growth and profit making because of insufficient and unsustainable procurement procedures.

Employees have been fired because of low performance rate persistent lateness and wrong attitude towards work (Johnson, 2008). Studies in ICT adoption frequently highlight in house technical capabilities and experience with ICT, as key contributory factors (Chapman et al, 2000). Price Waterhouse coopers (2002) defend this view by stating "we don't have enough internet human resources, and cannot hire people". Implementing a new technology needs skill and knowledge to operate in the organizations and most organizations do not implement because organizations' employees are not familiar with new technology. Empirical evidence identifies that organization whose employees have the necessary skills and technical knowledge are more likely to implement e-Government applications (Lin and Lee, 2005).

In Kenyan market, research conducted by Humphrey, et al. (2003) revealed that conducting e-commerce is mostly meant for provisions that enable the firms identify trading partners that they could contact off-line with a view to doing business. The follow-up to an initial contact generally is to taking place through other channels such as e-mail, hyperlink, the telephone, fax or the post. Despite the benefits of e-procurement as recognized by managers such as better coordination with suppliers, quicker transaction times, higher flexibility, better supplier integration, and lower costs (Kheng & Hawamdeh, 2002), it is clear that adaption of e-procurement is still very low (Gunasekaran & Ngai, 2008). According to Mitraet al. (2000), the most common forms of e-commerce in Kenya market are e-procurement, e-banking and of late embanking. Of the three, e-procurement which is user friendly; internet based purchasing system (Nikolaos, Poulo, & Bokos, 2006) has generated a lot of interest due to its ability in improving efficiency and transparency, thereby reducing the cost of operation within and between business parties (De Boer, *et al.*, 2002).

E-Procurement refers to the use of Internet-based (integrated) information and communication technologies (ICTs) to carry out individual or all stages of the procurement process including search, sourcing, negotiation, ordering, receipt, and post-purchase review (Croom & Brandon-Jones, 2004). While there are various forms of e-Procurement that concentrate on one or many stages of the procurement process such as e-Tendering, e-Marketplace, e-Auction/Reverse Auction, and e-Catalogue/Purchasing, e-Procurement can be viewed more broadly as an end-to-end solution that integrates and streamlines many procurement processes throughout the organization. Although the term "end-to-end e-Procurement" is popular, industry and academic analysts indicate that this ideal model is rarely achieved (DOIR, 2001) and e-Procurement implementations generally involve a mixture of different models (S&A, 2003).

Explaining the nature of e procurement (Ashis & Amit, 2007) contends that e-procurement Web sites allow qualified and registered users to look for buyers or sellers of goods and services. Depending on the approach, buyers or sellers may specify costs or invite bids. Transactions can be initiated and completed.

Ongoing purchases may qualify customers for volume discounts or special offers. E-procurement software may make it possible to automate some buying and selling (Davey,2007). Companies participating expect to be able to control parts inventories more effectively, reduce purchasing agent overhead, and improve manufacturing cycles. E-procurement is expected to be integrated into the wider Purchase-to-pay (P2P) value chain with the trend toward computerized supply chain management Andrew, Berger, John & Gatomana (2001).

E-procurement can provide real-time business intelligence to the vendor as to the status of a customer's needs. For example, a vendor may have an agreement with a customer to automatically ship materials when the customer's stock level reaches a low point, thus by passing the need for the customer to ask for it (Coulthard & Castleman, 2001). Studies by Ashis & Amit (2007) show that companies can track purchases being made in all department and ensure compliance to standards with use of e procurement. For example, a marketing agent might want to purchase a new laptop for his business trip. In a manual setup, the agent might be instructed to go to a local supply chain store, purchase the laptop and submit the receipt back to the company for reimbursement. Such purchases are difficult to track. With an electronic procurement system in place, the entire purchase runs through approval work flows and the person who approves of such requests ensures the laptop is bought only for the configuration needed in a business use (Gebauer, Beam, & Sage1998).

The turnaround time in making phone calls to suppliers, placing orders and delivery is reduced as buyers can place the order instantly. This ensures purchases, especially the critical ones are made on time, thus contributing to the overall process efficiency within an organization (Adelman, 2000). Despite the obvious advantages associated with e procurement, the value of the processes has yet to be integrated among many procuring entities. Studies by (David, George, Barbara, Isabel & Rewald 2008) show that many public procuring entities are yet to implement e Procurement in their organizations. The benefit of e procurement has on many occasions remained in paper and its real value in procuring entities has never been established (David et al, 2008).

Statement of the Problem

Technology has been and continues to be integral part in increasing efficiency and service delivery in every organization. Procuring entities have not been left out in the need for efficiency and customer satisfaction. The advantages associated with e procurement are enormous; however, the implementation rate with which procuring entities implement e procurement is wanting**.** A study by Davis, Bagozzi & Warshaw,(1989) show that more than 50% of procurement processes in procuring entities are carried out manually. Many procuring entities have

not embraced the culture of e procurement. The reason for low rate of implementation may probably lie in the perception that technology is always associated with change and therefore organizations might be slow in implementing changes that may occur as a result of new technology. Another study by (Kangogo & Gakure, 2013) contends that factors affecting eProcurement implementation in the automobile industry are organizational which mainly have to do with user involvement and customer interaction. (Robert, 2010) points out four conditions of successful implementation in his paper on eprocurement to the World Bank as Strong government leadership (e.g. Korea, Mexico at Presidential level), appropriate implementation framework (e.g. procurement policy, legislation, capacity building, standards), Infrastructure development (connectivity), Complaints mechanism & resolution, Oversight over collusion, bid rigging and managing political economy of reform. Few studies have been carried out on determinants of effective implementation of e procurement in procuring entities. The effect of information communication technology (ICT) infrastructure, employee competence, procurement regulations and management commitment on implementation of e procurement have not yet been established. This study intends to fill in this gap by establishing determinants of implementation of e procurement in procuring entities

Specific Objectives of the study

(i) To establish the effect of Information Communication Technology infrastructure on implementation of electronic procurement in procuring entities.

(ii) To establish the effect of the employees' level of information technology competence on implementation of electronic procurement.

(iii) To find out the effect of public procurement regulations on effective implementation of electronic procurement in procuring entities.

(iv) To establish the role of managerial commitment in effective implementation of electronic procurement in procuring entities.

(iv) What is the effect of managerial commitment in implementation of electronic procurement in procuring entities?

II. RELATED LITERATURE

Theoretical Review

1. Institution Theory

The history of institutional theory can be traced back to its early development in economics, political science, and sociology (Scott, 2008). This theory sees institutions as multifaceted, durable social structures made up of symbolic elements, social activities, and material resources. Institutions, however, are not just constraint structures but also simultaneously empower and control (Jepperson, 1991). According to Wijen & Ansari (2007), there are three 'schools' within institutional theory: 'old institutionalism' that focuses on issues of agency, vested interest, power, and informal structure; 'new institutionalism' that stresses structural constraints, embeddedness, and isomorphism; and 'institutional economics' that emphasizes human agency in constructing institutions that structure political, economic, and social interaction. These rich concepts provide useful insights into not only the persistence and the homogeneity of institutions but also institutional change and transformation (Dacin et al., 2002). Institutional theory has been used as a lens in different areas of information systems research. Most of the researchers using this theory believe that information technology (IT) it is an insufficient predictor of IT impact on organization performance improvement (Avgerou, 2000; Orlikowski & Barley, 2001). Avgerou (2000, p. 234) suggest that, 'IT innovation itself is a process of combining technical -rational and social forces, neither driving, nor subsumed in the forces of organizational change, but interacting with them'. IS scholars should take into account the institutional context where IS is developed and implemented (Orlikowski & Barley, 2001). In addition, institutional theory is also used to portray the relationship between actors and to explain isomorphic mechanisms between the actors which emerge during the IT implementation (Gil-Garcia & Martinez-Moyano, 2007; Kim et al., 2009). In the literature, there are various different mechanisms of institutional change. These included structural overlap and event sequencing (Thornton & Ocasio, 2008). Both structural overlap and event sequencing were not prevalent in this case of eProcurement implementation. Mergers and acquisition are examples of structural overlap (Dorado, 2005); and these were not the case in this study. Therefore, this study will focus only on three of the mechanisms, i.e., institutional isomorphism (DiMaggio & Powell, 1983; Frumkin &Galaskiewicz, 2004), competing institutional logics, and institutional entrepreneurs (Thornton et al., 2005; Thornton & Ocasio, 1999). Institutional isomorphism occurs when an institution has to respond to various external pressures (DiMaggio &Powell, 1983). Institutional entrepreneurs are actors who are taking advantage of the position to mobilize support and resources to create and empower institutions (DiMaggio, 1988). Competing institutional logics can both hinder and trigger institutional change (Nielsen & Jensen, 2011; Sahay etal, 2010; Thornton et al., 2005).

2. Technology Diffusion Theory

TDT is the common lens through which theorists study the adoption and development of new ideas. Diffusion is defined basically as the process by which an innovation is adopted and gains acceptance by individuals or members of a community. The diffusion theory represents a complex number of sub-theories that collectively study the processes of adoption. The most famous account of diffusion research by Roger (1995) where the definition of diffusion of four elements which are defined as:

Innovation: an idea, practices or object perceived as new by individual or group of adopters. Time: the non-spatial interval through which diffusion event takes place. The events include innovation diffusion process, relative span of time for the individual or group to adopt the innovation and social systems. A set of interrelated units that are engaged in joint problem solving activities to accomplish the goals. Rogers (1995) also came up with the perceived attributes theory that assumes that innovation bears the following characteristics: Relative advantage: degree in which an advantage is perceived as better than the idea it supersedes. Compatibility: degree that an innovation is seen to be consistent with existing values and norms. Complexity: the degree in which an innovation is seen to

be difficult or easy to understand and use. Trialibility: the degree in which an innovation may be experienced on a limited basis and observability as the degree to which the results of innovation are visible to others. The earlier it is for individuals to see results of an innovation, the more likely they are to adopt it argues Roger (1995). Although the process is not limited to these perceived attributes, the elements are helpful in formulating questions for potential adopters in better understanding what factors make adoption possible or desirable.

Endogenous growth theory however indicates that the rate of technological progress, and hence the long-run rate of economic growth, can be influenced by economic factors which will curtail technology adoption in procurement as technology is seen as being costly.

It starts from the observation that technology progress takes place through innovations, in the form of new products, processes and markets, many of which are the results of economic activities contends Lieberth (2007). Technological revolution has impacted on purchasing; the drivers for change in purchasing function must include the objectives of eradicating paper transactions to a secure system that facilitates procure to pay as an objective of a world class procurement which is seen to enhance the performance of the procurement function (Lysons & Farrington, 2012). The technology diffusion theory is important in guiding the firm to initiate change and adopt technologies in procurement in the shift toward world class procurement.

Conceptual Framework

Chandran (2004) defines a conceptual framework as a logically developed, described and elaborated network of interrelationships among variables deemed to be integral part of the dynamics of the situation being investigated. Adrian, (2002) further adds that the major function of a conceptual framework is to position the researcher in relationship to the research. It states the researcher's ideological position from his or her agreement or disagreement with the current discussion and issues.

III. CONCEPTUAL FRAMEWORK

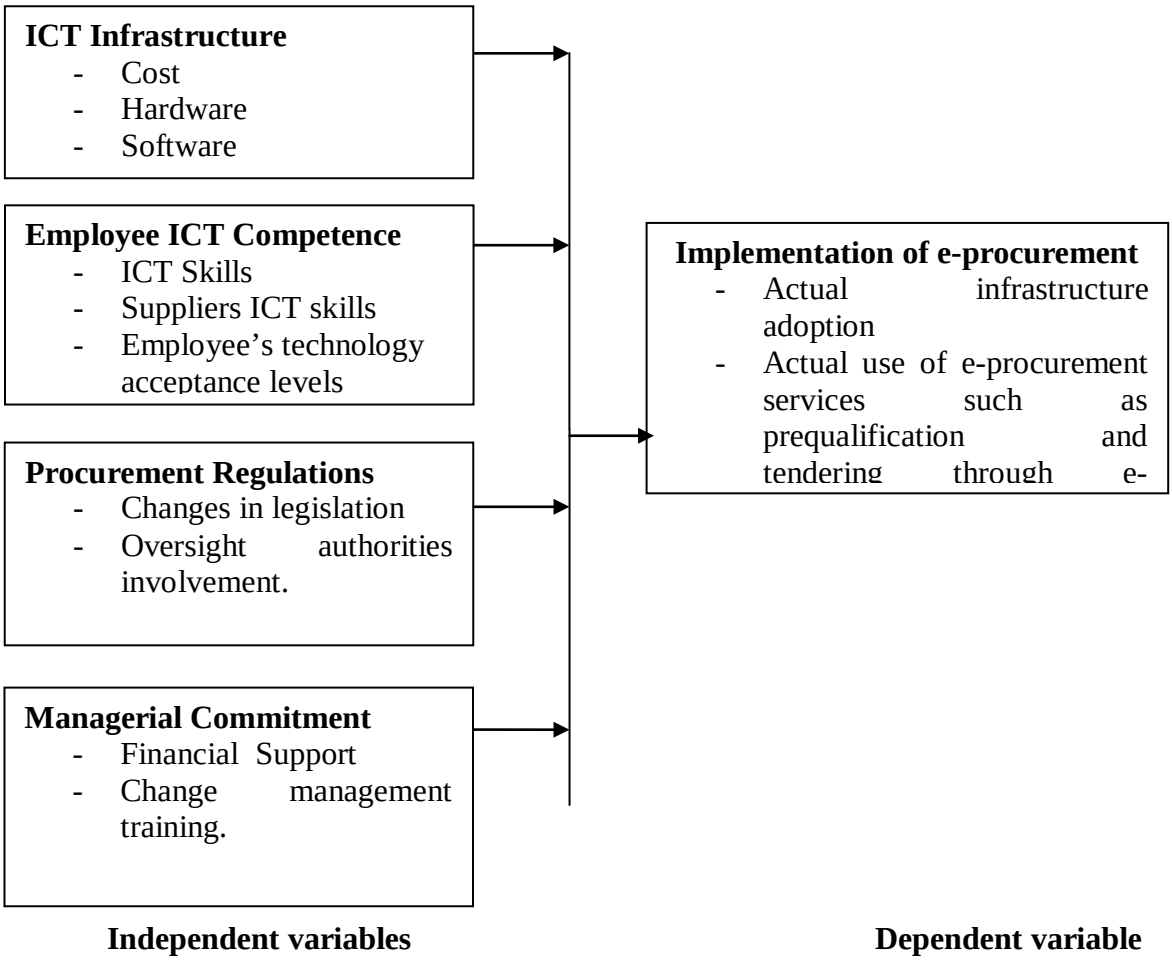

Fig. 2.1 Conceptual framework source author (2015).

REVIEW OF VARIABLES

ICT infrastructure

Implementation of e procurement usually involves using advanced communication technologies such as email and the Internet. Having an online presence creates important new methods of procurement for public procuring entities. Procuring entities have the role to create e procurement platforms in which stakeholder in the procurement department can sign in (Henriksen & Mahnke, 2005). Information Communication Technologies consists of a combination of hardware and software technologies. Hardware components are important for knowledge management system because they have the role of platform for the software and transfer of knowledge. Some of the hardware requirements include personal computers or workstations to facilitate the access to knowledge, servers for high traffic for the organization to be in network, open architecture for interoperability in distributed media, mass media rich in application that need integrated digital network of services and high speed optic fibre to offer access to public network email letter to the address provided at the site" and "the use of technology to enhance the access to and delivery of government services to benefit citizens, business partners and employees. Davis, (1989) developed technology acceptance model (TAM) based on the previous works by on Fishbein and Ajzens theory on reasons of actions (1975) to explain the intentions of use of IT and in organizations in the TAM model, ease of use and usefulness are two independent variables explaining attitude, behavioral intentions and actual use Taylor and Todd later showed that the TAM model is well suited to predict variation in adoption and use of IT in organizations. Usefulness and ease of use are important factors in the use of information system.

There are relatively few detailed empirical studies of eprorecurement implementation. Mcrat Manus (2000) examined the rate of implementation in US the sector, remarking that motivation for implementation was based on expectations of lower purchase prices, reduced transaction and process costs, and increased transaction speed. She also noted that the implementation of e-procurement had led to increased debate about some of the fundamental principles behind public sector procurement, including 'lower bid wins'. A case examples of Taiwanese military procurement by Liao et al (2003) documented the challenges for e-procurement implementation in terms of changing established procurement processes and practices, and particularly highlighted the significance of 'human deficiencies and faults (i.e, corruption and inefficiency) in the implementation process.

Two recent commercial reports have addressed the issue of successful e-procurement implementation: the IDC report (2003) highlighted the slow uptake of eprocurement systems, emphasized some of the information systems related issues that were inhibiting implementation such as software integration (including discussion of XML related opportunities). Research by the Aberdeen Group (2001) cited user adoption as an essential factor in successful eprocurement deployment. Lin & Hsieh (2000) used a single case study to highlight the importance of both web content management and content rationalization as significant issues for e-procurement operation. They noted that constantly changing prices, specifications and account details across the (on-line) supply base caused major problems in the maintenance of supplier catalogues. In addition, the way an item is described (item coding) has been found to be significant data management issue for eprocurement, and Lin & Hsieh also claim that material code proliferation within ERP systems has posed similar challenges for the management of IS infrastructure.

The extent to which the eprocurement system is able to integrate effectively with other IS, particularly production planning & control and finance systems, is posited by Subramanian& Shaw (2000) to be a major casual determinant of the efficiency and effectiveness of an eprocurement implementation, both with the customer's information infrastructure and in its links with suppliers.

Employee Competence

According to (Adelman, 2000) Information Technology (IT) is the acquisition, processing, storage, and dissemination of vocal, pictorial, textual, and numerical information by micro electronic based combination of computing and telecommunication**.** The human capacity in using Information Technology (IT) may play a vital role in implementation of eprocurement in public procuring entities. Employees must understand how to use ICT and how it will change the way they do business. This obstacle is more prominent for advanced ICT such as e-commerce, procure-to-pay IFMIS and ERP software than for basic ICT such as phone lines and fax. A response from one of the managers in a study carried out by Macmanus, (2002) indicated that, Lack of competences, need of training and absence of motivation in many public procurement officers, are some of the main reasons for which any new projects, new tools like e-Procurement, IFMIS or any change are hardly implemented and hence the need to improve the already existing bureaucratic standards in public institutions.

Study by (Sivin-Kachala, 1998) showed that the people's perception about technology rarely brings out the best out of many employees in public organizations'. In his study Sigel explains that technology has become closely associated with gadgets that enhance economic development through efficient mass production of goods. However to many technology remains a concept that is best left to engineers, scientists and the technically inclined since they believe its mastery requires long tedious hours of solitary work in laboratories or in isolated rooms of big machines. It therefore appears to be unquantifiable, uncontrollable and intangible to many including the very people especially the managers who can make serious decisions on it.

Further study by (Priest, 2000) shows that information technology in its simplest and most complex forms are essentially specialized knowledge, skills and tools. Priest further adds that there is a general feeling of helplessness among many employees in procuring entities due to their inability to use appropriate technology to further the goals of their organizations and this makes majority of them shun away from implementing e procurement due to the uncompetitive nature of procuring entities, employees may be reluctant to innovativeness that is usually witnessed in private institutions. Empirical studies have shown that competitiveness increases the likelihood of innovation and implementation. (Priest, 2000) contends that it is

a tough rivalry that pushes businesses to be innovative. Competition lead to environmental uncertainty and increases both the need and rate of implementation, However (Taylor & Todd, 1995) observes, the reluctant nature of procuring entities may lead to employees reluctance in learning and using new technologies associated with e procurement.

Public procurement regulations

At the international level public procurement rules depend on the country's legal setting and on purchase players (Government, public agency among others). International agreements on public tendering and procurement aim to regulate goods, services and trade opportunities between public procurement and private organizations across different countries. For example public procurement processes promoted by the World Trade Organization (WTO) and by the Organization for Economic Cooperation and Development (OECD) or financed by international agencies such as the World Bank or the European Bank for Reconstruction and Development must guarantee a public-private approach that avoids unnecessary trade restrictions, uses internationally harmonized measures, recognizes the equivalence of the other country's regulatory standards and applies principles of transparency and competitiveness. (West, 1999).

In Kenya, the processes of procurement are controlled by Public Procurement Oversight Authority (PPOA). The PPOA is mandated with the responsibility of Ensuring that procurement procedures established under the Act are complied with, Monitoring the procurement system and reporting on its overall functioning, Initiating public procurement policy, Assisting in the implementation and operation of the public procurement system by:- preparing and distributing manuals and standard tender documents, providing advice and assistance to procuring entities and develop, promote and support training and professional development of staff involved in procurement contends (Andersen, K. V., 2004).

The regulations for public procurement are contained in the Public Procurement and Disposal Act 2005, the Act ensures that public organization maximize economy and efficiency, promote competition and ensure that competitors are treated fairly, promote the integrity and fairness of those procedures, increase transparency and accountability in those procedures, increase public confidence in those procedures and facilitate promotion of local industry and economic development An Assessment of public procurement in Kenya by PPOA (2007) showed that there was low stakeholder awareness of web-based procurement in-formation system. Although the PPOA is well aware of the benefits of digitalization of the procurement system, the implementation level of e procurement in public procuring entities is still low.

The public procurement and disposal Act (2005) has indicated guidelines under which public procuring entities should undertake their tendering process, undertake disposal of public property and the whole procurement process. According to Williams (2003) the current legal framework in public procurement provides for a fully decentralized procurement process, leaving the full responsibility of undertaking procurements to the tender committee and procurement unit at the level of the individual entity. This decentralization of decision making authority represents a milestone in implementation of e procurement.

Managerial commitment towards implementation of e procurement.

Like any other technological change, e procurement brings change in an organization that requires organizational managers to adopt change management strategies towards making the transformation process success procurement Action Plan, (2005). One way in which managers in organizations can reveal commitment to change is to have change management team structures that identifies who was doing the change management work (Yildirim, Soner., 2000).

According to Andersen, K. V., (2004) change management structures outline the relationship between the project team and the change management team. Dean further adds that the most frequent team structures include: - change management being a responsibility assigned to one of the project team members or an external change management team supporting a project team. The key in developing the strategy is to be specific and make an informed decision when assigning the change management responsibility and resources Organization for Economic Co - operation and Development, (2009).

Most major e procurement initiatives are driven by top management. It's not unusual for a Chief Executive Officers (CEO) to be directly involved in the early stages of the process. One often unexpected demand of implementing an e procurement strategy is the requirement for new management techniques and specialized skills among the organization's management team as (Thomas et al 2008) argues.

Managerial commitment towards e procurement implementation has also been discussed by scholars concerning the style of leadership adopted by many managers. According to Kippis (2007) almost all managers of African organizations, perhaps because of societal norms and expectations emphasize bureaucratic practices with total reliance on rules and regulations that workers obey without questioning or offering constructive criticism (Alpar P. and Olbrich S, 2005).

Bureaucratic practices usually create a very cold and impersonal organizational climate. Most of them are unconducive to attainment of organizational goals Workers in such organizations behave like robots. The impersonal and legalistic environment according to kippis (2007) alienates workers from both their job and organization. Managers patronizing attitude towards employees may hinder from being innovative or adoptive to a change idea such as shifting from manual procurement to eprocurement that could be of benefit to the organizations.

A study by Ndongko (2005) on Cameroon public service institutions revealed that despite the culture which emphasizes on rigid hierarchical relationships, managers who were seen by workers to be democratic in their techniques of management and such exerted low control over them elicited higher levels of adopting new changes within the organization compared to authoritarian ones.

Implementation of e procurement which is at time associated with change might require managers to commit themselves in realizing the importance of their employees in making the adoption a success. A study by Howell (2005) on Liberian workers and that by Greenhouse (2007) showed a considerable

similarity exist in the work goals of employees around the world and that national differences regarding job related objectives were not as great as people thought. The findings of these studies indicate that human needs are universal, for workers to be motivated in adopting new ideas in an organization, it is important that organizational managers show commitment to motivate the work force and improve quality of work life. This will ease implementation of new technologies such as e procurement within the working fraternity.

Implementation of e-procurement

According to World bank (2003), e-procurement is "electronic government procurement (e-GP) is the use of information and communication technology (especially internet) by governments in conducting their procurement relationship with suppliers for the acquisition of gods, works and consultancy services required by the public sector". The public sector organizations use e-procurement for contracts to achieve benefits for example increased efficiency and cost savings, faster and cheaper in government procurement (Acher2005) and improved transparency, to reduce corruption, in procurement services. Procurement in the public sector has been rapid growth in recent years. In view of the above this paper seeks to establish implementation of e-procurement in procuring entities.

EMPIRICAL REVIEW

Empirical review entails findings by other scholars on use of e- Procurement in the government. Bottom line of the study is to enrich the already existing work on e- Procurement attainable through critical consideration of other scholars' work. The researcher will attempt to critic the findings and establish knowledge gap with a view to enhancing the factors affecting use of e- Procurement in firms. In a study carried out by (Kinuthia, W.M., (2014) she argues that procurement regulations and processes should be modernized. Established procedures and procurement regulations must recognize information and technology techniques if system developers are not to be constrained when re-engineering work processes. Further in her findings she contends that majority of the respondents acknowledged that ICT application like e-procurement, EDI, email were in use in the organization and had influenced the procurement process. According to (Croom 2000, De Boer et al 2002) impact of ICT adaptation on procurement processes mainly refers to time reductions and quality improvements, rather than cost reductions as reported by many authors. As e-procurement includes new technologies and changes in traditional procurement approaches, training of staff in procurement practices and the use of e-procurement tools are critical to the success of an e-procurement initiative (WB, 2003). The World Bank (2003) suggests that developing an e-procurement system in open environment allows it to link to other system for interoperability and simplifies upgrading the system. Supplier compatibility is important for e-procurement implementation to be successful. It is important to demonstrate the proposed solution to the suppliers and discuss any necessary changes, issues and concerns such as various options in developing and maintaining supplier catalogues (Birks et al., 2008). Systems specifications appear to be a critical issue in the uptake of e-procurement. The IDC report (2003) highlights the slow uptake of e-procurement systems, emphasizing some of the IS-related issues that inhibit implementation, including software integration. The extent to which an e-procurement system is able to integrate effectively with other information systems, particularly production planning & control and finance systems, is posited by Subramaniam & Shaw (2002) to be major causal determinant of the efficiency and effectiveness of an e-procurement system. Rajkumar (2001) also identifies system integration as critical success factor for e-procurement implementation, both with customer information infrastructure and its links to suppliers. Lin & Hsieh (2000) use a single case study to highlight the importance of both web content management and content rationalization as significant issues for e-procurement operations.

METHODOLOGY

Research Design

The study used descriptive design to obtain information from the selected respondents on the current status of the phenomena under investigation. A descriptive approach describes data and characteristics about the population or phenomena being studied. According to Mugenda & Mugenda (2012) the purpose of descriptive research was to determine and report the way things are and it helped in establishing the current status of the population under study. Borg & Gall (1996) noted that descriptive design was intended to produce statistical information about aspects of a study that interest policy makers.

Target Population

A population is an entire group of individuals, events or objects having common characteristics that conform to a given specification (Mugenda & Mugenda, 2012). According to Sunders, (2003), the population is the full set of cases from which a sample was taken. The target population for the study was employees working in the County Commissioner's office and prequalified contractors totaling to 117 employees and contractors.

Sampling and sampling technique

The study used purpose and stratified sampling to select the respondents to participate in the study. In purposive sampling the researcher chose the sample based on who they think would be appropriate for the study (Chandran, 2004). This is used primarily when there is a limited number of people that have expertise in the area being researched. The employees in procurement department were purposively selected to participate in the study. This was because they are the main implementors of e-procurement and also the resident contractors and suppliers. The total number of employees in the county commissioner's office was 52 and 65 contractors making a total of 117. The sample size was 33 which was representative.

Table 3.1: Showing sampling frame and sample size

Category	Target population	Sample size
1.Seniors Officer	6	30% of 6 = 2
2.Administrative Officers	8	30% of 8 = 2
3.Personnel Staff	10	30% of 10 = 3

4. Accounts Staff = 3	10	30% of 10
5. Procurement Staff = 5	18	30% of 18
6. Prequalified Contractors = 18	65	30% of 65
TOTAL 33		**117**

Data collection techniques and instruments.

A questionnaire was used as an instrument of data collection in the study. According to Chandran (2003), Questionnaires provide a high degree of data standardization and adoption of generalized information amongst any population. The questionnaire was open ended questions as well as structured questions based on the likert scale. All the questions were aimed at establishing the effect of ICT infrastructure, level of employee competence in information technology, public procurement regulations and management commitment on implementation of e procurement in public procuring entity.

Data Collection Procedure

These entailed both primary data and secondary data. Primary data was collected from the target population. Questionnaires were administered to the interviewees in the study. The questionnaires containing both closed and open-ended questions at five level likert scale were used to elicit information from the respondents. Secondary data collection was employed in the first phase of the study which included the development of background information, problem statement and literature review. The data helped in identifying the gaps in knowledge related to determinants of implementation of eprocurement. In addition, it was used in discussing and explaining data after analysis. The data collected was analyzed quantitatively. Quantitative analysis involved deriving statistical description and interpretation of data by use of descriptive statistics. This was done by the help of the Statistical Package for Social Sciences (SPSS) version 20. Therefore, the estimated regression model for this study involving the four independent variables and one dependent variable was therefore:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \varepsilon$$

Where;

β_0 = Regression constant

β_1, β_2, , β_3, β_4 are regression coefficients of the four independent variables; ICT infrastructure (X_1), procurement regulations (X_2), managerial commitment (X_3) and employee competence (X_4) respectively

Y= performance (e-procurement)

ε = error term

IV. ANALYSIS AND INTERPRETATION

Profile of Respondents

Age, gender, highest education level, position held by respondent and duration worked were the demographic characteristics the study examined. These characteristics will give the general view of the respondents in relation to the main research objective. The result presented in table1 shows the frequency distribution under each demographic variable. A majority of respondents, that is 40%(12) were in 36-45 years age bracket, and least was in the age bracket 26-35 years of age, 26.7%(8). Certificate holders comprised a majority (50% n=15) of the respondents followed by diploma(33.3%, n=10),then masters (10.0%, n=3) and least was bachelors degree (6.7%, n=2). Concerning on the job position held by the respondent, management and supervisors' positions were over 83% and the rest were subordinate staff. Over 60% of these employees had worked for over 10 years in the county offices. And 20% had worked for 5 to 10 years and another 20% had worked for 5 years and less.

Table 4.1: Demographics

		Frequency	Percent
Age	26-35	8	26.7
	36-45	12	40.0
	46-55	10	33.3
Education level	diploma	10	33.3
	bachelors	2	6.7
	masters	3	10.0
	certificate	15	50.0
Position held	management	18	60.0
	supervisory	7	23.3
	subordinate	5	16.7
Work duration	less 1 yr	1	3.3
	2-5 years	5	16.7
	5-10 yrs	6	20.0
	More than 10 yrs	18	60.0

Reliability and Validity

Reliability is the extent to which a measuring procedure yields consistent results on repeated administrations of the scale.

Reliability of the instrument is significant so as to determine how the items used was consistent, the questionnaire in this case, produce the same measures if repeated. To achieve this objective, Cronbach's Alpha measure of reliability was used. A Cronbach's alpha of more than 0.6 indicates a satisfactory internal consistency level of reliability (Malhotra & Birks, 2007). Table 4.2 result indicated that the Cronbach's alpha were between .675 and .921 hence all the variable items were acceptable as reliable. Managerial commitment (alpha=.811*) had initially seven questions, one statement ('the attitude of organizational managers towards e-procurement is positive') was dropped from further analysis since it poorly correlated with others.

Table 4.2: Reliability statistics using the Cronbach's alpha

Variable	Cronbach's Alpha	Number of Items
ICT Infrastructure	.921	5
Procurement Regulation	.700	7
Managerial commitment	.811*	6
Employee Competence	.675	6
E-procurement	.781	4

On the other hand validity is the degree a measuring procedure accurately reflects or assesses or captures the specific concept that the research is attempting to measure. Content validity is a non-statistical type of validity that involves "the systematic examination of the test content to determine whether it covers a representative sample of the behaviour domain to be measured" (Anatasi & Urbina, 2007). A test has content validity built into it by careful selection of which items to include. Items are chosen so that they comply with the test specification which is drawn up through a thorough examination of the subject domain. Foxcraft (2004), note that by using a panel of experts to review the test specifications and the selection of items the content validity of a test can be improved. In this study, the research supervisors and other university lecturers were consulted to review the items the research proposed to use and they noted that the items indeed covered a representative sample of the behavior domain.

To this end therefore all the items retained from reliability test were subjected to further analysis so as to achieve the objectives set out in this study. Descriptive and inferential statistics of each variable is therefore presented in the subsequent sections to achieve specific objectives in this study.

It was earlier noted that IT Infrastructure is the hardware, software, and the entire related network which enables both forward and backward linkages of the information system. The first objective therefore sought to determine the role of IT infrastructure on e-procurement in County offices in Lamu County. Using five items which were found to be reliable, Reponses were captured to gauge the level of ICT infrastructure in Lamu County offices using a 5-point Likert scale. The Likert scale used for all the independent variables ranged from 1= Strongly Disagree to 5= Strongly Agree. Table3 shows the mean of the responses on level of IT infrastructure in Lamu county offices. The mean ranged from 2.87 (there is reliable infrastructure) to 3.10 (there is sufficient budget allocation to ICT) with an overall mean = 3.01, SD= 1.002 this meant that the respondents were not sure (not in support) of the infrastructure statements posed in the questionnaire. Therefore the ICT infrastructure in place in Lamu county offices was not adequate to support e-procurement. For example, there are enough ICT equipments (mean=3.27, sd=1.112), allocated budget was not sufficient (mean=3.10, SD=1.125) and no enough software (mean=2.87, sd=1.196). Therefore there is lack of ICT infrastructure to support implementation of e-procurement.

ICT infrastructure in Lamu County Offices

Table 4.3: Descriptive Statistics on ICT infrastructure in Lamu County offices

	N	Mean	Std. D
There is Sufficient budget allocation for ICT	30	3.10	1.125
There are enough ICT equipments	30	3.27	1.112
There is reliable internet supply	30	3.03	1.033
We have enough software and hardware	30	2.87	1.196
There Sufficient ICT infrastructure	30	2.90	1.029
There is reliable structure	30	2.87	1.008
OVERALL MEAN ICT INFRUSTRUCTURE		**3.01**	**1.000**

4.1 Public Procurement Regulations in Lamu County offices

From the literature review, Public procurement regulation refers to the public procurement and disposal act of 2005. Therefore the second object sought to determine the role of public procurement regulations on e-procurement in Lamu county offices. The mean and standard deviations of the responses to the statements concerning public procurement in Lamu county offices are presented in table5. The mean ranged between 2.90 (not sure) to 3.83 (agree) that public procurement procedures were in place in their respective places of work. Specifically it wasn't clear that tendering process affects e-procurement positively (mean=2.90, SD=1.125). But there are adequate regulations in place (mean=3.83, SD=.950) and well laid down policies on procurement (mean=3.80, SD=.805). Overall there are weak public procurement regulations in place at Lamu county offices (**mean=3.49, SD=.968**). The next section deals with the managerial commitment in Lamu county offices.

Table 4.4: Descriptive Statistics on public procurement in Lamu County offices

	N	Mean	Std. D
Tendering process affects e-procurement positively	30	2.90	1.125
procurement as adequate regulations	30	3.83	.950
ICIT technology depend on set regulations	30	3.23	.971
budget allocation determine technology	30	3.30	.877
Well laid down policies	30	3.80	.805
Gvt promotes implementation of e- procurement	30	3.60	.855
LTD implementation of procurement	30	3.80	.761
Public procurement regulations		**3.49**	**.968**

Managerial commitment in Lamu County Offices.

Managerial commitment towards e-procurement in Lamu County was assessed in a view to determine its relation with e-procurement. The findings presented in table6 revealed that there was some level of managerial commitment towards e-procurement in Lamu County office (overall mean=3.48, SD=.804). That is to say, in Lamu county offices, management style promote change implementation (mean=3.67, SD=.922), it also rewards employees who do well in e-procurement (mean=3.60, SD=.514) and managerial policies somehow favour implementation of e-procurement but not to a large extent (mean=3.40, SD==.968). In section **Employees' level of competence on e-procurement is assessed.**

Table 4.5: management Commitment to e-procurement

	N	Mean	Std. Deviation
Mgt Style promote change implementation	**30**	**3.67**	**.922**
Managers reward employee who do well in e-procurement	**30**	**3.60**	**.814**
Managers support e-procurement activities	**30**	**3.47**	**.900**
managerial policies favour implementation of e-procurement	**30**	**3.40**	**.968**
Managers are committed to e-procurement	**30**	**3.23**	**.817**
Employees are trained on e-procurement skills	**30**	**3.50**	**.777**
Overall mean of Management commitment		**3.48**	**.804**

Employees' level of competence on e-procurement

The employees' level of commitment on e-procurement in Lamu county offices were assessed using six items. The findings presented in table7 indicated that the Lamu county office sponsors employees on ICT (mean=3.87, SD=.629), employees are guided on e-procurement and its challenges (mean=3.53, SD=.730). Also the findings further reveal that knowledge on e-procurement (mean=2.73, SD=.980) was least rated item of all the six employee commitment items. Based on this rating, therefore the employees of Lamu county office have no adequate knowledge on e-procurement policies and procedures. Consequently these may be a challenge in implementation of e-procurement in Lamu county office.

Table 4.6: Employee Competence to e-procurement

	N	Mean	Std. Deviation
County office sponsors employees on ICT	30	3.87	.629
supervisors guides on e-procurement challenges	30	3.53	.730
employees have basic IT knowledge	30	3.43	.858
managers well versed with e-procurement	30	3.37	.850
e-procurement is not a threat to their jobs	30	3.27	.907
Employee knowledge in e- procurement	30	2.73	.980
Overall mean of employee competence	**30**	**3.37**	

Implementation of E-Procurement

Implementation of e-procurement was the dependent variable assessed by four items with a reliability coefficient alpha of .781. The mean and standard deviation of the responses on the four items are presented in table8. The result indicate that the mean was between 3.10 to 3.43 ('Not Sure') indicating that it was not clear to the employees that implementation of e-procurement had been achieved(mean=3.43, SD=1.165). That is to say that in the county offices, it is not case that the e-procurement has been received positively (mean=3.10, SD=.885), nor reduced cost (mean=3.33, SD=.994) or reduced lead time significantly (mean=3.17 SD=.986).

Table4.7: implementation of e-procurement

	N	Mean	Std. Deviation
E-procurement is being adopted here	30	3.43	1.165
E-procurement has led to reduced procurement cost	30	3.33	.994
E-procurement has reduced time to procure	30	3.17	.986
e-procurement is embraced positively here	30	3.10	.885
Overall mean of e-implementation		**3.26**	

Correlation analysis presented in the next section seeks to determine the nature and strength of relationship between the independent variables (infrastructure, employee competent, management commitment and procurement regulations) and implementation of e-procurement.

Correlational Analysis between independent Variables and dependent Variable

The bivariate correlational analysis between each independent variable and the dependent variable (DV) obtained in table 4.8. The predictor variables (infrastructure, employee competent, and management commitment and procurement regulations) all had positive significant relationships with the dependent variable (DV) at 95% confidence interval. The result further reveal that ICT infrastructure had the strongest significant correlation with e-procurement (r=.735, p=.004) followed by procurement regulations (r=.730, p=.000), employee competence (r=.718, p=.000) and managerial commitment (r=.717, p=.000). The regression analysis in the next section was significant so as to determine the contribution of each of the four variables in predicting the implementation of e-procurement in Lamu county offices.

Table 4.8: Correlation coefficients

		1	2	3	4	*D .Variable.*
ICT Infrastructure	Pearson Correlation	**1**	**.515******(.004)**	**.306(.100)**	**.503******(.005)**	***.735********(.000)***
Procurement	Pearson		1	**.654******(.000)**	**.386*****(.035)**	***.730********(.000)***

Regulations	Correlation				
Managerial Commitment	Pearson Correlation		1	.507** (.004)	.717** (.000)
Employee Competence	Pearson Correlation			1	.718** (.000)
e-procurement	Pearson Correlation				1(.000)

Note: p values are in parentheses

Regression Analysis

Regression analysis highlights how independent variables (or variable in case of simple regression) relate to the dependent variable for the purpose of prediction. Therefore regression technique seeks to model the relationship between the dependent variable with the independent variables. Multiple linear regression involves a regression of one dependent variable with many independent variables where the relationship between the variables is linear in nature.

Table 4.9: Model summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.932[a]	.869	.849	.167

From the regression model summary, table 4.9 the predictor variables collectively account for about 85% (R square=.849) of the variations in observed in e-procurement implementation. The ANOVA table 4.10 suggest that the regression model is significant ($F_{4, 25}$= 41.626, p=.000) in predicting the level of e-procurement implementation from given levels of each predictor variables. Therefore the dependent variables significantly determine the success of e-procurement implementation in Lamu county offices.
Table 4.10

ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	4.668	4	1.167	41.626	.000[b]
	Residual	.701	25	.028		
	Total	5.369	29			

Dependent Variable: e-procurement implementation

From the operational framework proposed in this study in chapter 2, with one dependent variable and four predictor variables, consequently this study proposed the following estimated regression model;

$$e-procurement\ implementation = \beta_0 + \beta_1 ICTi + \beta_2 PPR + \beta_3 MC + \beta_4 EC + \varepsilon$$

Where; β_0 is the regression constant; the level of e-implementation when all predictors variables are zero $\beta_1, \beta_2, \beta_3, \beta_4$ are the regression coefficients of the four predictor variables. The exact values are obtained in the regression coefficient table 4.11. ICT_i= ICT infrastructure, PPR=public procurement Regulations, MC=management commitment, EC=Employee Commitment and ε = the error term. The nearer the error term is close to zero the better the estimated regression model. Therefore the fitted regression model using the coefficients table 4.11 is:

$$e-procurement\ implementation = .628 + .183 ICTi + .171 PPR + .217 MC + .235 EC$$

Table 4.11 Coefficients

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		

1	(Constant)	.628	.250		2.511	.019
	ICT Infrastructure	.183	.044	.386	4.122	.000
	Procurement Regulations	.171	.084	.216	2.022	.054
	Managerial Commitment	.217	.073	.315	2.997	.006
	Employee Competence	.235	.078	.281	3.015	.006

a. Dependent Variable: e-procurement implementation

ICT infrastructure (β=.183, p=.000), managerial commitment (β=.217, p=.006) and employee commitment (β=.235, p=.006) are significant determinants of implementation of e-procurement in Lamu county office at .05 level of significance. Procurement regulations (β=.171, p=.054) was not a significant determinant only at .05 level of significance. The next section presents the summary of findings.

V. SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Summary of Findings

In the foregoing sections, the mean and standard deviation of responses of each independent variable revealed that in Lamu county office; the ICT infrastructure was not adequate to support e-procurement (mean=3.01), Public procurement regulations laid out are weak (mean=3.49), there is some level of management commitment to e-procurement (mean=3.48) and employees are not adequately competent on e-procurement procedures and policies (mean=3.37). And finally implementation of e-procurement had not been adequately adopted in the County offices (mean=3.26). Correlation analysis revealed that ICT infrastructure was positively and significantly correlated with implementation of e-procurement. Regression analysis found that ICT infrastructure was a significant determinant of effective and efficient in e-procurement implementation. Therefore good links in customer information infrastructure with suppliers and stakeholders leads to effective implementation of e-procurement.
Procurement regulations were positively and significantly correlated with effective and efficient implementation of e-procurement. The study found that procurement regulations were not significant determinant in implementation of e-procurement. This lack of significant contribution of procurement regulations could be due to low stakeholder awareness of web-based procurement in information system as stated in public procurement in Kenya by PPOA (2007) report.

Managerial commitment to e-procurement was found to significantly correlate with successful implementation of e-procurement. The commitment was found to be a significant determinant of successful implementation of e-procurement. Therefore it is important that organizational managers show commitment to motivate the work force and improve quality of work life. This will ease implementation of new technologies such as e-procurement within the working fraternity.

Employee competence positively correlated with successful implementation of e-procurement and competence level was found to be a significant determinant of successful implementation of e-procurement. Employees must understand how to use ICT and how it will change the way they do business. Lack of competences and need of training in many public procurement officers, are some of the main reasons new tools like e-Procurement or any change are hardly implemented as noted in studies by MacManus, (2002). So summary ICT infrastructure, management commitment and employee competence were found to be significant determinants of implementation of e-procurement. Therefore they had positive and significant effect on implementation of e-procurement in county offices. Chapter five presents the research summary, conclusions and recommendations based on these findings.

Conclusions

The study concludes that ICT infrastructure, managerial commitment to e-procurement, public procurement regulations and employee competence had a significant positive relationship with successful implementation of e-procurement in county offices. Good ICT links between the potential suppliers and the county offices will therefore increase the chances of successful implementation of e-procurement. Therefore county offices having good links and ICT resources, other factors held constant are likely to easily implement e-procurement and consequently benefit in terms of reduced costs and increased efficiency associated with e-procurement.

Managerial commitment to the well-being of an organization, specifically to e-procurement, is accompanied by an increased ease of implementation of the e-procurement procedure in an organization. Therefore companies which train and motivate employee by addressing their needs, will have committed workforce and therefore have ease of implementation of the e-procurement.

Based on the findings, this study concludes that, improving employee skills, through training in ICT and e-procurement regulations and procedures results in increased employee competence and consequently resulting to ease of implementation of e-procurement.

Finally the study concluded that the ICT infrastructure was not adequate, also management commitment to e-procurement, employee competence and knowledge and application of public procurement regulations is low in County offices. This fact accounts for the low adoption of e-procurement in county offices.

To this end therefore, recommendations are presented in the next section.

Recommendations

Based on the above findings, study objectives, significance and limitations of this study, the following are the key recommendations:

To get the benefits associated with successful implementation of e-procurement, the procuring entities need to invest in ICT infrastructure both in hardware and software. Therefore the Procuring entities have the role to create e-procurement platforms in which stakeholder in the procurement department can sign in.

Secondly, Organizational managers should be able to adopt change management strategies towards making the transformation process a success. This is so because e-procurement brings change in an organization that requires managerial and employee commitment. Therefore managers should show accommodating and positive attitude towards employees to enhance innovative or adoptive to change like shifting from manual procurement to e-procurement that could be of benefit to the organizations.

Third, the employee especially the procurement officers, need to be trained and on all procurement procedures and functioning. Therefore bodies like PPOA which is mandated with the responsibility of ensuring that procurement procedures established under the Act are complied with, need to prepare and distributing manuals and standard tender documents, provide advice and assistance to procuring entities and employee.

The study was limited to county offices and never considered other variables; therefore the study recommends that related study be undertaken particularly to investigate the intervening effect of variables like leadership style and competence of county bosses on e-procurement in the county offices and also in government and non-government offices. Such studies should involve larger samples sizes than 30 which this study used to increase result reliability for further generalization.

REFERENCES

[1] Aberdeen Group. 2001. “Best Practices in e-procurement”.

[2] Adelman, C. (2000). A Parallel Post-secondary Universe: The Certification System in Information Technology. Washington, D.C.: Department of Education.

[3] Alter, S. (2006).The Work System Method: Connecting People, Processes, and IT for Business Results, Larkspur, CA: Work System Press. Retrieved April, 17, 2015 –http://www.is.theorizeit.org/wiki/work_system_theory

[4] Alpar, P., & Olbrich, S. (2005). Legal Requirements and Modeling of Processes in e- Government. The Electronic Journal of e-Government Volume 3 Issue 3, 107-116.

[5] Andersen, K. V. (2004). E-government and Public Sector Process Rebuilding (PPR): Dilettantes, Wheelbarrows, and Diamonds. Boston: Kluwer Academic Publishers.

[6] Ashis, K. P.,& Amit, A.(2007). e-procurement in emerging Economies. United States of America: Ideal group publishing.

[7] Attaran, M. (2001). The coming age of online procurement, Industrial Management and Data Systems, 101/4, 177-80Bharadwaj.

[8] Chandran, C. (2004). Research Methods with Illustrations from Christian Ministries. Nairobi: Daystar University.

[9] Cooper, R.,& Schindler, P.(2003). Business research methods.Tata McGraw Hill.

[10] Coulthard, D., & Castleman, T. (2001). Electronic Procurement in Government: More Complicated than Just Good Business. Proceedings of the 9th European Conference on Information Systems (ECIS 2001) AIS, (pp. 999-1009).

[11] IDC.2003, Easing into the Tub: Results of the 2002 procurement Manager Survey”

[12] David, A., George, M.,Barbara. P., Isabel, R., & Rewald, R. (2008).Advances in information Systems Research and Practice. Milano Italy.

[13] Davis, F.D.,Bagozzi,R. P & Warshaw,P.R. (1989). User acceptance of computer technology, A comparison of two theoretical Model. Management Science, Vol 35 No. 8.

[14] Gachoya, D. (2005). Factors Affecting the Successful Implementation of ICT Projects in Government. The Electronic Journal of e-Government, 3 (4), 175-184.

[15] Gebauer, J., Beam, C., & Sage, S. (1998). Impact of the Internet on Procurement. Acquisition Review Quarterly, 5 (2), 167-184.

[16] Heijboer,G.(2003). Quantitative Analysis of Strategic and Tactical Purchasing Decisions: “Electronic purchasing. Deyermining the optimal rolloutstrategy”Chapter 8 (pp 162-198) in twenty University Press.

[17] Henriksen, H.Z., et al. (2005). Public procurement In Denmark: Measurements of Suppliers’ e- Maturity, Blede Commerce Conference e-Global Bled, 17.

[18] Henriksen,H.Z.,&Mahnke,V.(2005). E-Procurement Adoption in the Danish Public Sector.Scandinavian Journal of Information Systems, 17 (2), 85-106.

[19] Heywood, J.B., Barton, M. & Heywood, C. (2001).A Guide to Successful E-Procurement Implementation.E-Procurement.

[20] Howell, P. et al. (2005). Research note, Cultural and situational determinants of jobsatisfaction among, Management in Liberia. Journal of Management studies, 12.Information and Communication for Development. (2009). Development data Group.

[21] Kalakota, R. & Robinson, M. (2001).Problematisation and Obfuscation in E-Government.In P.W. BostonAddison-Wesley Kawalek (Ed.), Second International e-Government.

[22] Kangongo J. &Gakure, R. (2013). Factors affecting electroni procurement implementation in automobile industry of Kenya.

[23] Kanungo, R.N. (2005). Work alienation in developing countries Western Models and Eastern Realities. New Deldhi: Thousand Oaks Sage.

[24] Liao, S-H; Cheng, C-H; Liao, W-B; &Chen, I-L. (2003), “ A Web-based architecture for implementing electronic procurement in military organization” Technovation, Vol 23(6), pp 521-532

[25] Laurel, J., & Maniatopoulos, G. (2005).A Comparative Analysis of Product Classification in Public vs. Private e-Procurement. The Electronic Journal of e-Government, 34, 201-212. 62

[26] Lin,B.,& Hsieh, C-t. (2000). “Online procurement: implementation and managerial implications”Human systems management. Vol 19,pp 105-110.

[27] Mugenda, M.O.,&Mugenda, G. A. (2003).Research Methods Quantitative and Qualitative Approaches. Nairobi: ACTS Press.

[28] Ndongko, T. M. (2005). Human Resource Management in Cameroon: A critical Review Cahiers Africa Administration. Morroco.

[29] Organization for Economic Co operation and Development. (2009). Information Technology

[30] Orodho, J. A. (2003). Elements for Education and Social Science. Maseno kenya: Kanezja.

[31] PPOA.(2009). Ministry of Education procurement. Review Report Publications.

[32] Procurement Action Plan.(2005). Retrieved March 2007, from European Union: http://europa.eu.int/idabc/en/document/3821/254

[33] Priest, L. (2000).The Story of one Learner: a Student’s Perspective on Online Teaching. In K.W. White and B.H. Weight, The Online Teaching Guide.

[34] Ramenyi, D., Williams, B., Money, A., & Swartz. (2003). Doing research in business. London: Cambridge University Press.

[35] Riffee, W.H.Putting a Faculty Face on Distance Education Programs. Syllabus: Technology for Online Journal of Distance Learning Administration, 5 (4).Higher Education.

[36] Roberson, T. J. & J. Klotz. (2002). How can Instructors and Administrators Fill the Missing Link in Online Instruction?

[37] Macmanus. (2002). Understanding The Incremental Nature of e procurement implementation at the state and local levels. Public procurement Vol.2, 5-58.

[38] Rajkumar, T.M. (2001). "E-procurement: Business and technical issues". Information Systems Management, Fall, Vol.18 (4),pp 52-60

[39] Sivin-Kachala,J. (1998). Report on the Effectiveness of Technology in Schools. Washington D.C.: Software Publisher's Association.

[40] Sommer, B. &Sommer, R. (2007).A practical guide to behavioral research. Mairill Publishing Company.

[41] Sommer, B. S. (2007).A Practical Guide to Behaviural Research . USA: Mairill Publishing company. 63

[42] Subramaniam, C.& Shaw, M.J. (2002)."Astudy of the value and impact of B2B E-Commerce: the case of web-based procurement". International Journal of Electronic Commerce. Vol. 6 (4) pp 19-40

[43] Taylor,& Todd.(1995). Understanding information Technology Usage. A test of competing Model Information Systems Research, Vol 6 No 2.

[44] West, G.B. (1999). Teaching and Technology in Higher Education: Changes and Challenges. Adult Learning, 16-18.

[45] Williams, P.E. (2003). Roles and Competencies for Distance Education Programs in Higher Education Institutions. The American Journal of Distance Education, 17 (1), 45—57.

[46] Yildirim, Soner. (2000). Effects of an Educational Computing Course on Pre-service and In- service Teachers: A Discussion and Analysis of Attitudes and Use. JRCE, 32 (4).

[47] Young, J. R. (2002). 'Hybrid' Teaching Seeks to End the Divide between Traditional and Online Instruction.Chronicle of Higher Education. 64

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Factors Influencing Procurement Performance in Humanitarian Relief Organization a Case of International Commitee of the Red Cross in Kenya

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***Abstract*-** Relief organizations deal with emergencies sometimes which are unpredictable. It may be difficult to plan the procurement and one may need to break some procurement regulations to deal with the emergencies and unpredictable situations. During an emergency and disasters, procurement of supplies is required. There may be over supply of the humanitarian supplies which may end up wasted once the emergency is over. The procurement chain of relief organization such as ICRC-Kenya provides emergency relief responses during disasters. Relief organization have a responsibility to fulfill their mandates without jeopardizing their relationship with such stakeholders as donors who fund such relief programs and at the core of maintaining this relations are the managers who have to come up with procurement policies aimed at streamlining these functions. It is the effects of all these efforts and functions on the performance of the procurement departments of such organizations that these study aimed at examining under the following, Organization structure, donor funding, procurement policies and information technology as the independent variables and procurement performance as the dependent variables. The research methodology used was descriptive study. The sample was purposively selected. Data was collected using Questionnaires, cleaned using Excel, coded and analyzed quantitatively using Statistical Package for Social Sciences version 21 and findings presented by frequency and percentage tables. It was established that of the independent variables (organization structure, procurement policies, donor funding and application of information technology), it was only application of information technology that significantly affected the procurement performance at ICRC-Kenya. The department resulted in increase in performance of the unit by 18.4%. it is recommended that procurement policies should be streamlined by the policy makers to ensure that they do not inhibit delivery of critical services. They should also invest in information technology especially e-procurement in their procurement departments to ensure that the procurement process are made more efficient towards aiding service delivery in such organization. To the future scholars, further studies should be carried out to unveil the nature of effects of information technology on procurement processes and how the challenges posed by the same can be overcome. The amount of wastage in Humanitarian organization

***Index Terms*-** procurement performance**,** electronic procurement, emergency, disasters

I. INTRODUCTION

Relief organizations deal with emergency humanitarian issues such as supply of drugs, food aid, water and sanitation, providing shelter to the affected communities among others. Humanitarian organizations put a lot of effort into helping nations and people to recover from disasters by providing relief commodities. Responding adequately to a disaster is difficult due to its complexity and uncertainty associated with it. Flexible but efficient supply chains are creating high demand on procurement operations (Berger & Garyfalakis, 2013).

There is only an extent to which the relief needs can be met. According to Brauman (2006), errors of judgment as to relief needs particularly the fear of epidemics, are observed whenever a natural disaster occurs. Humanitarian organizations provide assistance in times of need and they are required to provide help whenever disasters occur. The procurement departments of relief organization are involved in making sure supplies are available to meet the needs of the disaster.

Climate change has contributed to increasing temperatures which in turn leads to disasters such as displacement of people from their original homes with 20 million people estimated to have been temporarily displaced by climate related disasters. The Tsunami of December 26, 2004, was among the deadliest natural disasters of the past hundred years. In minutes, it completely devastated thousands of square kilometers, destroying several cities in its wake (Brauman, 2006). When disasters like these occur, procurement is involved in providing supplies to put up new infrastructure. Natural or man-made catastrophes lead to loss of lives, shortage of food and water, damage to the existing infrastructure as well as ruptured socio-economic conditions (Akhtar ,et al, 2012) and economic damages such as losses in sectors like fisheries, agriculture, livestock, tourism or microenterprises. To mitigate the negative impacts, humanitarian organizations prepare counter measures by creating infrastructure and planning relief operations in advance (Nikbakhsh & Farahani, 2011).In particular, governmental as well as non-governmental organizations (humanitarian organizations) all over the world put a lot of effort into helping nations and people to recover from disasters (Taupiac, 2001). These organizations usually provide food, water, blankets, shelters, medicines and other supplies to the affected population (Tomasini & Wassenhove, 2009).

Most of the 11,460 IDPs at Mawingo, Ol'Kalau district in Kenya fled to the neighboring Rift Valley Province in early 2008

during post-election violence that saw up to 660,000 people displaced across the country (Riley, 2015**)**.In this situation, procurement departments of relief organizations were involved in procuring basic supplies for the people to enable them start living in the camps.

Extreme poverty has led to increase in inequalities of income and wealth plaguing most nations (as approximately half the world's population lives on less than 1% of its wealth), extreme poverty and inequality continue to leave whole communities and households in an almost irreversibly devastating state of vulnerability and need (Gelsdorf,2010).Financial and economic crisis has increased. The world economy is now predicted to contract by 1.7%, remittances which accounted for some 2% of the major developing countries' GDP in 2007 have decreased to 1.8% in 2008 and falling by an additional 0.9% in 2010 (Gelsdorf,2010).Private capital flows dropped by some $700 billion compared to previous years and an additional 90 million people being pushed into poverty (Gelsdorf,2010).The financial and economic crisis has lead to unemployment, an increase in poverty, leading to a larger case load in need of humanitarian assistance (Gelsdorf,2010). The humanitarian organizations' procurement sections procure supplies to be distributed to the needy.

Food crisis has contributed to over 1 billion people worldwide, one-sixth of the world population suffering from hunger, over 30 cases of food-related unrest having erupted around the world since 2008, 25,000 children daily suffer from malnutrition, 2 billion people currently suffering from micro-nutrient deficiencies, local food prices in most developing countries being too expensive for hundreds of millions of people, disputes over depleting land resources, and projections that by 2025 food production will not be able to increase by the necessary 50% over current levels to keep up with population growth, the food crisis will continue to threaten lives and livelihoods worldwide (Gelsdorf, 2010).Humanitarian organization must deal with procurement of food to feed the increasing number of people who do not have food to eat.

Change morbidity disease patterns, climate change will fundamentally transform the way humanity approaches global security and livelihood sustainability (Gelsdorf,2010).Health pandemics and the discovery that infectious diseases that have been controlled historically are now demonstrating increased virulence, changing incidence, and shifting vectors of transmission, health pandemics and infectious diseases threaten to further degrade the lives of many Gelsdorf (2010).The 26th outbreak of Ebola and the first to occur in West Africa. It began in Guinea in December 2013 and then spread to Liberia and Sierra Leone (Aylward,2014).The death toll from the Ebola outbreak in three West African countries reached 9,004, according to the World Health Organizations, at least 22,525 people were infected with the deadly virus in Sierra Leone, Liberia and Guinea.The procurement in humanitarian organizations had to be involved in procuring supplies to deal with this outbreak.

Ongoing currency fluctuations, adverse economic conditions, insurance necessities, and price spikes for commodities used in humanitarian operations – such as fuel – may strain budgets. Other risks are now appearing on procurement's radar, including how to cope with commodity price volatility (Martindale, 2013).Supply chains may be very long due to the contracts being used and some items with short life expectancy end up expiring or arriving with very short life span remaining before reaching the beneficiary.

Procurement in the humanitarian sector basically has the same goals and intentions as in private business. As buyers, organizations want the best possible value at a reasonable price (Taupiac, 2001). In addition to that, humanitarian procurement processes try to ensure that organizations have all supplies required to meet the needs to provide adequate disaster relief (PAHO, 2001).

International Committee of the Red Cross

The International Committee of the Red Cross (ICRC) is a humanitarian institution based in Geneva, Switzerland. State parties (signatories) to the four Geneva Conventions of 1949 and their Additional Protocols of 1977 (Protocol I, Protocol II) and 2005 have given the ICRC a mandate to protect victims of international and internal armed conflicts. Such victims include war wounded, prisoners, refugees, civilians, and other non-combatants.The official symbol of the ICRC is the Red Cross on white background (the inverse of the Swiss flag) with the words "comite international geneve" circling the cross.

The International Committee of the Red Cross (ICRC) is an impartial, neutral, and independent organization whose exclusively humanitarian mission is to protect the lives and dignity of victims of war and internal violence and to provide them with assistance." It also directs and coordinates international relief and works to promote and strengthen humanitarian law and universal humanitarian principles.

Statement of the problem

One of the biggest hurdles to overcome in humanitarian relief supply chain is the huge uncertainty in demand and supply as well as the assessment of the needs accompanied by time pressure to supply on time. Hence humanitarian logistics is complex making the procurement field the most expensive part during disaster relief especially with about 80% of total expenditures (Wassenhove, 2006).

The total quantity of purchased relief items is rising, which makes disaster relief procurement important. The main reason for this rise is that humanitarian organizations often prepare for disasters through pre-stocking of critical relief supplies in strategic locations around the world. Although this method increases the ability to respond to a disaster quickly, it also comes with immense costs (Balcik, 2008). During emergencies and disasters, there may be over supply of the relief supplies which may end up wasted once the emergency is over like in the case of Ebola crisis, the protective equipment being used may never need to be used again once the crisis is over.

Standards and norms of the tendering processes may need to be amended as humanitarians are more frequently called to operate in increasingly 'non-traditional' emergencies or more complicated security environments, there may be a need for a new or amended set of standards, rules, codes, and norms to guide these interventions (Gelsdorf, 2010).

Low-value items are products purchased under the value of US$1,000, and are used mostly as supportive items, consumables

or products used in ad-hoc situations. These items are locally available, with a low technical profile and a low financial on the total expenditure. The procurement process for low-value purchases is conducted in 40% of the cases through the opening of a competitive bidding exercise, which adds complexity and effort. The need to conduct a tendering process and evaluation of bids extends the lead times. Although current procurement policies do not require purchasing experts to conduct low-value procurement through competitive bidding, the exercise is undertaken because it has a more detailed traceability and control over payments. However, while these procedures ensure obtaining the best bid, the high resource commitment increases the cost of the transaction, adding a substantial cost to the final cost of the product. On the other hand, innovation to create other methods for conducting low-value procurement is limited. Existing policies and regulations often constrain procurement processes and shape the way operations are to be undertaken (Larroya, 2011).

The concept of the emergency health kit which was brought up by WHO has been adopted by many organizations and national authorities as a reliable, standardized, affordable and quickly available source of the essential medicines and medical devices (renewable and equipment) urgently needed in a disaster situation. These kits are standard and some items in the kits may not be relevant in a particular country or situation or what is really required is in short supply. What is not relevant end up being disposed which is a loss of resources. The study tried to find out the challenges facing the procurement performance in International Committee of the Red Cross –Kenya.

Objectives of the study

To establish the factors influencing procurement performance in International Committee of the Red Cross -Kenya

II. RELATED LITERATURE

Theoretical framework

1. Theory of Internal Control

A system of effective internal control is a critical component of an organization's management and a foundation for its safe and sound operation. A system of strong internal control can help to ensure that the goals and objectives of an organization will be met, that it will achieve long term targets and maintain reliable financial and managerial reporting. Such a system can also help to ensure that the organization will comply with laws and regulations as well as policies, plans, internal rules and procedures, and reduce the risk of unexpected losses and damage to the organization's reputation.

The following presentations of internal control in essence cover the same ground. In USA, the Committee of Sponsoring Organizations of the Tread way Commission (COSO) issued Internal Control - Integrated Framework, 1992, which defined internal control as a process, effected by an entity's board of directors, management and other personnel, designed to provide reasonable assurance regarding the achievement of objectives in the following categories: Effectiveness and efficiency of operations; Reliability of financial reporting; Compliance with applicable laws and regulations. The Rutteman Report in UK defined internal control as the whole system of controls, financial and otherwise, established in order to provide reasonable assurance of effective and efficient operations; internal financial control and compliance with laws and regulations. The theory is relevant to the study because it outlines the internal control policies, procedures and rules to be followed in the procurement department.

2. Agency Theory

Agency theory is a concept that explains why behavior or decisions vary when exhibited by members of a group. Specifically, it describes the relationship between one party called the principal, that delegates work to another called the agent. It explains their differences in behavior or decisions by noting that the two parties often have different goals and, independent of their respective goals, may have different attitudes toward risk. The concept originated from the work of Adolf Augustus Berle and Gardiner Coit Means, who were discussing the issues of the agent and principle as early as 1932. Berle and Means explored the concepts of agency and their applications toward the development of large corporations. They saw how the interests of the directors and managers of a given firm differ from those of the owner of the firm, and used the concepts of agency and principal to explain the origins of those conflicts (Murtishaw & Sathaye, 2006).

Jensen and Meckling shaped the work of Berle and Means in the context of the risk-sharing research popular in the 1960s and '70s to develop agency theory as a formal concept. Jensen and Meckling formed a school of thought arguing that corporations are structured to minimize the costs of getting agents to follow the direction and interests of the principals. The theory essentially acknowledges that different parties involved in a given situation with the same given goal will have different motivations, and that these different motivations can manifest in divergent ways. It states that there will always be partial goal conflict among parties, efficiency is inseparable from effectiveness, and information will always be somewhat asymmetric between principal and agent. The theory has been successfully applied to myriad disciplines including accounting, economics, politics, finance, marketing, and sociology (Nikkinen and Sahlström, 2004).This theory is relevant to the study because all organizations have people who explain their differences in behavior or decisions by noting that the two parties often have different goals and, independent of their respective goals, may have different attitudes toward risk. Sections of organizations interact amongst themselves in exchange of key information and materials.

Empirical framework

Post-disaster reconstruction suffers bottlenecks and challenges due to the inadequacies of resource procurement. In the aftermath of the 2004 Indian Ocean Tsunami, difficulties in acquiring resources compromised donors' efforts in achieving a successful recovery.(Chang ,et al ,2011)

Risks are now appearing on procurement's radar, says Mr. Timmermans, including how to cope with commodity price volatility. "For many of the processing manufacturing industries, the speed with which the commodity prices go up and down is unseen(Gocke,2008).

Training and development is a key challenge for procurement organizations. That includes: skill development; the right recruiting and retention practices; and career paths in other functions outside of procurement (Gocke, 2008).Organization of global sourcing. That is, how to set up and how to manage global sourcing offices. That is also more in terms of processes, a linkage between the global sourcing offices and the headquarters. It's also how the global sourcing offices do work with other non-procurement functions (Gocke**,** 2008).

Cross-function and collaboration about how procurement work with not only engineering and quality management — which has been the nature of the procurement department for a long time already — but also with other functions like sales and marketing when it comes to requirements management? That's also with finance and controlling and with logistics and supply chain management (Gocke, 2008).

Managing spend creep and ensuring cost containment is often a challenging task. For CPOs, they need to have a strong team and capability across the end-to-end sourcing and procurement process to ensure costs are contained. Without a dedicated team to run a quality sourcing event, requirements are often not accurately captured or scrutinized and money is wasted on unnecessarily high-specification products and services. Without a dedicated team at the other end of the source to manage process and supplier adherence to contract, scope creep becomes an issue.

Finally, without the people, processes or technology to measure and track current spend, there is an 'overspend lag,' meaning that by the time anyone notices spend is going over-budget, it is too late (Clinton, 2014). Making the correct decisions regarding the leveraging of technology is crucial to delivering best-practice sourcing and procurement and the CPOs recognize this. The technology that supports procurement has moved on dramatically in recent years with spend analytics, eSourcing, Supplier & Contract Management, eWorkflow, spot buying /tail spend management, savings tracking and budget management, to name but a few. The coupling of these collective technologies with market intelligence and data will drive greater procurement effectiveness, improved processes, better visibility, detailed audit and more accurate tracking of savings. Additionally, the CPOs recognize that technology now needs to be applied holistically, connecting their business to the supply market in a way that enables the professional sourcing process but also creates an environment where the business user can also buy and leverage suppliers in a supported fashion. The challenge faced by the CPO is finding the up-front capital to invest in these technologies and justifying the increased cost required to better enable cost reduction (Clinton, 2014).

Conceptual Framework

Miles and Huberman defined a conceptual framework as a visual or written product, one that "explains, either graphically or in narrative form, the main things to be studied -the key factors, concepts, or variables -and the presumed relationships among them". A variable is a measurable characteristic that assumes different values among subjects.

Independent Variables are changes that occur in an experiment that are directly caused by the experimenter. It can be changed as required, and its values do not represent a problem requiring explanation in an analysis, but are taken simply as given (Dodge, 2003). A dependent variable is a variable dependent on another variable: the independent variable.

A dependent variable is what is measured in the experiment and what is affected during the experiment. The dependent variable responds to the independent variable (Everitt, 2002). Procurement performance is a function of several variables depicted in figure 2.1 below: The variables of the study will comprise one dependent variable (Procurement performance) and four independent variables (information Technology in procurement process, procurement policies, organization structure and Donor funding)

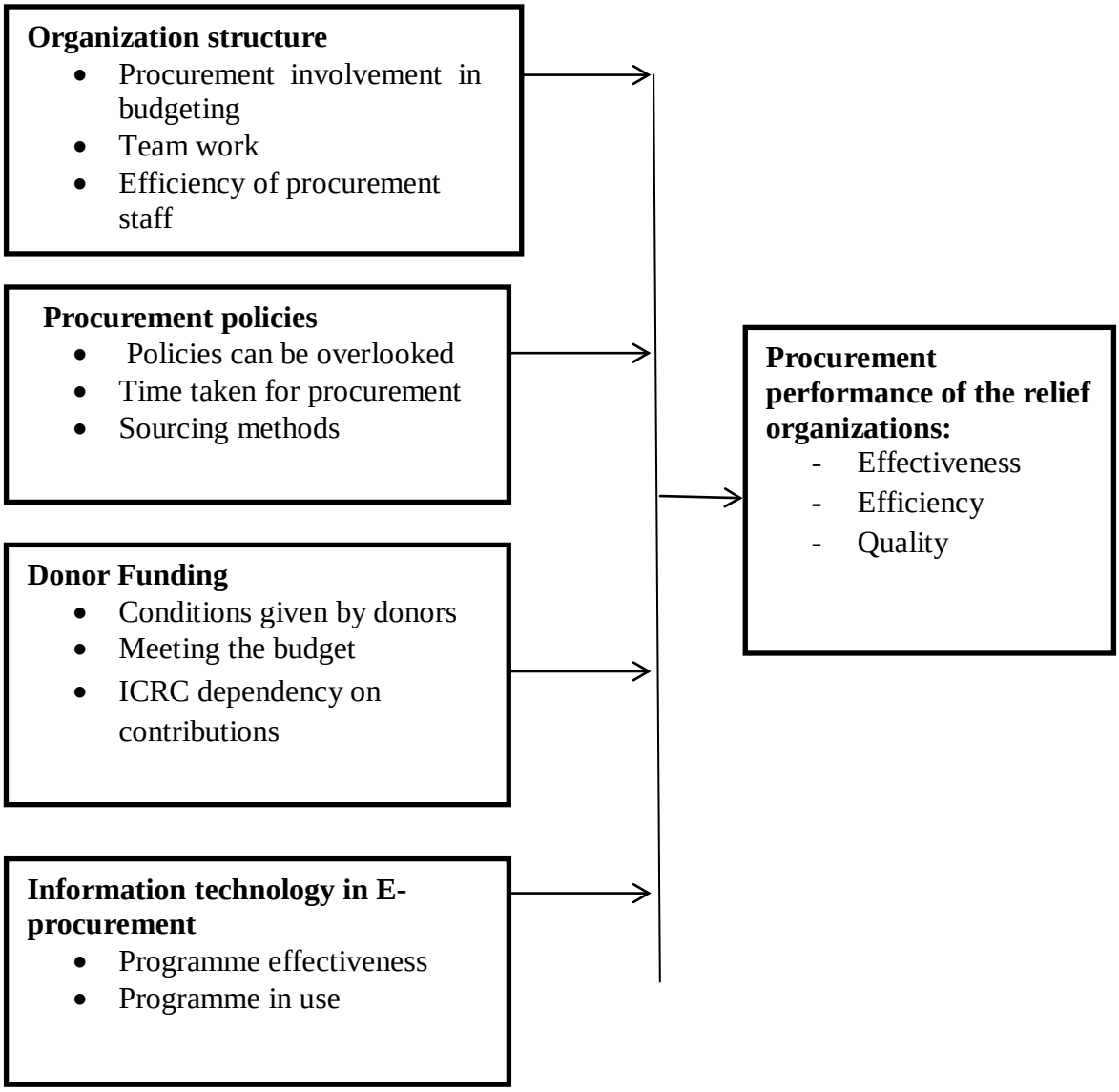

Fig 2.1 Conceptual Framework

III. REVIEW OF VARIABLES

Donor Funding

Most Humanitarian organization receives donations which may come in the form of money or supplies. The supplies donated may not necessarily be what is required at times. The donors may dictate on how the funds are to be used. A situation may arise where particular supplies are required but the funds cannot be used to procure these supplies. This is a big challenge in procurement.

Private funding from individuals, trusts and foundations, and companies and corporations is not only valued for its volume, humanitarian agencies also value the flexibility and reliability of private funds because they come with less earmarking and a longer time frame than funding from institutional or state donors. According to (Herzer & Nunnenkamp 2012), Government grants crowd in private donations in the long run, whereas commercial revenues crowd out donations in the long run. Because of this "crowding out" effect, a government choosing to increase funding to a charity by a given amount may actually increase the charity's revenues by only a fraction of that amount. The same effect can occur in the opposite direction. If a government sees that private donations to a charity have risen, then it may reduce its support of that charity. Additionally, government funding may "crowd in private donations if governments use grants as a signal of the quality of a public good (Heutel, 2009).

Despite its growing importance, there is no systematic reporting of private funds, so it is impossible to gauge accurately

how much there is, or where and how it is spent. Until there is a shared and reliable evidence base it is impossible to accurately measure progress, or to coordinate and target resources effectively. The ability to hold all actors to account are also severely hampered (Stirk, 2014).

The IKEA Foundation is the philanthropic arm of Swedish furniture giant, IKEA. Total donations have increased year on year from €45 million in 2010 to €101 million in 2013, and it is the largest corporate donor to UNICEF, UNHCR and Save the Children.

The foundation's emergency response funding focuses on providing support following natural disasters and in post-Conflict situations provides emergency shelter for refugees and displaced people. (Stirk, 2014).

ICRC is exclusively depending on voluntary contributions albeit from a variety of sources. ICRC's appeal for 2014 amounts to 1.3 billion CHF of which 192 million CHF to headquarter function. For ICRC the funding sources and patterns in 2013 were very similar to previous years; governments provided 84.5% of all resources (plus 7.3% provided by the EU/ECHO), while, National Red Cross and Red Crescent Societies provided 3.4% and private sources accounted for 4.8%. The Top 10 donors alone contributed 77.6% of ICRC funding. This illustrates a heavy reliance on a small number of traditional humanitarian donors. In large-scale disasters, such as the Haiti earthquake in 2010, more than 120 National Societies contributed funds, human resources or goods to the Red Cross Red Crescent response. Existing local capacity through an established National Society enables the Red Cross to play a key role on the ground, and it is often the first and main local responder. According to the IFRC, the Red Cross delivered six times as much relief in response to the 2010 Haiti earthquake than all other agencies combined (Stirk, 2014).

Procurement policies

Procurement is the process of obtaining services, supplies, and equipment in conformance with applicable laws and regulations (USG 1996)—takes place locally, nationally, and internationally among a number of public, private, national, and local entities (Rao, *et al*, 2006).

Relief organizations stockpile ready-to-dispatch inventory in locations with access to disaster prone regions (Balcik & Beamon, 2008). Instantly after a disaster strikes, relief organizations conduct an initial assessment (usually within one day after occurrence).The expected quantity of supplies required to meet the relief needs of the affected population is estimated (Thomas, 2003) as well as pre-positioned supplies, already available at the organizations warehouses, are evaluated. Relief items, which need to be procured from suppliers, are determined (Balcik & Beamon, 2008).

Demand for relief supplies varies in terms of magnitude, criticality and type of required materials and is highly unpredictable (Kovács & Spens, 2007). Supplies are mainly 'pushed' to the disaster area in the response phase, whereas during the reconstruction phase the principle of 'pull' in sourcing is predominately applied. Another key point is, that the customers (receivers of aid) do not generate demand voluntarily and do not intend to 'repurchase'. Thus no 'real demand' is created, as demand is assessed through aid agencies as per Long & Wood. Goods can be acquired differently, like in bulk or vendor stored, until needed (Russell, 2005) and procurement can consider just local or also global suppliers and vice-versa (Blecken, 2010). After a disaster struck, speed at any costs is of utmost importance, as the first 72 hours are crucial for providing relief. Goods are brought into the affected area as quickly as possible. After the first 90 to 100 days, disaster response is delivered more effectively at reasonable cost and speed. Humanitarian organizations start from then on to source relief items locally (Van Wassenhove, 2006).

Another approach of disaster response procurement is purchasing from local and regional suppliers instead of relying on long-distance donations in order to decrease transport costs and accelerate delivery (Nikbakhsh & Farahani, 2011). Nevertheless, local procurement usually faces quality problems and might lead to supply shortages. In addition, local purchasing can generate competition between organizations, which results in high prices for the relief items (PAHO, 2001). International or global procurement is primarily done to access larger quantities, get lower prices and keep consistent quality.

In contrast, delivery times are longer and transportation costs are higher by using global suppliers (Sowinski, 2003). In most cases, humanitarian organizations will have multiple suppliers for each relief effort (Falasca & Zobel, 2011).Humanitarian organizations often purchase relief items from global suppliers through competitive bidding processes (Balcik & Beamon, 2008) in order to provide equal opportunities to all firms interested. However, in cases of huge disasters, when providing goods quickly in large amounts is crucial, tendering techniques are not applied (Taupiac, 2001). In the bidding process, humanitarian organizations first identify potential suppliers, which are able to meet the item and delivery requirements.

The main objective of applying global sourcing is not only to exploit suppliers' competitive advantage, but also to profit from location benefits of different countries and global competition (Kotabe & Helsen, 2009). Global sourcing is characterized by high complexity, as firms have to overcome many barriers (Kotabe, Murray, & Mol, 2008). Murray, Wildt & Kotabe defined local sourcing in contrast is applied, when the sourcing firm and its suppliers are located in the same country. To minimize the cost/agility trade-off, many firms combine global and local sourcing concepts. Procurement policies related to time are closely linked to optimizations of inventory.

These procurement policies can be categorized as following: Stock sourcing, Demand tailored sourcing and just in time, Stock sourcing means, that a company builds up stocks, which contribute to avoid supply risks (Essig, 2000). In contrast, the next concept avoids stockpiling of goods, as demand tailored sourcing means'…both buying to current requirements and the so-called 'hand-to-mouth buying. Only the buyer tries to avoid owning stock' (Essig, 2000). A step-up of demand tailored sourcing is just-in-time. Ansari and Modarress defined this concept as'… a stockless supply through all levels of the supply chain (buyer and supplier)' (Essig, 2000). Just-in-time creates a significant cost reduction and requires close collaboration between the buyer and supplier (e.g. single sourcing) (Essig, 2000).

Tendering procedures in Kenya fall under the Public Procurement and Disposal Act, 2005 that came into operation on 1st January, 2007. The purpose of the Act is to establish procedures for procurement and the disposal of unserviceable, obsolete or surplus stores and equipment by public entities to achieve the following objectives— (a) to maximize economy and efficiency; (b) to promote competition and ensure that competitors are treated fairly; (c) to promote the integrity and fairness of those procedures; (d) to increase transparency and accountability in those procedures; and (e) to increase public confidence in those procedures; (f) to facilitate the promotion of local industry and economic development according to the PPDOA, Chapter 412c (2007).

ICRC has a range of internal cost control and auditing measures which aim to ensure full accountability to donors and stakeholders. Headquarters has direct control over local procurement and enforces tight guidelines.

The principles of procurement in ICRC include adherence to principles of WHO "a model quality assurance system for procurement agencies. Transparency and competitiveness in the procurement process, Quality assured products procured at the best value for money. Adherence to National and international laws (Zweygarth, 2013)

Low value acquisition: Low value items are products purchased under the value of US$1,000 and are used mostly as supportive items, consumables or products used in ad hoc situations These items are locally available, with a low technical profile and a low financial on the total expenditure the procurement process for low value purchases is conducted in 40% of the cases through the opening of a competitive bidding exercise, which adds complexity and effort. The need to conduct a tendering process and evaluation of bids extends the lead times (Larroya, 2011)

Open tender :A bidding process that is open to all qualified bidders and where the sealed bids are opened in public for scrutiny and are chosen on the basis of price and quality. Also called competitive tender or public tender (Lynch, 2013) .ICRC uses this method for procurement.

Restricted tender: Restricted tenders, restricted calls for tenders, or invited tenders are only open to selected prequalified vendors or contractors. This may be a two-stage process, the first stage of which produces a short list of suitable vendors. The reasons for restricted tenders differ in scope and purpose is because there is essentially only one suitable supplier of the services or product. There are confidentiality issues such as military contracts which involve procurement based on quotes being sought directly from one or more suppliers can be undertaken for any procurement under the relevant thresholds where it represents value for money. The value and reasons for the direct source must be documented. This method may be used where there is a need to weed out tenderers who do not have the financial or technical capabilities to fulfill the requirements (Lynch, 2013).

Information Technology in E-procurement

Davila, Gupta and Palmer (2003) define E-procurement as'… the use of electronic methods in every stage of the purchasing process from identification of requirements through payment and potentially to contract management (Aini & Hasmiah, 2011). Moreover, Anonymous (2001) describes e-sourcing as the process of using web based technologies to support the identification, evaluation, negotiation and configuration of products, suppliers and services into a supply chain network that can efficiently respond to changing market demands(Anonymous, 2001). (Berger & Garyfalakisfine, 2013) define e-procurement, as any purchase process, which is supported by the use of internet and electronic technologies, including all stages ranging from the supplier identification until delivery.

As the procurement function of many organizations is becoming more strategic, procurement technology allows for a process re-design that makes the procurement process open with improved accountability, transparency and reporting capabilities; thereby speeding up the procurement cycle and providing greater access to more opportunities for suppliers (Charles,2008).Procurement technology helps organizations accelerate procurement processes by integrating suppliers and inventory management in order to improve on stock level performance (CIPS, 2008).

The electronic reverse auctions (eRA) are an e sourcing method of competitive bidding between multiple qualified suppliers competing against each other in order to win a contract by a buying organization as opposed to the classical auction, where the product being sold is sold to the company/person who pays the highest price, here we deal with the buyer that wants to buy the product or the service with the lowest price from different suppliers. During the recent years buyers from public sector organizations and private sector businesses are increasingly adopting electronic reverse auction as a procurement tool to achieve greater savings as compared to traditional sourcing methods. But researchers reveal that these saving benefits for buyers come in expense of the suppliers, which may affect buyer-supplier relationship and which might yield in low or no participation from the good suppliers Memeti (2011).

Implementation of technology aides the procurement processes and supports the overall strategy of an organization. Technology can also increase supplier access to bid opportunities which can result in increased competition, diversity and inclusion of suppliers. Technologies that are currently available and applicable to procurement processes include: E-commerce; more specifically, e-sourcing, e-procurement, e-purchasing, e-tender, electronic payment solutions; Knowledge portals/supplier databases; E-invoicing/e-payables and ERP (Enterprise Resource Planning) systems. Benefits of technology in procurement include; reduction of time and costs associated with the procurement process; Collaboration with suppliers that can improve performance, product and costs. Other benefits of technology include accurate and instant information flows to provide information on the organization's total expenditure, suppliers, and inventory that can be retrieved and analyzed to improve procurement decisions. This helps to reduce stock levels, create savings, and further improve communication with the suppliers who will no longer have to rely solely on forecasts. Technology in procurement improves management of existing contracts, suppliers, and improved work flow e.g. approval and release of orders, etc. in real time. The use of technology can increase potential suppliers' knowledge of, and access to open solicitations, thereby increasing competition, diversity, and

inclusion. In terms of transparency, technology allows greater access to the procurement processes for procurement professionals, suppliers, and the public, thereby increasing transparency in tendering methods. It also contributes to improved information flow and data collection resulting in improved auditing capability (CIPS, 2008).

Going by the various benefits of technology applications in procurement processes, and Enterprise Resource Planning (ERP) system, the procurement processes are initiated and completed online, including payments. Process efficiency and administration costs are reduced. This therefore is a great achievement, bearing in mind that procurement records management is a great challenge to many public procurement entities. The study sought to examine the effects of technology applications by ICRC procurement department.

Organization structure

The governing bodies of the ICRC, comprising the Assembly, the Assembly Council and the Presidency, have overall responsibility for ICRC policy, strategy and decisions related to the development of IHL. These bodies oversee all the activities of the organization, including field and headquarters operations and the approval of objectives and budgets. They also monitor implementation by the Directorate of Assembly or Assembly Council decisions and are assisted in this task by a Control Commission and the internal and external auditors (ICRC, 2013).

The ICRC has a president and a vice-president. The president, who bears primary responsibility for the ICRC's external relations, represents the ICRC on the international scene and, in close cooperation with the directorate general, handles the ICRC's humanitarian diplomacy. At the internal level, he attends to the cohesion, smooth running and development of the organization (ICRC, 2013).

The Directorate is the executive body of the ICRC, responsible for applying and ensuring application of the general objectives and institutional strategy defined by the Assembly or the Assembly Council. The Directorate is also responsible for the smooth running of the ICRC and for the efficiency of its staff as a whole (ICRC, 2013).

The Assembly is the supreme governing body of the ICRC. It nominates the directors and the head of Internal Audit. Composed of between 15 and 25 co-opted members of Swiss nationality, the Assembly is collegial in character. Its President and Vice-President are the President and Vice-President of the ICRC (ICRC, 2013).

The Assembly Council is a subsidiary body of the Assembly. It prepares the Assembly's activities and takes decisions on matters within its competence, in particular strategic options relating to general policy on funding, personnel and communication. It serves as a link between the Directorate and the Assembly, to which it reports regularly. Composed of five members elected by the Assembly, it is chaired by the president of the ICRC (ICRC, 2013).

In Kenya the mission is headed by head of delegation. There are a total of 370 staffs in Kenya office. There is an administrative section and logistic section which has a head. The procurement is carried out in Nairobi office department which falls under logistics department and it is divided into 4 sections namely;-Medical, administration, water and sanitation and relief supply goods which include food. The Nairobi office which has 150 staffs working in the logistics and administration office headed by the section chief.

Procurement performance

Smith and Conway identified seven key success factors which influence procurement, namely; a clear procurement strategy, effective management information and control systems, development of expertise, a role in corporate management, an entrepreneurial and proactive approach, co-ordination and focused efforts. An eighth is fundamental; communicate the key success factors to all levels of the organization and set out a procurement strategy to achieve continuous improvement in value for money. This should be based on total cost, quality, and enhancement of competitiveness of suppliers using best procurement practice.

Supplier performance has an impact on procurement performance. According to Leenders and Fearon (2002), decisions to buy instead of make to improve quality, lower inventories, integrate supplier and buyer systems and create co-operative relations underline need for good supplier performance. Recent trends are to have fewer suppliers; long-term contracts, e-procurement and continuing improvement in quality, price, and service require closer co-ordination and communication between key procurement partners. Supplier switching for lower prices may not result in the best long-term value. Sharing information and assisting suppliers to improve performance is a necessity for world-class performance.

There is need to have coherent methods of performance in the procurement function in PEs. Lardenoije, van Raaij and van Weele (2005) asserted that basing on financial performance and neglecting non-financial performance cannot improve the procurement operations because only partial performance is considered. Realization of procurement goals is influenced by internal and external forces. Interactions between various elements; professionalism, staffing levels and budget resources, procurement organizational structure, regulations, rules, and guidance, and internal control policies, all need attention and influence procurement performance.

IV. METHODOLOGY

Research Design

Research design has to do with the blueprint for the collection, measurement and analysis of data (Cooper & Schindler, 2006). This study used descriptive research design. According to Mugenda and Mugenda (2006) a descriptive research is a process of collecting data in order to answer questions concerning the current status of the subjects in the study. The purpose of a descriptive research is to determine and report the way things are done. Descriptive research is used to obtain information concerning the current status of the phenomena to describe what exists with respect to variables or conditions in a situation. The methods involve a range of activities: from the survey which describes the status quo to the regression study which investigates the relationship between variables. The primary use of descriptive statistics is to describe

information or data through the use of numbers (create number of pictures of the information).

Study Population

The population of interest in the study was the employees of ICRC-Kenya with an estimated population of 150 employees. It is from these that the employees of the procurement department were sampled.

Data Analysis and Presentation

Upon collection of the data from the selected members of the target population using questionnaires, the questionnaires were cleaned, coded and edited for accuracy, completeness and uniformity. Quantification of Likert scale categories has been done by assigning numerical values to the various categories in order to facilitate statistical representation of data. The data was analyzed using SPSS version 21 using frequency and percentage tables and it is from those the recommendations were derived. The following mean range was used to arrive at the mean of individual indicators and interpretation.

Mean Range	Response Mode	Interpretation
4.21 - 5.00	Strongly Agree	Very satisfactory
3.41 - 4.20	Agree	Satisfactory
2.61 - 3.40	Not Sure	Unable to tell
1.81 - 2.60	Disagree	Poor
1.00 - 1.80	Strongly Disagree	Very Poor

A multivariate regression model was used to link the independent variables to the dependent variable as follows;

$$\mathbf{Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \mu}$$

Where; Y = Procurement performance measurement

X_1 = Organization structure

X_2 = Procurement policies

X_3= Donor Funding

X_4 = Information technology in procurement

In the model, $\beta 0$ = the constant term while the coefficient β_i, i= 1….4 was used to measure the sensitivity of the dependent variable (Y) to unit changes in the predictor variables. μ represents the error term which captures the unexplained variations in the model.

V. RESEARCH FINDINGS AND DISCUSSION

Descriptive Analysis

Organization structure and procurement performance at International Committee of the Red Cross –Kenya

The first issue of concern in this study was to explore the effects of organization structure on procurement performance at the International Committee of the Red Cross –Kenya. To explore this, four issues were evaluated using a 5 point likert scale. It was established here that majority of the participants strongly felt that the procurement department played a critical role in the company and as such was held in high esteem in the company hierarchy (mean=4.50). Regarding involvement of the procurement section during budgeting by the management, the general feeling was that the organization was involving the procurement department considerably towards that end as confirmed by the level of satisfaction of participants regarding this (mean=3.83). As for the involvement of staff in decision making (mean=2.82) and the team work in the organization aimed at ensuring efficiency in the procurement process (mean=2.64), the participants were not able to authoritatively confirm or deny the existence of the mentioned issues at the organization. This is shown in table 4.3 below.

Table 4.3 Perceptions regarding the effects of organization structure on procurement performance at ICRC-Kenya

Indicators	Mean	Std. Deviation	Response Mode	Interpretation
Procurement department is recognized in the organization	4.5	0.68	Strongly Agree	Very True
Staff involved in decision making	2.82	1.00	Not Sure	Not Sure
Management involve the procurement section during budgeting	3.83	0.75	Agree	True
Organization works as a team towards ensuring efficiency in the procurement processes	2.64	0.9	Not Sure	Not Sure

Procurement policies and procurement performance at the International committee of the Red Cross-Kenya

The perception of the participants regarding the procurement policies at ICRC-Kenya is largely that procurement process at the organization's procurement department are a barrier to service delivery in the organization (mean=3.95). It was also the general feeling among the participants that these procurement policies are inefficient in solving procurement challenges in the organization (mean=3.48). On the other hand, it was not clear whether or not these procurement policies were tedious and unnecessary (mean=3.13) or if they are rigid as to inhibit service delivery in the organization (mean=2.63) as is shown in table 4.4 below.

Table 4.4 Interpretation of staff perception of the procurement policies and its corresponding effect on service delivery at ICRC-Kenya

Indicators	Mean	Std. Deviation	Response Mode	Interpretation
Procurement process tedious and unnecessary	3.13	1.04	Not sure	Not Sure
Procurement processes a barrier to service delivery	3.95	0.6	Agree	True
Procurement processes are rigid	2.63	0.87	Not sure	Not Sure
Procurement processes are inefficient in solving procurement challenges in the organization	3.48	0.88	Agree	True

Donor funding and procurement performance at the International Committee of the Red Cross-Kenya

In order to evaluate the effects of donor funding on the procurement performance in the procurement department at the International Committee of the Red Cross-Kenya, participants opinion regarding adequacy of humanitarian supplies in the light of donor funding, the proportion of donor support with regards to the budget, whether or not funding comes from private donors and the government and finally whether or not restrictions exists in the usage of donor funds in the organization. Among the interviewed staff, there was a strong feeling that donor funding for the humanitarian supplies is adequate (mean=4.33) as well as that funding comes from private donors and the government for the organization (mean=4.65). Most of the participants were also of the opinion, though they did not feel strongly about it, that restrictions exists in the usage of donor funding (mean=4.00). When asked whether or not the donor catered fully for the budget, the participants were not very sure (mean=3.00) probably confirming the earlier finding among the participants that funding for the organization comes from private donors and the government. This is shown in table 4.5 below.

Table 4.5 Participant's perception regarding donor funding with respect to procurement performance at ICRC-Kenya

Indicators	Mean	Std. Deviation	Response Mode	Interpretation
Donor funding for the humanitarian supplies is adequate	4.33	0.47	Strongly Agree	Very True
Budget fully catered for by the donor funding	3.00	1.28	Not Sure	Not Sure
Funding comes from private donors and the government	4.65	0.58	Strongly Agree	Very True
Restrictions exists in the usage of donor funds	4.00	0.91	Agree	True

Application of information technology on procurement performance at the International Committee of the Red Cross-Kenya

This was the last question that the research study sought to establish. Here, it was established that majority of the participants were satisfied with the organization's investment in Information Technology (mean=3.45) and the impact of procurement programme on ordering and follow up time (4.13). As for the assistance of procurement programme to the procurement process and the impact of procurement programme on operation costs, the study established that most participants were not able to give an absolute response regarding whether or not they agreed with the state of affairs in the organization as confirmed by a mean response rating of 3.33 and 3.18 respectively. The mean response rating of the 4 variables is as shown in table 4.6 below.

Table 4.6 Perception of participants regarding the effects of information technology on procurement performance at ICRC-Kenya

Indicators	Mean	Std. Deviation	Response Mode	Interpretation
Organization's investment in Information Technology	3.45	0.99	Agree	Satisfactory
Procurement programme assistance in the procurement process	3.33	0.83	Not sure	Not Clear
Impact of procurement programme on ordering and follow up time	4.13	0.82	Agree	Satisfactory
Impact of procurement programme on operation costs	3.18	0.87	Not sure	Not Clear

Regression Analysis

Multiple regression analysis was then carried out to test the research objectives with the model equation being $Y = \beta_1 X_1 + \beta_2 X_2 + \ldots + \beta_n X_n + \varepsilon$. As is shown in table 4.7 below, 72.1% of the variations in the dependent variable were explained by the independent variable as measured by the goodness of fit (R-square). The model summary table 4.7 provides the R, R2, adjusted R2, and the standard error of the estimate, which can be used to determine how well a regression model, fits the data. From the table, R squared is the fraction of the variation in dependent variable (Procurement Performance at ICRC-Kenya) that can be accounted for by independent variables.

Table 4.7 Overall Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.849(a)	.720	.688	.27951

a. Predictors: (Constant), Information Technology, Procurement Policies, Donor Funding, Organization Structure

To test the fitness of the model in estimating the effects of the independent variables on the procurement performance at ICRC-Kenya, two way ANOVA was carried out where the statistics (F(4)=22.531, p-value=0.000) was realized as is shown in table 4.8 below: implying that the model was significantly fit to be used in predicting the effects of independent variables on procurement performance of ICRC-Kenya.

Table 4.8 ANOVA (b)

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	7.041	4	1.760	22.531	.000(a)
	Residual	2.734	35	.078		
	Total	9.775	39			

a. Predictors: (Constant), Information Technology, Procurement Policies, Donor Funding, Organization Structure
b. Dependent Variable: Procurement Performance

The model revealed that there the independent variables namely; organization structure, donor funding, procurement policies and information technology as in the case of e-procurement, had significant effects on procurement performance

at ICRC-Kenya. This was established from the significant results noted at 5% level of significance the use of information technology such as that of e-procurement (p=0.000). As for the organization structure (p=0.071), procurement policies (p=0.899) and donor funding (p=0.267) the findings were not significant. Further to this, it was established as is shown in table 4.9 below that if all the other factors were held constant, there would be a reduction in the procurement performance that would be achieved by ICRC-Kenya. For a change towards the use of information technology, the procurement department would experience an improvement by 0.184 units as shown in table 4.9 below.

Table 4.9 Coefficients (a)

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta	B	Std. Error
1	(Constant)	-.904	.274		-3.295	.002
	Organization Structure	.416	.223	.673	1.863	.071
	Procurement Policies	-.029	.228	-.046	-.128	.899
	Donor Funding	.081	.071	.133	1.128	.267
	Information Technology	.184	.039	.431	4.694	.000

a. Dependent Variable: Procurement Performance

Correlation Analysis

The association among the variables used in the study was examined using the correlation analysis whose results are presented in table 4.10 below. Correlation coefficient is a measure of linear association between two variables. Values of the correlation coefficient are always between -1 and +1. A correlation coefficient of +1indicates that two variables are perfectly related in a positive linear sense; a correlation coefficient of -1 indicates that two variables are perfectly related in a negative linear sense, and a correlation coefficient of 0 indicates that there is no linear relationship between the two variables.

In this study, organization structure was established to be strongly correlated with procurement policies (r=0.968) as well as donor funding (r=0.625) but negatively correlated with information technology (r=0.006) in a relationship which was also established to be weak. All these relationships except between organization structure and information technology were significant at 5% level of significant. As for procurement policies, between it and donor funding, a strong positive and significant correlation was noted (r=0.611) as shown in table 4.10 below.

Table 4.10 Correlation Analysis

Independent Variables		**Organization Structure**	**Procurement Policies**	**Donor Funding**	**Information Technology**
Organization Structure	Pearson Correlation	1	.968(**)	.625(**)	-0.006
	Sig. (2-tailed)		0	0	0.971
	N		40	40	40
Procurement Policies	Pearson Correlation		1	.611(**)	-0.004
	Sig. (2-tailed)			0	0.981
	N			40	40
Donor Funding	Pearson Correlation			1	0.173
	Sig. (2-tailed)				0.286
	N				40
Information Technology	Pearson Correlation				1
	Sig. (2-tailed)				
	N				40

**** Correlation is significant at the 0.01 level (2-tailed).**

VI. SUMMARY, CONCLUSION AND RECOMMENDATIONS

Summary

Organization structure and procurement performance at International Committee of the Red Cross –Kenya

Even though there was no direct significant relationship noted between organization structure and performance of the procurement department at ICRC-Kenya (p=0.071) at 5% level of significance or information technology which was established to be strongly correlated with procurement performance in the organization, there is a strong feeling of satisfaction among the employees in the department that procurement department played a critical role in the company and as such was held in high esteem in the company hierarchy (mean=4.50) as well as the role of procurement section in the budget making process by the management, the general feeling is that the organization involves the procurement department considerably towards that end (mean=3.83). As for the involvement of staff in decision making (mean=2.82) and the team work in the organization aimed at ensuring efficiency in the procurement process (mean=2.64), there are mixed feelings by the staff.

Procurement policies and procurement processes at the International committee of the Red Cross-Kenya

The perception of the participants regarding the procurement policies and procurement processes at ICRC-Kenya was largely that procurement policies at the organization's procurement department are a barrier to service delivery in the organization (mean=3.95) and that also that these procurement policies are inefficient in solving procurement challenges in the organization (mean=3.48). On the other hand, it was not clear what the general feeling regarding whether or not these procurement policies were tedious and unnecessary (mean=3.13) or if they are rigid as to inhibit service delivery in the organization (mean=2.63). This was despite the lack of notable significant evidence for the association between procurement policies and performance of the procurement department in the organization.

Donor funding and procurement performance at the International Committee of the Red Cross-Kenya

As for the effects of donor funding on the procurement performance in the procurement department at the International Committee of the Red Cross-Kenya, humanitarian supplies is very satisfactorily adequate (mean=4.33). The same for sources of funding which is mainly from private donors and the government (mean=4.65). A lot of restrictions also does exist in the usage of donor funding (mean=4.00) to the ICRC-Kenya. There is however mixed feeling regarding whether or not the donor catered fully for the budget (mean=3.00). This was despite the lack of evidence to support the relationship between donor funding and the performance of the procurement department.

Application of information technology on procurement performance at the International Committee of the Red Cross-Kenya

A significant association between application of information technology and performance at the procurement department was note at p=0.000. No other variable was found to be strongly correlated with information technology among the variables under study. Also noted was that majority of the employees at ICRC-Kenya procurement department are satisfied with the organization's investment in information technology (mean=3.45) and the impact of procurement programme on ordering and follow up time (4.13) but not with the assistance the procurement programme and its effect on operation costs, there is no clear cut understanding based on the responses given as to show whether or not the employees in this organization agreed with the state of affairs in the organization.

Conclusion

Of all the variables under study namely; organization structure of humanitarian organizations, procurement policies donor funding and investment and application of information technology in procurement processes at the organization, it is only application of information technology that significantly affects procurement performance at ICRC-Kenya. Procurement policies are a hindrance to service delivery

Limitation

Humanitarian organizations are very sensitive in matters of data confidentiality (Oloruntoba & Gray, 2006),(Burger& Owens, 2010) hence, gathering data besides the officially published material was difficult in the humanitarian aid sector. The staff completed the questioners after being explained to the research could assist the organization improve their performance. There was limited literature on procurement in humanitarian organizations. Data collection was challenging owing to the fact that travelling was involved to another town to administer the questionnaires which required time and money. One of the staff volunteered to collect the questioner once completed and sent them to the researcher.

Recommendation

The study recommends the following:

1. Procurement policies in humanitarian organizations should be streamlined by the policy makers in such organizations to ensure that they do not inhibit delivery of critical services.
2. Humanitarians organizations should invest in information technology especially e-procurement in their procurement departments to ensure that the procurement process are made more efficient towards aiding service delivery in such organization without necessarily compromising the integrity of any procurement process.

Suggestions for further study

Further study to unveil the nature of effects of information technology on procurement processes and how the challenges posed by the same can be overcome.

There is also need to find out how much wastage occurs in humanitarian organization in situations of items expiring or not being needed anymore once the disaster is over

REFERENCES

[1] ah, K. (2011). E-procurement implementation: A case of Malaysia government. Transforming Government: People, Process and Policy, 5 (4),330-344.

[2] Akhtar, P., Marr, N. E. & Garnevska, E. V (2012). Coordination in humanitarian relief chains: chain coordinators. Journal of Humanitarian Logistics and SupplyChain Management, 2 (1), 85-103.

[3] Alyward. B. (2014). Ebola Slowing in Liberia, W.H.O. Says, but International Support Is Still Necessary. New York Times.

[4] Anonymous (2001). Strategic E-sourcing could save business $1.7 trillion. Direct Marketing,64(2), 18.

[5] Balcik, B., Beamon, B. M. (2008). Facility location in humanitarian relief.International Journal of Logistics: Research and Applications. Vol. 11, No. 2,

[6] Balcik, B., Beamon, B., Krejci, C., Muramatsu, K. & Ramirez, M. (2010).Coordinationin humanitarian relief chains: practices, challenges and opportunities. International Journal of Production Economics, 126 (1), 22-34.

[7] Berger. K., Garyfalakis. E. (2013). Procurement policies in disaster relief - Analysis of sourcing practices applied by humanitarian organizations in the field of disaster response, Jönköping

[8] Blecken, A. (2010). Supply chain process modeling for humanitarian organizations. International Journal of Physical Distribution & Logistics Management, 40(8), 675-92

[9] Brauman. R. (2006). Global Media and the Myths of Humanitarian Relief: The Case of the 2004 Tsunami. Medicin san frontiers papers

[10] Burger, R. & Owens, T. (2010).Promoting Transparency in the NGO Sector: Examining the Availability and Reliability of Self-Reported Data.World Development, 38 (9), 1263-1277.

[11] Charles.D.(2008). Procurement technology success secrets;Retrieved from http;//www next level purchasing articles.com/procurement technology html.

[12] Clinton.N.(2014).The top 5 challenges for the Chief Procurement Officer: http://spendmatters.com/uk/.

[13] Davila, A., Gupta, M., & Palmer, R. (2003). "Moving Procurement Systems to the Internet: The Adoption and Use of E-Procurement Technology Models. "European Management Journal, 21(1): 11-23.

[14] Essig, M. (2000). Purchasing consortia as symbiotic relationships: developing the concept of "consortium sourcing. European journal of purchasing and supply management, 6 (1), 13-22.

[15] European Union (2007).EU Rules and Procedures Applicable to Property, Supply, Works, and Service Contracts awarded within the Framework of Humanitarian Actions Financed by the European Communities. Brussels: European Commission.

[16] Everitt, B. S. (2002). The Cambridge Dictionary of Statistics (2nd Ed.). Cambridge UP.

[17] Falasca, M. & Zobel, C. W. (2011).A two-stage procurement model for humanitarian relief supply chains. Journal of Humanitarian Logistics and Supply Chain Management, 1 (2), 151-169.

[18] Gattiker, T. F., & Carter, C. R. 2010.Understanding project champions' ability to gain intra-organizational commitment for environmental projects. Journal of Operations Management, 28(1): 72-85.

[19] Gelsdorf. K. (2010). Global Challenges and their Impact on International Humanitarian Action: OCHA Occasional Policy Briefing Series – No. 1

[20] Gläser, J. & Laudel, G. (2010). Expert in interviews and qualitative Analysis (4thed.). Wiesbaden: GWV Fachverlage GmbH.

[21] Gocke. A. (2008). Procurement — Challenges Facing Procurement Organizations: Interview.

[22] Gronhaug, P. G. (2005). Research Methods for Business Studies: A Practical Guide (3rd ed.). Prentice Hall

[23] Herzer. D. Nunnenkamp. P. (2012).Activities and Fundraising: Co-integration and Causality for NGOs in International Development Kiel Working Paper No. 1769

[24] Heutel. G. (2009) Crowding Out and Crowding In of Private Donations and Government Grants, NBER Working Paper No. 15004. May 2009. JEL. No. H4, L31.

[25] Kariuki. N. E (2010) Procurement performance measurement in commercial banks in Kenya. Project school of business studies University Of Nairobi.

[26] Kotabe, M. & Helsen, K. (2009).The SAGE Handbook of International Marketing. London: SAGE Publications Ltd.

[27] Kotabe, M., Murray, J. Y. & Mol, M. J. (2008). Research in Global strategic management. Emerald Group Publishing Limited, 14, 259 – 277.

[28] Kovács, G. & Spens, K. M. (2007).Humanitarian logistics in disaster relief operations. International Journal of Physical Distribution Logistics Management, 37, 99-114.

[29] Lardenoije, E. J., Van Raaij, E. M., & Van Weele, A. J. (2005).Performance Management Models and Purchasing:Relevance Still Lost. Researches in Purchasing and Supply Management, the 14th IPSERA Conference, (pp. 687-97). Archamps.

[30] Larroya. H. C (2011). Low value procurement in humanitarian organizations UNICEF and Department of Industrial Management and Logistics, Engineering Logistics, Lund University, Lund, Sweden.

[31] Leenders, M., Fearon, H., Flynn, A., and Johnson, P. (2002), Purchasing and supply management, McGraw-Hill Irwin, Chicago, IL.

[32] Lynch, J. (2013). Public Procurement and Contract Administration: A Brief Introduction.Lean pub.

[33] Martindale.N.(2013).Top 5 challenges facing purchasing. Published in Sunday Times

[34] Memeti. E. Electronic reverse auctions: factors of success; Research paper Department of Informatics: University of Neuchâtel.

[35] Mugenda, M.(2003). Research Methods, Quantitative and Qualitative Approaches. Nairobi: Acts Press.

[36] Murray, J. Y., Wildt, A. R. & Kotabe, M. (1995). Global sourcing strategies of U.S subsidiaries of foreign multinationals. Management International review, 35(4), 307 – 324.

[37] Murtishaw, S. & Sathaye, J. (2006). Quantifying the Effect of the Principal-Agent

[38] Nikbakhsh, E. & Farahani, R. Z. (2011). Logistics Operations and Management. London: Elsevier.

[39] Nikkinen, J. and Sahlström, P.(2004).Does agency theory provide a general framework

[40] Oloruntoba, R. & Gray, R.(2006),"Humanitarian aid: an agile supply chain?", International Journal of Supply Chain Management, vol. 11, no. 2, pp. 115-120

[41] Pan American Health Organization and World Health Organization (2001).Humanitarian Supply Chain and Logistics in the Health Sector.Washington: PAHO.

[42] Rao, Raja, Peter M, David S. (2006). Procurement Strategies for Health Commodities: USAID, Arlington, Va

[43] Riley. J. (2015) Humanitarian news and analysis Irin

[44] Russell, T. E. (2005). The Humanitarian Relief Supply Chain: Analysis of the 2004South East Asia Earthquake and Tsunami. United States: Massachusetts Institute of Technology.

[45] Sekaran, U. (2005). Research Methods for Business, a Skill Building Approach (4 ed.).

[46] Shen, Y. (2004). Strategic sourcing for short lifecycle products (dissertation)

[47] Shields, Patricia & Rangarjan, N. 2013. A Playbook for Research Methods: Integrating Conceptual Frameworks and Project Management. Stillwater, OK: New Forums Press.

[48] Sowinski, L. L. (2003). The lean, mean supply chain and its human counterpart.World Trade, 16 (6), 18-20.

[49] Stirk .C.(2014).Humanitarian Assistance from Non-State Donors:The Electrical Journal, Volume 58. 1907 Pg 826

[50] Taupiac, C. (2001). Humanitarian and development procurement: a vast and growing market. International Trade Forum, 4, 7-10.

[51] Thomas, A. (2003). Why logistics?Forced Migration Review. 18, 1-4.

[52] Thomas, A. S. &Kopczak, L. R. (2005).From Logistics to Supply Chain Management:The Path Forward in the Humanitarian Sector. Fritz Institute. San Francisco.CA, 2005.

[53] Thomas, A. (2004). Leveraging private expertise for humanitarian supply chains.Forced Migration Review (Oxford, UK) 21, 144–122

[54] Tomasini, R. & Van Wassenhove, L. N. (2009).Humanitarian Logistics.Palgrave Macmillan. Basingstoke, Hampshire. 2009.

[55] Tomasini, R.M. & Van Wassenhove, L. N. (2004). Pan-American health organization's humanitarian supply management system: de-politicization of the humanitarian supply chain by creating accountability. Journal of Public Procurement, 4 (3), 49-437.

[56] Treleven, M. & Schweikhart, S. B. (1988). A risk benefit analysis of sourcing strategies: single vs. multiple sourcing. Journal of operations management, 7(4), 93 –114.

[57] Turner, M. & Houston, P. (2009). Going Green? Start with sourcing. Supply Chain Management Review, 13 (2), 1-8.

[58] Van Wassenhove, L. N. (2006). Humanitarian aid logistics: supply chain management

[59] Weele, Arjan J. van (2010).Purchasing and Supply Chain Management: Analysis, Strategy, Planning and Practice (5th ed. ed.). Andover: Engage Learning. ISBN 978-1-4080-1896-5

[60] Williamson, K. (2002). Research methods for students, academics and professionals:information management and systems (2nd ed.). Wagga Wagga: Centre for Information Studies, Charles Sturt University.

[61] Zweygarth, M.(2013) Procurement policies and requirements: JOINT UNICEF, UNFPA & WHO meeting with manufacturers, Copenhagen

[62] Yan Chang. Y, Wilkinson. S, Potangaroa. R, Seville. E:Donor-driven resource procurement for post-disaster reconstruction: Constraints and actions:Habitat International Volume 35, Issue 2, April 2011, Pages 199–205

[63] Yin, R. K. (2003). Case study research: Design and methods (3rd ed., Vol. 5). Thousand Oaks, CA: Sage.

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Strategic Role of Distribution as a Source of Competitive Advantage in Fast-Moving Consumer Goods in Kenya

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Abstract- Developing successful strategy in distribution in today's fierce competitive environment is a complex undertaking. The general objective of the study is to establish the strategic role of distribution as a source of competitive advantage by fast-moving consumer goods firm in kenya. Specifically, the study addressed the following objectives:To establish the extent to which indirect distribution adopted by Fast-Moving Consumer Goods in Kenya can be source of competitive advantage.To establish the extent to which direct distribution adopted by Fast-Moving Consumer Goods in Kenya can be source of competitive advantage and To establish the extent to which Intense distribution adopted by Fast-Moving Consumer Goods in Kenya can be source of competitive advantage. This research adopted a descriptive research design. The researcher used a questionnaire as the primary data collection instrument. A pilot test was conducted to detect weakness in design and instrumentation and to provide proxy data for selection of a probability sample. The findings indicate that 85.7% of the responses were of the opinion that the strategies used ensured availability of the products to the intended customers while 14.3% were of the opinion that the strategies used did not ensure availability of the products to the intended customers. The study findings revealed that most of the respondents were of the opinion that Intensive distribution ensures customer convenience products as a source of competitive advantage. As regards the extent to which intensive distribution affected competitive advantage; majority were of the opinion of moderate. The findings revealed that most of the respondents were of the opinion that the organization moderately learned rapidly and adjust their distribution strategy in order to achieve competitive advantageThe study concluded that the company used most direct distribution strategy than indirect and intensive distribution strategies. This could be because of its advantages such as customers appreciate the opportunity to give profits directly to producers and artists. The usage of direct distribution strategy by the organization has resulted in gaining competitive by the company. The study recommended that the company should ensure direct distribution as a source of competitive advantage in that direct distribution channel cannot compete with the geographical reach and business volume of the distribution channel that includes major wholesalers and retailers.

Index Terms- Competitive Advantage, Distribution Strategy, Distribution Channels

I. INTRODUCTION

Distribution is one of the four aspects of marketing. A distributor is the middleman between the manufacturer and retailer. After a product is manufactured, it may be warehoused or shipped to the next echelon in the supply chain, typically either a distributor, retailer or consumer. Frequently there may be a chain of intermediaries; each passing the product down the chain to the next organization, before it finally reaches the consumer or end-user. This process is known as the 'distribution chain' or the 'channel.' Each of the elements in these chains will have their own specific needs, which the producer must take into account, along with those of the all important end-user (Kotler 2003).

Developing successful strategy in distribution in today's fierce competitive environment is a complex undertaking. Market globalization and deregulation has intensified competitive rivalry and motivated manufacturers to re-examine their current strategies and inherent weakness of these strategies and their inability to address current challenges and opportunities (Stem et al. 2006). As the key channel member in direct contact with the consumer end-user, the retailer's actions are also critical to the success of the marketing channel. If they are successfully to program their operations for high yield performance and if other channel members are going to play-significant roles in working with the retailers to make the distribution of their products and services more effective and efficient, it is necessary that all parties to the process recognize emerging opportunities and impending constraints by performing environmental analysis. Thus, the need to examine macro-environmental factors such as technological, social cultural, political and physical variables as well as internal variables or is necessary as they play important roles in influencing the channel structure and performance.

According to economic distribution channel theory, the “ideal” distribution system is one determined by exploring what the consumers want in terms of service outputs from the distribution channel, how much they are willing to pay for a given service level, how the services can be provided to them, and what the costs of the alternative distribution channels are (Stern et al., 2006). As a result they argue that it can be determined which distribution system most efficiently meets the customers‟ wants and it can be pointed out that the distribution channel strategy adopted by a firm should take a customer perspective and analyse the output from the commercial part of the different distribution channels and relates it to the customers‟ costs and benefits from the different levels of service output offered by the available distribution channels (Cohen et al.,

2003). Based on this information it can be determined which distribution system most efficiently meets the customers' wants. Thus, an economic distribution channel model puts the customer perspective in the forefront, analyses the output from the commercial part of the different distribution channels and relates it to the customers' benefits and costs from the different levels of service output offered by the available distribution channels.

Walker et al. (2002) state that to achieve desired performance levels, a firm's strategies and the resources available to it must interact positively with the requirements of the firm's markets. Both capabilities and market requirements need to be clearly defined and explicit. Arguably, both need active consideration during the strategy formulation stage. A key concern in the emerging strategic performance management in the current business environment is the need for organizations to implement systems and frameworks that not only deliver performance improvements (Witcher and Chau, 2008), but also the ability to control them against top level targets (Chau and Witcher, 2005). This remains the case for both commercial and regulated public sector companies. Distribution strategies play a crucial role in the launch of new products to the market. Distribution is crucial in the eventual acceptance and sales of a new product in the market as it determines the availability of the new product to customers. Past research suggest that the launch stage absorbs the second largest part of the innovation budget after product development and that compared to failed products, successful ones had significantly more time allotted to them (Cooper and Kleinschmidt, 2008). Distribution decisions are far reaching because changing them is both resource and time demanding and hence firms have to take great care in designing their distribution systems during the launch of innovations (Stern and Sturdivant, 2007). As distribution strategy plays a role in enabling the availability and application of the product in the marketplace, therefore the distribution strategy employed by the organization would impact the nature of "market support" capability that can be provided to the innovation.

Strategic role of distribution has evolved into a domain totally centered on "consumer experiences" and methods of providing and enhancing them (El-Ansary, 2005). Accordingly, the focal point in channel management when taking innovations to the marketplace would be the planning and implementation of positive consumer experiences through selection of channel mix, retail training in terms of physical stores, enriching experience at customer touch points, value-added services and consumer research would provide long term competitive advantage for the firm. In addition, value chain management would focus on partnering with up-stream and down-stream activities for efficiency enhancement and cost control. Partnership innovation management (Kay, 2003) is a relevant application, combining elements of process and product innovation management within a network structure to meet customer expectations at an economical cost.

The basic distribution intensity strategies that a manufacturer can employ are intensive, selective and exclusive. As stated by Stuart (2006) intensive distribution exists when a manufacturer sells products or services through all or most of the possible channel distributors that provide a particular category of product in a given market. Stuart (2006) further clarified that an intensive distribution approach gives manufacturers the highest probability of selling their products or services but only after the required investments in demand generation are made. Stem et al. (1988) argued that the higher the intensity of brand distribution in a given market, the lower the manufacturer's influence on channel member performance. Having too many channel partners can harm the brand image and its competitive position. This coverage strategy is more appropriate for manufacturers of brands placed near the low end of the quality continuum to promote convenience and competitive pricing for the customers (Frazier et al., 2009).

In selective distribution, a manufacturer's product or service is available from more than one channel partner, but the product is not accessible from all businesses that market the category of product (Stuart, 2006). Customers seeking particular brand of product will interact with the businesses in the market that the manufacturers has selected as partners. Selective distribution is a suitable choice when manufacturers would like to design their strategies so that their channel partners have a rather active than passive role (Stuart, 2006). Frazier et al., (2009) argued that manufacturers positioning their brands as high quality have reason to pursue a highly selective distribution policy.

Exclusive distribution provides high levels of channel partner profitability that allows them to offer functionality consistent with their roles in the 'push' strategy. According to Stem et al. (2008), exclusive distribution implies that a manufacturer can have strong influence over the distributors of the brand. However, manufacturers should be careful because exclusivity may lead to conflict between the manufacturer and the distributors due to the high level of control from the manufacturer's side. Exclusive distribution creates an image of the brand that has superior ability to perform its functions (Stem et al., 2008). The manufacturers need well-trained sales force to convince the target channel members to carry the brand. The strategy also involves active channel partners and loyal business partnerships between manufacturers, distributors and customers.

Competitive Advantage

According to Porter (1985), competitive advantage is the ability to earn returns on investment consistently above the average for the industry. This therefore means that competitive advantage can be achieved if the firm implements a value-creating strategy that is not simultaneously being implemented by any current or potential competitors. This can be interpreted to mean that sustained competitive advantage results from strategic assets; which Barney (2001) regards as those that are internally controlled and permits the firm to formulate and implement strategies that expand its efficiency and effectiveness. Competitive advantage is thus dependant not, as traditionally assumed, on such bases as natural resources, technology or economies of scale, since these are increasingly easy to imitate. Rather, competitive advantage is, according to the resource base view, dependant on the valuable, rare, and hard-to-imitate resources that reside within an organization (Stiles and Kulvisaechana, 2004). This group of assets can be said to be what Stewart (2007) said to be "invisible assets" which in real sense is intellectual capital.

Porter (2001) notes that, the competition strategy of a firm is to seek an advantageous competitive position in a particular industrial environment or to build up a profitable, consistent

market position by drawing on various factors that are decisive to being competitive in an industrial sector. In other words, both industry type and competitive strategies are two central points to be considered by managers in a market economy. This therefore means that Porter's competition strategy explicitly relies on the pursuit of advantages, which are determined by a firm's exogenous variables that require analysis of the competitors and opportunities in the market. When a particular high-value strategy of a firm cannot be implemented, imitated or replicated successfully by a potential competitor, the strategy provides the firm with a source of competitive advantage (CA). On his part, Oliver (2007) argues that both resources and institutional capital are indispensable to creating a CA. The capability-based view of the firm also moves a step closer to understanding how enterprises develop and maintain their sources of competitive advantage. Hence for a firm to be assured of a sustainable development, it must identify its competitive advantage variables and harness the same to a maximum benefit.

Statement of the problem

As one of the key elements of a company's success, selecting the proper distribution channel strategy has been a focal point in both supply chain and marketing channel structure. The distribution strategy decision is usually based on finding the most profitable way to reach a market (Ford and Mottner, 2003). Successful distribution channel strategy selection, implementation, and management cannot only help to meet the shopping needs and habits of the target customers efficiently under the cost constraints of the seller; they must also mitigate the disadvantages caused by distribution channel conflicts such as double marginalization.

According to Porter (2005), organizational competitive advantage can be achieved if the firm implements a value-creating strategy that is not simultaneously being implemented by any current or potential competitors. This can be interpreted to mean that sustained competitive advantage results from strategic assets; which Barney (2001) regards as those that are internally controlled and permits the firm to formulate and implement strategies that expand its efficiency and effectiveness. A firm's distribution strategy of its products and services is such a strategic asset. Fast-moving consumer goods firms in Kenya face challenges some of which were global competition technological advancement and changes in consumer tastes and preferences. In response to these challenges, the company undertook major changes to its products distribution.

Several studies have been undertaken locally on the subject area of distribution strategies adopted by various local companies. Irimu (2009), undertook a research on the effects of distribution strategies employed by sewing machine industry in Kenya on channel members. In her study, she found out that the location of the service facility is especially important for such business since many target customers may lack the funds for public transportation or they may feel psychologically uncomfortable to visit distance outlets. Njia (2009) researched on the Strategic responses employed by KCB to changes in Kenyan Banking industry. The study found out that the banking firms have formalized vision and mission statements. They employ competitive strategies of cost leadership, differentiation and focus to different degrees. On her part, Alumila (2004) researched on the distribution strategies used by health maintenance organization in Kenya. She found out that health care customers unlike other services value the face-to-face contact with the seller and also emphasizes a trustful relationship. In Denmark, Katz and Aspeden (2007) found out that the Internet banking customers is very similar to the PC segment. From the above studies and with the researcher not being aware of any other local study done on distribution strategies as a source of competitive advantage in the in Kenya, this gap leads to the research question. This study aims to fill the missing knowledge gap by finding out the strategic role of distribution as a source of competitive advantage

General Objective

The general objective of the study is to establish the strategic role of distribution as a source of competitive advantage adopted by fast-moving consumer goods firms in kenya.

II. RELATED LITERATURE

Theoretical Review

1. Competitiveness Theory

Early literature on the theories of trade between nations provided the basis for competitiveness theory. It alluded to the development of sustainable competitive advantage well before its time. Competitiveness theory evolved from the traditional trade theories, fundamentally 'The effect of the Wealth of Nations' Adam Smith in 1776 (later translated in 1937), which was revolutionary. In his book Adam Smith disputed the then existing philosophy Mercantilism view on trade which suggested that trade was a zero sum game in which a trade surplus of one country is offset by a trade deficit in another country. Smith in his argument viewed trade as a positive sum game in which all trading partners can benefit if countries specialized in the production of goods and services in which they had absolute advantage. This came to be known as the theory of absolute advantage.

Ricardo (1817) extended the theory of absolute advantage to comparative advantage where he stated that even if a country does not have an absolute advantage in any good this country and other countries will still benefit from international trade. However, Ricardo did not satisfactorily explain why comparative advantage differed across countries. To provide an explanation, in 1919 Swedish economist Eli Hecksher developed the factor proportions (endowment) theory which was later expanded by his former student, Ohlin in 2003 and later came to be known as H-O Theory. The two proposed that comparative advantage arises from differences in factor endowments, a theory which was virtually self evident.

Competitiveness theories proposed some kind of advantage as enabling a country gain more out of international trade. The same is true for the firm. If sustainable superior performance (which equals sustainable competitive advantage) is to be achieved a firm must differentiate itself. Alderson (1937) hinted at a basic tenet of sustainable competitive advantage, that a fundamental aspect of competitive advantage is the specialization of suppliers to meet the variations in buyer demand. Later Alderson (1965) recognized that firms should strive for unique characteristics in order to distinguish themselves from

competitors in the eyes of the consumer. He stated that differential advantage might be achieved through lowering prices, selective advertising appeals and/or product improvement and innovations. While these concepts lay the core foundation for firms in moving toward sustainable competitive advantage, the intense nature of competition today requires that firms be more innovative and entrepreneurial in their strategy planning than just lowering prices or improving existing products. The most important question then would be how then can companies build sustainable competitive advantage?

2. Kay's Model for Competitive Advantage

Kay (1995) presents the notion of sustained competitive advantage in organizations obtained through relational architecture, reputation, innovation and strategic assets. At the core of Kay's model is the resource based theory of the firm which focuses on the internal attributes or the resources and capabilities of the firm where, in order for the resources and capabilities of a firm to provide superior performance, they must be valuable in the sense of enabling a firm to exploit its environmental opportunities (and/or neutralize its threats), rare among its current or potential competitors, costly to imitate, and without close strategic substitutes (Barney, 1991). Kay states that organizations have a strong architecture where there is an expectation of long-term relationships both within the firm and among its members, a commitment to sharing the rewards of collective achievement and a high but unstructured degree of informality. He contends that this architecture adds value to individual contributions of its members through the creation of organizational knowledge, through the establishment of a cooperative ethic within the organization and by the implementation of organizational routines.

For Moller and Wilson (1995) good commercial relationships are fashioned through cooperation (joint activity towards a shared goal), coordination (the need for mutually consistent responses) and differentiation (the avoidance of mutually incompatible activities). However, Kay in passing, also suggest that the notion of sustained competitive advantage is relevant for understanding the differences in performances of non-profit organizations in situations, "where the added value or benefits are not retained by the firm, but instead are distributed to its members or the community" (Kay, 1995). Unfortunately Kay does not give attention to the paradox this raises where the purpose of the organization is to create knowledge and services and give them away for the public good rather than maximizing private profit. Kay's model articulates the components of this advantage including the internal and external relationship sand the network of relationships as the architecture that it frames; managers also use their knowledge of resource dependencies of their organizations in choosing their objectives and means of obtaining them.

3. Porters Theory of Competitive Advantage

The term "sustainable competitive advantage" emerged when Porter (2008) discusses the basic types of competitive strategies that a firm can possess (low cost or differentiation) in order to achieve a long run sustainable competitive advantage. In his book Competitive Advantage: Creating and sustaining superior performance, Porter explains the requisite approach to business success. Sustainable competitive advantage means sustainable superior performance. He goes ahead to state that structural conditions of an industry as proposed in his 5 Forces model determine average industry performance. Relatively strong competitive position and performance of a particular firm in an industry derives from two types of competitive advantage i.e. low costs and differentiation (Porter, 2008). The two approaches are not however alternatives because even when competition is based on differentiation, costs still do matter.

Porter's approach suggests that differentiation and cost leadership seek competitive advantage in a broad range of market or industry. By contrast differentiation focus and cost focus strategies are adopted in a narrow market industry. Differentiation involves selecting one or more criteria used by buyers in a market and then positioning the business uniquely to meet those criteria. The strategy involves charging a premium for the product – often to reflect higher production cost and extra value added features provided for the consumer.

For cost leadership strategy, the objective of the firm is to become the lowest cost producer in the industry. If achieved the selling price can at least equal (or nearly) the average for the market then the lowest cost producer will enjoy the best profits. A strategy usually associated with large scale business offering standard products. Cost focus strategy is for businesses that seeks a lower cost advantage in just one or a smaller number of market segments. The product will be basic-perhaps a similar product to the high priced and featured market leader – but acceptable to sufficient customers. Porter's approach however raises fundamental questions; why does the successful firm not buy the unsuccessful firm and teach it how to minimize costs? Why does the successful firm not sell its expertise in cost reducing to less successful firms? Why does the successful firm not cut its prices and drive its competitors out of business? Why does the unsuccessful firm not hire the executive in charge of cost drivers from the successful firm? (Porter & Kramer, 2006).

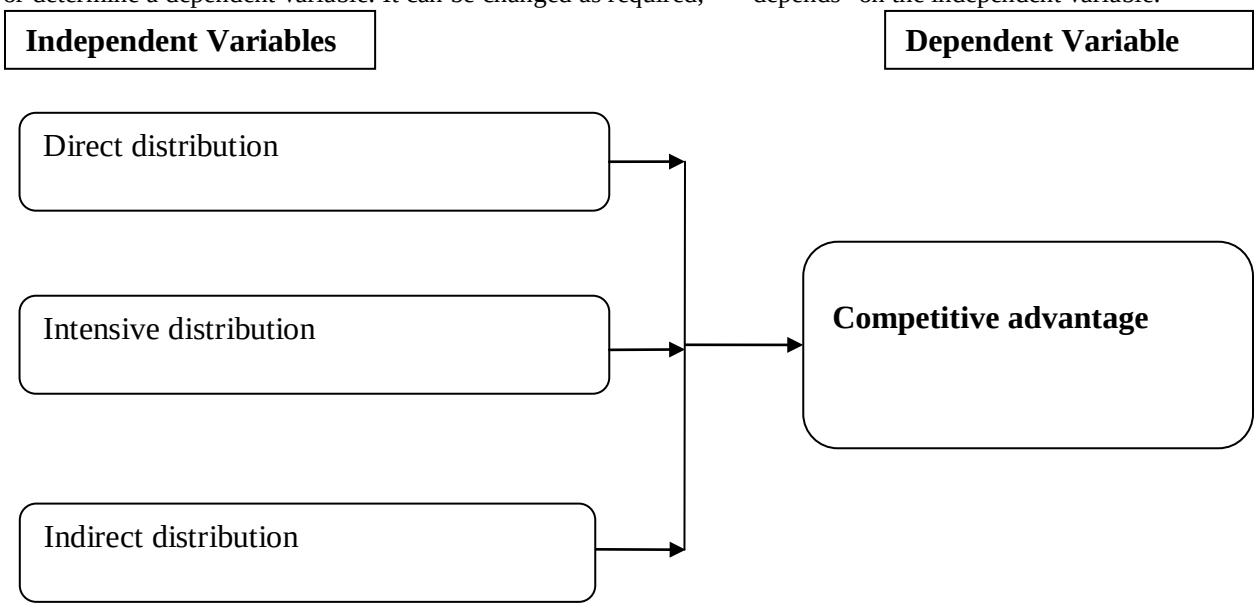
A business aiming to differentiate within just one or small number of target markets segments is viewed as applying the differentiation focus strategy. The special customer needs means that there are opportunities to provide products that are clearly different from competitors who may be targeting a broader group of customers (Porter, & Kramer, 2006). Important issue being that the business ensures that customers really do have different needs and wants i.e. there is a valid basis for differentiation and that existing competitors are not meeting those needs and wants. This strategy is common amongst niche retailers

In the following decade authors focused on capabilities approach to firm performance. Porter and Kramer (2006) discussed need for firms to be willing to learn how to create new advantages that will keep them steps ahead of competition. They argued that collective learning of the core competences would help the firm stay ahead of the game. Management's ability to consolidate technology and production skills into competencies help the business adapt quickly to changing opportunities. Identification, nurturing and full exploitation of these core competencies would offer competitive advantage. Furthermore they are difficult to imitate precisely because they have to be built over a long period.

Conceptual Framework

According to Bogdan and Biklen (2003) a conceptual framework refers to the result of when a researcher

conceptualizes the relation between variables in the study and shows the relationship graphically or diagrammatically. It is therefore a linked set of variables that are backing up in the critical analysis. It is made of the dependent and independent variables. Independent Variables are changes that occur in an experiment that are directly caused by the experimenter. An independent variable is that variable which is presumed to affect or determine a dependent variable. It can be changed as required, and its values do not represent a problem requiring explanation in an analysis, but are taken simply as given (Dodge, 2003). A dependent variable is a variable dependent on another variable: the independent variable. A dependent variable is what you measure in the experiment and what is affected during the experiment. The dependent variable responds to the independent variable (Everitt, 2002). It is called dependent because it "depends" on the independent variable.



The relationships are presented in a hypothetical framework as shown below

Independent Variables **Dependent Variable**

Figure 2.1: Conceptual framework , Source, Author (2014)

REVIEW OF VARIABLE

Direct Distribution

A direct channel of distribution describes a situation in which the producer sells a product directly to a consumer without the help of intermediaries. A direct chain of distribution may involve face-to-face sales, computer sales or mail order but does not involve any form of distributor other than the original producer. Chains of distribution that involve nonaffiliated retailers or wholesalers cannot be described as direct channels of distribution and are instead classified as indirect chains of distribution.

Using a direct channel of distribution to connect consumers with your product, especially a Web-based channel, can have several benefits. Most importantly, web-based selling has low overhead and gives your product a potentially global reach. Because no intermediaries share the profits, most direct distribution channels tend to have higher rates of profit than indirect distribution channels. Direct distribution via the Internet is convenient for customers and available 24 hours a day. Lastly, many customers appreciate the opportunity to give profits directly to producers and artists.

The most obvious disadvantage is that a direct distribution channel cannot compete with the geographical reach and business volume of a distribution channel that includes major wholesalers and retailers. If you make specialty coffee, you cannot sell as much product over your company website as you can if you sell through major grocery store chains. Some consider another downside to direct distribution of tangible products by phone, mail or Internet is that customers are often asked to shoulder the burden of shipping costs.

Distribution strategies has evolved into a domain totally centered on “consumer experiences” and methods of providing and enhancing them (El-Ansary, 2005). Accordingly, the focal point in channel management when taking innovations to the marketplace would be the planning and implementation of positive consumer experiences through selection of channel mix, retail training in terms of physical stores, enriching experience at customer touch points, value-added services and consumer research would provide long term competitive advantage for the firm. In addition, value chain management would focus on partnering with up-stream and down-stream activities for efficiency enhancement and cost control. Partnership innovation management (Kay, 1993) is a relevant application, combining elements of process and product innovation management within a network structure to meet customer expectations at an economical cost.

Intensive Distribution

Intensive distribution means that as may available outlets as possible hold this product, e.g. chocolate, newspapers, bread, sweets and chewing gums. Intensive distribution will mean convenience to the customer and increase customer satisfaction. (Bowersox et al 2006). Its a marketing strategy under which a company sells through as many outlets as possible, so that the consumers encounter the product virtually everywhere they go: supermarkets, drug stores, and gas stations. The sale of sweets and chewing gums in petrol and service stations is an example of how intensive distribution has grown.

Key characteristics of intensive distribution include: Maximum number of outlets covered to maximize availability; Target outlets in as many as geographical regions as possible; Consumer convenience products; High number of purchasers; High purchase frequency; Impulsive purchase and Low price. Cateora and Graham (2007) asserted that distribution relates to the flow of goods and services from the producer to consumer. A distribution strategy is intended to establish a dominant position in the geographic markets served by firms. The selection of an appropriate distribution strategy is a major determinant of an organizations success and distribution decisions represent much longer-term commitments than do other marketing decisions because of the time, costs and intermediate relationships that are involved in gaining access to an established channel.

Distribution represents a complex, specialized, sophisticated and coordinated supply chain in developed countries and increasingly in many developing countries. The distribution sector includes commission agents, wholesalers and retailers who act as enablers of trade (Matteo, 2008).The distribution strategy must be carefully integrated with all components of the marketing program. Before a manufacturer formulates a distribution strategy, two decisions should occur. These are determining whether the firm will sell directly to end-users or will utilize intermediaries and selecting the type of channel. Day (2008) hold that distribution channels evolved through the utilization of national resources contained within an area of trade. The need to move the resources to other areas where they were in demand brought about the need for distribution channels (Tang, 2007).

Indirect Distribution

Indirect distribution ia a chain of intermediaries through which a product moves in order to be made available for purchase by a consumer. An indirect channel of distribution typically involves a product passing through additional steps as it moves from the manufacturing business via distributors to wholesalers and then retail stores. In indirect channels of distribution there are one or more middlemen between the manufac-turer and consumers. There is no direct contact between the producers and the customers. Indirect channels of distribution may be classified as follows:

Manufacturer -> Retailer -> Consumer:

In this channel, the manufacturer sells goods to consumer through retailers. This channel of distribution thus has one middleman i.e. the retailer.

Consumer durables such as TVs, refrigerators, scooters, washing machines, cars and industrial machinery and equipment are generally sold through this channel.

When large scale retailers are available such as departmental stores and super bazar, the manufacturer finds it convenient to use this channel of distribution.

Manufacturer -> Wholesaler -> Retailer -> Consumer:

This channel consists of two types of middlemen, called, wholesaler and retailer. Consumer products of daily use such as soaps, cosmetics, detergents, etc. are generally sold through this channel.

For example, Hindustan Lever Ltd., sells its products through wholesalers and retailers. Small scale producers also find this channel convenient for the distribution of products enjoying widely scattered demand.

Manufacturer Agent -> wholesaler -> Retailer -> consumer:

This is the longest channel of distribution. The manufacturer sells his entire output to a sole selling agent who in turn appoints wholesalers. Wholesalers sell to retailers who in turn sell to ultimate consumers. This channel is popular in the distribution of cloth, food grains, sugar, edible oil, paper, etc.

Indirect channels relieve the manufacturer from the problems of distribution and he can concentrate fully on production. The expert services of middlemen become available. But indirect distribution creates distance between the producer and the consumers. The producer loses control over distribution. Distribution of goods may be slow due to intermediaries between producer and consumers.

Empirical Review

Muthuy (2008) conducted a study to investigate the distribution strategies adopted by various firms in their market and distribution of their products. Particular attention was paid to cosmetic companies. The objectives of this study was to find out the various distribution strategies adopted in marketing of wares and the factors influencing adoption of such strategies. The findings of the study revealed that, most of the firms are yet to embrace strategic marketing and distribution ways in order to sell their products and subsequently leap marginal profits. The choice of good distribution channel is paramount in ensuring high returns and easy distribution of the products to the consumers. Besides, firms should adopt modern technology in improving their distribution of the products. This technology may involve use of phones, internet, online catalogues, and use of couriers to deliver products to consumers, if embraced will see vast returns.

A study by Matteo (2008) revealed that existence of many firms in the target market leads to increased competition and this makes it difficult for a single company to effectively distribute its product in the competing market and increase its revenue. Lehtonen (2009) confirmed that lack of distribution of FMCG product in various market segments by many FMCG firms in Kenya can be attributed to an increase in supply of cheap Chinese FMCG products in the market. Clow (2007) identified that that high level of competition in the market that affects distribution of products is influenced by supply of China imported goods, existence of many suppliers, loss of market share to competitors and quality of competitor products. McCammon (2009) established that aspects of price that affects effective distribution of the company products includes; high transportation costs, increased inventory management cost, many middle men in the distribution channel and lack of price adjustments. Schendel (2008) found out that that of effectiveness of the company promotion campaigns in creating awareness of

the company products influences many customers to FMCG from the competing firms with more effective promotion campaigns. A study by Tang (2007) noted that supply of china imported goods, existence of many suppliers loss of market share to competitors and quality of competitor products affects distribution of the locally manufactured fast moving consumer goods.

METHODOLOGY

Research Design

This research adopted a descriptive research design. Mugenda and Mugenda (2003) describes descriptive research design as a systematic, empirical inquiring into which the researcher does not have a direct control of independent variable as their manifestation has already occurred or because the inherently cannot be manipulated. Descriptive studies are concerned with the what, where and how of a phenomenon hence more placed to build a profile on that phenomenon (Mugenda and Mugenda, 2003). Descriptive research design is more appropriate because the study seeks to build a profile about the strategic role of distribution as a source of competitive advantage in fast-moving consumer goods in kenya.

Data Analysis and Presentation

This included analysis of data to summarize the essential features and relationships of data in order to generalise from the analysis to determine patterns of behaviour and particular outcomes. Before processing the responses, the completed questionnaires were edited for completeness and consistency. Content analysis and descriptive analysis was also employed. Content analysis was also used to analyze the respondents' views about the strategic role of distribution as a source of competitive advantage in fast-moving consumer goods in kenya.The data was then coded to enable the responses to be grouped into various categories. Data was grouped into frequency distribution to indicate variable values and number of occurrences in terms of frequency. Frequency distribution table was informative to summarize the data from respondents, percentages and other diagrams such as bar charts, histogram, grouped frequency distributions and pie charts were used during the analysis. The organised data was interpreted on account of concurrence and standard deviation to objectives using assistance of computer packages especially SPSS and Microsoft Excel to communicate research findings. Content analysis (which is the systematic qualitative description of the composition of the objects or materials of the study and involves observation and detailed description of phenomena that comprise the object of study) was used in qualitative data which will first be coded to allow the use of some quantitative data analysis instruments.

ANOVA and Chi-square data analyses methods was applied to analyze the data collected using open ended questions where the respondents gave their personal opinions to find out the strategic role of distribution as a source of competitive advantage in fast-moving consumer goods in kenya. Inferentially, a correlation analysis was conducted to establish the correlation coefficients of each variable of interests. In order to make the data more user-friendly and attractive to the readers, different graphic interactive such as tables, graphs and charts will be generated using the computer spreadsheet to present the data. This added more value to the information and make it appealing to the reader.

The regression model to be used in the study takes the form below:

$Y = \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \varepsilon$ ……. (equation (i)

Where;

Y= the dependent variable (Distribution Strategies)

α - Is a constant; the concept explaining the level of success given and it's the Y value when all the predictor values (X_1, X_2, $X_{3,}$) are zero

β_1, $\beta 2$, $\beta 3$, – Are constants regression coefficients representing the condition of the independent variables to the dependent variables.

X_1 – Direct distribution

X_2 – Intensive distribution

X_3 – Indirect distribution

ε - (Extraneous) Error term explaining the variability of growth as a result of other factors not accounted for.

III. PRESENTATION, DISCUSSION AND INTERPRETATION OF FINDINGS

Presentation of findings

Reliability Analysis

The reliability of an instrument refers to its ability to produce consistent and stable measurements. Bagozzi (1994) explains that reliability can be seen from two sides: reliability (the extent of accuracy) and unreliability (the extent of inaccuracy). The most common reliability coefficient is the Cronbach's alpha which estimates internal consistency by determining how all items on a test relate to all other items and to the total test - internal coherence of data. The reliability is expressed as a coefficient between 0 and 1.00. The higher the coefficient, the more reliable is the test.

In this study to ensure the reliability of the instrument Cronbach's Alpha was used. Cronbach Alpha value is widely used to verify the reliability of the construct. Therefore, Cronbach Alpha was used to test the reliability of the proposed constructs. The findings indicated that Direct distribution had a coefficient of 0.904, Intensive distribution had a coefficient of 0.903, and Indirect distribution of 0.829. All constructs depicted that the value of Cronbach's Alpha are above the suggested value of 0.5 thus the study was reliable (Nunnally & Bernstein, 1994; Nunnally, 1974). On the basis of reliability test it was supposed that the scales used in this study is reliable to capture the constructs. Reliability of the constructs is shown below in table 4.1.

Table 4. 0 :Reliability Test of Constructs

Intellectual Capital (IC)	Reliability Cronbach's Alpha	Comments
Direct distribution	0.904	Accepted
Intensive distribution	0.903	Accepted
Indirect distribution	0.829	Accepted

4.1 Background information

The study sought to establish the background information of the respondents in an effort to ensure the sampling was done effectively. The study sought to determine the gender, age, level of education and how long they have worked in their current positions. The findings were presented in table 4.1 below;

Table 4.1 Background information of the respondents

Gender	**Frequency**	**Percent**
Male	15	71.4
Female	6	28.6
Total	21	100
Age		
Below 25	2	9.5
25-35	4	19.0
36-45	10	47.6
Above 45	5	23.8
Total	21	100
Level of education		
Diploma	1	4.8
Degree	14	66.7
Post graduate	6	28.6
Total	21	100
Duration of service		
Less than 5 years	2	9.5
5-10 years	2	9.5
11-15	15	71.4
16-20	2	9.5
Total	21	100

Source; Research Data (2015)

The findings on the age of the respondents indicated that majority of the respondents 71.4% were male while 28.6% were female. This implies that the study collected data from both genders.

The findings on the age bracket of the respondents indicated that majority of the respondents 47.6% were of age between 36-45 years, 23.8% were of age above 45 years, 19.0% were of age between 25-35 years and 9.5% were below 25 years. This implies that study collected data from aged employees who understood what had happened in the organizations.

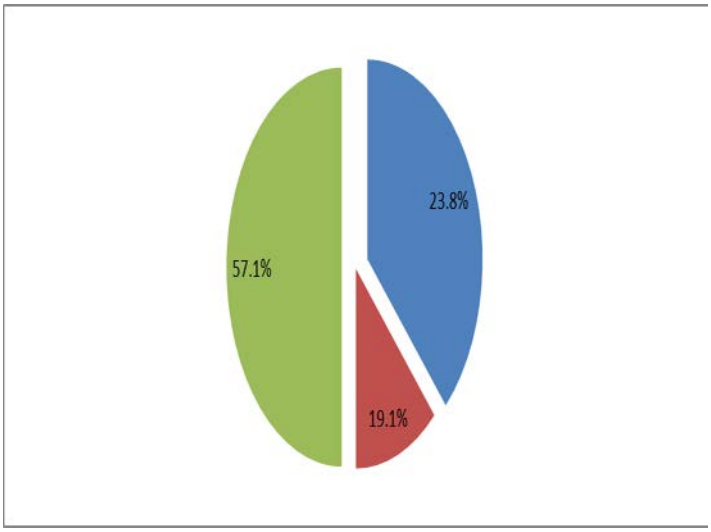
The findings of the study on the level of education of the respondents indicate that 66.7% had bachelor's degree, 28.6% post graduate and 4.8% had diploma. These findings imply that the respondents were learned people and understood what the study aimed at. These findings could also imply that the level of education of the respondents could be because financial matters and management need qualified, skilled and competent personnel.

The findings of the study on the number of years the respondents indicate that 71.4% had work experience of between 11-15 years, 9.5% of between 16-20 years and 9.5% 5-10 years experience and 9.5% less than 5 years. These findings indicate that the respondents had worked for a considerable long period of time and therefore were in a position to give informed judgment to the study. These findings imply that these employees could have worked well and according to the required policies of financial management. They could also have improved the performance of the organization over time and the employer chose to retain them for that long period of time.

The study findings a regards the distribution strategy used most by the company indicated that majority of the responses 57.1% were of the opinion that the company used direct distribution most, 23.8% were of the opinion that the company used intense while 19.1% were of the opinion that the company used indirect distribution.

These results are as shown in the pie chart below;

Figure 4.1 Pie chart showing distribution strategy used most



Source; Research Data (2015)

The study findings imply that the company used most direct distribution because many customers appreciate the opportunity to give profits directly to producers in this case the company in question.

Analysis of specific information

Direct Distribution and Competitive Advantage

As regards whether the use of direct distribution strategy has resulted in the gaining of competitive advantage, 66.7% were of the opinion that it has resulted while 33.3% were of the contrary opinion. This implies that using direct distribution results in the gaining of competitive advantage. This could be due to the fact that using direct distribution helps develop positive consumer experiences through selection of channel mix, retail training in terms of physical stores, enriching experience at customer touch

points, value-added services and consumer research would provide long term competitive advantage for the company.

The study findings on direct distribution as a source of competitive advantage were analyzed and presented as shown below;

Table 4.2 Direct distribution as a source of competitive advantage

Statements	Mean	%Mean	SD
Direct distribution via the internet is convenient for customers and available 24 hours a day	4.10	82.0	1.01
Direct distribution enables many customers appreciate the opportunity to give profits directly to the producer and artists	4.23	84.6	0.84
Direct distribution channel cannot compete with geographical reach and business volume of a distribution channel that includes major wholesalers	3.97	79.4	1.14
Using direct channel of distribution to connect consumers with your product especially a web based selling has a low overhead and gives the product a potentially global reach	4.04	80.8	1.08

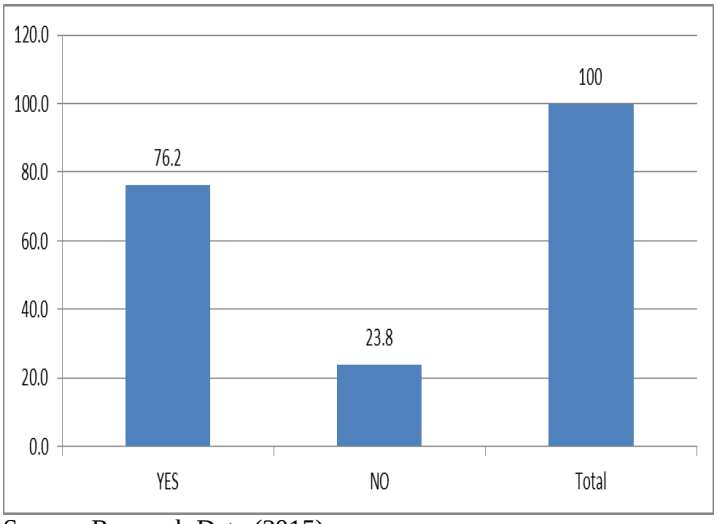
Source; Research data (2015)

The findings on direct distribution as a source of competitive advantage indicate that 84.6% of the responses were of the opinion that direct distribution enables many customers appreciate the opportunity to give profits directly to the producer and artists, 82.0% of the responses were of the opinion that Direct distribution via the internet is convenient for customers and available 24 hours a day, 80.8% of the responses were of the opinion that Using direct channel of distribution to connect consumers with your product especially a web based selling has a low overhead and gives the product a potentially global reach, while 79.4% of the responses were of the opinion Direct distribution channel cannot compete with geographical reach and business volume of a distribution channel that includes major wholesalers.

The findings on direct distribution as a source of competitive advantage implies that direct distribution enables many customers appreciate the opportunity to give profits directly to the producer and artists. This could be interpreted to mean that direct distribution enables the customers to directly interact with the producers and exchange one on one. In this case the customers will give the profits to the producers directly. On the other hand the producers are able to get views, complains and suggestions on the performance, taste and quality of their products. Considering and learning from these views from the customers enables the producers produce and distribute the products tailored to customers' needs and therefore gain competitive advantage.

The study findings on whether direct distribution affected competitive advantage of the firm indicated that 61.9% were of the opinion that it affected at a great extent, 23.8% were of the opinion that it affected a very great extent while 14.3% were of the opinion that it affected at a moderate extent.
These results are as shown in the graph below;

Figure 4.2 Bar Graph showing the extent at which direct distribution affected competitive advantage.



Source; Research Data (2015)

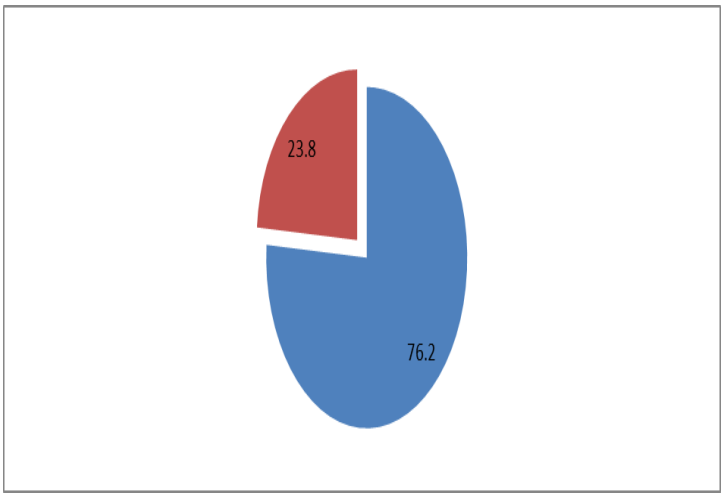
These findings imply that direct distribution affected competitive advantage of the firm. This could be because direct distribution deals directly with users of the final product of the firm and any changes in the customers perception of the product is able to be known immediately by the producer who happens to be the supplier. The producer is able to incorporate customers' opinions in the distribution of the final product and therefore may affect the competitive advantage of the firm.

Most of the respondents were of the opinion that the organization has developed capabilities to generate, disseminate and to respond to market intelligence and the processes to act on this information in order to achieve competitive advantage. This implies that the company could have opted to direct distribution in order to capture the market information and to be able to respond accordingly. Appropriate response to market information and intelligence enables the company incorporate prevailing conditions in its activities and therefore maintain or improve competitive advantage.

Indirect distribution as source of competitive advantage

The study sought to determine whether the overall strategy of the organization on how to distribute products is linked to the products and the markets it plans to serve. The results were analyzed and presented as shown below;

Figure 4.3 Pie chart showing the link between the overall strategy and products and the market



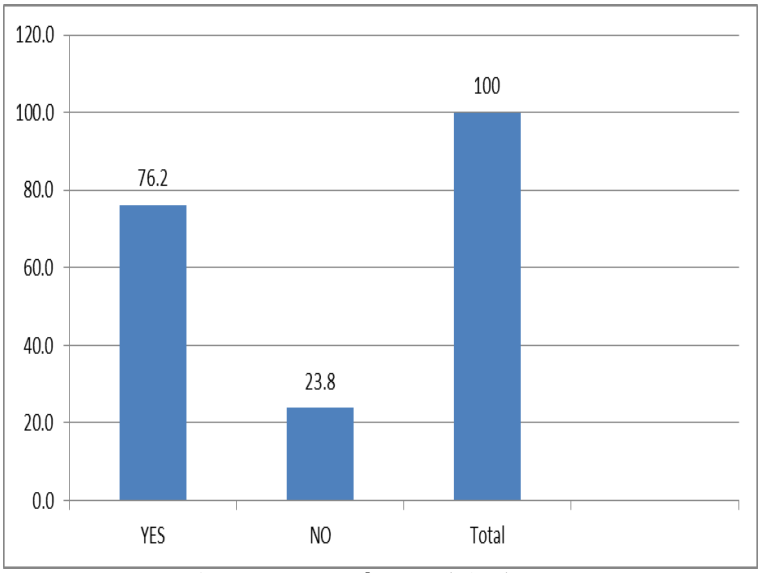
Source; Research Data (2015)

The study finding revealed that majority of the responses 76.2% were of the opinion that the overall strategy of the organization on how to distribute products is linked to the products and the markets it plans to serve while the 23.8% were of the opinion that the overall strategy of the organization on how to distribute products is not linked to the products and the markets it plans to serve. This implies that the overall strategy could have been linked to the product and the market and this could be because the nature of the products and the market determines the choice of the distribution channel to be adopted by the company.

As regards the extent of the effect of indirect distribution on the competitive of advantage of the company, 61.9% were of the opinion of moderate extent, 19.0% great extent, 14.3% low extent and 4.9% very great extent.

The results were as shown in the figure below;

Figure 4.4 Bar graph showing extent of indirect distribution on competitive advantage



Source; Research Data (2015)

The study results indicated that majority of the respondents were of the opinion that indirect distribution affected competitive advantage on a moderate extent. This could be because indirect distribution involves a product passing through additional steps as it moves from the manufacturing business via distributors to wholesalers and then retail stores. In indirect channels of distribution there are one or more middlemen between the manufac-turer and consumers. There is no direct contact between the producers and the customers.

The study also sought to determine whether the distribution strategies being used by the company have ensured availability of the products to its intended customers. The results are as shown;

Table 4.3 Strategies used and availability of the products to intended customers

	Frequency	**Percent**
Yes	18	85.7
No	3	14.3
Total	21	100

Source; Research Data (2015)

The findings indicate that 85.7% of the responses were of the opinion that the strategies used ensured availability of the products to the intended customers while 14.3% were of the opinion that t the strategies used did not ensure availability of the products to the intended customers. This implies the strategies used by the company met its intended objectives of ensuring the products reached the intended customers. This could also be interpreted to mean the company developed their

strategies considering the market and the intended customers and hence the company may have gained competitive advantage.

Intense distribution as a source of competitive advantage

The study sought to establish the extent of intense distribution advantage for the company. The results were analyzed and presented in the table below;

Table 4.4 Intense distribution as a source of competitive advantage

Statements	Mean	% Mean	SD
Intensive distribution include maximum number of outlets covered to maximize availability	4.14	82.6	1.04
Intensive distribution outlets in as many s geographical regions as possible	4.06	81.2	1.03
Intensive distribution ensures customer convenience products	4.54	90.8	0.58
Intensive distribution ensures high number of purchases	3.97	79.4	1.14
Intensive distribution ensures high purchase frequency	4.03	80.6	1.06
Intensive distribution ensures impulsive purchase and low price	3.86	77.2	1.22

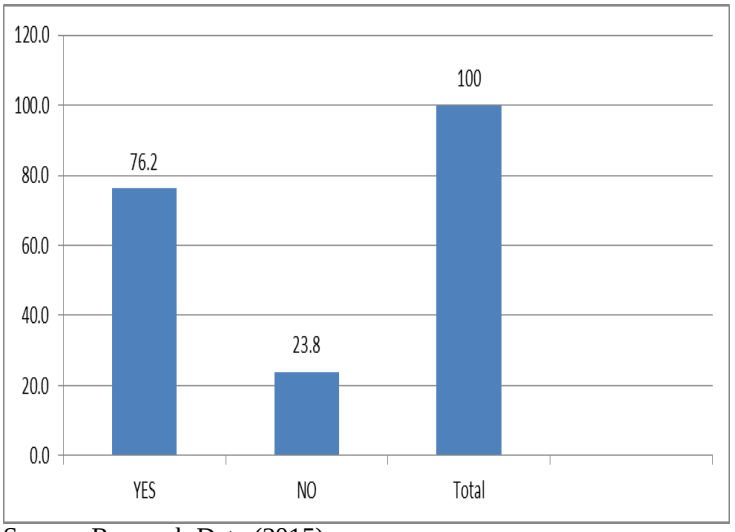
Source; Research Data (2015)

The study findings revealed that 90.8% of the responses were of the opinion that Intensive distribution ensures customer convenience products as a source of competitive advantage, 82.6% of the responses were of the opinion that Intensive distribution include maximum number of outlets covered to maximize availability as a source of competitive advantage, 81.2% of the responses were of the opinion Intensive distribution outlets in as many s geographical regions as possible as a source of competitive advantage while 80.6% of the responses were of the opinion that Intensive distribution ensures high purchase frequency as a source of competitive advantage another portion of the responses 79.4% were of the opinion that Intensive distribution ensures high number of purchases as a source of competitive advantage while 77.2% of the responses were of the opinion that Intensive distribution ensures impulsive purchase and low price as a source of competitive advantage.

These findings could be interpreted to mean that intensive distribution ensured consumer convenience products. This could be because a company sells through as many outlets as possible, so that the consumers encounter the product virtually everywhere they go.

As regards the extent to which intensive distribution affected competitive advantage; 42.9% were of the opinion of moderate extent, 33.3% great extent, 19.0% very great extent and 4.8% low extent. The results were presented in the figure as shown below;

Figure 4.5 Intensive distribution and competitive advantage



Source; Research Data (2015)

The study findings indicated that indirect distribution affected competitive advantage to a moderate extent. This could be because of the in intensive distribution the company does not deal directly with the customers and the selection of an appropriate distribution strategy is a major determinant of an organizations success and distribution decisions represent much longer-term commitments than do other marketing decisions because of the time, costs and intermediate relationships that are involved in gaining access to an established channel.

The study also sought to establish whether the company considered the competitive landscape and the demand for a product support when selecting distribution channel strategies for an organization. The study revealed that 66.7% were of the opinion that the company considered the competitive landscape and the demand for a product support when selecting distribution channel strategies for an organization while 33.3% were of the opinion that the company did not consider the competitive landscape and the demand for a product support when selecting distribution channel strategies for an organization. This implies that the company considered competitive landscape and the demand for a product support when selecting distribution channel. This is because selection of the distribution channel depends on several factors including competitors method adopted and the demand of the product. Considering these factors in selection of the distribution channel gives the company competitive advantage in that it enables compete favorably in the market. Having the distribution channel that fits the competitive landscape and the demand of the product gives an upper hand in the market.

The study sought to determine the extent the organization learn rapidly and adjust their distribution strategy in order to achieve competitive advantage. The results were analyzed in the table below;

Table 4.5 Organizational learning and adjusting on distribution strategy

Extent of learning and adjusting	Frequency	Percent
Very great extent	2	9.5
Great extent	6	28.6
Moderate extent	13	61.9
Total	21	100

Source; Research Data (2005)

The findings revealed that 61.9% were of the opinion that the organization moderately learned rapidly and adjust their distribution strategy in order to achieve competitive advantage, 28.6% were of the organization greatly learn rapidly and adjust their distribution strategy in order to achieve competitive advantage while 9.5% were of the opinion that the organization learned and adjusted at a very great extent their strategy in order to achieve competitive advantage.

These findings imply that the company learned and adjust on a moderate extent to its distribution strategy in order to achieve competitive advantage. This could be interpreted to mean that this impacted on the distribution strategy which may have translated to competitive advantage.

Most of the respondents asserted that the organization distribution strategy market oriented can generate, disseminate and respond to the market information about market forces and conditions better than the rivals in order to achieve competitive advantage. This could be interpreted to mean that the company used the distribution strategy that enable it adequately collect market information. Incorporating this information and conditions in the distribution enables the firm gain competitive advantage.

IV. SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

Summary of findings

The study findings on whether the use of direct distribution strategy resulted in the gaining of competitive advantage, 66.7% were of the opinion that it has resulted while 33.3% were of the contrary opinion. The findings on direct distribution as a source of competitive advantage indicate that 84.6% of the responses were of the opinion that direct distribution enables many customers appreciate the opportunity to give profits directly to the producer and artists. The study findings on whether direct distribution affected competitive advantage of the firm indicated that 61.9% were of the opinion that it affected at a great extent, 23.8% were of the opinion that it affected a very great extent while 14.3% were of the opinion that it affected at a moderate extent. The study finding revealed that majority of the responses 76.2% were of the opinion that the overall strategy of the organization on how to distribute products is linked to the products and the markets it plans to serve. As regards the extent of the effect of indirect distribution on the competitive of advantage of the company, 61.9% were of the opinion of moderate extent, 19.0% great extent, 14.3% low extent and 4.9% very great extent.

The findings indicate that 85.7% of the responses were of the opinion that the strategies used ensured availability of the products to the intended customers while 14.3% were of the opinion that the strategies used did not ensure availability of the products to the intended customers. The study findings revealed that 90.8% of the responses were of the opinion that Intensive distribution ensures customer convenience products as a source of competitive advantage. As regards the extent to which intensive distribution affected competitive advantage; 42.9% were of the opinion of moderate extent, 33.3% great extent, 19.0% very great extent and 4.8% low extent. The study revealed that 66.7% were of the opinion that the company considered the competitive landscape and the demand for a product support when selecting distribution channel strategies for an organization while 33.3% were of the opinion that the company did not consider the competitive landscape and the demand for a product support when selecting distribution channel strategies for an organization.

The findings revealed that 61.9% were of the opinion that the organization moderately learned rapidly and adjust their distribution strategy in order to achieve competitive advantage, 28.6% were of the organization greatly learn rapidly and adjust their distribution strategy in order to achieve competitive advantage while 9.5% were of the opinion that the organization learned and adjusted at a very great extent their strategy in order to achieve competitive advantage.

Conclusion based on findings

The study concluded that the company used most direct distribution strategy than indirect and intensive distribution strategies. This could be because of its advantages such as customers appreciate the opportunity to give profits directly to producers and artists. The usage of direct distribution strategy by the organization has resulted in gaining competitive advantage by the company.

The study concluded that direct distribution enables many customers appreciate the opportunity to give the profits directly to the producers and artists. Direct distribution affects competitive advantage of the company at a great extent. The overall strategy of the organization on how to distribute its products is linked to the products and the market the company plans to serve.

The study further concluded that indirect distribution affects competitive advantage at a moderate extent. The distribution strategies used by the company has resulted in the availability of the products to its intended customers. Intensive distribution ensures consumer convenience products. Intensive distribution strategy affects competitive advantage of the company at a moderate extent.

Recommendations based on findings

i. The company should ensure direct distribution as a source of competitive advantage in that direct distribution channel cannot compete with the geographical reach and business volume of the distribution channel that includes major wholesalers and retailers.

ii. The company should ensure intense distribution ensures impulsive purchase and low price in order to achieve competitive advantage.
iii. The company should analyze its indirect distribution channel to ensure it influences its competitive advantage at a greater extent.

REFERENCES

[1] Alumila G.M (2004), Distribution strategies used by Health Maintenance organization in Kenya, Unpublished MBA project, University of Nairobi

[2] Barney, J.B. (1991), Firm resources and sustained competitive advantage, Journal of Management, Vol. 17 No.1, pp.99-120

[3] Chege, J. M (2004), Factors influencing the choice of product distributions channels in Kenya. Unpublished MBA Project, Kenyatta University

[4] Cohen, W.M., Nelson, R.R. and Walsh, J.P. (2000), Protecting their intellectual assets: appropriability conditions and why US manufacturing firms patent or not, working paper 7552, National Bureau of Economic Research, Cambridge, MA,

[5] Cooper, D. R., & Emory, C. W. (2008). Business Research Methods (5th edition). USA: Richard D. Irwin.

[6] Cooper, D.R., & Schindler, P., S. (2003). Business Research Methods. London.

[7] Cooper, R. and Kleinschmidt, E. (1988), Resource allocation in new product process, Industrial Marketing Management, Vol. 17 No.3, pp.249-62

[8] Davis, F.D. (1986). A Technology Acceptance Model for Empirically Testing New End User Information Systems: Theory and Results, Sloan School of Management, Massachusetts.

[9] Davis, F.D. (1987). Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information Technology. MIS Quarterly, 13 (3). 318.

[10] Davis, F.D., (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology.MIS Quarterly 13 (3), 319–340

[11] Denscombe, M., 3rd Edition (2007). The Good Research Guide: For Small-scale Social Research. Buckingham: Open University Press

[12] Devaraj, S, Fan, M and Kohli, R (2002), 'Antecedents of b2C channel satisfaction and preference: Validation e-Commerce metrics', Information Systems Research, vol. 13, no. 3, pp. 316-333.

[13] Duke, C. R., and M. A. Persia (1993).Effects of Distribution Channel Level on Tour Purchasing Attributes and Information Sources. Journal of Travel and Tourism Marketing, 2 (2/3): 37-55.

[14] El-Ansary, A. (2005), "Interview", Jacksonville, FL, October 12, .

[15] Ford, J.B. and Mottner, S. (2003), Retailing in the non-profit sector: an exploratory analysis of church-connected retailing ventures, International Journal of Non-profit and Voluntary Sector Marketing, Vol. 8 pp.337-48.

[16] Ige, O. (2004), "Electronic shopping: young people as consumers", International Journal of Consumer Studies, Vol. 28 No.4, pp.412-27.

[17] Irimu S. T (2009), Effects of distribution strategies employed by the sewing machine industry in Kenya on channel members: A case of Amedo centre (k) ltd, Unpublished MBA project, University of Nairobi

[18] Javalgi, RG & White, DS, 2002."Strategic Challenges for the Marketing of Services Internationally", International Marketing Review, Volume 19, Issue 6 p. 563-81.

[19] Kay, J. (1993), Foundation of Corporate Success, OUP, Oxford, .

[20] Kimani S.N (2008). Comparative Study of Three Distribution Channels of Antimalarial Drugs in Embu District, Kenya.Unpublished MBA Project, JKUAT

[21] Minsky, BD and Marin, DB (1999), 'Why faculty members use E-mail: The role of individual differences in channel choice', The Journal of Business Communication, vol. 36, no. 2, pp. 194-217.

[22] Montoya-Weiss, M.M., Voss, G.B., Grewal, D. (2003), "Determinants of online channel use and overall satisfaction with a relational multichannel service provider", Journal of the Academy of Marketing Science, Vol. 31 No.4, pp.448-58.

[23] Mugenda, A., G. (2008). Social Science Research , Theory and Principles. Nairobi. Applied Research and Training Services Press

[24] Mugenda, O., M. & Mugenda, A., G. (2003). Research Methods, Quantitative & Qualitative Approaches, Nairobi: Acts Press

[25] Mugenda, O.M., &Mugenda, A., G. (2003). Research methods quantitative and qualitative approaches: Nairobi. Applied Research and Training Services Press.

[26] Nachmias, D., &Nachmias, C. (1996).Research Method in the social sciences: Boston, St.Martins Press

[27] Ngechu, M. (2004). Understanding the research process and methods. An introduction to research methods. Nairobi: Acts Press.

[28] Novak, T.P., Hoffman, D.L., Peralta, M. (1999), "Building consumer trust in online environments: the case for information privacy", Communication of the ACM, Vol. 42 No.4, pp.80-5.

[29] Oliver, G., (1997), "Towards a branchless banking society?", International Journal of Retail & Distribution Management, Vol. 22 No.2, pp.18-26.

[30] Öörni, A. (2003). Consumer Search in Electronic Markets: An Experimental Analysis of Travel Services. European Journal of Information Systems, 12: 30-40.

[31] Porter, M. (1985), Competitive Advantage: Creating and Sustaining Superior Performance, Free Press, New York, NY.

[32] Porter, M. (1991), Competition in Global Industries, Harvard Business School Press, Boston, MA

[33] Porter, M., (2001). Strategy and the Internet, Harvard Business Review,79(3), 63-78.

[34] Rosenbloom, B., T. Larsen, and B. Smith (2004).“The Effectiveness of Upstream Influence Attempts in High and Low Context Export marketing Channels.” Journal of Marketing Channels 11 (4), pp.3-19.

[35] Seuring S, Muller M, Reiner G, (2005). Conducting a literature review, the example of sustainability in supply chains.Physica-Verlag HD; p. 91–106

[36] Stern, L. W., and A. I. El-Ansary (1988).Marketing Channels. 3rd ed. Englewood Cliffs, NJ: Prentice Hall.

[37] Stern, L., and El-Ansary, A., 1992.Marketing channels, 4th ed., Prentice Hall, New Jersey.

[38] Stern, L.W. and Sturdivant, F.D. (2006), "Customer-driven distribution systems", Harvard Business Review, Vol. 65 No.4, pp.34-41

[39] Stern, L.W., Sturdivant, F.D. (1987), Customer-driven distribution systems, Harvard Business Review, Vol. 65 No.4, pp.34-41

[40] Venkatesh, V. and Davis, F.D. (2002). A Model of The Antecedents of Perceived Ease of Use: Development and Test. Decision Sciences, 27 (3). 451-481.

[41] Verhoef, P.C., Donkers, B. (2005), "The effect of acquisition channels on customer loyalty and cross-buying", Journal of Interactive Marketing, Vol. 19 No.2, pp.31- 43.

[42] Verhoef, P.C., Neslin, S.A., Vroomen, B. (2005), "Browsing versus buying: determinants of customer search and buy decisions in a multi-channel environment", University of Groningen, Groningen, working paper, .

[43] Walker J.C, Jarvenpaa, S., Davenport, T.H. (2002), "Towards an innovation sourcing strategy", MIT Sloan Management Review, Vol. 44 No.4, pp.43-9

[44] Wason Graham. Speech delivered on 22 nd-23rd February, 2001 at WTO / OMC Tourism Symposiumin Geneva,www.wto.org/english/tratop_e/serv_e/wttc.doc

[45] Witcher, K and Chau , G. (2008), "Understanding dynamic capabilities", Strategic Management Journal, Vol. 24 pp.991-5.

[46] Wynne, C., P. Berthon, L. Pitt, M. Ewing, and J. Napoli (2001). The Impact of the Internet on the Distribution Value Chain: The Case of the South African Tourism Industry. International Marketing Review, 18 (4): 420-31.

[47] Ytterhus, B., 2000. Supply Chain Management, Intermediary Firms and Sustainable Developments: Some Examples from the Tourism and Retailing Sectors (BI).

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Level of Knowledge of Physiotherapy among High School Sports Coaches in Harare, Zimbabwe

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Abstract- The aim of this study was to determine the level of knowledge of physiotherapy among sports coaches in government –administered high schools and determine the factors associated with the level of knowledge in Harare, Zimbabwe. Sports are a fundamental part of human existence across all ages with well documented positive health-related benefits. As such, high school sports form an integral component of the school curriculum in Zimbabwe with adolescents participating in local inter-schools or national competitions under the auspices of school coaches who in most cases are just but school teachers with respective passion for the sport. A recent observation of the inter-scholastic and national sporting events in Harare involving adolescents showed that sports-related injuries are common and the predominant number of these injuries could be avoided or severity reduced if the schools had medical personnel such as physiotherapists incorporated into their teams as resident sports physiotherapists. Physiotherapy has been shown to be important in sports circles with regards to injury prevention, performance enhancement, identification, and immediate management of acute athletic injuries and the long term rehabilitation of injuries in the literature. This prompted an investigation into the level of knowledge of the sports coaches with regards to physiotherapy. A cross-sectional study was conducted targeting sports coaches in the all high schools within the seven educational districts of Harare Province. One school was randomly selected from each educational district and all the sports coaches meeting the inclusion criteria were eligible. One hundred and twenty questionnaires were administered and 102 (85%) were returned completely filled in. The questionnaire used for the study was adopted and slightly modified for the local context from one used in a previous study in South Africa. The questionnaire was evaluated for content validity by experts and tested for reliability in a test re-test preliminary study. The data was analysed descriptively using Statistica version 11 with alpha set for significance at <0.05. The Chi-square test was used to determine the factors associated with the level of knowledge. The median age of the participants was 37 years [Interquartile range= 30-44 years]. Overall, the majority (66.7%) of the sports coaches had adequate knowledge about physiotherapy in terms of the scope of practice, therapeutic benefits, place of work, conditions seen, areas of concern for sports physiotherapists, equipment used and the role of physiotherapists in injury prevention in high school sports. Three-quarters of the sport coaches with adequate knowledge on physiotherapy indicated that their source of information about physiotherapy was mainly the media. The level of knowledge of physiotherapy among the sport coaches was associated with number of years in coaching (p=0.03). Although these results show that sports coaches are knowledge about physiotherapy future studies with large sample sizes using mixed methods are needed to evaluate the uptake of physiotherapy services in high schools.

Index Terms- Knowledge, physiotherapy, sports coaches, high schools, Zimbabwe

I. INTRODUCTION

One of the primary goals of the Ministry of Primary and Secondary Education in Zimbabwe is to enable full participation of school-children in sport. To that effect, sport has been made an integral component of the schools curricula across the country. This is laudable given the link between physical inactivity with obesity and cardiovascular disturbances in the young population[1, 2]. The objective is to encourage school-children to be physically active under the auspices of sports coaches who are usually local school teachers with just but passion in the respective sport. Although the sports coaches are usually forgotten and their views less explored in the literature with regard to sports related injuries during adolescence, the sports coaches play a number of critical roles in high school sports including coaching, screening, physical training, conditioning and advising athletes among other functions. Unfortunately, they usually lack the necessary foundational knowledge and the pre-requisite qualifications for some of these peripheral roles[3]

Over the recent years, high school sports for the youth have become organised and competitive in nature worldwide[4, 5]. In Zimbabwe, a number of critical sporting events organised at national level characterise the high school sporting calendar every year. The most common annual sporting events include the Diariboard Schools Rugby Festival for rugby, National Association of Secondary School Heads Tournament for soccer, and the Zimbabwe National Youth Games for all sports. Together with the usual inter-scholastic sporting competitions for various sports, these events are a testament to the popularity of high school sports in Zimbabwe and the support by educational structures for inclusion of sport in the school curricula. Sports are important for the physical, psychological and emotional health and development of adolescents[6]. However, the downside of increased participation in sport has always been the high risk of injuries[2] . This is a major concern especially if there are no resident or part time medical personnel such as physiotherapists working consistently with the school teams and everything seems to rest with the sport coaches. This implies that the school coaches need to have extensive knowledge not only in coaching

and training of athletes but should also have a deeper understanding on injury prevention measures and be aware of the role of the various medical personnel who can assist high school athletes in the various respects.

Sports have been implicated as a leading cause of musculoskeletal injuries among adolescents in high schools[2,7,8]. Although absolute rates vary with sport, context and methodological procedures, the overall injury incidence in youth sport has been reported within a range of 1-10 injuries per 1 000 hours[4]. In Zimbabwe, there is dearth of epidemiological data on youth injuries. There are no studies that have been published documenting the extent of this problem. This is a significant shortcoming militating against effective preventative strategies in schools for sports injuries. However, a recent observation of the last editions of the Diariboard Schools Rugby Festival and the Zimbabwe National Youth Games showed that sports-related injuries are common among high school adolescents. Most of the injuries observed were musculoskeletal in nature and were not severe and could have been avoided or the severity reduced through proper education, specific training of essential skills in respective sports, and acquisition of the pre-requisite physical, motor and physiological attributes by athletes. This could be done by the local school sports coaches with the assistance from medical professionals such as physiotherapists. Surprisingly, none of the participating schools or teams in the tournaments had a resident sports physiotherapists with them. Medical support for these national tournaments was outsourced specifically for the tournaments. This situation is similar for the local inter-schools competitions organised at local school level. This observation prompted the researchers to question whether the role of physiotherapists is known in high school sports by sports coaches, directors or coordinators particularly those involved in contact sports and athletics. The primary concerns for lacking adequate physiotherapy knowledge among sports coaches include but not limited to improper rehabilitation of injures and increased recurrence of injuries[9]. The situation in Zimbabwe is similar to other low-income countries. In a study conducted in Rwanda among 360 high school male soccer players aged between 11 and 26 years, showed that the majority of the injuries were not severe and could have been avoided if medical support was available during the entire period of the soccer tournament[9].
There is a general lack of awareness of physiotherapy and its role in the community among people who should have some knowledge by virtue of their position or job[10,11]. A cross-sectional study conducted in India involving 112 Anganwadi workers popularly known for their pivotal role as village workers in the rural areas reported that nearly 50% of these workers were not aware of the role of physiotherapy in the health sector. This lack of information is surprising given the nature of their job which requires them to identify people within the community with health-related concerns and refer them appropriately. Physiotherapy was not substantially taught in their training with only three percent of the workers indicating that it formed part of their training. Dissayanaka and Bannehekka (2014) conducted a cross-sectional study involving 776 Advanced level high school science students in Sri Lanka to determine the awareness of physiotherapy as a profession among these prospective university students. Surprisingly, the majority of the students (63%) were not aware of physiotherapy as a career, its treatment methods and its application in disease conditions other than sports injuries[11]. Sheppard (1994) conducted a national telephonic survey which randomly selected 510 members of the general public in Australia and found that there was little awareness of the full range of services provided by physiotherapists to children and women. Specific studies evaluating the awareness of physiotherapy among sports coaches in high schools are limited in the literature. Studies have investigated the awareness of medical personnel and high school students of physiotherapy[12,13]. Over the years, research has demonstrated the benefits of physiotherapy with regards to health, injury prevention and treatment in sports[14,15]. Although there are diverse areas of specialisation, physiotherapists play an instrumental role in injury prevention, performance enhancement, optimising movement efficiency, maximising health, recognition and management of acute athletic injuries, treatment and rehabilitation of injuries, education and research in public and private health institutions, educational settings, sports clubs and work place settings[10,16-18]. In Zimbabwe, sports physiotherapists work with schools in high school sports at the request of the sports coaches. Therefore, the aim of this study was to determine the level of knowledge of sports coaches in Harare, Zimbabwe working with adolescents in government- administered high schools. Secondarily, the study aimed to determine the association between level of knowledge with pre-selected factors such as age, gender, qualifications, years of experience coaching, having a sports physiotherapist at the school, having a sports training certificate and having benefited personally from physiotherapy.

II. METHODS

Study design

The study used a descriptive cross sectional study design to describe and quantify the level of knowledge at one point in time targeting high school sports coaches in government-administered schools within the seven educational districts of Harare Province, Zimbabwe.

Population and sampling

The study targeted all sports coaches from the seven educational Districts in Harare Province, Zimbabwe. The sports coaches were identified as teachers working directly or indirectly with high school adolescents in sport related activities after school in the capacity of a coach, director or coordinator. A cluster sampling method was used to select the schools and the participants. There are 55 government-administered high schools in Harare Province with an equal proportion across the seven educational districts. Initially, a list of all the schools in each district was obtained from the Harare Province Educational office. One school was then randomly selected from each educational district resulting in seven high schools being included in the study. Secondly, all the sports coaches from the selected schools were then eligible to participate in the study provided they met the inclusion criteria for the study. They had to indicate the willingness to participate. Both male and female sports coaches were eligible. Additionally, sport coaches were selected on the basis of having been a coach, director, trainer or coordinator for at least one year in any sporting discipline offered at the school whilst being a full-time school teacher. However,

eligible sports coaches absent on the day of data collection were excluded. From a total of seven schools selected, a convenient sample of 101 sport coaches was recruited.

Instrument

The data was collected using a self-administered English questionnaire with four sections. The questionnaire was adopted and modified for use from a similar study investigating the Premier Soccer League team managers' knowledge on the role of physiotherapy in South Africa[19]. Section A collected demographic data of participants including the number of years in coaching and the sport coached. Section B extracted information on the knowledge of physiotherapy through 41 multiple choice questions each with a correct answer expected. The questions ranged from places where physiotherapists can be found, the likely gender of physiotherapists, conditions likely to be seen by physiotherapists, possible roles of physiotherapists in sports, equipment used by physiotherapists, prevention and treatment aspects of physiotherapy which coaches should be familiar because of the nature of their job.

Instrument development

The questionnaire was subjected to content validation according to a criterion illustrated by Yagmale (2003). Three registered physiotherapists with 8.4±2.3 years of experience as sports physiotherapists were recruited to assess whether the instrument adequately covered all the content it is supposed to measure. The experts rated the questionnaire separately, rating each question on a four point scale based on four factors: relevance, clarity, simplicity and ambiguity[20,21]. For example, the four options available for relevance were 1=not relevant, 2= item need some revision, 3= relevant but need some minor revision, 4= very relevant. This scoring was similar for the other three factors. Experts had the liberty to refine, recommend additions or omissions of the items in the questionnaire. Percentage agreement for the items were compared for the three experts. Of all the questions, 30 (73.2%) were rated four by all the three experts and were left unchanged. However, questions with controversial ratings were either refined based on the suggestions proposed by content experts. The number of questions did not change after the validation. After the validation of the study questionnaire, a test-retest reliability study was conducted at one randomly selected high school omitted in the main study. A convenient sample of 20 high school coaches from two nearby private schools were recruited in the initial test but only 12 questionnaires were completed in the re-test. The participants did know they will be retested after seven days. An analysis of the 12 questionnaires showed substantial to perfect kappa coefficients of 0.72 to 1 for the knowledge questions in the questionnaire based on the Landis and Koch (1977)[22] criteria for interpreting the Kappa statistic. An important lesson learnt from the reliability study was to make the necessary prior arrangements with the school authorities for data collection to be conducted smoothly. It was important to notify the school headmasters who would then notify the sports coaches in advance of an impending visit by the researchers. However, no recommendations for change of questions were suggested by the sports coaches.

Procedure

After permission was granted by the Ministry of Primary and Secondary Education (Ref: C/426/3), the researchers got authorisation from the Harare Provincial Education Director (Ref: G/42/1) to conduct the study in schools within Harare Province. Ethical clearance was sought from Joint Research Ethics Committee (JREC/257/13) and the Medical Research Council of Zimbabwe (MRCZ/B/598). In addition, the researchers sought permission from selected schools through the headmasters and the sport coaches signed an informed consent form. Data collection for the main study was conducted for two months from January to March 2014. The seven schools were visited consecutively in the mornings with the questionnaires collected on the day on administration. The researchers targeted tea break sessions when all the school teachers report to the staff room. For sport coaches unavailable during this time had to be visited to their offices separately after school hours. Every questionnaire had an information sheet detailing the rationale of the study to participants. Furthermore, a verbal explanation had to be given to consolidate the information and clarify on issues of concern to sport coaches especially to the meaning of some terms used to describe conditions in the questionnaire which may be interpreted differently such as heart pain, stomach pain and broken bones. Anonymity of the schools and the sports coaches recruited in the study was maintained throughout the data collection.

Data Analysis

Raw data was entered on Excel spreadsheet after coding and then imported onto Statistica version 11 for statistical analysis. Questionnaires with missing data (at least one variable missing) were omitted from the analysis. Data normality was checked using Shapiro Wilk test. Parametric and non-parametric tests were used for normally distributed and skewed data respectively. Frequencies were used and expressed as percentages for age, gender, years of coaching and sport coached. For the level of knowledge, every correct answer was scored as 1 and incorrect answers were scored as 0 to calculate the total score on knowledge for each participant. For statistical purposes, the level of knowledge was dichotomised into two categories: inadequate knowledge (0-20 scores) and adequate knowledge (21-41scores). Chi-square was used to assess for the association between the level of knowledge and the pre-selected factors. Fishers exact replaced the chi-square test when the expected frequency was less than 5 in any one cell. The level of significance was set at $p < .05$

III. RESULTS

One hundred and twenty questionnaires were administered to the eligible sports coaches. Of the 120 sports coaches approached, 102(85%) completely filled in the questionnaires and were subsequently analysed. Figure 1 illustrates the flow chart of participants in the study. Table 1 shows the baseline characteristics of the participants. Of that total sample, 66(64.7%) were males. The age distribution of the participants was not normally distributed as indicated by Shapiro Wilk test [W=0.97, p=0.15]. The median age of the sports coaches was 37 years [Interquartile range, IQR=30-44 years]. However, there was no statistically significant difference on the age ranks

between male and female sports coaches according to the Mann Whitney U test [U= 284, p= 0.81]. The majority of the sport coaches indicated having a diploma as their highest level of qualification. In terms of coaching experience, the majority (68.6%) of the sports coaches had 1-10 years of experience in high school sports. On average, the coaches had 8.94 years (SD=3.4) without a significant difference between the male and female sport coaches [t (N=102) =0.18, p=0.86]. Approximately, 30% of the sport coaches were involved in coaching soccer at the time of the study. All the sports coaches (100%) were of black ethnicity.

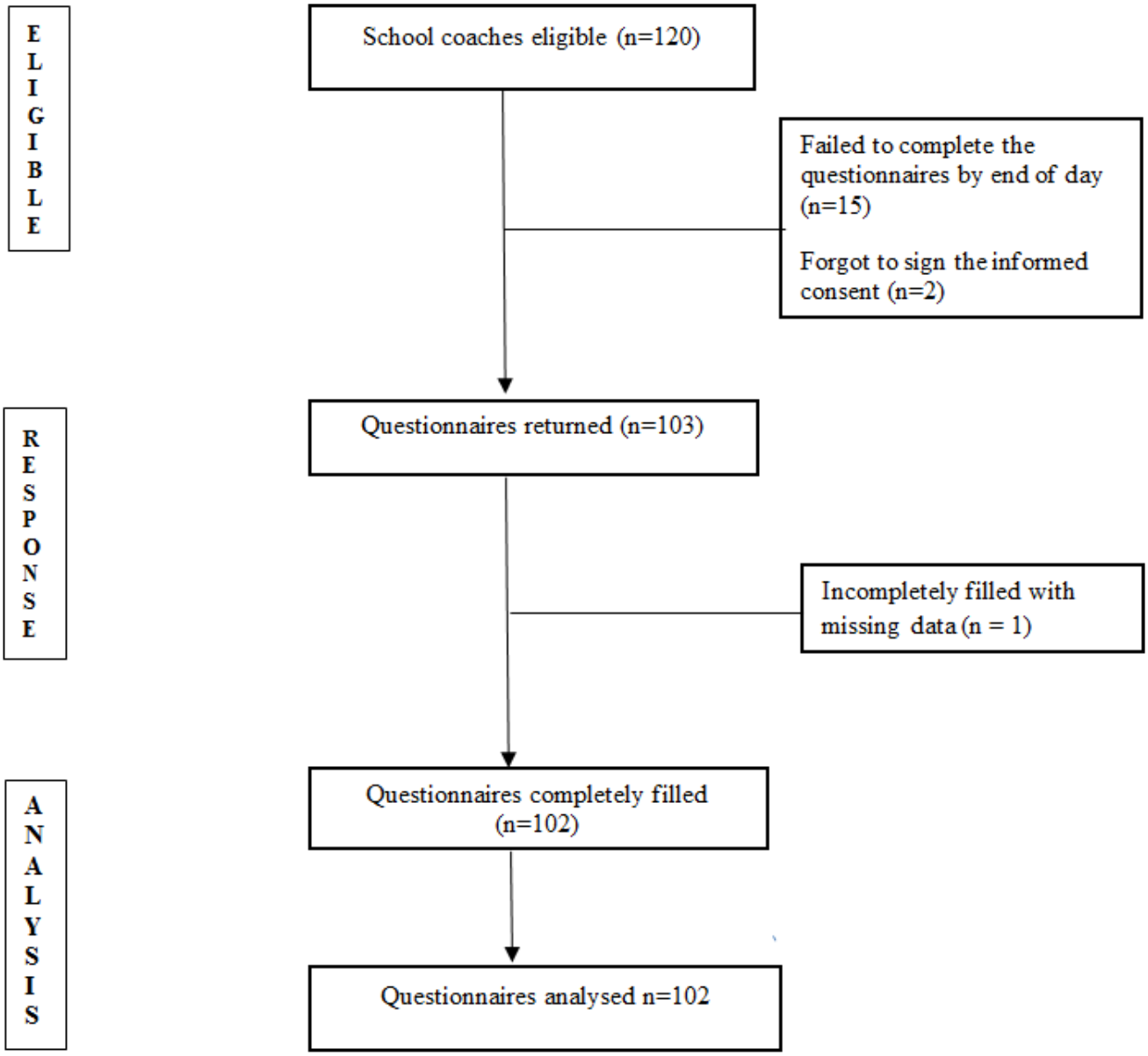

Figure 1: Flow chart of questionnaire distribution

Table 1: Demographic and coaching-related data of participants (n=102)

Characteristic	Response	Frequency n (%)	Cumulative %
Gender	Male	66 (64.7)	64.7
	Female	36 (35.3)	100
Age (years)	21-30	28 (27.5)	27.5
	31-40	36 (35.3)	62.8
	41-50	34 (33.3)	96.1
	51+	4 (3.92)	100
Ethnic group	Black	102 (100)	100
	White	0 (0)	
	Coloured	0 (0)	
	Other	0 (0)	
Level of education	Diploma	88 (86.3)	86.3
	Bachelors	10 (9.8)	96.1
	Masters	4 (3.92)	100
Number of years coaching	1-10	70 (68.6)	68.6
	11-20	20 (19.6)	88.2
	20+	12 (11.7)	100
Sports coached	Athletics	10 (9.8)	9.8
	Basketball	8 (7.8)	17.6
	Cricket	10 (9.8)	27.4
	Handball	4 (3.9)	31.3
	Netball	10 (9.8)	41.1
	Rugby	10 (9.8)	50.9
	Soccer	30 (29.4)	80.4
	Hockey	2 (1.97)	82.3
	Volleyball	18 (17.6)	100

Knowledge about physiotherapy

Table 2 below illustrates responses of the participants on the knowledge items of the questionnaire. The majority of the respondents knew what physiotherapy was about in terms of maximising health (78.4%), optimising movement efficiency (88.2%), identification and management of acute injuries (62.7%), treatment and rehabilitation of injuries (92.2%). Overall, 85.3% indicated that physiotherapy had therapeutic benefits. The majority of the sport coaches knew where physiotherapists were commonly found with 94.1% indicating government hospitals, 90.2% sports clubs and 72.5% hinting on private hospitals or clinics. Rightly so, 96.1% of the total coaches knew that physiotherapists were not found in the funeral parlours. Additionally, the majority of the sports coaches (82.3%) knew that physiotherapy was a bisexual profession with both females and males capable of being physiotherapists.

In terms of the conditions commonly referred to physiotherapists, 95.1% indicated muscle pain, 86.2% indicated back pain, 88.2% indicated ligament injuries, and 80.4% indicated joint pain. The majority sport coaches showed awareness in that physiotherapists do not manage stomach pains (92.2%) and cardiac pains (86.3%).

On the possible role of physiotherapists in schools, the majority of the sport coaches indicated that the physiotherapists should assist with first aid treatments (72.5%), sports injury prevention (62.7%) and treatment of sports-related injuries (74.5%). Only a few thought physiotherapists could perform surgeries to injured athletes (37.3%). With regards to the knowledge of equipment commonly used by physiotherapists, the sport coaches knew that physiotherapists use ice (88.2%), exercise machines (90.2%), and prescribe walking aids (82.4%). However, a 31.4% knew that physiotherapists do use electrotherapy equipment. In addition, the sports coaches knew techniques used by physiotherapists such as massage (90.2%), exercises (94.1%) and patient education (80.4%) and what they were unable to do such as prescribing drugs (62.7%) and performing operations (90.2%).

Table 2: Participants responses on knowledge of physiotherapy (n=102)

Question	Responses	Right answer	Wrong answer
Physiotherapy is about	a. Maximising health	80 (78.4)	22 (21.6)
	b. Optimising movement efficiency	90 (88.2)	12 (11.8)
	c. Identification and management of acute injuries	64 (62.7)	38 (37.3)
	d. Treatment and rehabilitation of injuries	94 (92.2)	8 (7.8)
Does physiotherapy have therapeutic benefits?	Yes/No	87 (85.3)	15 (14.7)
Where do physiotherapists work?	a. Government Hospital	96 (94.1)	6 (5.9)
	b. Sporting activities	92 (90.2)	10 (9.8)
	c. Funeral parlour	98 (96.1)	4 (3.9)
	d. Private hospitals/clinics	74 (72.5)	28 (27.5)
Physiotherapists are typically of which gender	Male/Female/Both	84 (82.3)	18 (17.7)
Which of the following factors make a person more likely to be attended to by physiotherapist?	Broken bones	78 (76.5)	24 (23.5)
	Stomach pain	94 (92.2)	8 (7.8)
	Ligament injury	90 (88.2)	12 (11.7)
	Muscle pain	97 (95.1)	5 (4.9)
	Cardiac/Heart pain	88 (86.3)	14 (13.7)
	Joint pain	82 (80.4)	20 (19.6)
	Back pain	88 (86.3)	14 (13.7)
Sports physiotherapist attends to the following areas	a. Injury prevention	64 (62.7)	38 (37.3)
	b. Surgery of an injured athlete	38 (37.3)	64 (62.7)
	c. Injury treatment	76 (74.5)	26 (25.4)
	d. First aid treatment on field	74 (72.5)	28 (27.5)
The equipment used by the physiotherapist includes the following	a. Ice	90 (88.2)	12 (11.7)
	b. Exercise machines	92 (90.2)	10 (9.8)
	c. Electrical machines	32 (31.4)	70 (68.6)
	d. Bandages	84 (82.4)	18 (17.6)
	e. Walking aids	84 (82.4)	18 (17.6)
	f. Training beds	72 (70.6)	30 (29.4)
Does warming up before the game and training reduce the risk of injury?	Yes/No	98 (96.1)	4 (3.9)
Does cool down after the game and training reduce the risk of injury?	Yes/No	94 (92.2)	8 (7.8)
Does strapping before the after the game reduce the risk of injury?	Yes/No	54 (52.9)	48 (47.1)
Does returning too early to play after the injury lead to re-injury?	Yes/No	88 (86.3)	14 (13.7)
Does playing with injury lead to disability?	Yes/No	80 (78.4)	22 (21.5)
Can the physiotherapist conduct training sessions with the team?	Yes/No	72 (70.6)	30 (29.4)
Physiotherapy treatment includes	a. Massage	92 (90.2)	10 (9.8)
	b. Operations	10 (9.8)	92 (90.2)
	c. Exercises	96 (94.1)	6 (5.9)
	d. Medication	38 (37.3)	64 (62.7)
	e. Education	82 (80.4)	20 (19.6)
Physiotherapists provide services	a. during the game matches only	72 (70.6)	30 (29.4)
	b. during training and game matches	82 (80.4)	20 (19.6)
	c. during training matches only	24 (23.5)	78 (76.5)

The majority of the sport coaches knew that physiotherapists could be involved in providing services during training and game matches (80.4%). However, 23.5% of the sports coaches recognised that the importance of physiotherapists during training matches. The coaches indicated to have knowledge of the following preventative measures: warming up before the game and training (96.1%), cooling down after the game and training (92.2%), returning to play early after an injury (86.3%) and playing with an injury (78.4%).

Table 3: Coaches' level of knowledge on physiotherapy services by gender (N=102)

Level of knowledge (score)	Frequency N (%)	Male N (%)	Female N (%)	$X^2(1)$	P value
Inadequate knowledge (0-20)	34 (33.3)	24 (36.4)	10 (27.8)	0.77	0.38
Adequate knowledge (21-41)	68 (66.7)	42 (63.6)	26 (72.2)		
Total	102	66	36		

Table 3 shows that 66.7% of the sports coaches had adequate knowledge about physiotherapy services. There was no statistically significant difference in the level of knowledge between male and female sport coaches. Three-quarters of the sport coaches with adequate knowledge on physiotherapy indicated that their source of information about physiotherapy was mainly from the media. Figure 2 below shows the source of information for the sports coaches for physiotherapy. As indicated in Table 3 below, the level of knowledge of physiotherapy among the sport coaches was associated with coaching experience (p=0.03).

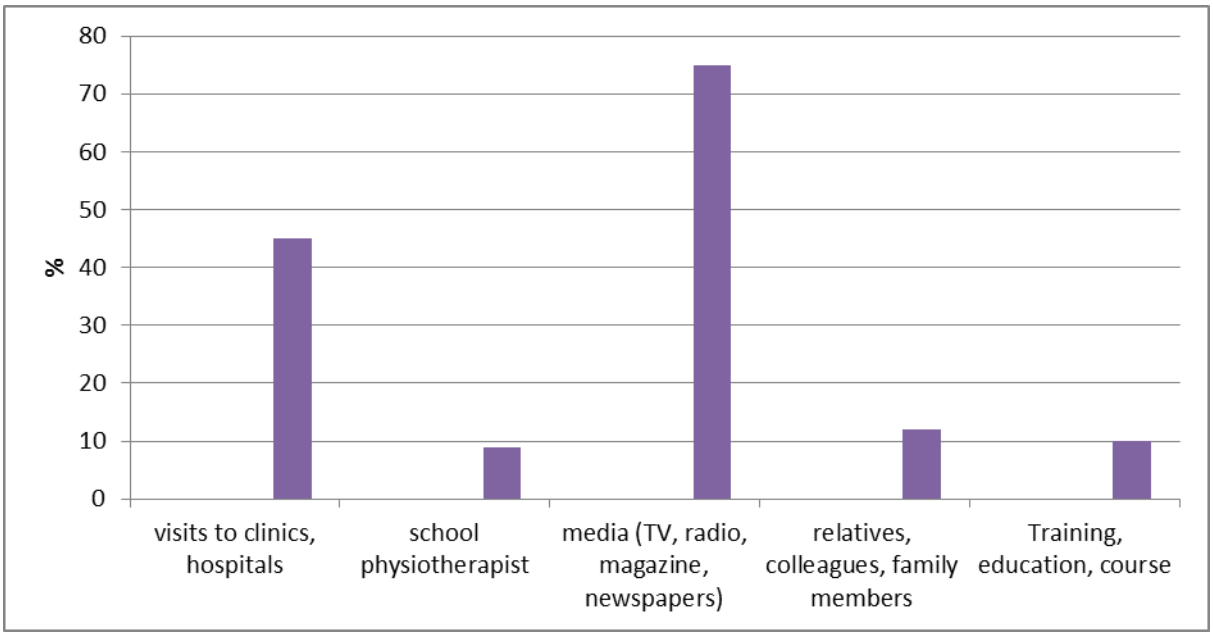

Figure 2: Sources of information for sport coaches with adequate knowledge on physiotherapy (N=68)

Table 4: Factors associated with the level of knowledge for the sport coaches (N=102)

Factors	Responses	Level of knowledge		Total	Statistic	P value
		Adequate Knowledge	Inadequate Knowledge			
Age	≤ 40 years	42 (61.8)	22 (64.7)	64	0.08	0.77
	> 40 years	26 (38.2)	12 (35.3)	38		
	Total	68	34	102		
Qualification	Diploma	57 (83.8)	31 (91.2)	88	Fishers	0.24
	Diploma +	11 (16.2)	3 (8.8)	14		
	Total	68	34	102		
Coaching experience	≤10 years	42 (61.8)	28 (82.4)	70	4.46	**0.03**
	> 10 years	26 (38.2)	6 (17.6)	32		
	Total	68	34	102		
Sport coached	Team based	60 (88.2)	32 (94.1)	92	Fishers	0.49
	Not	8 (11.8)	2 (5.9)	10		
	Total	68	34	102		
Having a sports physiotherapist at the school	Yes	15 (22.1)	7 (20.6)	22	0.03	0.86
	No	53 (77.9)	27 (79.4)	80		
	Total	68	34	102		
Having a sports coaching training certificate	Yes	9 (13.2)	6 (17.6)	15	0.35	0.55
	No	59 (86.8)	28 (82.4)	87		
	Total	68	34	102		
Having personally benefited from physiotherapy	Yes	7 (10.3)	3 (8.8)	10	Fishers	0.56
	No	61 (89.7)	31 (91.2)	92		
	Total	68	34	102		

IV. DISCUSSION

The study sought to determine the level of knowledge on physiotherapy and its services amongst sports coaches in Harare, Zimbabwe. Studies relating to the knowledge level of sports coaches with regards to physiotherapy services are limited in literature. This renders comparisons with other studies difficult. Although this could have limited participants from fully expressing their concerns, the questions on knowledge were asked as close-ended questions with one correct answer in order to deduce a total score on knowledge for each individual coach. Future studies using mixed methods and larger sample sizes focusing on sports coaches and athletes may provide more useful information. Therefore, this study should be seen as a pilot study describing the baseline level of knowledge of high school sports coaches in government-administered schools with regards to physiotherapy. Nevertheless, the response rate for the study was satisfactory eliminating bias from non-participation and was consistent with other cross-sectional studies evaluating awareness of physiotherapy among members of the community[11]. The high response rate could be attributed to immediate collection of the questionnaires after being completed by the participants. Moreover, assistance from the school headmasters ensured that all the participants were prepared for the impending visit by the researchers.

The present study showed that 67% of the sports coaches had adequate knowledge about physiotherapy. This was in terms of the scope of practice, place of work, conditions seen, equipment used, and treatment techniques used by physiotherapists. Additionally, the majority (85.3%) of the sport coaches were aware of the therapeutic benefits of physiotherapy and 92.2% indicated that physiotherapy was crucial for treatment and rehabilitation of sports injuries. However, 37.3% of the sports coaches were not aware of the role of physiotherapists play in injury prevention. These findings suggest high school sports coaches in Harare, Zimbabwe government schools are aware of physiotherapy, its services and its role in treatment and prevention of sports injuries in high school sports. This is important for sport coaches in high schools to understand as they can advocate for physiotherapists to be employed on part time or resident basis in high schools as a local resource for injury prevention and treatment. Although studies specifically evaluating awareness of physiotherapy among sports coaches working with high school adolescents are limited, the present study findings are consistent with other studies that found increased awareness of physiotherapy among different participants[19,23,24]. In the present study, the actual reasons for the adequate knowledge on physiotherapy among sports coaches are unclear but could be related to coaching experience. About 33% of the sports coaches with adequate knowledge had more than ten years of experience in coaching compared to 17.6% of the coaches without adequate knowledge.

It is encouraging to realise that high school sport coaches are aware of physiotherapy and its therapeutic benefits but these findings create a need for future researches to investigate the uptake of physiotherapy services by schools and the factors favouring or militating against that especially in government-administered schools. Unfortunately, the adequate theoretical knowledge of the importance of physiotherapy by coaches seem not to translate into practical knowledge of acquiring the services of these health professionals. This is evident in the present study with only 21.6% of the coaches indicating having a sports physiotherapist at their school to assist with physical training, conditioning, treatment and rehabilitation of injuries. This decreased uptake of physiotherapy services in government-administered high schools could be due to financial constraints. It could be expensive for the government-sponsored high schools to employ physiotherapists at permanent basis. However, with the ever-increasing emphasis on sports participation among high school adolescents in Zimbabwe by the Ministry of Primary and Secondary Education, there is need for the schools to engage the services of qualified medical personnel on regular basis to assist with the prevention and management of injuries. Sports in high school adolescents have been recognised as a leading cause of musculoskeletal injuries sometimes with long term health-related consequences[2,7,8].

Another possible reason for the poor uptake of physiotherapy services in the schools could be lack of formal training of the sports coaches. Quite often, sports coaches are school teachers with but just passion in the respective sport without the necessary pre-requisite qualifications to coach the sport. In the present study, only 15% of the sports coaches indicated having obtained a formal training certificate as a sports coach. However, there was no statistically significant association between knowledge and having obtained a coaching training certificate. This probably indicates that the content of the training courses do not expose the sport coaches to medical information relevant to the sport the coach is involved in. This create a need for conducting medical training workshops sensitising and educating the local high school sports coaches on the roles of all the health-care professionals involved in sports and how they can contribute to talent identification, screening of athletes, physical training, conditioning and injury prevention. Health-related information regarding the pertinence and relevance of professions such as physiotherapy in high school sports could then be emphasised in the training. There is also a need to mandate formal training of all high school sports coaches in order for them to have a certificate of competency in the sport that they coach. That way the training courses can be used as a platform to educate the coaches on physiotherapy. In the present study, the majority of the sports coaches admitted sourcing their information on physiotherapy from the media (newspapers, television, radio and magazines). This was also shared by Johnsey et al (2013) who found that half of all Indian village health workers who knew about physiotherapy relied on the media for their information.

The present study revealed that the participants knew the conditions commonly treated by physiotherapists such as muscle pain, joint pain and back pain. Motha (2010) reported similar

results among South African team managers of Premier League Clubs although that study had a relatively small sample size. A study by Holdsworth (2006) revealed that 54% of the patients who self-referred themselves to physiotherapists presented with back pain indicating that the patients knew that physiotherapists treat such conditions involving muscle and joint pain[25]. The present study findings suggest that sports coaches in government-administered high schools are aware of the conditions in need of physiotherapy. This is important for coaches in high school sports to understand as early identification and appropriate management of these impairments is crucial. There were few coaches who thought physiotherapists directly assist with heart pain (13.7%) and stomach pain (7.8%) in their line of work. This may have been attributed to the observation of the general role adopted by physiotherapists in field games of assisting any athlete who may need medical assistance. The majority of the sports coaches knew that physiotherapists could be involved in both training and competitive matches but it was surprising to note that 76.5% of the sport coaches were not aware that physiotherapists could be involved in training matches only. This creates a need to raise awareness among high school sports coaches of the potential role that could be played by physiotherapist in training games. Training matches offers physiotherapists an opportunity to implement preventative strategies, educate athletes and for screening athletes for various functional or biomechanical deficits that predisposes athletes to injuries. This probably explains why results on the role of physiotherapists in injury prevention were not satisfactory with 62.7% of the sport coaches showing awareness of the involvement of physiotherapists in injury prevention.

V. CONCLUSION

Cognisant of the limitations of the study, the study showed that the majority of the high school sports coaches were adequately knowledgeable about physiotherapy with regards to its scope of practice, place of work, conditions seen, equipment used, and treatment techniques used by physiotherapists. Most of the information about physiotherapy that sports coaches had was from the media. The level of knowledge was significantly related to the number of years in coaching. A few of the sports coaches had formal training awarding them with a certificate in the sports they coach and the level of knowledge was not associated with having a sports training certificate. This create a need for formal training of sports coaches through regular workshops as a means to educate them on the potential benefits of physiotherapy and its relevance in sports context especially with regards to injury prevention. These workshops may assist in improving awareness of physiotherapy.

ACKNOWLEDGEMENTS

The authors wish to extend profound gratitude to the headmasters and sports coaches who participated in this study. Additionally, the authors would to thank members of staff in the department of rehabilitation at the University of Zimbabwe especially Mrs Mlambo for her guidance.

REFERENCES

[1] Caine D, Purcell L, Maffulli N. The child and adolescent athlete: a review of three potentially serious injuries. BMC Sports Science, Medicine and Rehabilitation. 2014; 6(1): 1–10.

[2] Spinks BA, McClure RJ. Quantifying the risk of sports injury: a systematic review of activity-specific rates for children under 16 years of age. British Journal of Sports Medicine. 2007; 41: 548-557

[3] Van Gent MM, Spamer EJ. Comparisons of positional groups in terms of anthropometric , rugby-specific skills , physical and motor components among U13,U16, U18 and U 19 elite rugby players. Kinesiology. 2005; 37(1), 50–63.

[4] Theisen D, Malisoux L, Seil R, Urhausen A. Injuries in youth sports: Epidemiology, risk factors and prevention. German Journal of Sports Medicine. 2014; 65: 248-252

[5] Brown JC, Verhagen E, Viljoen W, Van Michelen W, Hendricks S, Lambert MI. The incidence and severity of injuries at the 2011 South African Rugby Union (SARU) Youth Week tournaments. South African Journal of Sports Medicine. 2012; 24(2): 49-54

[6] Emery CA. Risk factors for injury in child and adolescent sport: a systematic review of the literature. Clinical Journal of Sports Medicine. 2003; 13(4): 256-268

[7] Nshimiyimana JB & Frantz JM. Epidemiology of soccer related injuries among male high school players in Kigali, Rwanda. African Journal for Physical, Health Education, Recreation and Dance. 2012; 18(3): 597-603

[8] Hogan KA, Gross RH. Overuse injuries in paediatric athletes. Orthop Clin North Am. 2003; 34:405-415

[9] Johnsey T, Swaminathan N, Rebello S, Vishal K. Awareness of physiotherapy among the Anganwadi workers in Dakshina Kannada: A survey. Muller Journal Medical Science Research. 2013; 4: 57-63.

[10] Dissanayaka TD, Bannehekka S. Awareness of physiotherapy among high school students. International Journal of Scientific and Research Publications. 2014; 4(7): 1-5

[11] Sheppard L. Public perception of physiotherapy: Implications of marketing. Australian Journal of Physiotherapy. 1994; 40(4): 265-275.

[12] Ogiwara S, Nozoe M. Knowledge of physiotherapy: A study of Ishikawa High School students. Journal of Physical Therapy Science. 2005; 17: 9-16.

[13] Dhiraj RS, Jayant T, Reshma RK. Awareness of Physiotherapy in Medical Practioners at Rural Area. American Journal of Advances in Medical Sciences. 2013; 1(1): 1-5.

[14] Bennet CJ, Grant MJ. Specialisation in physiotherapy: A mark of maturity. Australian Journal of Physiotherapy. 2014; 50(1): 3-5

[15] Mancinelli CA, Davis DS, Alboulhosn L, Brady M, Eisenhoef J, Foutty S. The effect of massage on delayed onset muscle soreness and physical performance in female collegiate athletes. Physical Therapy Journal in Sport Medicine. 2005; 7:5-13.

[16] Kennet J, Hardaker N, Hobbs S. Cooling efficiency of four common cryotherapeutic agents. Journal of Athletic Training.2007; 42(3): 343-348.

[17] Hogue RE. Physical Education: The present. Physical therapy. 2005; 10(2): 300-355.

[18] Motha G. Team manager's knowledge of the role of physiotherapy South Africa soccer teams in the Premier Soccer League. MSc Physiotherapy Thesis. 2009. University of Limpopo

[19] Yagmale F. Content validity and its estimation. Journal of Medical Education. 2003; 3: 25–27

[20] Waltz CF, Bausell RB. Nursing Research: Design, Statistics and Computer Analysis. 2nd Edition 1983. Philadelphia: FA Davis Company.

[21] Landis, JR, Koch GG. The measurement of observer agreement for categorical data. Biometrics 1977; 33: 159–174.

[22] Hirose Y, Ito Y, Fuji Y et al. A survey of high school students' awareness of physiotherapy. Journal of Japanese Physical Therapy Association 1996; 23: 153.

[23] Hachimatsu K, Harata N, Umezaki M. A survey of Saga high school students' awareness of physiotherapy, Journal of Japan Physical Therapy Association, 1998; 25 (Supplementary 2): 98

[24] Holdsworth L, Webster, V, McFadyen A. Are patients who refer themselves to Physiotherapy Different from those Referred by GPs: Results of a National Trial. Physiotherapy. 2006; 92: 26-33.

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Role of different HAART regimens in ART program of INDIA on Missing appointments of On Treatment PLHIVs in Srikakulam.

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Abstract- Missing regular appointments to ART centres in Srikakulam have increased by over 5% in the last one years. In 2015, between January to June, with the help of staff of ARTC, RIMS GH, Srikakulam, we conducted a retrospective cohort study in srikakulam district of Andhra Pradesh. PLHIV of age group 15-74, and regular on treatment at srikakulam by the end of DEC 2014 were considered for study at 50:50 gender ratio. In the study, a total of 1258 new missed appointments were found out of 22800 scheduled appointments. The most frequently reported drug regimen in missed appointments were TDF+3TC+EFV (TLE) (752 episodes), ZDV+3TC+NVP (ZLN) (442 episodes) and ZDV+3TC+EFV (ZLE) (56 episodes), and 24-44 age group has a share of 70% new miss. So, we recommend a thorough relook into national guidelines for implementation of TLE as single drug, owing to its high rate of missing appointments in productive age group (25-44 years) as it may hamper the national program and a further study recommended for cause of rejection of regimen in PLHIV is much needed.

Index Terms- Tenofovir (TDF), Effavarinz (EFV), Adherence, Resistance, missing HAART.

I. INTRODUCTION

At the end of March 2015, an estimated 36.9 million people were living with the human immunodeficiency virus (HIV) worldwide and 15 million were receiving life-saving antiretroviral treatment (ART) worldwide [1]. Despite scaling up ART in low- and middle-income countries, an estimated 41% coverage of those in need of ART have access to ARV drugs. Universal access to treatment (defined as 80% or greater coverage) is thus still to be achieved in almost all parts of the world [1].

In India, the total number of people living with HIV/AIDS (PLHIV) was estimated at 2,100,000 in 2012 [2]. In recent years, the country has put considerable efforts in expanding HIV-testing sites, and about 200,000 new HIV-positive individuals are diagnosed each year [2]. Access to CD4-testing facilities and ART centres has also been expanded. Despite establishment of Link ART centres and Link ART plus centres in ICTCs with concept to reduce time, cost, of travel to ARTC and to increase adherence to ARV drugs through national program, late presentation of patients to ART sites who are receiving ARV drugs is known to be an operational challenge for two major reasons. One is failure to reach to LAC and LAC+ centres owing to stigma for the near place and; and the other is failure to attend ARTC for timely refill of ARV drugs owing to longer distance.

In the State of Andhra Pradesh in south India, HIV-testing sites and ART facilities have been scaled up dramatically to increase access to testing and treatment from Nation program. However, HIV-testing sites are physically disconnected from ART centres. While HIV-testing facilities are available at the primary healthcare level, ART centres are situated mostly at the district level. For an HIV-reactive individual (sick or healthy), this thus implies a ‘‘journey’’ from diagnosis to care that involves travel, time and other direct and indirect costs. In Srikakulam, in spite of having 12200 registered cases [3], we are having only one ART centre to cover total district that made PLHIV to travel more than 100km to reach ARTC and another 100 km to reach their homes.

In the Srikakulam District of AP, we thus determined to have a look at the role of ART regimens used as per revised national guidelines for any possible impact for missing the scheduled appointments to ARTC as, it has been shown that virological suppression can be achieved if high level of adherence was maintained [4].

II. STUDY DESIGN

This was a Retrospective Cohort study involving a review of records routinely maintained under the National AIDS Control Programme (NACP).

Study setting, sites and study population:-

Srikakulam district with a population of 2.71 million, is one of the smallest district in state of Andhra Pradesh of India and is considered to have a relatively advanced HIV epidemic [5]. In 2009, the district had an HIV prevalence of <0.50% [6]. There are 17 public HIV-testing sites (16 are standalone, while 1mobile testing centre) and 1 ART centre with 3 Link ARTC+ and 6 LACs. All HIV-positive persons diagnosed at the HIV testing sites are referred to the nearest ART centre for further management and are expected to reach these ART centres on their own. ART centre, located at tertiary care medical college of the district, Rajiv Gandhi Institute of medical sciences, far from the point of HIV diagnosis; distances are in the range of 5-120 km, and they are often not well connected by public transport.

TABLE 1

Status	Total(n)	n (%)
D	118	0.52
LFU	177	0.78
MIS	1579	6.93
OT	20822	91.32
ST	4	0.02
ST-P	8	0.04
T	92	0.40
TOTAL	22800	100.00

Patients most often have to spend a whole day for each visit to the ART centre.

On arrival at ART centres, patients are registered, given a pre-ART registration number and classified into World Health Organization (WHO) clinical stages. They then undergo basic investigations, including CD4 count assessments, and if found ART eligible they are initiated on ART and followed up monthly. Those who are not eligible for ART are asked to return for six monthly follow-ups, including a CD4 assessment.

ART eligibility assessments were done in accordance with national guidelines, which are in tune with current WHO recommendations [7]. Briefly, any person in WHO clinical stages 1 or 2 with a CD4 count <=350 cells/mm3 and anyone in stages 3 or 4 irrespective of CD4 count were eligible for ART, pregnant women, and patients with TB are started on HAART. Srikakulam district has District AIDS Prevention and Control Units (DAPCUs) monitoring the operations under NACP. Each unit is headed by a district-level Programme officer who in turn is assisted by paramedical staffs to monitor the process of linking HIV-positive persons who were diagnosed at HIV testing sites to the ART centres, and to maintain information on all of the HIV-positive patients detected in their respective districts.

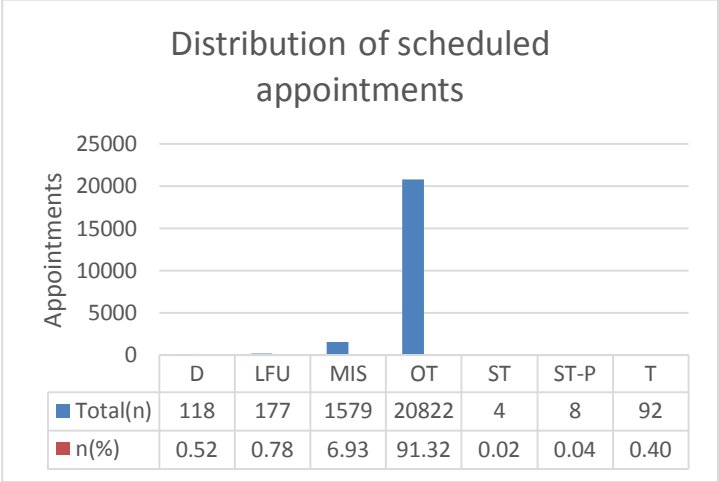
This study was conducted at ARTC, RIMS, Srikakulam from January 2015 to June 2015, across the district on PLHIV who are alive and on treatment and are scheduled to pick up medicines in January 2015.

Data and statistical analysis:-

The sources of data were HIV-testing records and ART centre records (pre-ART registers, ART enrolment registers and patient treatment cards). For each patient, we reviewed the records through the end of June 2015 from January 2015 to ascertain whether the respective patient had complete updated record. The data was cross checked with Dec 2015 visit and due dates. A total of 3800 PLHIV who took medicine in Dec 2014 and scheduled for Jan 2015 were sampled for next 6 months follow up. A total of 22800 scheduled visits for these 3800 PLHIV for next 6 months were considered in this study and followed up. The data analysis and RR, 95% CI, P-value are calculated using Medcalc software.

III. RESULTS

A total of 3800 PLHIV with total scheduled visits of 22800(n) at 50:50 gender ration, 1900 are male and 1900 are female with each having scheduled appointments of 11400 each and the mean (SD) age was 35 years.



Of those scheduled visits for refill of HAART(Table 1), 20822 (91.32%) visits were as per schedule and picked up their respective pill box, 118 (0.52%) visits were marked as Death, 177 (0.78%) visits were marked as Lost to Follow up (LFU), 1579 (6.93%) were marked as total missed appointments, 12 (0.05%) were marked as stopped owing to health problems, and 92(0.40%) were marked as transferred out to other centres.

Overall missed appointments were 1579 standing at 6.93% of total appointments of which 1258 were marked as new miss and other 321 visits were repeat miss following last month miss appointment. Of 1258 new misses that were considered for study (Table 2), 636 (50.55%) were scheduled for males and 622 (49.44%) were scheduled for female. Of 1258 new misses, 445 (35.37%) were 25-34 years age group and 461 (36.65%) were 35-44 age group causing 70.02% of total new miss. And again, of 1258 miss recorded, 752(59.78%) were recorded among PLHIV using TDF+3TC+EFV (TLE) regimen and 442(35.14%) among PLHIV using ZDV+3TC+NVP and found that TLE regimen got RR of 1.63 (CI 1.14 - 1081 and p value <0.0001).

IV. DISCUSSION

This is one of the studies in India that assessed the cause of regimens for the linkage between regular HAART usage and Missing of appointments at ART centres, and it shows that about 60% of PLHIV who were recorded as new miss were due to use of TDF+3TC+EFV regimen and two thirds of miss were caused by EFV based regimen when compared to NVP based regimen.

A key finding of this study is that, in the ‘‘linkage pathway’’ between HAART prescription and missing of appointments, 91.32% of HIV-positive individuals were retained in care as per schedule and 6.93% of those who were on treatment were missed over the period of 6 months. A recent study estimated a relatively high rate of patients in VF while among them an important proportion harbored wild-type viruses and this highlights a real need to reinforce treatment adherence [8]. Since missing new cases to TLE, may be a point of view to enhance chance to increase adherence by some corrections in the national program.

Firstly, since over 26% of attrition was related to early deaths at the stages of HIV testing and ART eligibility, it is likely to reflect late presentation of patients and advanced disease. A recent study from India showed that 85% of patients

present late to health facilities [9]. Accordingly, late presentation to ARTC after HIV testing along with regular missing of scheduled pick up of refill will culminate proportionately to increase wild type virus [8], causing illness and death, and we lost total scheduled appointments 0.52% to deaths in our study.

Second, to the point of concern, the high proportion of new miss (70.02%) were within age group between 25-44, which is considered to be earning age group and is backbone to Indian economy in future, are also missing at higher number even with better care and decentralized service for care of PLHIV and there is a clear need to decentralize ART further and bridge the geographical disconnect between HIV testing and care, as separate (disconnected) services are known to result in lower ART uptake [9].

Third, as a process of implementation of TLE as a single best regimen for all [7], i.e., treating PLHIV, PEP, ANC cases infected with HIV, by WHO and NACO in India, we tend to study nature of new miss to analyze chances of different regimens as a cause of new miss. Further into the study, we selected the scheduled appointments in spite of number of PLHIV on treatment, to fast identify each appointment effectively and to reduce errors caused by repeat misses by the PLHIV. In the process, we described MIS as the failure of PLHIV to pick the medicine at ARTC in the scheduled month and the first missed appointment is calculated and if the PLHIV is missed for 3 months, then it is labelled as 'LFU' [10]. Again, if a PLHIV picked medicine in January and dint turn up in Feb but again visited in March for the refill and was miss again in April, i.e., alternate month MIS, then the both missed appointments are calculated as new miss, as each missed month was preceded by visit having a counselling session at ARTC, consisting of importance of HARRT and resistance to the drugs, and clarification on side effects of the regimen.

Of all the new missed appointments occurred during the study period, regimens TLE (RR 1.63, CI 1.14 - 1081) with significant P-value of <0.0001 and ZLN (RR 0.63, CI 0.55 - 0.70) with p- value <0.0001.These two regimens has caused a significant number of new miss and again, TLE has relatively increased risk (1.63 times) of missing an appointment than other regimens in the national guidelines in India. In this context, a point to compare, even ZLE (RR 1.06, CI 0.81 - 1.37) with p-value of 0.55 has a considerably higher risk of missing the appointment.

A very encouraging finding from the study [11] is that almost all (i.e. all but one) co-infected HIV-TB patient and all HIV-positive pregnant women reached ART centres which is very encouraging as compared to results of studies elsewhere [12,13]. As per the study provided [11], the initiation of HAART in ANC infected with HIV and TB co-infected patients in India is absolutely 100 %, and these are group of persons needed to be started on TLE [7, 10] or else ZLE, in cases of known toxicities for TDF based regimen, culminating the risk of missing new cases with the prescribed regimen is at its higher level which may disrupt the RNTCP and PPTCT programs in India. This merits further investigation into using the regimen.

The strengths of this study are that patients were rigorously counselled on drug use ranging from 6 months to more than 4 years, as the group selected for the study has a HAART initiation date as long as 12/05/2007 and latest date as 31/7/2015. We tried to explore reasons for miss through telephone calls and outreach visits and, the data come from routine clinics as it is likely to reflect the on-the-ground reality. We also adhered to the guidelines for reporting of observational studies [14] and ethics [15]. Limitations include the fact that roughly 1.75% of patients who were lost to follow-up, died and transferred out.

V. CONCLUSION

In Srikakulam, a small district of Andhra Pradesh, state of India, 59.78% of all new missed appointments of scheduled appointments were lost due to TLE regimen and another 35.14% lost to ZLN but in numbers, a massive difference of 310 new missed recorded towards a future regimen in productive age group of 24-44 years (causing 70% new miss), which is of considerable problem in respect of using it towards the single regimen in the ground level and requires to re think in national guidelines.

REFERENCES

1. UNAIDS. Fact sheet global statistics-2014.How AIDS changed everything?
2. UNAIDS global report 2013 and NACO HIV estimates 2012.
3. Monthly report submitted to NACO by ARTC.
4. Jiamsakul A et al. Journal of the International AIDS Society 2014, 17:19053, HIV multi-drug resistance at first-line antiretroviral failure and subsequent virological response in Asia
5. Census of INDIA 2011.
6.HIV/AIDS Situation and Response in Srikakulam District: Epi demiological Appraisal Using Data Triangulation
7. 2013 WHO guidelines for HAART initiation and follow up.
8. Antiretroviral treatment outcome in HIV-1-infected patients routinely followed up in capital cities and remote areas of Senegal, Mali and Guinea-Conakry. Diouara AAM et al. Journal of the International AIDS Society 2014, 17:19315.
9. Sogarwal R, Bachani D. Are persons living with HIV timely accessing ART services in India? J Indian Med Assoc. 2009;107(5):288_90, 307.
10. Revised NACO guideline for ARTC 2014.
11. Shastri S et al. Journal of the International AIDS Society 2013, 16:18502
12. Harries AD, Lawn SD, Getahun H, Zachariah R, Havlir DV. HIV and tuberculosis _ science and implementation to turn the tide and reduce deaths. J Int AIDS Soc. 2012;15(2):17396. doi: 10.7448/IAS.15.2.17396.
13. Zachariah R, Teck R, Ascurra O, Gomani P, Manzi M, Humblet P, et al. Can we get more HIV-positive tuberculosis patients on antiretroviral treatment in a rural district of Malawi? Int J Tuberc Lung Dis. 2005;9(3):238_47.
14. von Elm E, Altman DG, Egger M, Pocock SJ, Gøtzsche PC, Vandenbroucke JP. The strengthening the reporting of observational studies in epidemiology (STROBE) statement: guidelines for reporting observational studies. Bull World Health Organ. 2007;85(11):867_72.
15. Edginton M, Enarson D, Zachariah R, Reid T, Satyanarayana S, Bissell K, et al. Why ethics is indispensable for good-quality operational research. Public Health Action. 2012;2(1):21_2.

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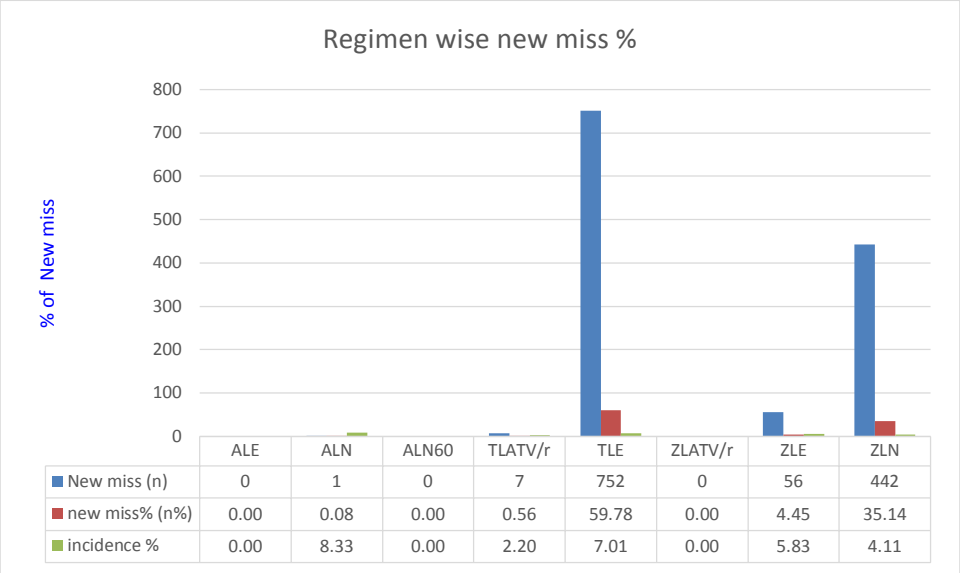
Table – 2 :- STUDY PROFILE

Period	Jan 15 to June 15
Criteria	Total on treatment as on 01/01/2015
Total Selected population(PLHIV)	3800 for 6 months
Total scheduled appointments	22800
total regular	20822
Total missed	1579
New Miss	1258
Repeat miss	321

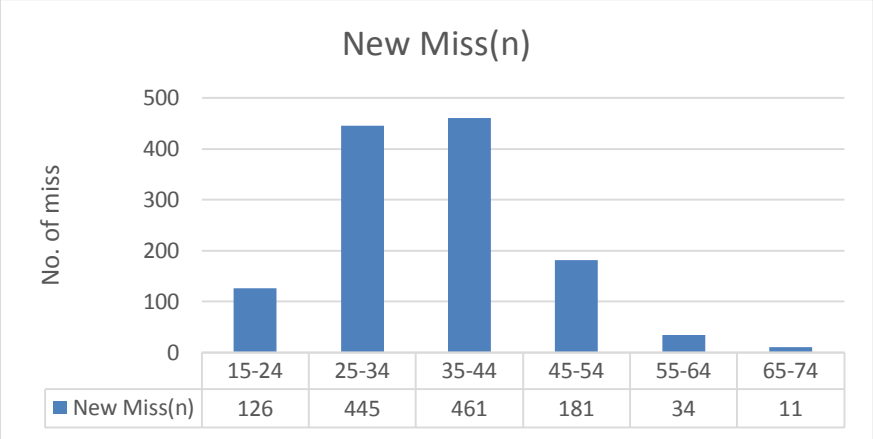
Gender Wise

1	Missed Schedules	Other Schedules	RR	95% CI	P-value
MALE	636	10764	1.02	0.91 - 1.37	0.70
Female	622	10778	0.97	0.88 - 1.09	0.70
TOTAL	**1258**	**21542**			
2	**Age group wise**				
15-24	126	1956	1.10	0.92 - 1.31	0.28
25-34	445	7637	1.00	0.89 - 1.11	0.95
35-44	461	8095	1.02	0.90 - 1.14	0.76
45-54	181	2969	1.05	0.89 - 1.02	0.56
55-64	34	722	0.82	0.59 - 1.14	0.24
65-74	11	163	1.14	0.64 - 2.02	0.66
TOTAL	**1258**	**21542**			
3	**Regimen Wise**				
ALE	0	6	1.37	0.09 - 19.74	0.81
ALN	1	11	1.44	0.22 - 9.68	0.69
ALN60	0	6	1.37	0.09 - 19.74	0.81
TLATV/r	7	311	0.41	0.20 - 0.86	0.02
TLE	752	9976	1.63	1.14 - 1081	<0.0001
ZLATV/r	0	6	1.37	0.09 - 19.74	0.81
ZLE	56	904	1.06	0.81 - 1.37	0.68
ZLN	442	10322	0.62	0.55 - 0.70	<0.0001

TOTAL	**1258**	**21542**



	ALE	ALN	ALN60	TLATV/r	TLE	ZLATV/r	ZLE	ZLN
New miss (n)	0	1	0	7	752	0	56	442
new miss% (n%)	0.00	0.08	0.00	0.56	59.78	0.00	4.45	35.14
incidence %	0.00	8.33	0.00	2.20	7.01	0.00	5.83	4.11



	15-24	25-34	35-44	45-54	55-64	65-74
New Miss(n)	126	445	461	181	34	11

Techniques for Web Usage Mining

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Abstract- Web mining merges two areas of research: the World Wide Web and data mining. Web mining is applying data mining methods to estimate patterns from the data present on the web. This helps in improving web based services. It also has various commercial uses in the areas of artificial intelligence, business support services, personalization of web services and so on .Effective user behavior patterns can be found by applying mining techniques like clustering and association rules to web log data. This paper provides the overall perspective of web mining. It mainly focuses on the application of various data mining techniques to web data to obtain patterns of web usage.

Index Terms- Association rules mining, Clustering, Web Mining, Web Usage mining.

I. INTRODUCTION

The Web has become one of the most extensive platforms for exchanging or retrieving information. As it has become easier to publish documents, there is a rise in the number of users and as the information grows, searching for relevant information is turning into a time-consuming operation. Web mining aims to extract and mine useful knowledge from the Web.

The coverage of Web information is very wide. Almost all types of data is present on the web and it may or may not be linked. This information changes constantly. It is vital to keep up with these changes since these changes are directly linked to various industries.

Web mining is the process of examining data sets collected from various sources methodically and in detail, in order interpret it to get useful information. These data sets may consist of web log data .Researchers have classified web mining into 3 types, namely , web structure, content and usage mining[1]. This classification is based on the type of data to be mined.

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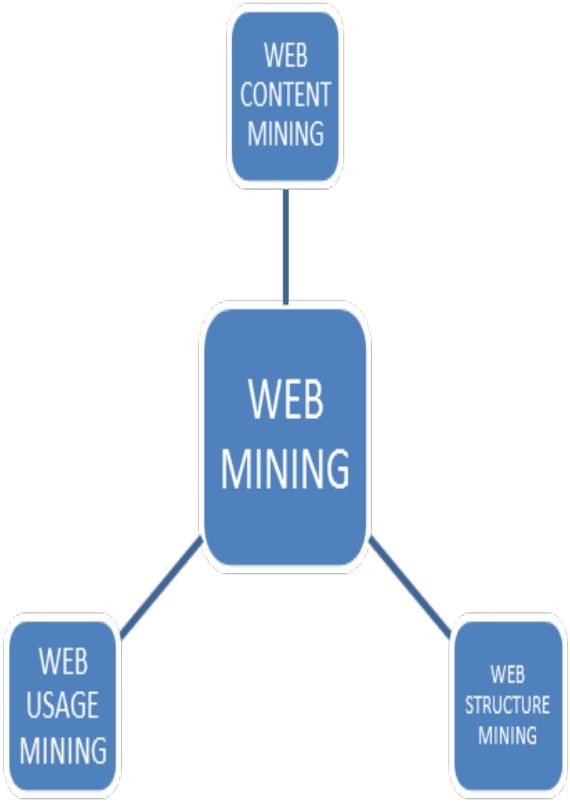

Figure 1: Classification of Web Mining.

II. TYPES OF WEB MINING

A. Web content mining

Web content mining is the process of obtaining useful patterns between data available on web like images, audio files and text. The natural language processing (NLP) and information retrieval (IR) are the technologies which are used to implement this.
Sometime, when the input data for mining is text based, the process is known as web text mining. Multimedia mining is the type in which information to be mined is from online multimedia resources.
Web content mining from two approaches: unstructured data and semi- structured data [2].The HTML(Hypertext Markup Language)or the hyperlink structures are used for the semi-structured data.

B. Web structure mining

Web structure mining is the method of using graphs and hyperlinks to obtain information of the website architecture and connection. Hyperlinks are the structures which link the web pages to a place.
There are two types of web structure mining: in the first type the patterns are discovered from the hyperlinks of the web pages, and in the second type the patterns are discovered from the document structure. Web structure mining gives the structure of a website and the relation between multiple web sites or web pages.

C. Web usage mining

Web usage mining is the process of estimating the user patterns of web browsing based on the web log data stored in client, proxy servers etc. The future behavior of the user on the web can be estimated using this kind of mining. In web usage mining, the mining techniques are applied on web log files. Web log files are files, which consist of data like who has visited the site, their location and their activity on the web site. They can be taken from servers or through proxy servers. It may also be present in the user's computer. There are various types of log files like: access log, error log, agent log and referrer log file.
The web usage mining process is divided into different stages. The first stage is the pre processing stage. In this, the data on which the mining techniques are applied is first cleaned and made ready for the further stages of usage mining.

III. STAGES OF WEB USAGE MINING PROCESS

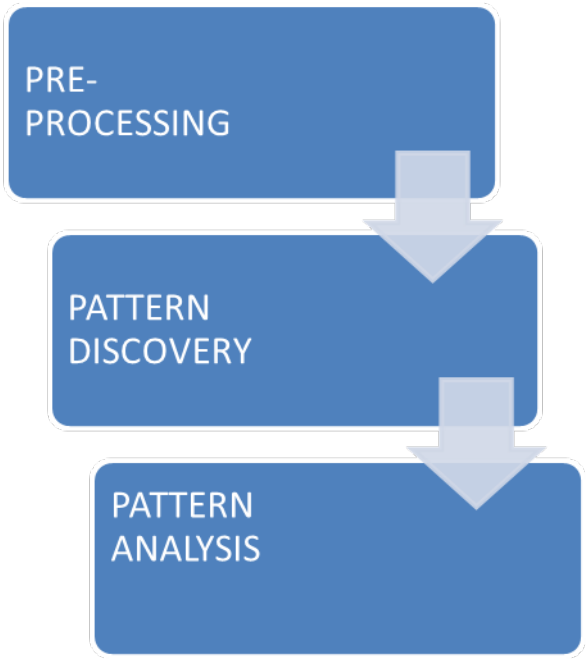

Figure 2:Stages of Web Usage Mining .

Web Usage Mining is composed of three different stages: Pre-processing, Pattern Discovery and Pattern Analysis [3].

A. Pre-processing

The data on which the web data mining algorithms are applied has to be made ready for it.The unprocessed raw data has to be converted to usable form so that data abstraction can be implemented. Data abstraction is the process of providing only the essential information and hiding the unnecessary background details. The data is collected from the client, server or proxy servers.
Pre-processing can be of usage pattern, content or structure.Data abstraction is implemented using the user identification algorithm and Data Cleansing of Web Log File algorithm. These algorithms take the web server log file as an input and give the log database as an output.
User and session identification is also done as a part of the process of cleaning of raw data. The aim of that is to categorize a user that accesses a web page and is likely to visit the web page multiple times into individual sessions. The last step of pre-processing is formatting. In this step the sessions obtained are formatted properly. This is followed by analyzing and discover of the patterns in the processed data.

B. Pattern Discovery

Pattern discovery is the key component of web usage mining. It merges the algorithms and techniques from data mining, machine learning and pattern recognition.
A variety of methods to find out hidden data information are implemented on Web server logs. Pattern discovery involves application of methods like association rules, clustering and sequential patterns.

- *Association Rule Mining Algorithm*
  - Association rules are used to find out the pages on web which are accessed together. This helps in foretelling which pages may be accessed by the user in future. The pages which are accessed together are put in a single server session. There is a specific support value based on which the web pages which are accessed together are found out. This happens if the support value is greater that the specific value.Association rules are useful in prefetching the data or web pages so that they are ready for later use. This reduces the time delay and latency. The websites can be restructured easily by using these rules from the access logs.
  - The setbacks of Association rule mining are that a lot of rules are produced and those rules may not be relevant. Based on parameters like minimum support and confidence, there may be incorrect estimations of these rules. This may lead to faulty results of pattern estimation. Clustering is done on the data to overcome this drawback. This leads to reduction of input data to be small for association rule mining algorithm. This avoids the rules produced to be incorrect or irrelevant.
  - If association rule mining algorithm is applied to clustered data, this algorithm will overcome the limit of the association rule mining algorithm. This limit is that irrelevant rules and wrong rule predictions may be generated on the basis of parameters like minimum support and confidence. The accuracy and results of the pattern discovery are improved using a combination of association rule mining and the clustering techniques.

- *Clustering Algorithm*
  - Clustering is the method by which similar data items are identified and grouped together. It helps in discovering, groups of users who have almost identical navigation patterns on the web and also patterns in sets of data. Different types of clustering are partitional Clustering, incremental clustering and hierarchical clustering.
  - It is useful for personalization of web sites for users, e-commerce, online marketing and various other commercial applications. It is also useful for search engines and web services since it can be utilized to get pages having almost identical content.
  - Complete Linkage algorithm is suggested for use, which is a combination of hierarchical complete linkage and incremental leaders algorithms. This composite algorithm enhances the quality of clustering.
  - Hybrid Leaders complete linkage algorithm (LCL) is used to categorize the users on the web into distinct clusters and also to cluster web data logs so that there is no need of reorganising the data objects. The input data is initially split into n clusters .This is followed by formation of a hierarchical structure on the basis of those n sub clusters.
  - The web log data is clustered and the user web usage pattern is estimated. Association rule mining is used to discover relation between sets of data and to interpret patterns in them. This rule is also used to obtain the web pages which are visited repeatedly. APRIORI algorithm is used to identify a particular user's navigation pattern on the web.

- *Kmeans Algorithm*
  - If Kmeans algorithm and vector matrix is implemented together it results in effective clustering of the web users. The first step before clustering process of the web data logs is the formation of the vector matrix consisting user and Uniform resource locater(URL).
  - The K means algorithm is a type of clustering algorithm. A data set is categorized into groups or clusters. Suppose, the number of clusters are assumed to be k in number. K number of centroids are defined for each cluster and they should be placed as far from each other as possible. This is followed by associating each point to its nearest centroid [4].The initial group centroids are kept into space which is depicted by the objects which are currently being a part of clustering process.

The group having the closest centroid gets an object. After this allocation, the centroid positions are recomputed.

- This results in a loop and k centroids change their position until no more changes are done. This is continued till centroids become stable. This results in formation of groups of objects. The K means algorithm is practical and has the ability to manage a growing amount of work in a capable manner .It is very easy to implement.

C. Pattern Analysis

Pattern Analysis is the last stage of web usage mining process. This is done after the output from the pattern discovery stage is obtained. In this stage, repeated association rules or patterns are eliminated and relevant and meaningful patterns are found. Techniques like Structured Query Language (SQL) and On-line Analytical Processing (OLAP) to make the output into suitable format.SQL is a knowledge query mechanism. OLAP is used to build a multi-dimensional data cube. For these methods, the output obtained at previous phase has to be structured.

IV. Conclusion

This paper explores the different techniques of web mining with emphasis on web usage mining. A detailed description of these methods and their advantages is given. The distinction between web mining types is also introduced .Overall the usage mining process is illustrated. Various combination of algorithms like association rule mining and clustering are suggested to produce effective results of discovering web usage patterns. Since the web continues to develop in size and complexity with time, it has become difficult to find information which is to the point. Hence, web data mining techniques are developed to get useful data from the web pages.

Acknowledgment

We would sincerely our professors for the constant mentorship. We are also grateful towards our peers for the encouragement and the constructive criticism.

References

[1]Pooja Sharma, Rupali Bhartiya," An efficient algorithm for improved web usage mining"
[2] R. Kosala, H. Blockeel,"Web mining research: A survey"
[3] Ilampiray.P," Efficient resource utilization of web using data clustering and association rule mining"
[4] JinHuaXu, HongLiu,"Web User Clustering Analysis based on KMeans Algorithm"
[5] Shaily G.Langhnoja, Mehul P. Barot, Darshak B. Mehta, "Web Usage Mining Using Association Rule Mining on Clustered Data for
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Privacy Preserving In Data Mining: A Survey

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***Abstract*-**Privacy preserving has becomes important issue in the past decade due to the immergence of various data mining techniques. Privacy preserving data mining has become extremely essential because it allows sharing of critical data for analysis purposes. The availability of personal data has made the problem of privacy preserving data mining very critical. This paper aims at giving an overview into data mining and the concept of privacy preserving. It gives an insight in to privacy preserving models, framework and techniques.

***Index Terms*-** Data mining, Privacy preserving data mining.

I. INTRODUCTION

In today's world there is a continuous advent of advanced technology, a tremendous amount of data is being generated my various organization. As the data is increasing different data mining techniques to analyze this data need to be adopted. Data mining is technique used to extract useful information from large amount of data. The extracted data might provide information about an individual's private details. Hence individuals are faced with the task of releasing data which does not compromise privacy. The idea is to release data, and mine this data to analyze trends while preserving privacy. Privacy preserving in data mining is extremely important to preserve the data holder's confidential information. Various techniques are implemented to preserve the same. This paper is formatted in the following manner, the second section an introduction to data mining, the third section gives us a the classification of the data mining model, the third section tells us about privacy preserving, the fourth gives an insight into the models of privacy preserving in data mining and the final section tells us about the techniques for preserving privacy in data mining.

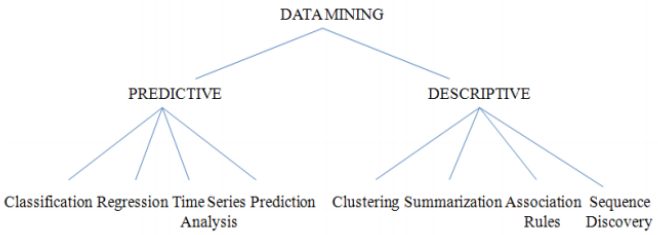
II. DATA MINING

There has been an exponential rise in the generation of data in the past decade. Data mining in layman terms is information and knowledge discovery, it is the process of analyzing large amount of data summarizing it and extracting useful information from it. Various software's are available for implementing data mining techniques, such tools allow users to analyze data by multiple ways, categorize the data and establish relationships. It is process of examining relational databases in or to extract business critical information. The basic objective is to apply a model for one problem to which the answer is known and then apply that model to a different problem in which the answer is required.

Consider a product company. Data mining is used by such a company to determine to relationships between internal factors like price, staff efficiency etc. And external factors like competition, economy trends. It permits them to understand the impact each factor has on the sales of the product, understand the gross profits of the company and get a detailed summary of the transactional data.

III. DATA MINING MODEL

The data mining model can be classified as Predictive or Descriptive in nature.



The predictive model: As the name suggests, this model predicts the values of data based on the previous values of the data. [1]
The descriptive model: This model analyses the relationship between the data. In this model all the properties of the data can be scrutinized.[1] A Data mining software analyses the relationships between the data stored in a data warehouse based on user generated queries. The types of relationships aimed are:

1. Classes: The stored data is located within predefined groups
2. Clusters: The data items are mined according to logical representations.
3. Associations: Mining can be done through association.
4. Sequential Discovery: Data mining is performed to anticipate behavioral trends.

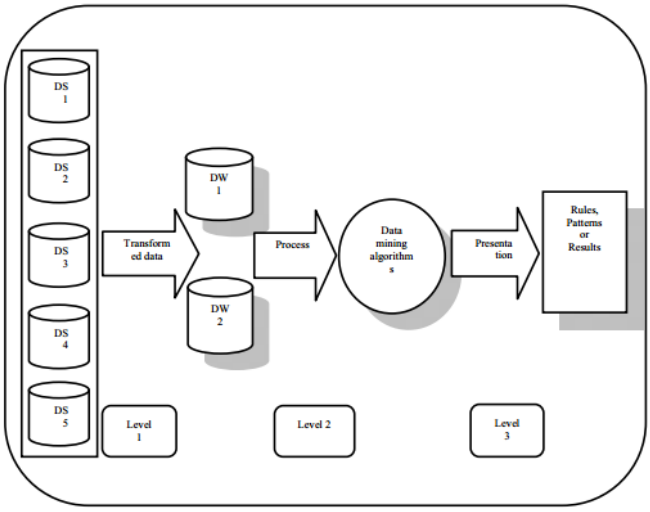
IV. PRIVACY PRESERVING IN DATA MINING

Data mining can be looked at as a threat to privacy. The confidentiality of the data holder comes into question. Privacy preserving is concerned with applying certain algorithms on confidential data that is not supposed to be disclosed. For example, medical information from the database of hospital can be crossed linked with voters ID database to find out confidential information like address of the data holder. So sensitive data like

addresses, names, IDs should be trimmed or modified from the original database, in order to not compromise privacy.
There are two types in privacy preserving:
Individual privacy preserving is the protection of data which if retrieved can be directly linked to an individual when sensitive tuples are trimmed or modified the database. When such data is mined the protected data should not be disclosed.
Collective privacy preserving includes protecting not only individual specific information but also trends and patterns relating to a particular organization. This is similar to a statistical database. The aim of collective privacy preserving is to protect strategic patters which are the most important agenda of the strategic plan of any organization.

V. Privacy preserving framework

Privacy preserving follows a particular framework. The data collected from various sources is first stored in a data warehouse, then it is converted to a suitable format for analytical purposes. And then data mining techniques are applied to it. Throughout this process privacy preserving has to be implemented at each step.
The figure below shows the framework of privacy preserving.



The levels of the privacy preserving framework are:
Level 1: At this stage the data from various sources is collected and checked whether it is suitable for further processing. At this stage to it is checked if the privacy is not compromised.
Level 2: At this level the data is sanitized. Processes like blocking, sampling, perturbation, generalization etc. are applied. The data mining algorithms are altered to preserve privacy.
Level 3: At this level the information revealed after data mining is checked in order to maintain privacy.

VI. Privacy preserving Models

There three main models of privacy preserving are:

1. Trust third party model: It is assumed that there exists a third party that to whom all the data is given. It is understood that no one other than that particular third party has any access to the data. The aim is to implement privacy preserving techniques to maintain the confidentiality of this third party.
2. Semi honest model: Very party follows certain protocols using correct formats but it is free to use any protocol during the execution if it feels the security is threatened.
3. Malicious model: Since the semi-honest model does not provide protection for all applications the malicious model is used. The malicious model is free to use any protect it wishes to protect privacy. It is difficult to develop efficient protocols for this model.

VII. Privacy preserving techniques\

The privacy preserving techniques are classified into five categories:

Anonymization based Privacy Preserving:
The data in the table consists of 4 different attributes:

1. Explicit Identifiers: It is a set of attributes that identify an owner record explicitly.
2. Quasi Identifier: These are a set of attributes if combined with a publicly available tuple would identify the owner.
3. Sensitive Identifiers: An attribute which contains sensitive information about the owner e.g. salary.
4. Non-Sensitive Identifiers: If revealed such attributes create no privacy problems.

Anonymization is an approach where sensitive information about an individual is to be hidden. Quasi identifiers when combined to a publically available database can reveal sensitive information. For e.g. if a voters ID database is combined with the employee database of a company, sensitive information like the salary of a particular employee can be revealed. So k-anonymization involves hiding or the modification of certain quasi identifiers such that when the data is dent in for data mining the quasi identifiers are not disclosed. Where if there is 1 quasi identifier then the data sent for data mining will have k-1 tuples. Thus protecting privacy. This is accomplished by generalization and suppression. Although the anonymization method ensures that the transformed data is correct but it suffers heavy information loss. This method is not immune to similar attack and background knowledge attack. Limitations of the k-anonymity model are, first, it may be very hard for the owner of a database to determine which of the attributes are available or which are not available in external tables. The second limitation is that the k-anonymity model assumes a certain method of attack, while in real scenarios; there is no reason why the attacker should not try other methods.
Perturbation based PPDM

The dictionary meaning of perturbed is being unsettled or upset. Similarly in data mining perturbation means replacing or upsetting the original values with some synthetic data values such that the statistical information of the data is preserved. The data records do not correspond to the individual's actual data. So in a malicious attack, cross linking cannot be done to retrieve sensitive information. Thus preserving privacy. Therefore the perturbed data are meaning less and contain only statistical information. Perturbation is done by adding noise to the original data, data swapping or synthetic data generation.

Randomized Response based Privacy Preserving

Randomized response is a statistical technique. In this the data is scrambled in such a way that the central place cannot tell if the data that is coming from the user contains true or false information.

The information received from each individual user is scrambled and if the number of users is more, the cumulative information of all users can be estimated with a pretty good accuracy. This is very useful for decision-tree classification since decision-tree classification is based on aggregate values of a dataset, rather than individual data items. The data collection process is a twostep process. During first step, the data providers randomize their data and transmit the randomized data to the data receiver. In second step, the data receiver reconstructs the original distribution of the data by employing a distribution reconstruction algorithm.

Randomization method can be implemented at data collection time, therefore it does not require a trusted server to keep all the records to perform the anonymization process. The limitation of randomization technique is that it treats all the records same even if they are of different local density. This leads to a problem where the outer records become more vulnerable to adverse attacks as compared to records in more inner regions in the data.

Cryptography base Privacy Preserving

Cryptographic techniques are based on the fundamentals of distributed computing, where multiple parties come together to compute results or share non sensitive mining results and avoiding disclosure of sensitive information. Cryptographic techniques are beneficial because of two reasons: First, it offers a model for privacy that includes methods for proving and quantifying it. Second a vast set of cryptographic algorithms and constructs to implement privacy preserving data mining algorithms are available in this domain. The data may be distributed among different collaborators vertically or horizontally. In vertically partitioned data between different collaborators, the individual entities may have different attributes of same set of records and in case of horizontally partitioned data, individual records are spread out across multiple entities, each of which has the same set of attributes.

Although cryptographic techniques ensure that the transformed data is exact and secure but this approach fails to deliver when more than a few parties are involved. Moreover, the data mining results may breach the privacy of individual records. There exist a solutions of this problem in semi-honest models but in case of malicious models not much studies have been made.

Condensation Approach base Privacy Preserving

This methods constructs a constrained clusters in dataset and then generates pseudo data from the statistics of these clusters. It is called as condensation because it uses condensed statistics of the clusters to generate pseudo data. It constructs groups of non-homogeneous size from the data. Subsequently, pseudo data is generated from each group so as to create a synthetic data set with the same aggregate distribution as the original data. This approach can be effectively used for the problem of classification. The use of pseudo-data provides an additional layer of protection, as it becomes difficult to perform adverse attacks on synthetic data. The aggregate behaviour of the data is preserved, making it useful for a variety of data mining problems. This approach helps in better privacy preservation as compared to other techniques as it uses pseudo data rather than modified data. It works even without modifying data mining algorithms since the pseudo data has the same format as that of the original data.

VIII. CONCLUSION

In this paper we have documented a survey on privacy preserving in data mining. In today world every second tremendous amounts of data is generated, it is extremely essential to remove valuable information from this data. But while data mining we have to make sure that the confidentiality of the data is maintained. This paper gives us an overview of the privacy preserving models in data mining, the framework and the techniques of privacy preserving. Different organization use different techniques and models depending on their requirements.

ACKNOWLEDGMENT

We would sincerely like to thank our professors for the constant mentorship. We are grateful towards our peers for the encouragement and constructive criticism.

REFERENCES

[1] Analysis of Privacy Preserving K-Anonymity Methods and Techniques S.Vijayarani#1, A.Tamilarasi#2, M.Sampoorna#3 #1, #3School of Computer Science and Engg., Bharathiar University, Coimbatore, Tamilnadu,India #2Dept. of MCA, Kongu Engg. College, Erode, Tamilnadu, India #1vijimohan_2000@yahoo.com #3m.sampoorna87@gmail.com.

[2] W.-K. Chen, *Linear Networks and Systems* (Book style). Belmont, CA: Wadsworth, 1993, pp. 123–135. Privacy Preserving Data Mining Techniques: Current Scenario and Future Prospects Majid Bashir Malik Department of Computer Sciences, BGSB University, Rajouri, J & K. majid.malik@rediffmail.com M. Asger Ghazi School of Mathematical Sciences and Engineering, BGSB University,

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The Expediency Hypothesis and modes of secondary term formation in ICT terminology in Sinhala: A bilingual corpus analysis

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Abstract- This study investigates the formation typology of borrowings within the genre of information and communication technology (ICT) in Sri Lanka utilizing a corpus of Sinhala secondary terms. The main instrument of analysis is the *Glossary of Computer Terms- Sinhala Dictionary Resources*[1] a bilingual corpus of 5,086 ICT terms in English with their equivalent terminology provided in Sinhala. Data collection utilized random and then selective sampling procedures and shortlisted the final terminology (n=500) which underwent typological identification and term analysis to discern the borrowing procedures. Formulating and applying the Expediency Hypothesis this study theorizes that preference for importation is due to convenience and sociolinguistic laziness. Coinage formation especially loan creations, though cognitively challenging, has painstakingly generated Sinhala terms with unwieldy pronunciation which do not trigger any associated schemata to the ICT concept. Evidence for trends in ICT terms borrowed from English is scaffolded through a brief lexical analysis of the *G.C.E. (O/L) IT Teacher Instructional Manual of Sri Lanka* (Sinhala medium)[2]. The findings reveal that non translated English words in English fonts splatter the contents of the Sinhala medium manual making their frequency of occurrence approximate 34%. Importations followed by loan translations too inflated the Sinhala ICT wordstock of the manual but coinages were rare and loan creations had a zero occurrence. This study concludes that the redundancy of coinages enforced through preference for English importations sociolinguistically tarnishes and threatens the purity of Sinhala: a minority language of the world. This redundancy is not restricted to ICT terminology but can be extended to all spheres saddling Sinhala with a substantial lexical debt owed to English in its day to day linguistic parlance.

Index Terms- ICT terminology, borrowing, Sinhala, linguistic purity

I. INTRODUCTION

Background

Etymologically the vocabulary of a language consists of two main assemblages: lexical items native to the language and foreign elements which are loanwords. The omnipresence of loanwords in languages of the world is succinctly worded by Haspelmath and Tadmor (2009, p. 55) [1] who state that a language 'entirely devoid of loanwords' is a very rare occurrence. According to Postolea (2012: 103) [2] concepts 'being basic units of knowledge, are almost never bound to their place of birth. Packed in their original language, they easily travel across borders'. This is very true to ICT terminology and the influx of these ICT terms 'packed in their original language': English, results in a linguistic metamorphosis in the recipient languages. Sinhala, a language which is struggling to preserve its purity against linguistic pressures inherent to globalization and technological development, is witnessing an ascendency of English borrowings in the ICT word stock. Linguistic purism which safeguards the linguistic rights of minority languages, as defined by Geers (2005)[3] aims to purify above all the lexical system of a language from loanwords and other harmful language units replacing them mainly out of the native resources of a language.

According to Sager (1997) [4] the first process where the new concept is named by its creator in his/her native language is primary term formation and when the name given to a concept by its original creator passes from its original language into other languages it is secondary term formation. Within the genre of ICT almost all the newly innovated terms originate in English thus making it the original language of creation. In the Sri Lankan context the process of secondary term formation is a complex procedure which involves the gamut of strategies in loanword formation of which the three main components are: Importation, Partial substitution and Substitution. Many scholars over the ages (Betz, 1959[5]; Duckworth, 1977[6]; Haugen, 1950[7]; Toury 1995[8]; Weinreich, 1953[9]; Betz, 1959[10]; Zenner, 2013 [11]) have theorized on various types of norms identified in the borrowing process. Thus there are a multitude of taxonomies but this study uses the taxonomy put forth by Grzega (2003: 26)[12] where Betz's (1959)[13] terminology with revisions of Duckworth's (1977)[14] are combined together with Haugen's (1950) [15] terminology of lexical borrowing.

1.1 Modes of borrowing

Words taken over from foreign languages are known as borrowed words or loan words and the term borrowing is used to denote the process of adopting words from one language to another. Lexical borrowing is by far the most common category of borrowing in the field of ICT in Sri Lanka. Literature has theorized that the motivation to borrow lexical items occurs in two modes. Theorizing on modes of borrowing the Dominant Hypotheses was formulated by Higa (1979)[16] and Kachru (1994) [17] formulates the Deficit hypothesis. While both

[1] http://www.sinhaladictionary.org/index.php/list/glossary+of+computer+terms/5,b.xhtml
[2] http://www.nie.sch.lk/ebook/e11tim33.pdf

hypotheses are applicable in the context of borrowings in the field of ICT in Sri Lanka this paper compiles evidence for and formulates another mode in borrowing and classifies it within the taxonomy as the Expediency Hypothesis.

1.1.1 The Dominance Hypothesis

Higa (1979: 378)[18] had defined that 'the Dominance Hypothesis presupposes that when two cultures come into contact, the direction of culture learning and subsequent word-borrowing is not mutual, but from the dominant to the subordinate'. Furthermore the borrowing is not necessarily done to fill lexical gaps. Many words are borrowed and used even though there are native equivalents because they seem to have prestige. This study repudiates the use of the term *dominant language* in the current sociolingistic context in Sri Lanka but upholds the worldwide recognition given to English as the donor language. According to Trask (1996: 41)[19] 'English itself has become the most prestigious language on earth, and today English is primarily a donor language'. Thus this study proposes that the Dominant Theory should be replaced by a donor/ recipient hypothesis. Agreeing with Trask (ibid) that English (be it British or American) is 'the most prestigious donor language on earth' it is noted that a vast corpus of words enter recipient languages such as Sinhala and are borrowed from English. This is clearly evidenced in the secondary ICT term formation.

1.1.2 The Deficit hypothesis

This hypothesis presupposes that, Borrowing entails linguistic gaps in a language and the prime motivation for borrowing is to remedy the linguistic deficit, especially in the lexical resources of a language. (Kachru, 1994:139) [20]

Agreement comes from Fantini (1985: 146) [21] who states,

One of the initial reasons for borrowing is when one language has a semantic *gap* in its lexicon (i.e., when there is no existing word in the language with the same meaning as the loanword) and needs to borrow a term to express the necessary idea or concept.

It seems that this lexical deficit is a worldwide ongoing phenomenon. Unique lexical inventions coined to represent innovations in science, information technology, social networking etc. enter the English vocabulary daily. Languages which need to assimilate these words into their word stock solve the problem of by simple lexical borrowing.

Relinking with the discussion on modes of borrowing in the Sri Lankan sociolinguistic sphere ample proof for yet another mode of borrowing is evidenced. It might have had its origins roughly during mid-colonial stages, and its evolution is recorded in the history of loanword assimilation in Sinhala. Sinhala, initially borrowed a large stock of loanwords from the language of its ex-colonizer, English. At one stage during this superstrate borrowing process a large number of Sinhala words were coined to satisfy the deficit created by English vocabulary. But these coinages gradually became redundant and the English lexical importations were retained. I suggest that most of these English lexical importations were preferred over the coinages by the speakers of Sinhala due to expediency. It is linguistic pragmatism which provided the impetus to follow this mode where importations is preferred and the vernacular coinages are rejected.

1.1.3 The Expediency Hypothesis

Expediency carries connotations of an action done due to desirability and convenience. It is a practical method of solving intricacies in the context of linguistic behavior. On the other hand it connotes sociolinguistic laziness. Using the Sri Lankan sociolinguitic paradigms evidenced in the ICT field in Sri Lanka evidence is produced to validate that expediency is another motivation for the preference for importation in over coinages. The Expediency Hypothesis finds agreement from Katamba (2005, p. 138-139) [22] who states that 'to adopt a word [is much easier] rather than to make up an original one from nothing'. Danesi and Rocci (2009, p. 161)[23] too posit that borrowing is 'a practical strategy' which can add to the word stock of a language. Thus importation is a less cognitively taxing process than creating new words for new notions.

But in Sinhala though a large stock of coinages are created with much effort it is evidenced that most of them have faced redundancy in day to day as well as ICT parlance. This study classifies and discusses this mode under the Expediency Hypothesis and argues through the provision of evidence from the secondary ICT term formation in Sinhala that it differs from the two loanword borrowing processes identified by Kachru (1994)[24] and Higa (1979) [25].

According to the Expediency Hypothesis a linguistic community is persuaded by practicality and pragmatism, a case in point is the Sinhala speech community, to reject their own coinages which satisfy the deficit of vocabulary and favor the loanword. The term expediency also carries the flavour that it is not necessarily moral[3]. The moral aspect, as far as linguistic behaviour is concerned, is to disdain a process which struggles to uphold linguistic purity in a language. The suggested process of the Expediency Hypothesis when applied to secondary ICT term formation in Sinhala could be recorded as follows.

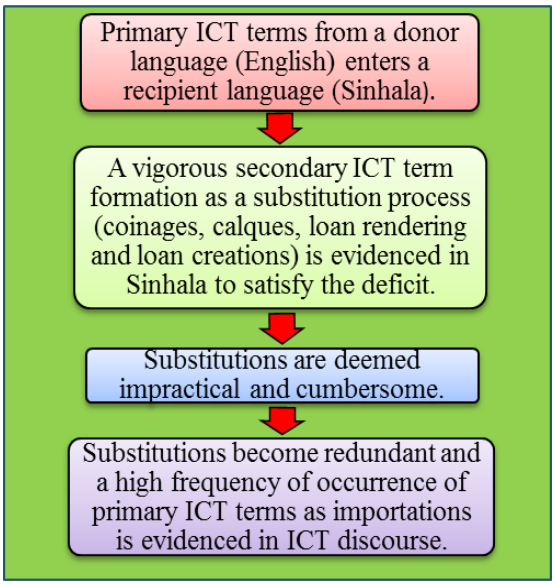


Figure 1: Applicability of the Expediency Hypothesis to secondary ICT term formation in Sinhala

[3] Oxford Advanced learners' Dictionary http://www.oxfordlearnersdictionaries.com/definition/english

II. METHODOLOGY

Bowker & Pearson (2002, 45) [26] have pointed out, "there are no hard and fast rules that can be followed to determine the ideal size of a corpus. Instead, you will have to make this decision based on factors such as the needs of your project, the availability of data and the amount of time that you have'. Based on the above premise the *Glossary of Computer Terms- Sinhala Dictionary Resources* was selected as the main instrument of analysis in this study**.** It is a bilingual corpus of 5,086 ICT terms in English with their equivalent secondary terminology provided in Sinhala. Random sampling procedures selected every other page of the corpus and 128 out of 255 pages were browsed. Each page underwent selective sampling procedures to compile 500 lexical terms for scrutiny. The study followed a term analysis process which consisted of three tiers: identification, comprehension and cross linguistic (English- Sinhala) comparison. While most words were single lexicalized units multi word terms which functioned as a unit of meaning and identified a concept too went under analysis. The second instrument was the G.*C.E. (O/L) IT Teacher Instructional Manual of Sri Lanka* (Sinhala medium). Scrutinizing the manual excerpts were obtained selectively. Then the two shortlisted sets of terms were analyzed to validate the Expediency Hypothesis. This paper cites a few selected terms when providing examples for each borrowing process.

III. TAXONOMY OF LEXICAL BORROWINGS IN SECONDARY ICT TERM FORMATION IN SINHALA

Thus study utilizes the Betz-Duckworth-version for a taxonomy of lexical borrowings assembled by Grzega (2003: 26) [27] incorporating terms of Haugen (1950) [28]. The taxonomy subdivides loans as Importation, Partial substitution and Substitution illustrated by Figure 2 below.

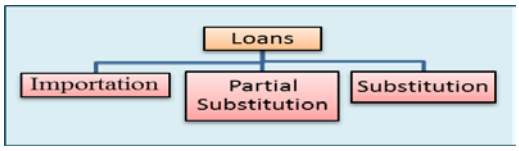


Figure 2: Extract of *loans* from Betz-Duckworth-version for a taxonomy of lexical borrowings assembled by Grzega (2003: 26) [29]

3.1 Importation

Importations are typical borrowing which are words consciously imported from another language. According to Capuz (1997: 87) [30] 'the direct transference of a lexeme, both in meaning and form'. is importation and the original form of the loan is discernible (Russ 1994, 222) [31]. The taxonomy sub-divides Importation to nonassimilated Foreign words and assimilated Loanwords. Figure 3 below depicts the typology for Importation.

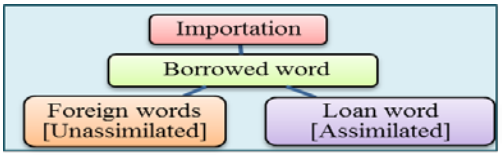


Figure 3: Extract of Importation from Betz-Duckworth-version for a taxonomy of lexical borrowings assembled by Grzega (2003: 26) [32] with Haugen's terms added in square brackets.

3.1.1 Foreign words

A *foreign word* is a nonintegrated word where both words show analogy in form as well as in meaning. In Table 1 below the pronunciation of the word is retained unchanged other than in video where the word final diphthong is monophthongized which is a norm in Sri Lankan pronunciation.

Table 1: Examples for *nonintegrated foreign words* from ICT term formation in Sinhala

Primary ICT term[4]	Secondary term
Cartridge /kɑ:trɪʤ/	කාට්රිජ් /kɑ:trɪʤ/
Fax /fæks/	ෆැක්ස් /fæks/
Intelsat /ɪntelsæt/	ඉන්ටෙල්සැට්/ɪntelsæt/
Video/vɪdiəʊ/	විඩියෝ/vɪdio:/
Virus /ʊairəs/	වයිරස /ʊairəs/
Peek /pi:k/	පීක් /pi:k/
Mouse /maʊs/	මවුස් /maʊs/
Ribbon cable /rɪbən keibl/	රිබන් කේබල් /rɪbən ke:bl/
Ultra Fiche /ʌltrə fi:ʃ/	අල්ට්රා ෆිෂ් /ʌltrə fi:ʃ/

3.1.2 Loan words

Loan words are integrated word forms adapted to Sinhala. In this category the assimilation of borrowings is a partial or total conformation to the suffixation paradigms of the receiving language Sinhala.

[4] Pronunciation for all Primary term obtained from *Oxford Learners Dictionaries.* http://www.oxfordlearnersdictionaries.com/definition/english

Table 2: Examples for *integrated foreign words* from ICT term formation in Sinhala

Primary ICT term	Secondary term[5]
Type 1: Addition of the suffix /ə/	
Algorithm	ඇල්ගොරිතම් /ælgorɪ̣təmə/
Type 2: Addition of the suffix /əjə/	
Micro Chip	ක්ෂුද්‍ර චිපය /maɪkrocɪpəjə/
Hologram	හොලොග්‍රැම්ය /hɒlograæ:məjə/
Zoom	සූමය /zu:məjə/
Card Hopper	කාඩ් හොපරය /kɑ:d hɒpərəjə/
Carriage	කැරේජය /kære:jəjə/
Clone	ක්ලෝනය /klo:nəjə/
Loop	ලූපය /lu:pəjə/
Megabyte	මෙගාබයිටය /megabaɪtəjə/
Type 3: Addition of the suffix /ʊə/	
Menu	මෙනුව /menuʊə/
Logo	ලෝගෝව /lo:go:ʊə/
Type 4: Germination and addition of the suffix /ʊə/	
Gate	ගේට්ටුව /ge:ʈʈuʊə/
Ticket	ටිකට්ටු /ʈɪkəʈʈuʊə/

3.2 Partial substitution

Naming these terms as loan blends Haugen (1950: 215)[33] defined them as those instances of lexical borrowing in which we find both *importation* and *substitution* transferred stem and Indigenous affix.

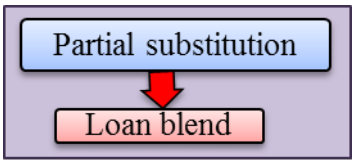


Figure 4: Extract of Partial substitution from Betz-Duckworth-version for a taxonomy of lexical borrowings assembled by Grzega (2003: 26) [34].

Table 2 below records examples for loan blends where the composite word constitutes of one part borrowed from English the other substituted from Sinhala. It is to be noted that the English component of the composite word has undergone suffixation to fit the assimilation paradigms of Sinhala.

Table 3*:* Examples for *loan blends* from ICT term formation in Sinhala

Primary ICT term	Secondary term[6]
Analog Modem	ප්‍රතිසම් මොඩේමය /prəʈɪgʰamə moɖəməjə/
Application Package	යෙදුම් පැකේජය /jedum pækeɟəjə/
Antivirus	ප්‍රතිවයිරස /prəʈɪʊairəsəjə/
Closed Loop	වැසූ ලූපය /ʋæsu: lu:pəjə/
Communications Protocol	සන්නිවේදන ප්‍රොටෝකෝලය /sannɪʊe:ɖənə proʈoko:ləjə/
Disk Drive	ඩිස්ක ධාවකය /ɖɪskə dʰa:ʊəkəjə/

[5] Pronunciation for the Secondary term transcribed by author.
[6] The Sinhala term in each composite word is highlighted in yellow while the partially assimilated English component is underlined.

3.3 Substitution

As a process substitution subdivides into multiple modes of borrowing.

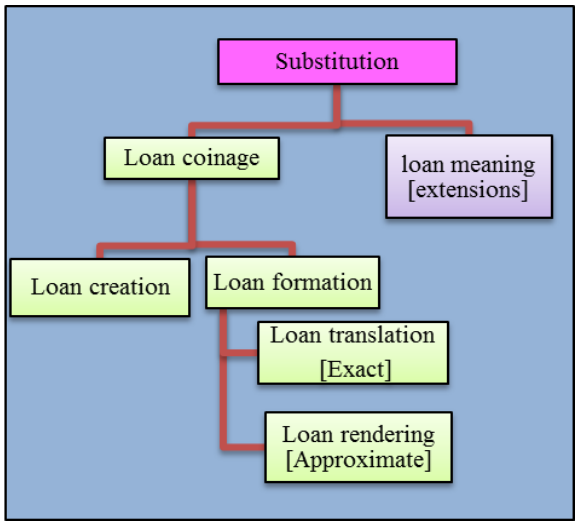


Figure 5: Extract of substitution from Betz-Duckworth-version for a taxonomy of lexical borrowings assembled by Grzega (2003: 26) [35] with Haugen's terms added in square brackets.

3.3.1 Coinage

As illustrated in Figure 5 above Coinages are subdivided into Loan formations and Loan creations.

3.3.1.1 Loan formation

The two branches of loan formation: loan translation and loan rendition according to Tesch (1978: 114)[36] cannot be separated reliably. According to Grzega, (2003: 28)[37] 'As to an onomasiological theory it should be underscored that loan *formations*, which Haugen (1956) [38] calls *creations*, are hard to detect'. What is foreign is the concept, but there is no foreign linguistic import. The word is created just like any word out of indigenous material (Grzega, 2003: 26) [39].

3.3.1.2 Loan translation (calque)

Durkin (2014: 164) [40] states that Loan translations are newly created words exactly translating the compositional elements of the foreign language form. The Routledge Dictionary of Language and Linguistics (Bussmann 2006, 151)[41] records that 'While, in the case of borrowing, a foreign word and its meaning are adopted wholesale into the other language as a loan word, a calque emerges when the language is adapted to new concepts. This can happen in several ways: (a) by way of a borrowed meaning through change and expansion of the meaning of native words; (b) through neologisms loosely based on a foreign concept; (c) through word-for-word loan translation; (d) through a loose loan translation". Based on Russ (1994, 222) [42] it could be stated that 'if each part of the English word is rendered literally' by its Sinhala counterpart it is a loan translation. 'It can either be a single word or a fixed phrasal expression created by an item-by-item translation of the (complex) source unit' (Haspelmath and Tadmor, 2009: 39) [43].

Table 4: Examples for *loan translations* from ICT term formation in Sinhala

Primary ICT term	Secondary term
All Purpose Computer	සර්වකාර්ය පරිගණකය /sarʊəkaːrjə parɪgʰanəkəjə/
Data Encryption	දත්ත ගෝපනය /d̪atːə goːpənəjə/
Data Table	දත්ත වගුව /d̪atːə ʊaguʊa/
End of reel block	පටි අන්ත කට්ටිය /paʈɪ anʈə kaʈːɪjə/

3.3.1.3 Loan rendering

Russ (1994: 222)[44] states that if the formation of the word is only partially or approximately literal then it is Loan rendering. Agreement comes from (Zenner, 2013:14)[45] who states that loan rendition is imperfect or partial translation and cites the following formation: Dutch *Wolkenkratzer* for English *sky scraper* is literally *cloud scraper.*

Table 5: Examples for *loan rendering* from ICT term formation in Sinhala

Primary ICT term	Secondary term	Literal meaning of the highlighted Sinhala term
Holding time	ධාරණ කාලය /dʰaːrənə kaːləjə	Learning time
Domain tip	වසම් ඉම /ʊasam ɪmə/	Domain Line
Piggyback[7] file	රුකුල් ගොනුව /rukul gonuʊa/	Bolstered[8] file

In the three examples above the primary ICT terms have undergone only a partial translation during the rendering. The literal meaning of the secondary term when translated back to English is different from the primary ICT term prior to borrowing.

3.3.1.4 Loan creation

'*Loan creation* covers the rather vague idea of conceptual transmission i.e. the creation of a new word in a language' (Zenner, 2013: 15)[46]. Russ (1994: 222)[47] states that 'if nothing of the English word is literally translated but an attempt is made at an interpretation of its meaning by an approximate translation it is a loan creation'. Furthermore they confirm that all components of the Loan creation come from and its construction has no prior equivalent in the recipient language,

Table 6: Examples for *loan creation* from ICT term formation in Sinhala

Primary ICT term	Secondary term
Programme	ක්‍රමලේඛය /kraməleːkʰəjə/
Churning	මන්ථන /manʈʰənə/
Software	මෘදුකාංග /murd̪ukaːngə/
Computability	ආගණනීයතාව /aːganjə̪aːʊəjə/
Icon	නිරූපකය /nɪruːpəkəjə/

3.1 Loan meaning

Haspelmath and Tadmor (2009: 39)[48] identify one sub process where the meaning of the foreign word is transferred on an indigenous word. Thus Table 8 below records a Sinhala word to which the meaning of the English word is transferred.

Table 7: Examples for *loan meaning* from ICT term formation in Sinhala

Primary ICT term	Secondary term
driver[9]	ධාවකයා[10] /dʰaːʊəkəjaː/

The Secondary term ධාවකයා in Table 7 above is polysemous as it is used to express a different meaning from the normal usage in ICT term formation in Sinhala.

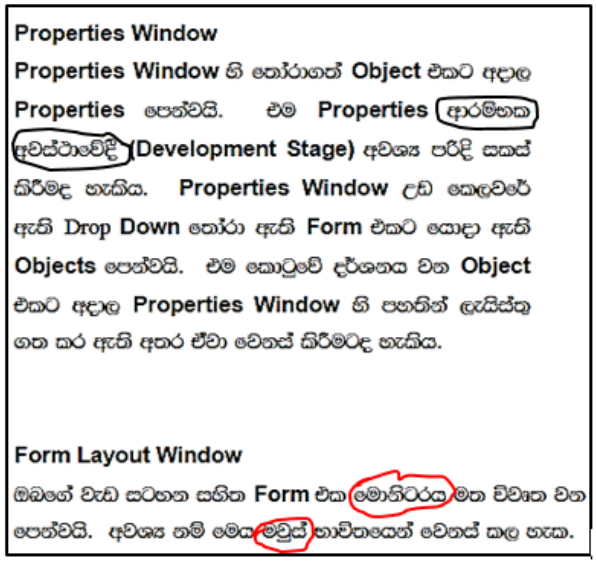
IV. THE EXPEDIENCY HYPOTHESIS AND MODES OF SECONDARY TERM FORMATION IN SINHALA

Recall that the Expediency Hypothesis theorizes that a linguistic community is persuaded by practicality and pragmatism to reject their own loan coinages which satisfy the deficit of vocabulary and favour importation. Secondary ICT term formation in Sinhala bears evidence for this theorization. Both processes Loan translation and Loan creation are time consuming and need weighty cognitive manipulation. Loan creation is the heavier process as it has to avoid all known words in the Sinhala wordstock. As a mother tongue user of Sinhala I find the examples for loan creations given in Table 6 not only unfamiliar but also rarely used words within the domain of ICT while the English terms are familiar importations with a high frequency of usage. Furthermore the enunciation of the Sinhala loan creations is an arduous task. Tracing the linguistic evolution of the Sinhala speech community which symptomizes a history of avoiding heavy coinages of Sinhala and a preference for English importations Widyalankara (2014)[49] posited the Expediency Hypothesis and conducted a comprehensive sociolinguistic analysis. This study compiles further evidence to argue that though Sinhala ICT coinages are formed under the objective of preserving the purity of the language, expediency which opts for convenience and reflects sociolinguistic laziness makes the Sinhala ICT coinages redundant. Providing evidence

[7] Piggybacking is the unauthorized access of a Wireless Local Area Network.
[8] Support or strengthen.
[9] A *driver* is a piece of software that converts commands such as 'PRINT', into instructions that the particular piece of hardware (printer) can understand.
[10] A person who drives a vehicle.

this study surveys the *G.C.E. (O/L) IT Teacher Instructional Manual of Sri Lanka* (Sinhala medium) which currently provides guideline to teachers who teach ICT to Grade11 students with a mean age of 16 years.

Of the 79 words in the extract in Figure 6 below 22 are English words denoting a high frequency of 28% in the occurrence of English words in the whole extract though it guides teachers to teach in the Sinhala medium.



Properties Window

Properties Window හි තෝරාගත් **Object** එකට අදාළ **Properties** පෙන්වයි. එම **Properties** ආරම්භක අවස්ථාවේදී **(Development Stage)** අවශ්‍ය පරිදි සකස් කිරීමද හැකිය. **Properties Window** උඩ කෙලවරේ ඇති **Drop Down** තෝරා ඇති **Form** එකට යොදා ඇති **Objects** පෙන්වයි. එම කොටුවේ දර්ශනය වන **Object** එකට අදාළ **Properties Window** හි පහතින් ලැයිස්තු ගත කර ඇති අතර ඒවා වෙනස් කිරීමටද හැකිය.

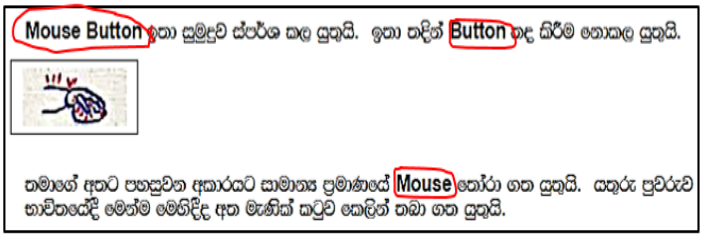
Form Layout Window

ඔබගේ වැඩ සටහන සහිත **Form** එක මොනිටරය මත විවෘත වන පෙන්වයි. අවශ්‍ය නම් මෙය මවුස් භාවිතයෙන් වෙනස් කළ හැක.

Figure 6: Extract from the *G.C.E. (O/L) IT Teacher Instructional Manual of Sri Lanka* (Sinhala medium), National Institute of Education in Sri Lanka, 2008: 16

Additionally in Figure 6 above note that there are only two importations (circled in red). The first is an assimilated loanword[11] where the pronunciation equivalent to *monitor* is transliterated in Sinhala graphemes and a suffixation based on the norms of the recipient language is added. The second is *mouse*[12] written in Sinhala font which is an unassimilated foreign word and retains the pronunciation. There is one instance where the Sinhala loan calque is provided its translation equivalent in English[13] (circled in black). What is of interest is that rather than using secondary forms a high frequency of usage of English words in English fonts is evidenced in the extract above.

This validates the Expediency Hypothesis which states that linguistic laziness and practicality generates a preference for the importation and in this instance also favours the English word over the Sinhala equivalent.



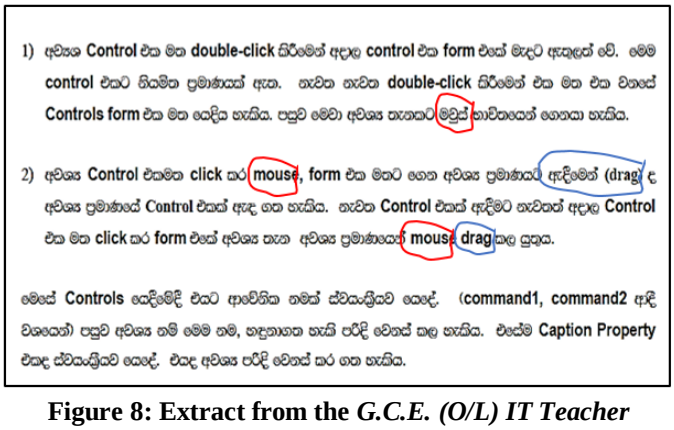
Mouse Button ඉතා සුමුදුව ස්පර්ශ කල යුතුයි. ඉතා තදින් Button තද කිරීම නොකල යුතුයි.

තමාගේ අතට පහසුවන අකාරයට සාමාන්‍ය ප්‍රමාණයේ Mouse තෝරා ගත යුතුයි. යතුරු පුවරුව භාවිතයේදී මෙන්ම මෙහිදීද අත මැණික් කටුව කෙලින් තබා ගත යුතුයි.

Figure 7: Extract from the *G.C.E. (O/L) IT Teacher Instructional Manual of Sri Lanka* (Sinhala medium), National Institute of Education in Sri Lanka, 2008: 194

Figure 7 above is an extract which instructs the use of the mouse. Note that instead of the Sinhala nonintegrated importation[14] used in Figure 6 the English term *Mouse* is used. The word *button* on the other hand has a translation equivalent *boththama*[15] which has a high frequency of usage and a corresponding schemata activation. It is a naturalized denizen from Portuguese to Sinhala.

Adherence to the Expediency Hypothesis is witnessed not only in the rejection of the Portuguese denizen but also that in all instances the English word is preferred over a Sinhala equivalent. In Figure 8 below note the interchangeable use of the word *mouse* and its nonintegrated foreign transliteration මවුස්. The English word *drag* is provided Sinhala word[16] which is a loan meaning substitution (circled in blue). Thus it could be assumed that the teacher has to use the Sinhala word and provide its translation to the students. But within the same extract instead of the Sinhala word the English term *drag* is used.



1) අවශ්‍ය **Control** එක මත **double-click** කිරීමෙන් අදාළ **control** එක **form** එකේ මැදට ඇතුලත් වේ. මෙම **control** එකට නියමිත ප්‍රමාණයක් ඇත. නැවත නැවත **double-click** කිරීමෙන් එක මත එක වනයේ **Controls form** එක මත පෙදිය හැකිය. පසුව මෙවා අවශ්‍ය තැනකට මවුස් භාවිතයෙන් ගෙනයා හැකිය.

2) අවශ්‍ය **Control** එකමත **click** කර **mouse**, **form** එක මතට ගෙන අවශ්‍ය ප්‍රමාණයට ඇදීමෙන් (drag) ද අවශ්‍ය ප්‍රමාණයේ **Control** එකක් ඇද ගත හැකිය. නැවත **Control** එකක් ඇදීමට නැවතත් අදාළ **Control** එක මත **click** කර **form** එකේ අවශ්‍ය තැන අවශ්‍ය ප්‍රමාණයෙන් **mouse drag** කල යුතුය.

මෙසේ **Controls** පෙදිමේදී එයට ආවේණික නමක් ස්වයංක්‍රියව යෙදේ. (**command1, command2** ඇදී වශයෙන්) පසුව අවශ්‍ය නම් මෙම නම, හඳුනාගත හැකි පරිදි වෙනස් කල හැකිය. එසේම **Caption Property** එකද ස්වයංක්‍රියව යෙදේ. එයද අවශ්‍ය පරිදි වෙනස් කර ගත හැකිය.

Figure 8: Extract from the *G.C.E. (O/L) IT Teacher Instructional Manual of Sri Lanka* (Sinhala medium), National Institute of Education in Sri Lanka, 2008: 22

An analysis of the full manual depicts an approximately 34% of occurrence of English words in English font, all ICT terminology, embedded in the Sinhala matrix contents. The next high frequency of occurrence of ICT terminology was of assimilated loanwords (18%) which was closely followed by unassimilated foreign words (16%). Partial substitutions were rare but what was noteworthy was that there was a zero

[11] මොනිටරය/mɔnɪʈərəjə/
[12] මවුස් /maʊs/
[13] ආරම්භක අවස්ථාවේදී /a:rambʰəkə əʊastʰa:ʊe:ɖi:/ (Development stage)
[14] මවුස් /maʊs/
[15] බොත්තම /boʈʈəmə/
[16] ඇදීමෙන්

occurrence of loan coinages which are cognitively laborious constructs.

Recall that Figure 1 constructed an applicability process for the Expediency Hypothesis through secondary ICT term formation in Sinhala. Further the Expediency Hypothesis posits that many languages which have undergone colonial contact with English, for example Sinhala, along its evolutionary process since colonization have coined words to satisfy the deficit created by English vocabulary. But these coinages gradually became redundant and the English lexical importations were retained. Thus expediency results from linguistic pragmatism and laziness which provide the impetus to prefer importations and reject the vernacular coinages.

V. CONCLUSIONS

Based on a translational perspective this study examined the core borrowing procedures discernable in the secondary ICT term formation in Sinhala. Analysis of the selected bilingual corpus constructs the following conditional propositions.

1. There are a multitude of online sites[17] which provide secondary ICT terminology in Sinhala for primary English ICT terms.
2. Screening of the material included in the corpus of this study it was noted that while importation is a robust ICT term forming procedure a large number of substitutions especially in the form of coinage are evidenced in the corpora in these sites. The findings demonstrate that though coinages, loan translations and loan creations introduce new Sinhala ICT terms importation is the tool of choice in secondary ICT terminology formation and it is a predominant norm.
3. This study argues that the high preference for primary English terms and importations over vernacular coinages, loan translations and loan creations evidenced in the instrument *G.C.E. (O/L) IT Teacher Instructional Manual of Sri Lanka* (Sinhala medium) is due to practicality and pedagogical pragmatism.
4. Thus at the very introductory stage of ICT education the Sri Lankan student population will retain the importations and will have no exposure to the vernacular coinages which pedagogy has deemed as cumbersome. This linguistic behavior reflects an adherence to the tenets of the Expediency Hypothesis.
5. As Sinhala is a minority language in the world its purity is threatened if new coinages, especially in a discipline as ICT which has a high utilitarian value, become redundant.

It is suggested that further studies need to extend the field of this research to secondary formation of terms to Sinhala written and speech formats to confirm whether the trends discerned in this small-scale investigation are applicable and to compile further validation to the Expediency Hypothesis.

[17] http://www.kaputa.com/sinhalaunicode/sinhala_ict_glossary.htm
http://advanced-level-ict.blogspot.com/2011/10/ict-sinhala-ict-glossary.html
http://www.sasrutha.com/article/2241146/gce-advanced-level-ict-ict-sinhala-ict-glossary

REFERENCES

[1] [43] [48] M. Haspelmath, and U. Tadmor, Loanwords in the world's languages: a comparative handbook. Berlin, De Gruyter Mouton, 2009.

[2] S. Postolea, from regularities to norms in the secondary formation of Romanian ICT terms. Linguaculture, 2, 101-115.

[3] M. Geers, "A Comparative Study of Linguistic Purism in the History of England and Germany." Linguistic Purism in the Germanic Languages. Eds. Nils Langer and Winifred V. Davies. New York: Walter de Gruyer, 2005.

[4] J. C. Sager, Term formation, S. E. Wright and G. Budin (ed.) Handbook of Terminology Management, Amsterdam, John Benjamin's, 1997, 1, 25-41.

[5] [10][13] W. Betz, "Lehnwörter und Lehnprägungen im Vor- und Frühdeutschen". In: Maurer, Friedrich and Stroh, Friedrich (eds.): Deutsche Wortgeschichte. 2nd ed. Berlin: Schmidt, 1959, 1, 127–147.

[6] [14] D. Duckworth, "Zur terminologischen und systematischen Grundlage der Forschung auf dem Gebiet der englisch-deutschen Interferenz: Kritische Übersicht und neuer Vorschlag". In: Kolb, Herbert / Lauffer, Hartmut (eds.) (1977): Sprachliche Interferenz: Festschrift für Werner Betz zum 65. Geburtstag. Tübingen: Niemeyer, 1977, 36–56.

[7] [15][28][33][38] E. Haugen, The Analysis of Linguistic Borrowing, Language: Journal of the Linguistic Society of America, 1950, 26(2), 210-231. [Accessed 11 September 2015].

[8] G. Toury, Descriptive translation studies and beyond. Amsterdam and Philadelphia: John Benjamins, 1995.

[9] U. Weinreich, Languages in contact: findings and problems. New York, Linguistic Circle of New York, 1953.

[10] [11][45][46] E. Zenner, Cognitive Contact Linguistics The macro, meso and micro influence of English on Dutch. Routledge, 2013.

[11] [12][27][29][32][34][35][37][39] J. Grzega, Borrowing as a word-finding process in Cognitive Historical Onomasiology Onomasiology Online, 2003, 4: 22-42

[12] [16][18][25] M. Higa, Sociolinguistic aspects of word borrowing. In W Mackey., J. F Ornstein (eds). Sociolinguistic studies in language contact method and cases. 1979, 277-292. The Hague: Mouton Publishers.

[13] [17][20][24] B. Kachru, Monolingual bias in SLA research. TESOL Quarterly. 1994, 28, 4: 795-800.

[14] [19] R. L. Trask, Historical Linguistics. London: Arnold, 1996.

[15] [21] A. Fantini, Language acquisition of a bilingual child: A sociolinguistic perspective. Clevedon, England: Multilingual Matters Ltd., 1985.

[16] [22] F. Katamba, English words: structure, history, usage. London, Routledge, 2005.

[17] [23] M. Danesi, and A. Rocci, Global Linguistics: An Introduction. Berlin, Mouton de Gruyter, 2009.

[18] [26] L. Bowker & J. Pearson, Working with Specialized Language: A Practical Guide to Using Corpora. London: Routledge. 2002.

[19] [30] G. Capuz, "Towards a Typological Classification of Linguistic Borrowing (Illustrated with Anglicisms in Romance Languages)". Revista Alicantina de Estudios Ingleses, 1997, 10: 81-94.

[20] [31][42][44][47] C. Russ, The German Language today: A linguistic introduction. Routledge, 1994.

[21] [36] G. Tesch, Linguale Interferenz. Theoretische, terminologische und methodische Grundfragen zu ihrer Erforschung. Tübingen: Narr. 1978.

[22] [40] P. Durkin, Borrowed Words: A History of Loanwords in English. Oxford University Press, 2014.

[23] [41] Bussmann, Hadumod. Routledge Dictionary of Language and Linguistics. Gregory Trauth and Kerstin Kazzazi (eds.). Translated by Gregory Trauth and Kerstin Kazzazi. London and New York: Routledge. 2006.

[24] [49] R. C. Widyalankara, A cause- effect analysis of the phonology of Sri Lankan Englishes: Influence of Sinhala on Sinhala/Sri Lankan English bilingual pronunciation. LAP Publications: Amazon, 2014.

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Enhancing Germination in Seeds of *Centrosema pubescens*

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Abstract- Breaking of dormancy in seeds of *Centrosema pubescens* was investigated through laboratory experiment to elucidate the best method that can be used to enhance germination of the seed. The treatment were: 1) control, 2) scarification with sand paper, 3) immersion in hot water (80^{o}C) for 2, 4, 6, 8 and 10 minutes and 4) immersion in sulfuric acid for 3, 6, 9, 12, 15, 18, 21 and 24 minutes. The results showed that regardless of immersion time, sulfuric acid scarification had the highest germination percentage, followed by scarification with sand paper and immersion in hot water. The lowest germination percentage was obtained in control. Scarifications with sulfuric acid for 18 minutes was the best method for breaking dormancy of *Centrosema pubescens* which resulted in an increased total germination to 100% , the highest germination speed and the lowest germination time.

Index Terms- *Centrosema pubescens*, sulfuric acid, sandpapering, hot water, germination

I. INTRODUCTION

Centrosema pubescens, common name centro , is a perennial twining, trailing and climbing legume that native to sub-humid and humid regions of central and South America and now it has been naturalized in tropical Asia and Africa. It has a high potential adaptation to diverse habitat such as dry and high altitude of the tropics, poorly drained and/or seasonally flooded conditions and acids, low fertility soils (Schultze-Kraft et al., 1990). Centro is widely used as forage and source of protein, calcium and phosphorus to livestock. It can be intercropped with grasses and increasing crude protein content of associated grasses. Centro is also used as green manure crop in rubber, coconut and oil palm plantation (Lascano *et al.*, 1990). It can be grown for cover crops because it naturally suppressed weeds. Like other N-fixing legumes, centro is soil improver. Its association with grasses is beneficial to grass yield making N fertilization is unnecessary (Castillo *et al*., 2003). The amount of nitrogen fixed by centro is average of 259 kg/ha with ranged from 126 – 395 kg/ha (Adegboola and Fayemi, 1972).

Centro is suitable to be used as animal feed. Annual yields of green matter are around 5 – 14 tons/ha, but 40 tons/ha has been recorded (Ecocrop, 2009). It contains 18.29 crude protein, 57.35% NDF, 27.40% ADF, 8.14% ADL and 8.81% ash (Ajayi and Babayemi, 2008). Centro is a high quality forage and is recommended for pasture improvement in Indonesia.

Despite the great importance and characteristics, establishment of centro is difficult. One of the major constraint in its successful establishment is due to high proportion of hard seed (Verhoeven, 1958). Field observations have indicated that without seed treatment, germination of centro is low (Serpa and Achicar, 1970). High hard seed content in a seed lot can lead to delayed or decreased seedling emergence. As a result, plant stand becomes thin, sporadic and less competitive with weeds or undesirable species. Therefore, reduction of hard seed content in seed lot of centro is very important. As a successful establishment of plant depends initially on high germination rate over a short period of time, therefore, this study was conducted to find suitable treatment that would increase germination as well as to improve seedling quality of *Centrosema pubescens*.

II. MATERIALS AND METHOD

Seed collection

Mature seeds of *Centrosema pubescens* were collected from plant growing naturally in Hasanuddin University campus, Makassar, Indonesia (latitude 5^{o}10'S, longitude 119^{o}20'E) and 7 m above sea level, from August to September 2015. Seeds were selected by sorting out the healthy and uniform seeds. Malformed and unhealthy seeds were discarded. Uniform seeds were used to reduce non-treatment variation since germination percentage and seedling vigor is positively correlated with seed size. Before the experiment was done, the seeds were tested for viability by floatation method in distilled water. The seeds that floated were discarded and assumed not to be viable and only the seed that sunk were used for study.

Experimental design and treatment

The experiment was completely randomized design with 15 treatments and each treatment containing four replicates.
The seed treatments were as follows:

- Control (no seed treatment) (T0)
- Mechanical scarification: seeds scarified by rubbing between sand paper for 15 seconds (T1)
- Hot water scarification: seeds immersed in hot water (80^{o} C) for 2, 4, 6, 8 and 10 minutes (T2, T3, T4, T5 and T6).
- Acid scarification: seeds immersed in concentrated sulfuric acid (96%) for 3, 6, 9, 12 , 15, 18, 21 and 24 minutes (T7, T8, T9, T10, T11, T12, T13 and T15).

The seeds under hot water and sulfuric acids scarification were gently stirred periodically and after the treatment duration, seeds were washed thoroughly. Seeds that had been immersed in sulfuric acid, were repeatedly washed in running tap water until they were considered safe to handle.

Twenty five seeds of centro were kept in sterile Petri dish (9 cm diameter) lined with one layer of filter paper. The filter papers were kept saturated with addition of distilled water throughout the experimental period. The petri dishes were kept on laboratory bench at the temperature of 27 – 36° C and covered to prevent the loss of moisture by evaporation. The germinated seeds were recorded daily till the germination ceased. After 10 days of incubation, the final germination and length of seedling were recorded. Germination was regarded to have occurred when the radicle was observed.

Measurement

Germination indices measured were: 1) total germination (TG): number of germinated seeds/total number of seeds in petri dish x 100, 2) mean daily germination (MDG): total number of germinated seeds/total number of days of germination period, 3) germination period (GP): the time in the days between the first and the last germination events occurred, 5) germination speed (GS) was calculated following the formula given by Czabator (1962) as follows: n1/d1 + n2/ d2 + n3/d3 + ……, where: n – number of germinated seeds and d – number of days, 6) mean germination time (MGT), was calculated as formula given by Ellis and Roberts (1981) as follow:

$$MGT = \frac{\sum Ti\ Ni}{\sum Ni}$$

Where Ti is the number of days from the beginning of experiment and Ni is number of seeds germinated per day.

Seedling vigor index (SGI) was determined according to the formula given by Abdul-Baki and Anderson (1973) as seedling length (cm) x germination percentage/100.

Data collection and analysis

The data on germination indices and seedling growth index were subjected to statistical analysis of variance. The means were compared using Least Significant Difference (LSD) test at 5% probability level.

III. RESULTS AND DISCUSSION

The results of the germination test for different methods of breaking dormancy are shown in Table 1. There was significant difference ($P < 0.05$) in parameters measured between treatments. Generally, it was observed that regardless of immersion time, sulfuric acid scarification was the method that had the highest TG, MDG, GS, SGI values and the lowest GP and MGT values, followed by seeds treated with sand paper and seeds immersed in hot water. The lowest TG, MDG, GS, SGI and the highest GP and MGT values were recorded in control (T0).

Table 1. Effect of different pre-treatment on germination indices and seedling growth of *Centrosem pubescens.*

Treatments	TG (%)	MDG (%/day)	GP	GS (seed/day)	MGT	SGI
			(days)		(days)	
T0	11.00	1.10	10.20	0.38	5.17	1.04
T1	82.00	10.25	8.10	8.54	2.81	7.87
T2	66.00	8.25	10.40	3.85	5.62	5.48
T3	76.00	9.50	9.60	5.20	4.93	6.31
T4	58.00	7.25	8.70	4.72	3.15	4.79
T5	53.00	5.90	8.20	3.62	3.52	4.68
T6	47.00	5.22	7.60	2.94	4.52	3.90
T7	65.00	6.50	10.20	4.68	3.86	5.91
T8	86.00	9.55	9.80	7.93	3.40	7.40
T9	95.00	10.55	9.20	10.61	2.53	8.20
T10	100.00	11.11	8.30	11.71	2.10	8.50
T11	100.00	25.00	5.40	12.11	2.04	8.20
T12	100.00	33.33	2.10	12.50	2.01	7.90
T13	96.00	19.20	5.40	11.77	2.09	7.60
T14	95.00	19.00	5.40	11.60	2.19	7.50
LSD at 5%	14.25	5.40	4.21	4.65	1.21	1.32

Sulfuric acid scarification is well known to be effective to improving germination of species with hard seed coat (Youssef, 2008). The positive effect of sulfuric acid scarification on seeds of centro indicates that the low germination of centro is probably due to physical dormancy which is agreement with previous research reported in legumes (Missanjo *et al*., 2013; Olatunji *et al*., 2013)). This also is in agreement with Wine Pe *et al.* (1974) who reported that percentage of germination of centro increased from 30 to 80% when the seeds were treated with concentrated sulfuric acid. The superiority of sulfuric acid scarification over other breaking dormancy methods had also been reported in *Flemingia macrophylla* by Asare and Otsyina (1980), in *Parkia biglobosa* by Aliero (2004), and in *Vitellaria paradoxa* by Iroko *et al*. (2013)

Time of exposure of seeds to sulfuric acid is very critical. In the present study, as increasing soaking time, TG, MDG and GS values were increased and peaked at 18 minutes, but with the longer time of exposure, the values of the three germination indices were decreased. This is agree with *Missanjo* et al. (2013) that insufficient soaking may be not effective enough as it just makes the seed coat glossy, conversely, exposure of seeds to the chemical in the long time may damage the embryo.

Treatment with sulfuric acid for a period of 18 minutes gave the lowest MDG value. Compared to control, it reduced the amount of MGT value by 60%. This indicates that immersion of seeds in sulfuric acid for 18 minutes was quickly ruptured the seed coats, thereby resulted in high TG, MDG and GS values and less germination time. Therefore, immersion of seeds in sulfuric acid for 18 minutes is the best option to obtain uniform and rapid germination in seeds of centro. This is in line with Agbodogi *et al* (2007) that the soaking of *Dacryodes edulis* seeds in concentrated sulfuric acid reduced the GP value considerably and concluded that it was the best method although it dangerous to handling. The harmful effect of immersing sulfuric acid for 21 and 24 minutes indicates that prolonged immersion of seeds was injurious to seeds of centro as the acid may damage the vital parts of the embryo or may hinder the embryo metabolism. In nature, germination of centro may extend over weeks, months or even years and in order to propagate centro efficiently, it therefore is necessary to treat the it seeds with concentrated sulfuric acid before sowing to ensure not only a high final germination percentage but also a rapid and an uniform germination.

Sulfuric acid scarification affected SGI. SGI value continued to increase from 3 to 15 minutes of immersing of seeds in sulfuric acid, but at 18, 21 and 24 minutes of immersing, SGI value decreased (Table 1). This decrease in SGI value of seeds immersed for 21 and 21 minutes was attributed to both the lower TG value and length of seedling. However, in seeds immersed for 18 minutes, the decrease of SGI was purely attributed to lower seedling length, as TG value was 100%. This might be attributed to the abnormality of seed metabolism under prolonged of seed immersion.

In the present study scarification with sand paper was the second best pre-sowing treatment method. Mechanical scarification with sand paper significantly increased seed germination compared to control and hot water scarification. This result agrees with Duguma *et al*. (1998) and Aduradola *et al*. (2005) that mechanical scarification was the most effective way of improving seed coat permeability in seeds of *Leucaena leucocephala* and *Chrysophyllum abidum*, respectively. The damaging of lignified palisade cells after sandpapering that permitting water and oxygen entering the cells may be the causative factor for positive effect of mechanical scarification (Yildiztugay *et al.*, 2012).

Hot water scarification had a positive effect on breaking dormancy. It was recorded that TG, MDG, GP, GS and SGI values increased as increasing soaking time up to 4 minutes, then they were decreased, conversely, MGT value increased up to 4 minutes of soaking and after that, it decreased (Table 1). The highest of some germination indices of seeds immersed in hot water for 4 minutes might be attributed to the increased penetration of water and oxygen into the seeds. Deleterious effects of immersing the seeds for 6, 8 and 10 minutes might be due to the death of embryo as caused by long time of exposure to hot water. Rincon et al. (2003) reported that soaking the seed in hot water induced seed germination, however, increasing the contact time of the seeds with hot water decreased seed germination.

IV. CONCLUSION

This study showed that scarification of seeds with sulfuric acid, sand paper, and hot water significantly induced germination in seeds of *Centrosema pubescens*. The best germination value was recorded from acid sulfuric scarification, followed by sand paper scarification and immersion in hot water. Although sulfuric acid had the highest positive effect in breaking seed dormancy, because its application by most farmers is not easy, therefore, sand papering and hot water treatments could be considered for substitution.

REFERENCES

[1] Abdul-Baki, A. and Anderson, J.D. 1973. Vigor determination in soybean seed by multiple criteria. Crop Sci., 13 : 630 – 633.

[2] Agbogidi, O.M. Bosah, B.O. and Eshegbeyi M.O. 2007. Effects of acid pre-treatment on the germination and seedling growth of African pear (Dacryodes edulis Don. G. Lam. H.J.). Int. J. Agric. Res. 2 : 952 – 958.

[3] Adegboola, A.A. and Fayemi, A.A. 1972. Fixation and excretion of nitrogen by tropical legumes. Agron. J. 64 : 409 412.

[4] Aduradola, A.M., Adeola, B.F. and M.O. Adedire, 2005. Enhancing germination in seeds of African star apple, Chrysophyllum albidum (G.Don). J. Food, Agric Environ., 3 (2) : 292 – 294.

[5] Ajayi, F.T. and Babayemi, O.J. 2008. Comparative in vitro evaluation of mixtures of Panicum maximum cv Ntchisi with stylo (Stylosantthes guianensis), Lablab (Lablab purpureus), Centro (Centrosema pubescens) and Histrix (Aeschynomene histrix). Livestock Research for Rural Development, 20 (6). http://www.lrrd.org/lrrd20/6/ajay20083.htm.

[6] Aliero, B.L. 2004. Effects of sulphuric acid, mechanical scarification and wet heat treatments on germination of seeds of African locust bean ree, Parkia biglobos. Afr. J. Biotechnol. 3 (3) : 179 – 181.

[7] Asare, E.O., Otsyina R.H.M. 1980. The effects of six-presowing treatments on germination and germination of Flemingia macrophylla. Ghana J. Agric. Sci. 13 : 19 – 22.

[8] Castillo, E., Ruiz, T.E., Stuart R., Galindo, J., Hernandez, J.L. Diaz. H. 2003. Effect of the protein energetic supplementation on the performance of male bovine growing natural pastures associated with a mixture of creeping legumes. Cuban J. Agric. Sci. 39 (2) : 143 – 147.

[9] Czabator, F.J. 1962. Germination value: An index combining speck and completeness of pine seed germination. Forest Science, 8 : 386 – 395.

[10] Duguma, B., Kang B.T. and Okali, D.U. 1998. Factors affecting germination of Leucaena leucocephala seeds. Sci. Technol. 16 : 489 – 500.

[11] Ecocrop, 2009. Ecocrop database, FAO. http://ecocrop.fao.org/ecocrop/srv/en/home.

[12] Ellis, R.H and E.H. Roberts, 1981. The quantification of ageing and survival in orthodox seeds. Seed Sci. Technol, 9 : 373 – 409.

[13] Iroko, O.A., Asinwa, I.O. Kareem A.A. and F.K. Ibrahim, 2013. Pre-treatment effects on seed germination of Vitellaria paradoxa (Gaertn) hepper. Scholarly J. Abric. Sci, 3 (4) : 121 – 125.

[14] Lascano, C.E., Teitzel, J.K., Kong, E.P. 1990. Nutritive value of Centrosema in animal production. In: Shultze-Kraft Rainer (Ed). Centrosema: biology, agronomy and utilization. Ciat publication No. 92, 666 p.

[15] Missanjo, E., Maya, C., Kapira, D., Banda, H and G.K. Thole, 2013. Effect of seed size and pretreatment method on germination of Albizia lebbeck. Int. Scholarly Res. Notices. http://www. hindawi.com/journals/isrn/2013/969026/. Accessed on September 11, 2015.

[16] Olatunji, D., Maku, O.J and Odumefun, O.P. 2013. The effect of pre-treatment on germination and early seedling growth of Acacia auriculiformis Cunn Ex. Benth. Afr. J. Plant Sci., 7 (8) : 325 – 330.

[17] Rincon, R., Culebro, N., Gutierres F.A. and Dendooven, L. 2003. Scarification of seeds of Acacia angustissima Mill Kuntze and its effect on germination. Seed Sci. Technol., 31 : 301 – 307.

[18] Serpa, A. and Achicar, J. 1970. The influence of maturation on the production of hard seed in Cenrosema pubescens. J. Pesquisa Agropecuaria Brasileira, 5 : 125 – 128.

[19] Verhoeven, G. 1958. Tropical legume seed can be harvested commercially. Queensland Agric. J., 84 : 77 – 82.

[20] Wine Pe, Hill, M.J. and Johnson, E.H. 1974. The effects of seed storage and treatment on germination of Centrosema pubescens (Centro) seeds. N. Zealand J. Exp. Agric, 3 : 81 84.

[21] Yildiztugay, Evren and M. Kucukoduk, 2012. Dormancy breaking and germination requirements for seeds of Sphaerophysa kotschyana Boiss. J. Global Biosci. 1 : 20 – 27.

[22] Youssef, A.M. 2008. Adaptive responses of some desert plants from different ecosystems of Suez road, Egypt. Res. J. Agric. Biol. Sci., 4 5) : 595 – 603.

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Indications for Relaparotomy in Cesarean Section in a Tertiary Care Hospital of a Developing Country

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Abstract- Introduction: Caesarean section though a simple obstetric surgery is at times associated with complications. Complications if grave may demand relaparotomy in such patients.

Material and methods: A prospective descriptive study over a period of 3 years was done to find out the incidence, indications, complications and outcome of relaparotomies done in patients of caesarean section.

Results: the incidence of relaparotomies in caesarean sections in our setup was 0.16%, most were emergency sections(85.2%) and done on previous caesarean patients (30.88%). Hysterectomy was the commonest procedure done at relaparotomy (27.8%). Maternal mortality was high (11.76%).

Conclusion: Good surgical technique and perfect hemostasis with proper labor protocols can help reduce incidence of relaparotomies in all set ups.

Index Terms- cesarean section , relaparotomy, postpartum haemorrhage , fetal distress .

I. INTRODUCTION

Caesarean section is the most common operation carried out in daily obstetric practice. With the improvement of operative techniques, safe anesthesia, safe and multiple transfusion facilities the rate of caesarean sections has increased considerably. Increasing age at first pregnancy and maternal requests are other factors for expanding rate of caesarean sections [3]. The rate of caesarean section worldwide reported in recent literature is around 50 – 55%. Complication rates associated with cesarean section are several fold than that associated with a normal vaginal delivery. The low risk uncomplicated caesarean section has an eight fold higher mortality than vaginal delivery [1]. Complications depend on indication of caesarean section, quality of surgery and institutional facilities available to deal with those complications. Relaparotomy in a caesarean section is in some cases considered as near miss maternal mortality. It is performed when the condition of the patient is too critical to withstand the risk of anesthesia and a repeat surgery. It requires good clinical judgment to take a decision for relaparotomy. On the other hand it may be the only resort to save the patient.

II. OBJECTIVE

Aim of our study was to find out the incidence, risk factors, indications, operative findings, maternal morbidity and mortality associated with relaparotomy and measures that should be taken to prevent it.

III. MATERIALS AND METHODS

This was a prospective descriptive study conducted in the Department of Obstetrics and Gynecology, Government Medical College, Srinagar from July 2012 to July 2015. Lalla Ded Hospital is the sole tertiary care hospital of the valley where majority of patients received belong to high risk category. As such caesarean section rate is very high in this institution. Relaparotomies were done by senior consultants. Data regarding age, parity, indication for primary caesarean section, indication for relaparotomy, interval between the two surgeries, blood transfusions received, ICU admission, total hospital stay and final maternal outcome was collected.

IV. RESULTS

A total of 68,194 deliveries were conducted during the period July 2012 to July 2015. Of these 41,112 cesarean sections were done with a rate of 60.28%. A total of 68 patients underwent relaparotomy of which 40 had caesarean section done in this hospital and 28 were referred from periphery. The incidence of relaparotomy following caesarean section was 0.16% in our study. If referred patients are excluded then the incidence of relaparotomy in our study is 0.09%. Age of patients ranged from 20 – 40 years, parity ranged from 1 to 5. Patients with previous 1 cesarean section were 13, previous 2 cesareans were 8. Depending upon nature of surgery 58 (85.2%) patients had undergone emergency caesarean section and 10 (14.7%) elective sections.

INDICATIONS OF RELAPAROTOMY

1	Parietal wall hematoma	18	26.47%
2	Atonic PPH	12	17.64%
3	Broad ligament hematoma	8	11.76%
4	Uterine scar bleeding	2	2.94%

5	Intramyometrial hematoma	1	1.47%
6	Secondary PPH	6	8.82%
7	Burst abdomen	8	11.76%
8	Peritonitis	2	2.94%
9	Retained succenturiate lobe	1	1.47%
10	Cervical tear	1	1.47%
11	Adhesions causing bowel obstruction	2	2.94
12	Hemoperitoneum	7	10.29%

INDICATIONS OF PRIMARY CAESAREAN SECTION

Fetal distress	12	17.64%
Post LSCS	21	30.88%
Prolonged labour	5	7.35%
Malpresentation	3	4.41%
Placenta previa	3	4.41%
Obstructed labour	6	8.82%
Severe PIH	11	16.17%
Placental abruption	4	5.88%

PROCEDURES PERFORMED DURING RELAPAROTOMY

Hysterectomy	19	27.94%
Exploration of sub-rectal hematoma and ligation of vessels	18	26.47%
Uterine brace sutures	1	1.47%
Bilateral four vessel ligation	2	2.94%
Bilateral internal iliac ligation	4	5.88%
Debridement and repair of anterior abdominal wall	8	11.76%
Peritoneal toileting	3	4.41%
Adhesiolysis	1	1.47%
Gut resection	1	1.47%

INTERVAL FROM LSCS TO RELAPAROTOMY

Within 24 hrs	40	58.82%
24hrs to 7 days	17	25%
7 – 15 days	4	5.88%
16 – 45 days	1	1.47%

Maternal mortality n = 8 (11.76%)

Cause of death	
DIC	2
Irreversible shock	1
Renal failure	1
Sepsis	2
Intestinal obstruction	1
Pulmonary embolism	1

ICU admission 33 (48.52%)

V. DISCUSSION

In the current study the incidence of relaparotomy after caesarean section was 0.16%. The majority of previous studies reported a rate of relaparotomy of 0.2 – 0.7% [3,5,6,7]. The lower incidence in our setup is probably due to majority of caesarean sections being less complicated and technically simple. There is a rising trend of cesarean section (60.28%) in our hospital as it is a referral hospital and majority of patients admitted are high risk patients usually requiring caesarean sections.

Maximum patients in our study were operated as emergency caesarean section(85.2%). Around 58.82% patients were done in our hospital and 41.17% patients were referred from periphery. The commonest indications of primary caesarean section in our study was previous caesarean (30.88%) and fetal distress (17.64%), contrary to other studies where the commonest indication was prolonged and obstructed labor [2, 6.] Relaparotomy was most frequently done in previous caesarean pregnancy, fetal distress, placenta previa, placental abruption, obstructed labor and cases of cephalic pelvic disproportion which is consistent with findings of other studies [2, 3, 9, 10]

Commonest finding on relaparotomy in caesarean section was parietal wall hematoma (26.47%) followed by atonic PPH(17.64%). Bleeding secondary to uterine atony is preventable by adopting active management of third stage by oxytocin infusion or rectal misoprostol [8.] Securing bleeding points on undersurface of rectus sheath and rectus muscle before closing rectus sheath must be taught to trainees to reduce the number of cases of relaparotomy after caesarean section. Another important indication of relaparotomy in our study was sepsis. common risk factors for sepsis were obesity and ruptured membranes. Experience of primary surgeon was a big risk factor [11] in our study as seen in other studies as well.

Incidence of cesarean hysterectomy was high in our study (27.94%). Reports from different studies indicate an incidence of 10.61% [6] to 38.18% [2.] Instead of hysterectomy selective angiographic embolisation may have a role in these cases [18].However this facility was not available in our set up. Number of blood products received was an average of 4. Length of hospital stay was 10 days. There were 8 maternal deaths in our study. Unfortunately maternal mortality was high in our study (11.7%). Reports from different studies mention maternal mortality ranging from 2.85% [11] - 12.73% [2] which is comparable with other studies.

VI. CONCLUSION

Centers carrying out caesarean sections in peripheral hospitals should have blood transfusion facilities and experienced staff. Use of partograms to prevent prolonged and obstructed labors should be mandatory. Careful and aseptic surgical technique, meticulous hemostasis especially on the undersurface of rectus muscle and the placental bed and prophylactic balloon catheters are important steps to reduce the incidence of relaparotomy. Examination of vagina in patients of obstructed labor especially with impacted head should be made a routine. Although caesarean section is a life saving and most common obstetric operation, relaparotomy after caesarean is considered to be near miss fatality having high mortality.

REFERENCES

[1] Petitti DB. Maternal mortality and morbidity in cesarean section. Clin Obstet Gynecol. 1985 Dec;28(4):763-9.

[2] S P Biswas S.Halder, FB Shirin. Indications and outcome of relaparotomy after caesarean section. Bang Med J (Khulna) 2012 45:19 – 23.

[3] Ahmed E Ragaab, Yasir H, Mesbah Rafik I Brakat Abdel hadi A Zayed and Mohamed Al Khatim Alsaammani. Relaparotomy after caesarean section. Risks, indications and management options. Journal of the academy of medical sciences in Bosnia and Herzegovina V68 1 2014 Feb 41 – 43.

[4] Landon MB. In Gabbe S G, Niebyl JR, Simpson J H. Cesarean delivery Editors 5th edition Philadelphia Churchill Livingstone 2007. PP 486 – 654.

[5] Levin, Rapapot AS, Satzer L, Maslovitz,Lessing JB, Almog B. Risk factors for relaparotomy after caesarean delivery. Int. J gynaecol obstet 2012 nov 119 (2) 163 – 165.

[6] Seal S L, Kamilya G, Battacharyya S R, Mukherji J, Bhattacharyya A R. Relaparotomy after caesarean delivery. Experience from an Indian teaching hospital. J obstet gynecol Res 2007, 33 (6) 804 – 809.

[7] Seffah J D. Relaparotomy after caesarean section. Int J gynaecol obstet 2005, 88(3) 253 – 257.

[8] Badeko B O, Olaiya D S, Fatusi A O, Kuti O, Orli E O, Ounniyi S O. Adjunctive rectal misoprostol versus oxytocin infusion for prevention of postpartum hemorrhage in women at risk, a randomized controlled trial. J Obstet Gynaecol Res.2012, Nov 38 (11) 1294 – 1301.

[9] Hasegawa J, Nakamura M, Hamadas, Mastbuoka R, Ichizukak, Sekizawa A, Okai. Prediction of hemorrhage in placenta previa. Taiwan J Obstet Gynaecol 2012. March 51(1) 3 – 6.

[10] Kessous R, Danor D, Weintraub Y A, Wiznitzer A, Sergienko R, Ohel I, Sheiner E. Risk factors for relaparotomy after caesarean section. J maternal fetal neonatal med 2012 Nov 25 (11); 2167 – 70.

[11] Sakme Turgut A, Evsen M S, Soydine H E, Ozler A, Saks, Gul T. Relaparotomy after initial surgery in obstetrics and gynaecologic operation. Analysis of 113 cases. Ginekol Pol 2012 June 1983 (6): 429 – 432.

[12] Gedi K Basi A, Akyol A, Asar E, Bingol B, Uncu R Sargin A et al. Relaparotomy after caesarean section. Operative complications in surgical delivery. Arch gynaecol obstet 2008, 278 (5): 419 – 425.

[13] Shweni P M, Bishop B B, Hansen J N, Subrayen K T. Severe secondary post partum hemorrhage after cesarean section.S Afr med J 1987;617 – 619.

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Human Health Aspects in Relation to Climate Change

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Abstract- Human beings are exposed to climate change through changing weather patterns (precipitation, sea-level rise, temperature, and more frequent extreme events) and indirectly through changes in air water, food quality, changes in ecosystems, agriculture industry, settlements and the economy. Global average temperatures are projected by The United Nations & World Health Organization to increase between 1.4 to $5.8^{O}C$ by the end of this century: an associated rise in sea level is also expected. The number of people at risk from flooding by coastal storm surgery is projected to increase from the current 75 million to 200 million in a scenario of mid- range climate change, in which a rise in the sea level of 9-88 cm is envisaged by the 2100s. [3] The study based by NASA'S Goddard Institute 2005 was the warmest year since reliable data available in the late 1800 century. The Women's are expected to be affected more than Men from climate change due to they have to take over the biggest part of the additional work burden, specifically additional care work, and the burden of nurturing the family, as well as providing the daily essentials. The aims of this paper are to briefly summaries what are known about likely impacts of climate change on human health.

Index Terms- Precipitation, industrialization, urbanization and carbon emission

I. INTRODUCTION

Climate change is the result of the buildup of greenhouse gases in the atmosphere, primarily from the burning of fossil fuels for energy and other human activities. These gases, such as carbon dioxide and methane, warm and alter the global climate, which causes environmental changes to occur that can harm people's health and well-being. There is scientific evidenced show that the green house gases (GHG) concentration increasing in rapid rate in the atmosphere due to industrialization, urbanization, coal based power plants and increasing the living standards. The carbon dioxide levels are currently highest of the available data, the values is 345 ppm and 450 ppm is supposed to be very risky. These anthropogenic GHG were not present 50 years back. More than last four decades climate has been noticed to be hotter and hotter; even in the last fifteen years were recorded 10 hottest year globally whenever scientific data available from 1850, in these years temperatures recorded approximate $0.5^{o}C$ more than the normal temperature. In 1988 established Intergovernmental penal on climate change (IPCC) which works on the current phenomenon like climate change. In Kyoto Protocol in 1997 commit to 5.2 % reduce carbon emission by the developed countries in 2008 to 2012.

Changes in climate, including changes in climate variability, would affect many vector-borne infections. Populations at the margins of the current distribution of diseases might be particularly affected. Climate change represents an additional pressure on the world's food supply system and is expected to increase yields at higher latitudes and decrease yields at lower latitudes. This would increase the number of undernourished people in the low-income world, unless there was a major redistribution of food around the world. Assuming that current emission levels continue, air quality in many large urban areas will deteriorate. Increases in exposure to ozone and other air pollutants (e.g., particulates) could increase morbidity and mortality.

India is confronted with the challenges of sustaining rapid economic growth amidst the increasing global threat of climate change. Evidence has shown that climate change will affects the distribution and quality of India's natural resources, which will ultimately threaten the livelihoods of the most poor and sector of the population who are closely tied to India's natural resources base. More than 56% of workers are engaged in agriculture and allied sector, while many others earn their living in coastal areas through tourism or fishing; indeed most of the poorest people live in rural areas and are almost completely reliant on natural resources for their food and shelter. [12]

II. CLIMATE CHANGE SCENARIO

Climate change is a scientifically proven phenomenon that includes "any change in the climate, whether due to its natural variability or as a result of human activity"; [2] it is also a reminder of a sometimes forgotten fact: we are ecologically inter-dependent [15] Human activity takes place within ecological systems not bound by political frontiers and will have generally negative impacts on the environment and on people's well-being if not managed in a sustainable manner.

The latest scientific studies focus on the high atmospheric concentrations of carbon dioxide (CO_2), nitrous oxide (N_2O) and methane (CH_4). The gas with the highest emission volume is CO_2 and it is to a large extent associated with energy generation and productive processes. A third of N_2O emissions are of human origin, mainly due to some of the fertilizers used in agriculture. [2]

The average global surface temperature is projected to increase by $1.4\text{-}3^{o}C$ from 1990-2100 for low emission scenarios and $2.5\text{-}5.8^{o}C$ for higher emission scenarios of green house gases (under the new SRES 'marker' scenarios) in the atmosphere. Study conducted by NASA'S Goddard Institute for space studies 2005 was the warmest year since reliable data available in the late 1800s. The Indian meteorological Department assessed the eight warmest years which occurred in the decades 1997-2007. These warmest years were 2002, 2006, 2003, 2007, 1998, 2004, 1999, and 2001, in the order of warmness. The annual average air

temperature over India was 0.55oC above the averages the normal temperature in these warmest years.

Scientific studies indicate that saturating the sinks, as well as increasing the global temperature, will release additional CO_2 from the natural reserves; this could cause an increase of 200 parts per million (ppm) in the concentration of this GHG in the atmosphere in the next 100 years. This is a substantial increase, especially in view of the fact that the increase in the previous century was only 100 ppm, from 280 to 380 ppm.[11]

III. IMPACTS OF CLIMATE CHANGE ON HUMAN HEALTH

Global climate change is thus a significant addition to the spectrum of environmental health hazards faced by humankind. The global scale makes for unfamiliarity— although most of its health impacts comprise increases (or decreases) in familiar effects of climatic variation on human biology and health. Health includes physical, social and psychological wellbeing. Population health is a primary goal of sustainable development. Human beings are exposed to climate change through changing weather patterns for example more intense and frequent extreme events) and indirectly though changes in water, air, food quality and quantity, ecosystems, agriculture, livelihoods and infrastructure (Figure 1). These direct and indirect exposures can cause death, disability and suffering. Ill health increases vulnerability and reduces the capacity of individuals and groups to adapt to climate change. Populations with high rates of disease and debility cope less successfully with stresses of all kinds, including those related to climate change. Categories of human health consequences of climate change directly or indirectly: Asthma, respiratory Allergies, and Airway Diseases, Cancer, Cardiovascular Disease and Stroke, Foodborne Diseases and Nutrition, Heat-Related Morbidity and Mortality, Human Developmental Effects, Mental Health and Stress-Related Disorders, Neurological Diseases and Disorders, Vector-borne and Zoonotic Diseases, Waterborne Diseases and Weather-Related Morbidity and Mortality

Global warming is the increase in the average temperature of the earth's near-surface air and oceans since the mid-20th century and it project continuation. Global warming is the current issues in front of the world, which cause millions of death, occurred in every year world wide. The global warming affects human health by both ways directly and indirectly. The global warming impacts directly to human as heat and cold waves, indeed extreme weather condition, sea level rise alter the life of humans. In the figure 1 illustrated the possible pathways of impacts of the climate change on human health. High temperatures also raise the levels of ozone and other pollutants in the air that exacerbate cardiovascular and respiratory disease. The known impacts of climate change on human health (table 1). The World Health Organization (WHO) has declared that most health consequences of climate change will be adverse. It is estimated that, in 2000 alone, climate change was responsible for 2.4% of diarrhea cases and 6% of malaria cases worldwide.

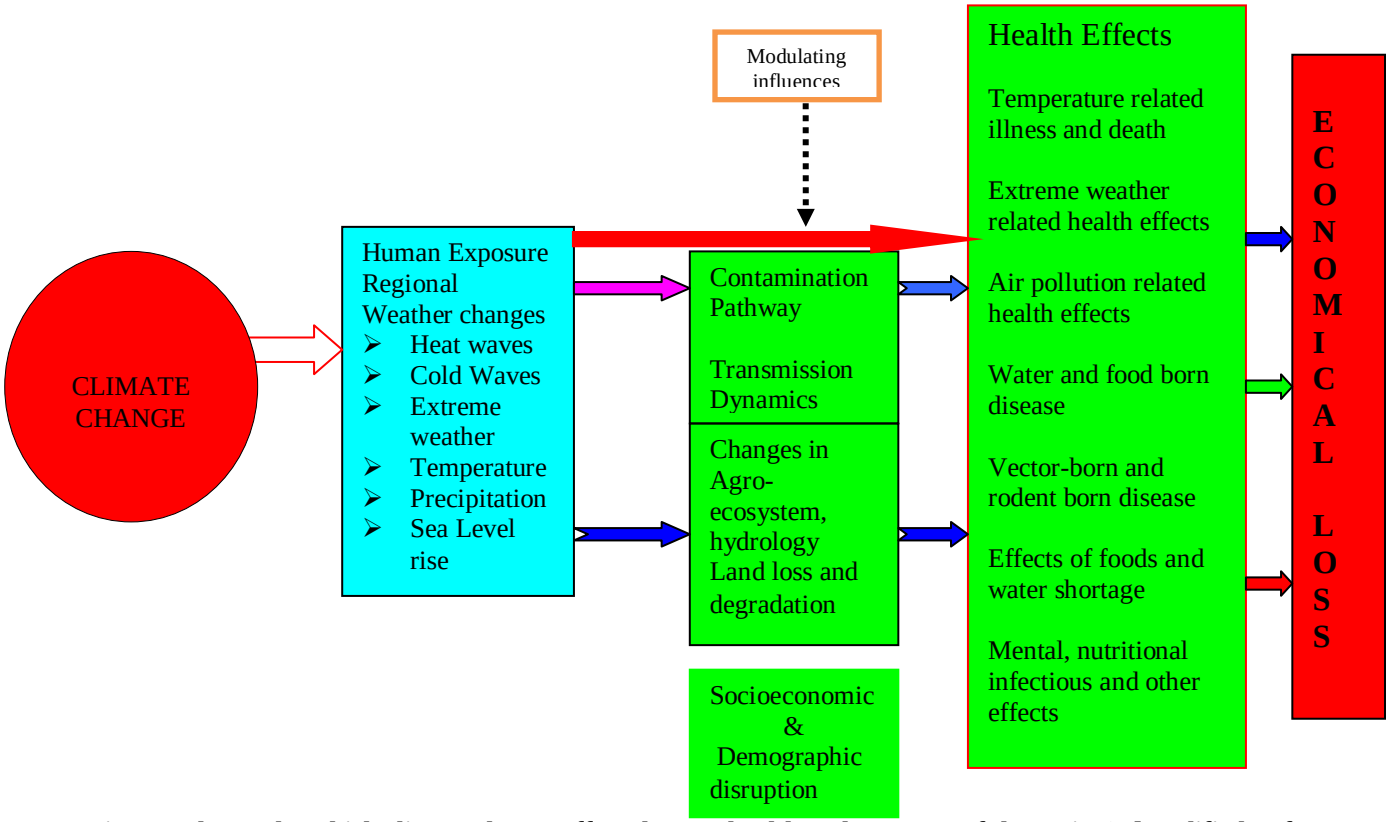

Fig. 1 Pathways by which climate change affects human health and economy of the nation's [Modified Reference, 7]

One recent study predicted that climate change will put 40 million to 300 million extra people at risk of hunger in 2060. This population would join the 640 million others expected to face food shortage by that date even without climate change, one study by researchers in Netherlands estimates that climate change will case 1 million extra malarias deaths per year by the middle of the this century.

Climate change will have three general types of effects on health:

1. Direct effects of extreme climate events;
2. Effects caused by environmental damage;
3. Tertiary effects caused by the displacement of populations as a result of economic problems, environmental degradation or conflicts arising from climate change (i.e., traumas, infections, psychological diseases and negative effects on food security, among others).[13]

Reduce child mortality - Extreme climate conditions such as out-of-season rains, floods and droughts may increase infant mortality. Water-borne diseases and those caused by poor sanitation (such as diarrhea) and respiratory infections related to pollution, are the main causes of mortality in children under five years of age.[4]

Health effects of rising sea levels - Today about 350 million people can be considered displaced [8] – some temporarily, some long-term. They include over 150 million people involuntarily displaced—people forced from their homes by weather-related disasters, gradual environmental degradation such as desertification and sea level rise or due to development projects, such as the construction of dams, mines, roads, factories, plantations and wildlife reserves. The IPCC and the Stern review speak in the next 20 years 150 million and 200 million permanently displaced due to rising sea-levels, floods and droughts in 2050. These are widely disputed estimates[5], but give an order of magnitude that shows that by 2030, the number of Climate Displaced People could at least triple. They migrate because they are driven from their homelands by weather disasters or gradual environmental degradation that generates economic migration. [5, 9]

Table 1. Health impact of climate change and ozone layer depletion (Modified from reference 13)

Health Effects	**Known Effects**
Thermal Stresses	• Mortality (especially cardiopulmonary) increases with cold and warm temperatures • Older age group and people with underlying organic diseases are particularly vulnerable • Mortality increases sharply during heat wave
Vector-born diseases	• Climate conditions (particularly temperature) necessary for some vectors to thrive and for the microorganisms to multiply within the vectors are relatively well Known
Water/food-born diseases	• Survival of disease organisms (and insects which may spread them) is related to temperature • Water-borne diseases most likely to occur in communities with poor water supply and sanitation • Climate condition affect water availability • Contamination of portable water, particularly following extreme rainfall; seepage of contaminants from illegal dumping of solid waste and other waste into underground aquifers
Food Production	• Temperature, precipitation, solar radiation and carbon dioxide are important for crop production • The potential indirect effect of increased UV-B level reaching the Earth lead to impairment of photosynthesis on land (food crops) and in the sea (phytoplankton), reducing the world's food production • Crop failure may lead to malnutrition • Undernourishment may increase susceptibility to infectious diseases
Skin Cancer	• Skin cancer is related to UV exposure (both melanoma skin cancer and non-melanoma skin cancer), people with lightly pigmented skin being most susceptible • Aging increases the risk of skin cancer
Cataracts	• UV radiation damages the eye, more particularly the lens • Different types of cataracts will react differently to changes to UV radiation • Aetiology of cataracts is assisted with age, diabetes, malnutrition, heavy smoking, hypertension, renal failure, high alcohol consumption, and excessive heat

Immune suppression	•UV suppresses immune system in animal models, and may adversely affect various infections • In man, serial UV radiation may cause proper immunization to fail • UV-induced immuno-suppression appear to be a risk factor for skin carcinomas

Potential effects on health due to sea level rise [6] include:

1. Death and injury due to flooding.

2. Reduced availability of fresh water due to saltwater intrusion.

3. Contamination of water supply through pollutants from submerged waste dumps.

4. Change in the distribution of disease-spreading insects.

5. Health effect on the nutrition due to a loss in agriculture land and changes in fish catch

6. Health impacts associated with population displacement.

India has a 7500 km long densely populated coast line, which is vulnerable to coastal floods, hurricanes, cyclones, and tsunami. Any increase in frequency and severity of these extreme climate events or change in coastline as projected is likely to have serious effects and can cause population displacement. These displaced people are likely to face diverse health consequences - traumatic, infectious, nutritional, psychological, and other - that occur in demoralized and displaced populations in the wake of climate-induced economic dislocation, environmental decline, and conflict situations. [14]

IV. CONCLUSION

Climate change endangers human health, affecting all sectors of society, both domestically and globally. Global climate change has become one of the most visible environmental concerns of the 21st century. The carbon dioxide levels are currently highest of the available data, the values is 345 ppm and 450 ppm is supposed to be very risky The number of people at risk from flooding by coastal storm surgery is projected to increase from the current 75 million to 200 million in a scenario of mid- range climate change, in which a rise in the sea level of 9-88 cm is envisaged by the 2100s.

REFERENCES

[1] Hansen James E. et al., 2006, Goddard Institute for Space Studies, GIS surface Temperature Analysis. NASA Goddard Institute for Space Studies.

[2] IPCC. (2007). Fourth Assessment Report (FAR) Climate Change 2007. Cambridge, United Kingdom and New York, NY, USA: Cambridge University Press.

[3] Intergovernmental Panel on Climate Change (2001). Impact Adaptation and vulnerability, Contribution of working group to the third Assessment Report, Cambridge University Press Cambridge. UK, 1-1000.

[4] Malchinkhuu, D. (2001). 2001 MGL: Survey on Mortality in Children under Five: Causes and Influencing Factors. UNICEF and MOHSW.

[5] Myers, N. (2005). Environmental refugees: an emergent security issue. 13 Economic Forums. http://www.osce.org/documents/eea/2005/05/14488_en.pdf.

[6] Patil, R.R. and Deepa T M. (2007). Climate change: The challenges for public health preparedness and response: An Indian case study. Indian J Occup Environ Med., 11:113-5.

[7] Patz, J. A. (2000). The potential health impacts of climate variability and change for the report of the health sector of the U. S. National Assessment. Environmental Health perspective, 108(4):367-76

[8] Renner, M. (2008).Environment a Growing Driver in Displacement of People. World Watch Institute, September. http://www.worldwatch.org/node/5888.

[9] Stern, N., et al. (2006). Stern Review: The Economics of Climate Change. HM Treasury, Chapter 6, http://www.hm-treasury.gov.uk/stern_review_report.htm.

[10] Thullier, W. (2007). Climate Change and the Ecologist, in: Nature 448/2: 550-552.

[11] United Nations Educational, Scientific and Cultural Organization (UNESCO) & Scientific Committee on Problems of the Environment (SCOPE). (2006). the Global Carbon Cycle. UNESCO-SCOPE Policy Briefs 2, Paris.

[12] UNDP (2007/8). Fighting climate change: Human Solidarity in a divided world. Human Development Report.

[13] World Health Organization. (2003).Climate change and human health – Risks and responses. [http://www.who.int/globalchange/climate/en/ccSCREEN.pdf]. (Last consulted 01 March 2011).

[14] World Health Organization. (2005). Health impacts from climate variability and change in the Hindu Kush-Himalayan Region: Report of an inter-regional workshop, Mukteshwar, India.New Delhi: WHO Regional Office for South-East Asia; 2005.

[15] Wyman & Stevenson. (2000). All nations and all human beings share the same atmosphere and we only have one. UNDP, 2007.

[16] Confalonieri, U., B. Menne, R. Akhtar, K.L. Ebi, M. Hauengue, R.S. Kovats, B. Revich and A. Woodward, 2007: Human health. Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, M.L. Parry, O.F. Canziani, J.P. Palutikof, P.J. van der Linden and C.E. Hanson, Eds., Cambridge University Press, Cambridge, UK, 391-431.

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Evaluation of the herbicide treatment on two common wheat varieties on the basis of mathematical-statistical analysis

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Abstract- A field experiment with two varieties of common wheat was conducted during the period 2012 - 2014 in the training experimental terrain at Trakiya University of Stara Zagora. An assessment of the impact of treatment`s different options on yield in common wheat variety "Enola" and "Iliko" was made with a two-factor analysis of variance. The effect of the treatment of herbicides was as follows: Axial one (pinoxaden + florasulam) - 1000; Axial 050 EC (pinoxaden) - 900 ml.ha^{-1}; Traksos 045 EC (pinoxaden + clodinafop) - 1200 ml.ha^{-1}; Logran 20 WG (triasulfuron) - 37.5 g.ha^{-1}; Lintur 70 WG (triasulfuron + dicamba) - 150 g.ha^{-1}.

With a high degree of confidence, it was established a statistically significant influence on the grain yield indicator, on the factor “variety”, followed by the treatment options.

It was made an assessment of similarity and distance of the different options` influence on the wheat treatment (varieties "Enola" and "Iliko") and their grouping, based on main biometric identifiers by applying cluster analysis. Classification and grouping options are made by hierarchical cluster analysis, which allows the increase of the objectivity in evaluating the complex impact of the options of treatment on the structural elements of the two wheat varieties.

Index Terms- Herbicides, Wheat varieties, ANOVA, Cluster analysis, Dendrogram

I. INTRODUCTION

Modern conditions of the climate, on one hand, and the requirements of the global market, on the other hand, impose the search for mechanisms for increasing the productivity of crops and for improving the quality of grain from wheat. The introduction of varieties with high productivity and adaptability to the environmental conditions has a greater significance.

Ecological plasticity of varieties guarantees the stability of the productivity, that is why the choice of an appropriate variety is crucial for the efficiency of grain production. The proper variety structure, depending on the specific agro-ecological conditions of the region, can significantly increase yields and quality of production [1-3]. Yields and their structural elements are strongly influenced by the conditions of the year and the plasticity of the variety, considered [4].

Weeds control is an essential element of the complex agronomic techniques. Herbicides are the primary factor in modern integrated technologies for weeds control. Obtaining high yields of agricultural crops is impossible without their use [5-8].

The aim of the study is to assess the effect of the treatment on the yield in common wheat varieties “Enola” and “Illico”.

II. MATERIALS AND METHODS

Filed study was conducted in the period 2012-2014, in the area of the training experimental field of Faculty of Agriculture, Trakia University, Stara Zagora. The soil type was characterized as a typical meadow-cinnamon soil. The profile power was 103-105 cm, with well-defined horizons. The humus horizon was clear and had a range 0-50 cm. According to the mechanical composition, the soil was sandy loam. The soil supply with organic and mineral substances in the layer 0-30 cm is reflected in Table 1.

The soil in the area has a slight acid reaction. It is with an average stock humus - 3.93%. The soil is averagely supplied with mineral nitrogen - 33.2 mg/1000g soil. Ammonia nitrogen is 13.6 mg/1000g soil and nitrate - 19.6 mg/1000g soil. There are also weak stocks of movable soil phosphorus - 3.9 mg/1000g. The movable potassium content is 44.0 mg/1000g soil, which characterizes the soil as a very well stocked with potassium. With these indicators and content of organic matter in arable layer of soil, it is suitable for growing grain cereals.

Table I: Content of organic and mineral substances in the arable layer of soil

Indicators	pH (KCi)	Humus, %	Mineral nitrogen mg/1000g soil	$N\text{-}NH_4$, mg /1000g soil	$N\text{-}NO_3$, mg/1000g soil	Assimilable P, mg/ 1000g soil	Assimilable K, mg/ 1000g soil
Values at moment betting of the experience	5.44	3.93	33.20	13.60	19.60	3.90	44.00

The study was set by the method of fractional plots. Two common wheat varieties - Enola and Iliko were examined. The effectiveness of some herbicides and herbicidal compositions was studied, which were applied separately or as a tank mix.
10 variants were tested for treatment of crops:

1. Control - no treatment with herbicides;
2. Axial one - 1000 $ml.ha^{-1}$;
3. Lintur + Traksos 150 $g.ha^{-1}$ + 1200 $ml.ha^{-1}$ - tank mixture;
4. Logran + Traksos 37.5 $g.ha^{-1}$ + 1200 $ml.ha^{-1}$ - tank mixture;
5. Lintur + Axial 150 $g.ha^{-1}$ + 900 $ml.ha^{-1}$ - tank mixture;
6. Logran + Axial 37.5 $g.ha^{-1}$ + 900 $ml.ha^{-1}$ - tank mixture;
7. Lintur + Axial 150 $g.ha^{-1}$ + 600 $ml.ha^{-1}$ - separate treatment;
8. Lintur + Traksos 150 $g.ha^{-1}$ + 1200 $ml.ha^{-1}$ - separate treatment;
9. Logran + Axial 37.5 $g.ha^{-1}$ + 600 $ml.ha^{-1}$ - separate treatment.
10. Logran + Traksos 37.5 $g.ha^{-1}$ + 1200 $ml.ha^{-1}$ - separate treatment;

The following method was used: the treatment of sowing-seed was made by tank mixtures spray and by separate spray. The bringing in of a tank mixture meant that the solution of plant protection chemicals was prepared together, i.e. herbicides were dissolved in one container and the treatment was carried out simultaneously. In the separate treatment, Logran was brought as a first herbicide, or Lintur respectively, and after a week the crops were treated with another medicine (Traksos and Axial), as it was set out by methodology.

A hierarchical cluster analysis was made by the method of the intergroup connection [9,10].

Data processing was carried out with the statistical program SPSS.

III. RESULTS AND DISCUSSION

With regard to the climate, the region, where the experimental field is located, refers to the European continental climate area and the transitive continental sub-area. It includes the region of East Central Bulgaria with the Thracian lowland. The winter season is relatively soft and warm. The altitude of the training experimental field is 160m. The slope of the terrain is characterized as flat, with a slope of 3%.

Years of field research differ significantly according to their probability of precipitation (Table. 2). The last year was characterized as humid, with provision of P - 2.0%. The first and second years of the experiment were characterized as medium moist with provision respectively of 34.8 % and 48.8 %. The amount of precipitation throughout the year was distributed very unevenly (Fig. 1). Temperatures stocks were high in the three years as of the study. Regarding the air temperature and the provision, the years were characterized as warm, respectively, with provision 6.7 %, 9.0 % and 13.7 %.

In the first economic year there were registered minus values of the daily average temperatures during the winter months - January and February. There were registered temperatures below -10 ° C. The reported permanently lower values contributed to the stop of the culture vegetation, but did not cause plants freezing. The measured temperatures in April were higher (17%) of the rate for the month (12.0 °C). Permanently higher daily average temperatures favored the development of plants. During the third year there were registered permanently higher temperatures during the autumn-winter months (Fig. 2).

Table II: Meteorological factors for the region of Stara Zagora

Factor		**Average for the period**	**2011/12**	**2012/13**	**2013/14**
Σ N	mm	556.5 mm (average for 85)	617.0	548.6	1054.6

		P %		34.8	48.8	2.0
Σ N –	Σ T^o	^{o} C	160.5 ^{o} C (average for 85)	162.6	163.8	160.5
		P %		9.0	6.7	13.7

precipitations, Σ T^o – temperature,
P % - provision of the meteorological factors;

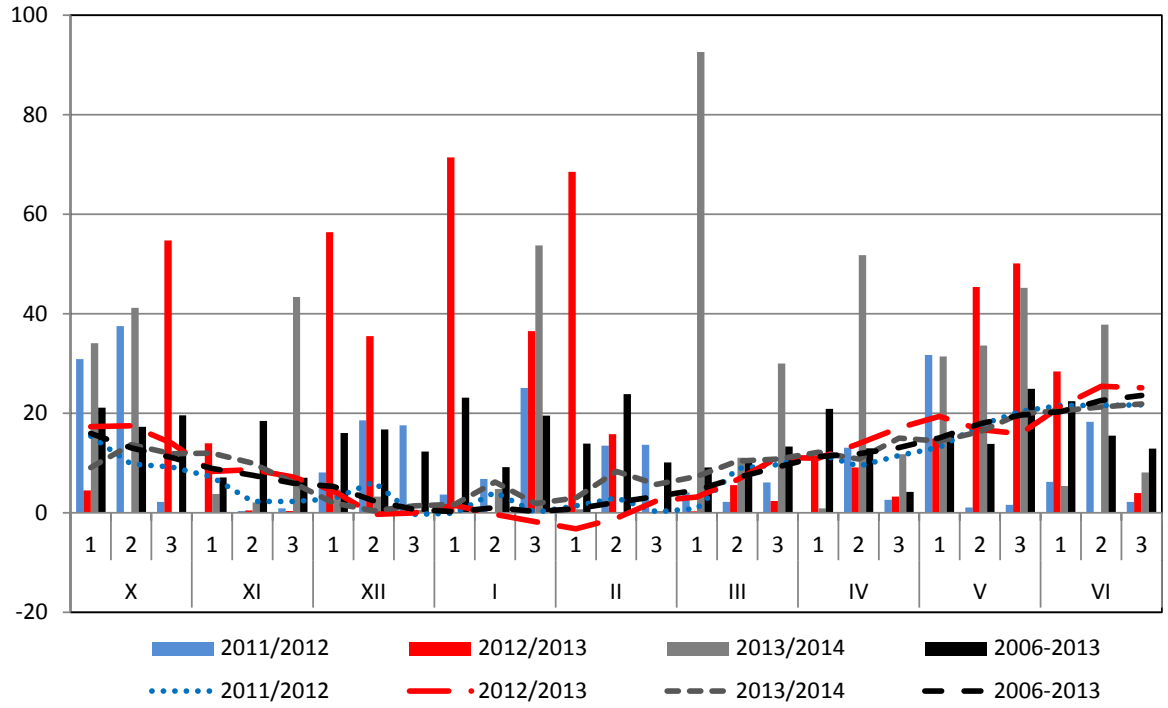

Figure 1. Climate graph for vegetation period of common wheat for the period of 2011-2014 filed study area of the city Stara Zagora

Long-year research determined this area as suitable in terms of moisture provision. In the three experimental years the nature and amount of precipitation were extremely different. Wheat wais provided with sufficiently with easily accessible moisture throughout the growing season. In the first year`s autumn of the field study the amount of rainfall was unevenly distributed (table 2). In October, the amount of precipitation was 70.6 mm, at a rate of rainfall for the month 44.16 mm. In November it decreased - only 1.3 mm. This amount was extremely insufficient, but thanks to moisture stockpiling the previous month, wheat was sufficiently humid. In March and April rainfall was again below the monthly norm. However, the seeds had enough moisture for their germination and sprouting.

In the autumn of the economic year 2013-2014 rainfall varied from 8.6 to 75.3 mm. The amount and distribution of rainfall throughout the growing season of wheat provides enough moisture, easily accessible for the development of culture. During the critical phases of development, wheat does not suffer from water deficit and one can talk about water logging. There were registered 133.7 mm in March, the tendency of exceeding the norm continued in the remaining three months of vegetation. The amount of rainfall during the third economic year was 28.2% above the norm.

A two-factor analysis of variance was made to assess the importance and the power of influence of "treatment", "biometric identifiers" and their interaction on the studied wheat varieties. The experimental data were statistically processed by the computer software MS Excel. Assessment of the influence power of the factors was calculated by Plohinski method [11]. It was defined as part of the inter-group variation in total variation. It works with the sum of squares and was calculated as follows:

$h_x^2 = \frac{D_x}{D_y}$, where D_x - the sum of the squares of the factor x, D_y - total sum of squares (SS). It was established, with a high degree of confidence, a statistically significant influence on the interaction of two factors "treatment" and "biometric identifiers" and their interaction in the two wheat varieties.

The conducted dispersive analysis for the influence of factors “variety”, “treatment options” and their interaction on the yield of wheat variety "Enola" and "Ilικo" are presented in tables 3, 4 and 5. Table 3 summarizes the results from the analysis of wheat varieties yield data for the first experimental year. A greatest impact on the variation of the trait has the variety with influence of 77 %, followed the variants of irrigation with 15 %. The interaction of the two factors is expressed less ($p \leq 0.01$).

Table III: Two-way analysis of variance factors: A - variety and B - variants of treatment on the yield of wheat in 2012

Source of variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*	Strength influence
Variety (A) ***	50477735.15	1	50477735.15	616774.32	0.000	4.08	77%
Variants of treatment (B)***	9917053.88	9	1101894.88	13463.77	0.000	2.12	15%
Interaction **	5234272.92	9	581585.88	7106.25	0.004	2.12	8%
Errors	3273.66	40	81.84				
*****, **, *** - proven respectively $p \leq 0.001$, $p \leq 0.01$ and $p \leq 0.05$; n.s. – unproven							

For indicator "yield" in 2013 (table 4), there was a strongest influence of the factor “variant of treatment” with dominant influence of 45% and a clear credibility $p \leq 0.001$ on climate indicator. On the second place it was the variety influence of 31% and 24% - respectively, the interaction of two factors.

Table IV: Two-way analysis of variance factors: A - variety and B - variants of treatment on the yield of wheat in 2013

Source of variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*	Strength influence
Variety (A) ***	14107990.94	1	14107990.94	8641.17	0.000	4.08	31%
Variants of treatments (B)***	20443954.55	9	2271550.51	1391.33	0.000	2.12	45%
Interaction ***	10873867.17	9	1208207.46	740.03	0.000	2.12	24%
Errors	65305.92	40	1632.65				

The results, obtained for this indicator "yield", gave reliable variances for the factor “variety”, with force of impact - 89%, and the options of treatment had reliability rate ($p \leq 0.01$). The interaction of these two factors was statistically less expressed (Table 5).

Table V: Two-way analysis of variance factors: A - variety and B - variants of treatment on the yield of wheat in 2014

Source of variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*	Strength influence
Variety(A) ***	44133811.35	1	44133811.35	49541.24	0.000	4.08	89%
Variants of treatment (B)**	3408160.42	9	378684.49	425.08	0.003	2.12	7%
Interaction **	2150204.82	9	238911.65	268.18	0.005	2.12	4%
Errors	35634	40	890.85				

According to the one-way ANOVA, as well as the conducted analysis for the impact of the two factors (variety and options of treatment) separately, and their interaction, the impact on grain-yield index was statistically proven at a very high degree of reliability ($p \leq 0.001$). A greatest impact on the variation of the trait had a variety factor (89 %) in 2014, followed by the variety factor (77 %) for 2012. The second treatment factor was less expressed with force of impact (45 %) in 2013 and the interaction between them (24 %) 2013.

The cluster analysis is a statistical generalizing method, which aim is to assess the impact of individual factors. In this study, an assessment was made for the similarity and the remoteness of the impact of different options treatment for common wheat (variety "Enola" and "Iliko") and their grouping, based on main biometric indicators with the application of a

cluster analysis. The experimental data from the 3-rd field experiment was analyzed, including 10 variants of herbicide and herbicide mixtures treatment.

The evaluation of the tested products was made on the basis of the following parameters: plant height, length of ears, number of ears, number of grains in an ear, weight of the grains in an ear, mass of 1000 seeds and specific weight.

Grouping of the studied variants was performed by hierarchical cluster analysis. Used is the method of intergroup binding [9,10].

$$D(x,y) = \sqrt{\sum_{i=1}^{n}(x_i - y_i)^2}$$

A dendrogram was constructed by which graphically presented the generated clusters. The dotted horizontal line of the dendrogram showed the rescaled distance at which clusters are formed.

Following the cluster analysis, it was clear that the impact of treatment on biometric identifiers in wheat variety "Enola" was grouped in three main clusters. The results are presented in tables, with the steps of combining the clusters and the inter-group distances (Table 6), and by the dendrogram (Fig. 2 and 3).

Table VI: Combing of clusters and inter-group distances

Variety Enola				Variety Iliko			
Steps	Combined clusters		Coefficients	Steps	Combined clusters		Coefficients
	cluster 1	cluster 2			cluster 1	cluster 2	
1	2	8	2.661	1	3	5	2.711
2	2	6	3.698	2	3	4	3.421
3	1	9	6.530	3	2	3	6.607
4	4	7	7.454	4	6	9	6.619
5	3	10	7.713	5	2	8	8.920
6	4	5	9.679	6	2	6	9.435
7	1	3	10.294	7	1	2	10.977
8	1	2	13.713	8	1	10	16.689
9	1	4	17.769	9	1	7	28.180

Results for variety "Enola" showed that the options were divided into three clusters. The first cluster with very close results included options 2,8,6 and the second variants - 1,9,3,10. The next stage they combined with the first cluster. They were with a greatest similarity in all tested indicators and a least euclidean distance between them. The third cluster included 3 options: 4.7 and 5. The control for all variants was the farthest one from options 4, 2, 3, and option 9 was the closest one to the control. The options that were close to other indicators are 2, 6 and 8. The other equally effective options are 4 and 7, 3 and 10 (Fig. 2).

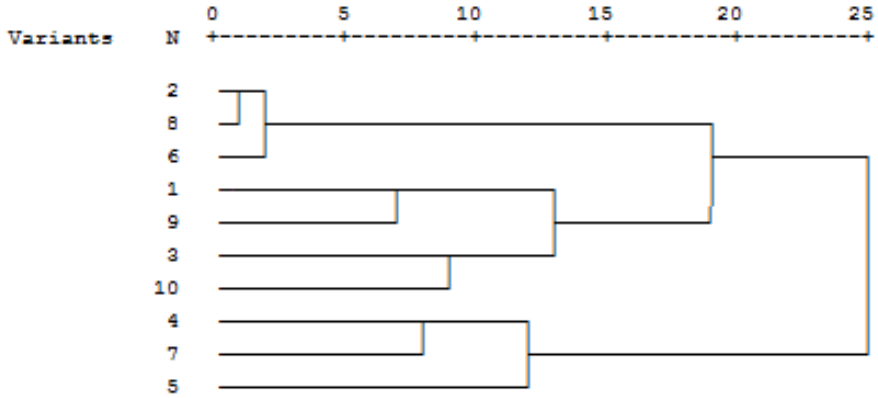

Figure 2. Hierarchical cluster analysis of a variety Enola - dendogram based on average intergroup distances

Results for variety "Iliko" showed that the options were allocated again in two main clusters. The first cluster with very close range included two sub-clusters, one is again with 2, 5, 4, and, later, variant 2 joined (Fig. 3). The second cluster consisted of one main cluster of variants 8, 6, 9 and 1.

The dendrogram showed that for the variety "Iliko", the control of all parameters, was the furthest one from the variants 7, 10, 2, and the closest one to the control was var. 2. The variants, similar to other indicators, were variants 3, 5, 4 2 and 3, 6 and 9. Intergroup distances between these variations showed

that they differed on the overall assessment of the examined indicators.

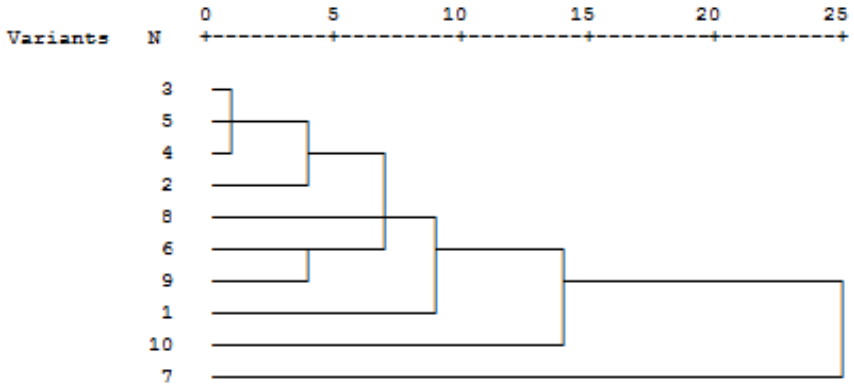

Figure 3. Hierarchical cluster analysis of a variety Iliko - dendogram based on average intergroup distances

According to the classification and grouping options, a hierarchical cluster analysis allows the increase of objectivity in evaluating the complex impact of treatment options on biometric identifiers of the two wheat variants.

IV. CONCLUSIONS

The following conclusions can be made by the conducted examination and analyzes:

According to the two-way analysis of variance, and considering the impact of the two factors (variety and variants of treatment) separately, and their interaction, it was statistically proven a very high degree of reliability ($p \leq 0.001$) of the impact on grain yield index. "Variety" had the greatest impact on the variation of the trait factor, the force of impact was by 31 % to 89 % on average - 65.7%. Classification and hierarchical cluster analysis of grouping options allowed the increase of objectivity in evaluating the complex impact of the treatment options on the structural elements of the two wheat varieties.

REFERENCES

[1] Cheleev D, Todorov S. and Belcheva L. Plant Science, 5-6, (1993), 17-23.
[2] Tzenov N., Kostov K. and Todorov I. Field Crops Studies, 5,(2), (2009), 261-273.
[3] Ilchovska M. and Ivanova I. Agricultural Science And Technology, 6, (1), (2014),14-16.
[4] Georgieva Hr., Tsankova D. and Samodova A. Field Crops Studies. 1, (2004), 51-56.
[5] Chhokar R, Sharma R, Jat G, Pundir A and Gathala M (2007) Effect of tillage and herbicides on weeds and productivity of wheat under rice–wheat growing.
[6] Delye C., Garden J. A. C., Boucansaud K., Chovel B. and Petit C. Weed Research, 51, (5), (2011), 433-437.
[7] Dospatliev L. Science & Technologies, 2,(3), (2012), 156-159.
[8] Delchev Gr. Ecology and Safety, 6,(2), 338-347.
[9] Ward J. H. Journal of the American Statistical Association. 58, (1963), 236-244.
[10] Duran B and Odelle P. Cluster analysis. Moskow. (1977).
[11] Lakin G. Biometrics, Higher School. Moscow. (1990).

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Influence of Ultrasonic Vibrations on Grain Size and Mechanical Properties of A-356 by Adding Al-5Ti-1B Master Alloy during Solidification

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Abstract- The refinement of the grain size will improve the mechanical properties of AA-356 alloy by propagating ultrasonic vibrations through the die into the melt and adding Al-5Ti-1B master alloy during solidification. Ultrasonic vibrations produces cavitation effect by reducing pores, degassing and formation of more heterogeneous nucleating sites of AA-356 due to the presence of TiAl3 and Bal2 solutes of master alloy. The melt was vibrated at various frequencies and amplitudes with certain interval of time by adding master alloy (Al-5Ti-1B) at different fractions by using Taguchi Technique. From heterogeneous nucleation experimental results shows that the AA-356 structure was changed from columnar dendrite structure into equi-axed globular grain structure with reduction in grain size. The experimental results shows that due to reduced grain size, the mechanical properties like hardness, ultimate tensile strength were increased.

Index Terms- AA-356, Grain size, Master alloy, Mechanical properties, Ultrasonic vibrations.

I. INTRODUCTION

Aluminum and its alloys plays very important role in engineering applications due to their light weight, low density, easy to fabricate, low thermal expansion, physical properties, low wear rate and its excellent corrosion resistance in most environmental conditions(1). AA-356 alloy is used in Aerospace, automobile, marine industry etc.

AA-356 is a hypoeutectic aluminum alloy containing 6.5-7% of silicon and contains about 50 volume % of eutectic phases (2). The final microstructure can be found by eutectic reaction (3).AA-356 is used to improve flowability of the melt and interfacial properties. To optimize the mechanical properties it necessary to control the grain size 0f AA-356 which otherwise solidifies with coarse columnar grain structure. So the grain refinement play a vital role to improve the properties of AA-356.This can be achieved by adding grain refiners like Al-5Ti-1B,Al-10Ti,Al-3B,Al-3Ti-3B etc in to AA-356 melt(4) and also by inducing ultrasonic vibrations(5,6,7). The Mechanical vibrations can be obtained by(8),electro magnetic vibrations(9),Magneto hydrodynamics(6),electro magnetic stirring mechanisms(11) etc,in to the melt through die .

In die casting and squeeze casting process it consists of so many defects like shrinkage, porosity, pores, discontinuity ,hot tears, air or hydrogen is trapped while pouring the molten metal in to the die cavity during solidification of metals(8). The ultrasonic vibration waves produce more heterogeneous nucleation in the melt. This is due to cavitations phenomena occur within the melt. This leads to degassing, reduce in hot cracking, reduction in porosities and formation of equi-axed grains in small size (7).

There was so much debate on ultrasonic vibrations that the vibrations are propagates in to the melt produces cavitations with large forces also the temperature variations in the melt (10, 11, 12). These pressure , temperature and force fluctuations induces heterogeneous nucleation and segregation control in the melt with reduced in grain size and formation of globular equi-axed non dendrite structure(13-16).

A fine grain size creates a more uniform distribution of secondary intermetallic interphases in addition to pores which form from the evolution of dissolved in the melt (16). The resultant increase in casting integrity is companied by improvements in both mechanical properties and pressure tightness (17-20).

Ultrasonic vibration treatment was known to induce refining effect in AA-356 alloys (17-22). The basic principle is introduction of acoustic waves with frequency 20 KHz to 30 KHz in to the liquid metal and high amplitude oscillations result in the cavitations of the melt and also promote intense mixing through agitation (23). The reported nucleation through local under cooling and wetting of substrates to fragmentation forming grains.

II. TAGUCHI METHOD

Taguchi method offers a powerful tool for design of experiments. This methodology has taken the design of experiments from the exclusive world of the statistician and brought it more fully into the world of manufacturing (24). Taguchi method provides a simple, efficient and systematic approach to optimizing designs for performance, quality and cost. Taguchi proposed that engineering optimization of a process or product should be carried out as a three-step approach viz system design. Parameter design and tolerance design (25, 26).

Taguchi method is structured approach for determining the best combination of inputs to produce product or service. Based on design of experiments (DOE) methodology for determining parameters levels. DOE is important tool and is method for quantitatively identifying the right inputs and parameter levels for Making a high quality product and service (27, 28). The major step in Design of experiments is the evaluation of combination of factors and levels which provide desired information. Analysis of experimental results uses a signal to noise ratio to aid in the determination of the best process design using MINITAB software (29).

In present work the ultrasonic vibrations range from 20Khz, 24Khz and 28Khz were induced in to the melt through die during solidification to refine the grain structure from columnar dendrite structure into equi-axed globular grain structure with reduced in grain size . The ultrasonic vibrations were induced around the die isothermally for different frequencies, amplitudes with certain interval of time for different fractions of master alloy (Al-5Ti-1B) and the effect of grain size and properties have been investigated.

III. EXPERIMENTATION

A. AA-356 alloy

In the present investigation the commercial aluminum AA-356 is used as base material. The composition is as shown in table1.

Table1

Element	Si	Mg	Mn	Fe	Ni	Zn	Sn	Ti	Pb	Al
Wt %	6.5-7	0.3	0.02	0.1	0.05	0.01	0.01	0.02	0.02	Bal

A Teflon coated permanent steel mold die is used in the experimental setup. A cavity is made around the die to supply water for cooling purpose and the cavity can be closed at the top as shown in fig.1and fig.2. Fig.3 shows the experimental setup used to produce ultrasonic vibrations in the range of 1Hz to 100MHz

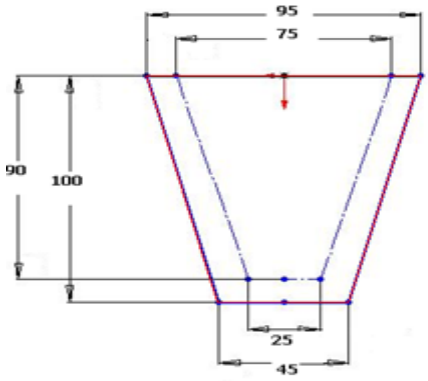

Fig.1 Die (All dimensions in mm)

Fig 2. Die with copper winding

A copper coil having 3Ω resistance was wound around the die and is connected to the functional signal generator through transistor and D.C supply. A sine wave was generated by signal generator in the range of 1Hz to 1MHz and fed in to the coil as shown in fig.3. These Ultra-sonic vibrations around the die were propagate into the melt . The aluminum AA-356 alloy was melted separately using graphite crucible melting furnace, the melt is maintained at liquids temperature of 614◦C and the temperature was increased to 800◦C for 3hrs to melt completely. The primary Fcc structure of aluminum dendrites starts to form at 614◦C and the binary at 574◦C.Tertiary eutectic and complete intermetallics form at the later stages.

B. Master alloy

The master alloy or grain refiner (Al-5Ti-1B) was prepared separately by electrolysis method and it is cut in to required Wt% fraction and add into the AA-356 melt. The master alloy is added to the AA-356 melt and allow to melt for one more hour, the mixer is thoroughly mixed using mechanical stirrer for different fractions 0.4Wt%(Al-5Ti-1B),0.6Wt%(((Al-5Ti-1B), 0.8Wt%((Al-5Ti-1B). The castings were prepared according to taguchi method using L9 orthogonal array by taking the molten metal using ladle and poured into permanent steel mold die and it is solidified without inducing ultrasonic vibrations. Further for next experiments was generated using orthogonal arrays and analysis of parameters was done using ANOVA technique ,the molten metal is poured in to the die and ultrasonic vibrations were induced during solidification with 20Khz.24khz,28Khz at 40µm,60µm,80µm amplitude for 40s,80s,120s respectively for different compositions 0.4Wt%(Al-5Ti-1B), 0.6Wt%(Al-5Ti-1B),0.8Wt%(Al-5Ti-1B) etc.

Taguchi method yields the rank of various parameters with the level of significance of a factor or the interaction of factors on a particular output response. The response table for signal to noise ratio is as shown in table .2. Analysis of varience of th

S/N ratio is performed to identify the statically significant parameters.

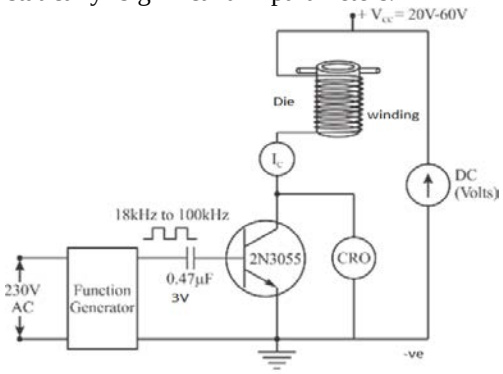

Fig 3. Circuit diagram of ultrasonic vibration set up

The specimens are prepared using castings according to ASTM standards for grain size, hardness and tensile test, the specimens were polished, etched with use of HCL, HNO3,Cu and water solution for grain size and hardness . On etched specimens , hardness and tensile specimens were conducted. Compare them with and without ultrasonically treated specimens and analyzed using Taghuchi Method using "Larger the better".

$$\text{S/N ratio} = -\log_{10}\left(\frac{1}{n}\sum_{i=1}^{n}\frac{1}{y_i^{\,2}}\right) \quad \text{dB}$$

Where $y_1, y_2, \ldots . y_i$ are responses. n is number of observations.

L9 test	A Master alloy	B Frequency (kHZ)	C Amplitude (μm)	D Holding time(s)
1.	A1	B1	C1	D1
2.	A1	B2	C2	D2
3.	A1	B3	C3	D3
4.	A2	B1	C2	D3
5.	A2	B2	C3	D1
6.	A2	B3	C1	D2
7.	A3	B1	C3	D2
8.	A3	B2	C1	D3
9.	A3	B3	C2	D1

Table2 L_9 Orthogonal array of Taguchi

IV. RESULT AND DISCUSSION

The Vickers hardness test carried out in the present investigation and the cast samples before and after the addition of grain refiners with or without ultrasonic vibrations.The main aim of the experimental plan was to find the important factors and combinations of factors influencing the mechanical properties to increase hardness and tensile strength. The experiments were developed based on the orthogonal array with the aim of influence frequency,amplitude and period of time. Taguchi recommends analyzing the S/N ratios using conceptual approach

that involves graphing the effects and visually identifying the significant factors.

The results for various combinations of parameter were obtained by conducting the experiments as per the orthogonal array. The measured results were analyzed using the commercial software MINITAB 14 specially used for design of experiment applications. Table 3 and table 6. Shows the experimental results of average repetitions for hardness and tensile strength.To measure the quality characteristics the experimental values are transformed in to signal to noise ratio. The influence of control parameters such as frequency, amplitude and period of time has been analysed using signal to noise response table.

EX. No	Process parameter level				Hardness			HV	**S/N ratio (dB)**
	A Master Alloy	B Frequency (KHz)	C Amplitude (µm)	D Holding Time (Sec)	Test run				
					1	2	3		
1	0.4	20	40	40	62	66	63	64	36.12359948
2	0.4	24	60	80	77	74	71	74	37.38463439
3	0.4	28	80	120	74	73	78	75	37.50122527
4	0.6	20	60	120	67	72	71	70	36.9019608
5	0.6	24	80	40	66	70	68	68	36.65017825
6	0.6	28	40	80	70	76	76	74	37.38463439
7	0.8	20	80	80	74	68	74	72	37.14664993
8	0.8	24	40	120	67	69	74	70	36.9019608
9	0.8	28	60	40	67	64	64	65	36.25826713

Table3 S/N ratio for Hardness (HV)

The mean S/N ratio for each level is summarized in the response table 4. The total mean S/N ratio for the nine experiments is also calculated.

Total mean S/N ratio = 36.98465462

Symbol	**Process parameter**	**Level 1**	**Level 2**	**Level 3**	**Optimum level (max. S/N ratio)**
A	Master Alloy	37.00	36.98	36.77	A_1
B	Frequency (KHz)	36.72	36.98	37.05	B_3
C	Amplitude (µm)	36.80	36.85	37.10	C_3
D	Holding Time (S)	36.34	37.31	37.10	D2

Table4 Response table for mean S/N ratio for hardness and significant interaction

A response graph is drawn using the values from the response table 4. The response graphs exhibit a pictorial view of variation of each parameter and describe what the effect on system performance would be, when a parameter shifts from one level to another. Fig.4 shows the response graph for hardness.

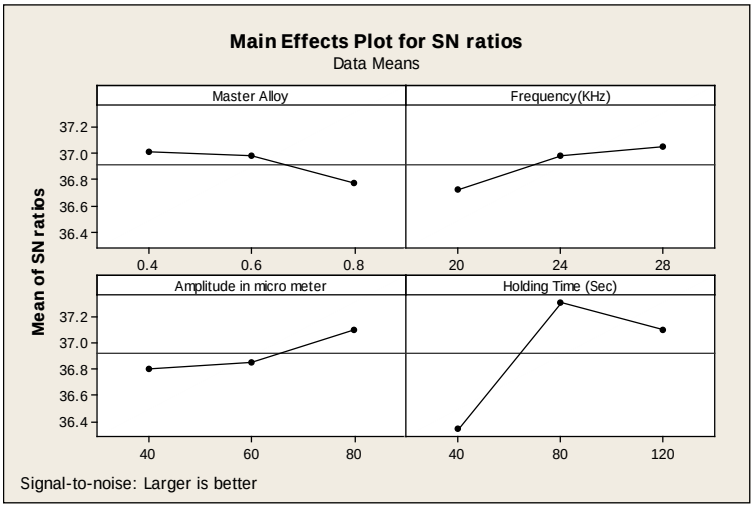

Fig. 4. Response graph for hardness

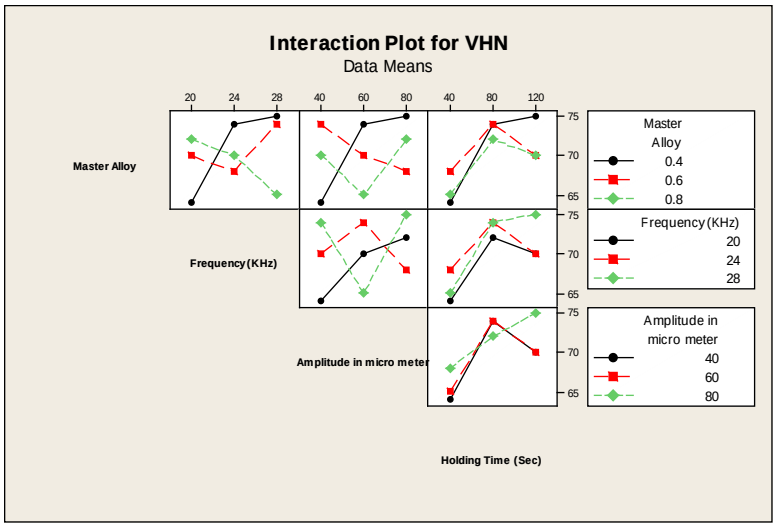

Fig. 5. Interaction plot for hardness

From the response graph, the optimal parameters for maximum hardness are:

- Master Alloy at level 1, A_1 = 0.4wt%(Al-5Ti-1B)
- Frequency at level 3, B_3= 28Khz
- Amplitude at level 3, C_3 = 80(µm)
- Holding Time at level 2, D2 = 80s

A. Analysis of variance (ANOVA)

The contributing ratio of the control factors in getting the maximum as brought out by ANOVA is shown in table 3 and the corresponding Pareto ANOVA diagram is shown in Fig. 4. It is seen that the F ratio values of parameters A, B , C and D are all greater than F-ratio values at 76% significance level drawn from table . The Pareto analysis shows that the weight fraction of master alloy at 0.4wt% has contributed higher impact on hardness. It is concluded that the weight fraction is the major contributing factor and frequency at 28Khz,amplitude at 80(µm) and holding time 80s were influencing higher imact factor(77.69%)on hardness . The weight fraction of master alloy at 0.4wt% has contributed higher impact on hardness.

Source of variation	**Degrees of freedom**	**Sum of squares**	**Variance**	**Pure variation**	**F-ratio**	**Contribution %**
Weight fraction Master Alloy % - A	2	6.89	3.44	0.934	0.07*	5.48
Frequency (KHz) - B	2	11.56	5.78	0.894	0.12*	9.20
Amplitude (µm)- C	2	9.56	4.78	0.911	0.10*	7.62

Holding Time (S)-D	2	97.56	48.778	0.011	10.45	77.69
Total	8	125.56				100

Table 5: Results of analysis of variance for hardness

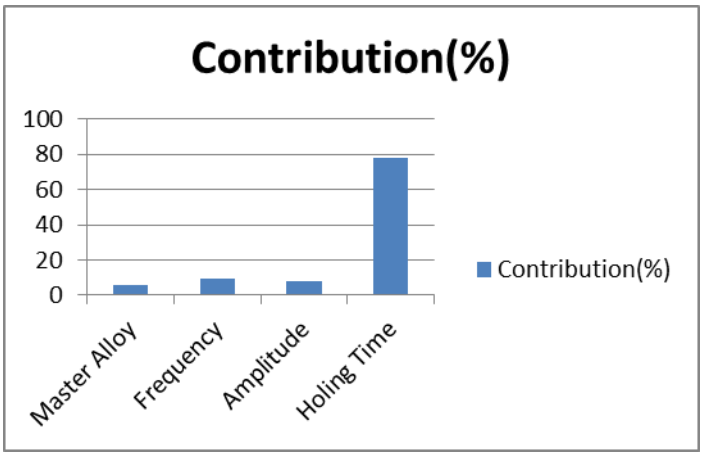

Fig. 6. Pareto analysis for Hardness

B. Prediction of optimum performance

At the optimum setting condition, the optimum hardness is estimated using following Eq.

Predicted optimal hardness = $(A'_1 - T) + (B'_3 - T) + (C'_3 - T) + T$

where A'_1 is the average hardness value for first level weight fraction, B'_3 is the average hardness value for third level of frequency combination, C'_3 is the average hardness value for third level of amplitude and T is the mean hardness value from all experimental data. In calculating the estimate, we use only strong effects.

Predicted optimum value of hardness = (71 – 70.22) + (69 – 70.22) + (70.66 – 70.22)
+ 70.22 = 70.22

C. Confidence interval

From Eq. 1, the confidence interval of the above predicted estimate at 76% significance = ±1.22 i.e., the experimental values should lie within the predicted range of 70.22±1.22 = 71.44.

D. Confirmation test

A confirmation test was carried out at the optimum settings of the process parameter recommended by the investigation, i.e., 0.4wt% weight fraction, 28Khz frequency, 80 □m amplitude and 80s of holding time. The hardness value obtained at the optimum setting is 70.95

EX. No	Process parameter level				Tensile strength (N/mm^2)	S/N ratio (dB)
	A Master Alloy	B Frequency (KHz)	C Amplitude (μm)	D Holding Time (Sec)		
1	0.4	20	40	40	175.5	44.8855
2	0.4	24	60	80	173.7	44.796
3	0.4	28	80	120	175.7	44.8954
4	0.6	20	60	120	191.5	45.6434
5	0.6	24	80	40	187.5	45.46
6	0.6	28	40	80	177.8	44.9986
7	0.8	20	80	80	192.8	45.7021
8	0.8	24	40	120	186.7	45.4229
9	0.8	28	60	40	191.7	45.6524

Table 6: S/N ratio for Tensile strength

The mean S/N ratio for each level is summarized in the response table 4. The total mean S/N ratio for the nine experiments is also calculated.
Total mean S/N ratio = 45.2484

Symbol	Process parameter	Level 1	Level 2	Level 3	Optimum level (max. S/N ratio)
A	Master Alloy	44.86	45.37	45.59	A_3
B	Frequency (KHz)	45.41	45.23	45.18	B_1
C	Amplitude (μm)	45.10	45.36	45.35	C_2
D	Holding Time (S)	45.33	45.17	45.32	D1

Table7 Response table for mean S/N ratio for Tensile strength and significant interaction

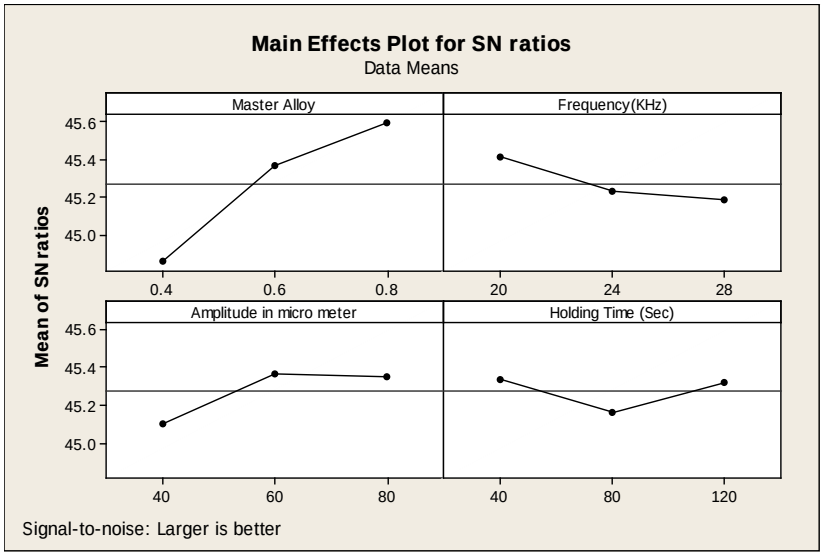

Fig. 7. Response graph for tensile strength.

A response graph is drawn using the values from the response table 8. The response graphs exhibit a pictorial view of variation of each parameter and describe what the effect on system performance would be, when a parameter shifts from one level to another. Fig.7 shows the response graph for tensile strength.

From the response graph the optimal parameters for maximum tensile strength are,

- Master Alloy at level 3, A_3 = 0.8wt%(Al-5Ti-1B)
- Frequency at level 1, B_3= 20Khz
- Amplitude at level 2, C_2 = 60(μm)
- Holding Time at level 1, D1 = 40s

E. Analysis of variance (ANOVA)

The contributing ratio of the control factors in getting the maximum as brought out by ANOVA is shown in table 9 and the corresponding Pareto ANOVA diagram is shown in Fig. 8. It is seen that the F ratio values of parameters A, B , C and D are all greater than F-ratio values at 76% significance level drawn from table . The Pareto analysis shows that the weight fraction of master alloy at 0.8wt% has contributed higher impact on tensile strength. It is concluded that the weight fraction is the major contributing factor (75.29%) and frequency at 20Khz, amplitude at 60(μm) and holding time 40s are second influencing factors (12.13%). The weight fraction of master alloy at 0.8wt% has contributed higher impact on tensile strength.

Source of variation	Degrees of freedom	Sum of squares	Variance	Pure variation	F-ratio	Contribution %
Weight fraction Master Alloy % - A	2	374.3	187.17	0.056	16.76*	75.29
Frequency (KHz) - B	2	40.23	20.11	0.357	1.8*	8.09
Amplitude (µm)- C	2	60.27	30.13	0.270	2.7	12.13
Holding Time (S)-D	2	22.33	11.16	0.270	2.7	4.49
Total	8	497.13				100

Table 8: Results of analysis of variance for tensile strength

F. Prediction of optimum performance

At the optimum setting condition, the optimum tensile strength is estimated using following Eq.

Predicted optimal hardness = (A'3 – T) + (B'1 – T) + (C'_2 – T) + (D'1-T) + T

where A'3 is the average tensile strength value for third level weight fraction, B'_1 is the average tensile value for first level of frequency combination, C'_2 is the average tensile strength value for second level of amplitude, D'1 is the average tensile strength of first level and T is the mean tensile strength value from all experimental data. In calculating the estimate, we use only strong effects.

Predicted optimum value of tensile strength = (190.4 – 183.65) + (174.96 – 183.65) + (185.6 –183.65) + 183.65 = 183.66

G. Confidence interval

From Eq. 1., the confidence interval of the above predicted estimate at 77.7% significance = ± 1.22 i.e., the experimental values should lie within the predicted range of 183.66 ± 1.22 = 184.88 N/mm^2.

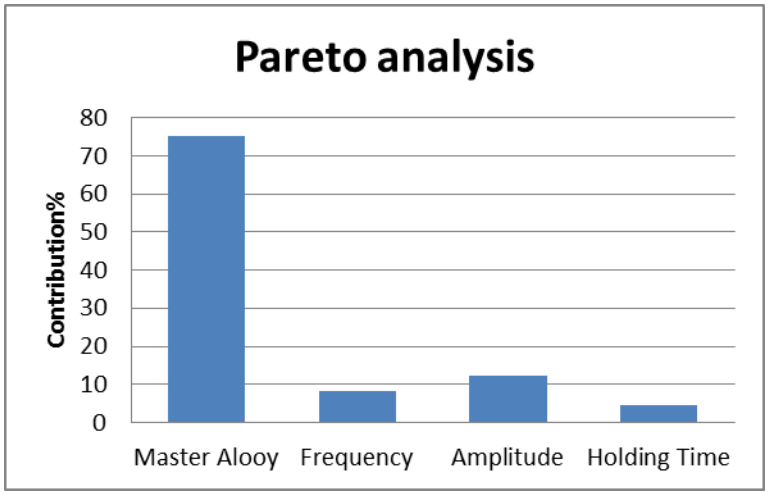

Fig. 8 Pareto analysis for Tensile strength

H. Confirmation test

A confirmation test was carried out at the optimum settings of the process parameter recommended by the investigation, i.e., 0.8wt% weight fraction, 20Khz frequency, 60 □m amplitude and 40s of holding time. The tensile strength value obtained at the optimum setting is 185.01

I. Tensile strength

The results for various combinations of parameters were obtained by conducting the experiments as per the orthogonal array. The data on the Tensile stength was analyzed by using Taguchi method by using MiniTab-15 software. The contributions of the input variables and their interaction are shown in main effects plot fig 4. According to Signal to-noise ratio for larger is the better, the higher mean value of ultimate tensile strength is given by 0.8wt%(Al-5Ti-1B), 28KHz,60µm and 40s holding time as shown in fig 7.

From the interaction plot it is concluded from fig 9. it can be seen that the higher mean values of ultimate tensile strength given by 0.8wt % (Al-5Ti-1B), 28KHz,80µm and 80s of holding time. From overall results the ultimate tensile strength is increased by around 16% compare to pure AA-356 according the standards given in ASTM hand book.

V. CONCLUSION

In present investigation high intensity ultrasonic vibrations eliminate coarse grains and forms globular equi-axed grains small grains approximately 25µm, which shows that the grains are refined is related to nucleation (hetrogeneuos) and survival of small nuclei or embryos of grains formation by improving mechanical properties like hardness and ultimate tensile strength. From the confirmation test it is concluded that the optimum settings of the process parameter recommended by the investigation, for hardness i.e., 0.4wt% weight fraction, 28Khz frequency, 80□m amplitude and 80s of holding time. The hardness value obtained at the optimum setting is ----

Again from the confirmation test it is concluded that the optimum settings of the process parameter recommended by the investigation, for tensile strength i.e., 0.8wt% weight fraction, 28Khz frequency, 80 □m amplitude and 40s of holding time. The tensile strenth value obtained at the optimum setting is ----

The experimental result shows that the overall results the hardness and ultimate tensile strength is increased by around 13% and 16% respectively compare to pure AA-356 when it is treated ultrasonically when it is compare with the pure aluminum AA-356 without ultrasonic treatment.

It can be seen that for hardness 0.4wt % (Al-5Ti-1B), 28KHz,80µm and 80s of holding time is more effective and for ultimate tensile strength 0.8wt%(Al-5Ti-1B)grain refiner is more effective when it is treated 20KHz frequency with amplitudes 80µm for 80 se. This is due to cavitations assisted fragmentation is the main contributor to grain refinement to produce small grain size to increase tensile strength.

The microstructure shows that the porosities are reduced to larger extent under ultrasonic treatment which leads to better flow properties for fluidity of complex mold designs.

REFERENCES

[1] ASTM Hand book Vol.2. “Properties and selection non ferrous alloys and special purpose materieals”. USA; ASM interaction, The material information society;.1990.

[2] S.R Sharma Z.Y.Ma,R.S Mishara, “Effect of friction strirr processing on fatigue behavior of A- 356 alloy”, Scripta materials,51(2004),237-241.

[3] Jain X,Xu.H Meek TT,Han Q. “Refinement of eutectic silicon phase of aluminium AA-356 alloy using high intensity ultrasonic vibrations”. Scripta materialia 54(2006) P893-896.

[4] K T.Kashyap ,T.Chandrashekar. “Effects and mechanism of grain refinement in aluminium alloys”. Mater sc. Vol.24,no4.2001.P345-353.

[5] Jain X,Xu.H Meek TT,Han Q “Effect of power ultrasound on solidification of AA-356 alloy,Meter.lett 2005 59,P190-193.

[6] G.I Eskin. “Ultrasonic treatment of light alloy melts”. Amasterdom,Gordon and Breach publishers. 1998,P 155.

[7] Sahadeva G.N, A.S Ravindran,H.R.Vitala,T.Chandrashekar, “Grain refinement of AA-356 by inducing ultrasonic vibrations and adding grain refiners during solidification”. IJMMR,(2014),pp 723-730.

[8] Chaowalik limmance, v.chiitr,songwid pongana npanya, Kajornchaiyakal.”Metallurgica structure of AA-356 alloy solidified under mechanical vibrations”.2009,Materials and design Elseware 30,3925-3930.

[9] Charles Vives. “Grain refinement in aluminium alloy by means of electromagnetic vibrations including cavitation phenominona”. 1998 vol.50 no2 JOM.

[10] Songli zang,yutoo zhao,Xico nongchand.”High energy ultrasonic field effect on microstructure and mechanical bevaviur of AA-356 alloys”.Journal and component ,470(2009),168-172

[11] Jain X,Xu.H Meek TT,Han Q “Effect of power ultrasound on solidification of AA-356 alloy,Meter.lett 2005 59,P190-193.

[12] A.Das and H.R Kotadia, “Study of high intensity ultrasonic irradiation on the modification of solidification microstructure in a Si-rich hypoeutectic Al-Si alloy,” Mater.Chem. Phys, 125(2011)P.853-859.

[13] S.L Zang et al. “High intensity ultrasonic field effects on the microstructure and mechanical behavior of A-356 alloy,” J. alloys compd, 47 (2009),P. 168-172.

[14] A.H.Freedom and J.F. Wallance, “Yhe influence of vibrations on solidifying metals,” Trans. AFS 56 (1997), P. 578-597.

[15] N. Abu-Dheir et al., “Silicon morphology modifications in the eutectic Al-Si alloy using mechanical vibrations.” Mater. Sci.Eng. A.393A (2005).P. 109-117.

[16] Han y,Li.K Wang J,Shu.D.sun B. “Influence of high intensity ultrasound on grain refinement of Al-5Ti-1B alloy on aluminium”.Mater Sc Engg 2005 A405,p306-312.

[17] H.Ghadami,S Hossein Nedjhad,B.Egballi. “Enhanced grain refinement of cast aluminium by thermal and mechanical treatment of Al-5Ti-1B master alloy.” Trans.Nonferrous Met Soc Chaina 23(3013) 1563-1569.

[18] V Abramov,O Abramov,V Bunlga Kov, Fsommer. “solidification of aluminium alloys under ultrasonic irradiation using water cooled resonator”. Materials letters 37 (1998) p27-34 .elseware.

[19] J.L Laborde,A Hita,. “Ultrasonics” 38(2000) P297-300 .Elseware.

[20] L.Zang, D.G Eskin, A Miroux and Katgermanl. “Formation of microstructure in Al-Si alloys under ultrasonic melt treatment”. Light metals,2012,TMS ,P 999-1004.

[21] T.V. Alamanenko etal. “Criteria of grain refinement induced by ultrasonic melt treatment of aluminium alloy containing Zr and Ti”. Matall.Mater Trans.41A(2010),P 2056-2066.

[22] D.G Eskin et al. “Onthe mechanism of grain refinement by ultrasonic treatment in the presence of transition metals”.Light metals. (2010) P607 – 611.

[23] D.G Eskin, L.Zang and L Katgerman. “Influence of ultrasonic melt treatment on the formation of primary intermetallics and related grain refinement in alumium alloys”. J.Master sc. 46,(2011),P5252-5229.

[24] Shim Taguchi and Hioshi Yano, :Taguchi’s quality engineering handbook”, John Wiley and sons.

[25] Ross PJ, “Taguchi’s technique for quality engineering”, McGraw-Hill, (1988).

[26] Park S.H., “Robust design and analysis for quality engineering”, Chapman and Hall (1996).

[27] G. Taguchi, “Introduction to quality engineering”.Asian productivity organization,1990.

[28] Ross PJ, “Taguchi’s technique for quality engineering”, McGraw Hill publications, Newyork.Ny,USA,2nd edition, 1996.

[29] Mintab User manual (Release 13.2), Making data analysis Esier,MINITAB,State college, Pa, USA,2001.

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Design & Construction of a Solar Driven Ammonia Absorption Refrigeration System

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Abstract-A solar driven ammonia absorption refrigeration system was designed, constructed and tested. It was an intermittent system where ammonia and calcium chloride were used as refrigerant and absorbent respectively. A small capacity vapor absorption system was first analyzed and its characteristics at various points were measured. The main components like evaporator, condenser and generator were designed based on capacity. The necessary heat and mass transfer equations describing the working properties were specified .The experimentally obtained COP was in the range of 0.104-0.126, average 0.118. Information on designing the condenser, evaporator, and generator of the unit has been presented.

Index Terms- Ammonia, Calcium chloride, Intermittent System, Parabolic Solar Collector, Refrigeration system.

I. INTRODUCTION

Energy crisis is the primary concern around the world because world's demands on the limited natural resources those are used to power industrial society are diminishing as the demand is rising gradually [1].Vapor absorption drives without compressor and its refrigerants are C.F.C free so it saves both energy and environment. The best use of vapor refrigeration system is in remote places where acute shortage of electricity is present or only available power source is solar energy. Many agricultural products like fruits, vegetables, meat, fish etc. can be maintained in fresh conditions for significantly longer period of time if they are stored at lower temperature. This situation is even worse in the remote areas like Bangladesh where these fresh food materials are produced. As a result, sharp difference in food supplies exists between the harvest and off harvest periods. High market valued agricultural products are usually abundant and cheap during the harvest season and expensive at other times. Solar refrigeration can assist to change this trend. Besides food products it can play significant role on preserving the immunization vaccines effectiveness by maintaining them at lower temperature in remote places [2].

Absorption refrigeration system depends on the absorption of a refrigerant gas into an absorbent at low pressure and subsequent desorption by heating. The basic cycle of the single effect absorption ion machine consists of the four processes of absorption, evaporation, regeneration and condensation [3].

In the recent years, many research works have been completed on the absorption system as an alternate of vapor compression system. Vapor compression cycle is described as work-operated cycle because it requires work to run the compressor for elevating the pressure of the refrigerant. On the other hand, absorption cycle is referred as heat operated cycle because most of the operating cost is associated with providing the heat that drives off the vapor from the high pressure liquid or solid. In the vapor compression system, energy in the form of work is normally much more valuable and expensive than energy in the form of heat that can be obtained by solar energy, a fossil-fueled flame, waste heat from factories, or district heating [4].

II. ABSORPTION REFRIGERATION SYSTEM

The absorption cycle is similar in certain respects to the vapor compression cycle. In this system, refrigerant is vaporized by absorbing latent heat of vaporization from the materials which have to be cooled at low pressure region; alternately the refrigerant condenses at the condenser by rejecting latent heat of condensation to the adjacent medium at high pressure region. There are three types of absorption systems- intermittent absorption system, continuously absorption system and double intermittent absorption systems. The difference is in the operating period of cycle. In the continuously operating cycle, heat is added in the generator for 24 hours by an external heat source and evaporator maintains it temperature for 24 hours whereas in intermittent system heat is added for a certain period. Intermittent absorption systems are able to use waste heat and solar energy. The intermittent process works with ideal refrigerant and an absorbent. High pressure or heat separates the two elements during the generating phase and cooling/refrigeration takes place through the absorption/adsorption of the pair. Ambient cooling is an intermediate phase which takes place to reduce high

pressure gas/vapor into a refrigerant working liquid. Double intermittent absorption systems are the refinement of the intermittent systems that work either in cascade, at a higher pressure and producing refrigeration more than single intermittent absorption process. [5], [6].The coefficient of performance of the absorption cycle (COP $_{abs}$) is calculates as equation (1) [7],

$$COP = \frac{\text{refrigeration rate}}{\text{rate of heat addition at genarator}}$$

$$= \frac{Q_e}{Q_g} \quad \ldots\ldots (1)$$

III. Design and Experimental Setup

The solar intensity, temperature, generation period was assumed by considering the surrounding environment of experiment (Khulna, Bangladesh). The temperature at day fluctuated between 25^0C to 35^0C where solar intensity was around 700-760 (W/m2) and average generation period was 6-7 hrs. There are various types of refrigerant and absorber pair are being used at present time. Among them NH_3/H_2O is widely used where low temperature is required and NH3/LiBr systems are used where moderate temperature are required like air conditioning [6]. Several refrigerant and absorber pairs were studied and it showed the superiority of solid absorbents over liquid absorbents and calcium chloride was found better, less expensive and available compared to other absorbents [8]. Again the boiling temperature between ammonia and calcium chloride is so distinct that there is no possibility of boiling calcium chloride with the boiling temperature of ammonia. So the design parameter were assumed as follows-

Table 1.0 Design Parameters

Solar Intensity	750 (W/m^2)
Generator temperature	105^0C
Condenser output ammonia temperature	37^0C
Evaporator temperature	2^0C
Pressure at generator	1.3MPa
Pressure at evaporator	0.45MPa
Generation period	6hrs
Mass of water in evaporator	8 kg
Refrigerant /absorber	Ammonia/Calcium chloride

A. System Description

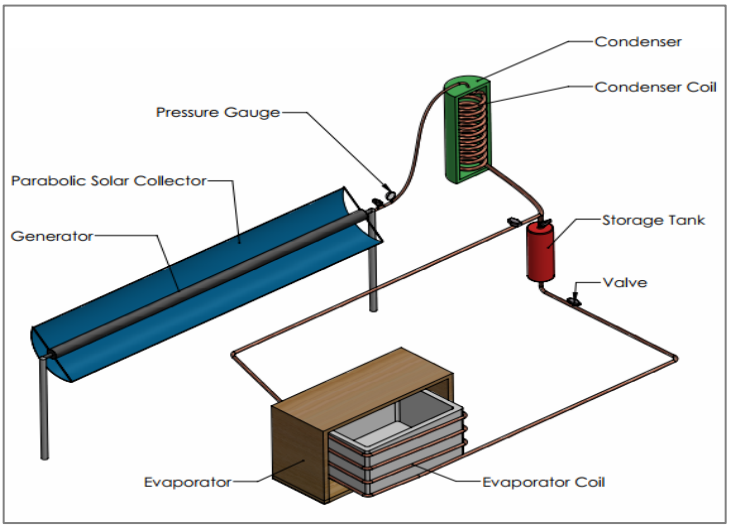

Fig 1.0 Proposed Design of Intermittent vapor absorption system

This system actually was not a true refrigeration system. It was an intermittent refrigeration system because here the mass flow rate was not constant throughout the system. The mass flow rate of the ammonia vapor in system increased when the temperature of the generator increased. The proposed system used-a generator for heating the salt-ammonia mixture, a condenser coil for condensing the vapor ammonia into liquid ammonia, a storage tank for storing the liquid ammonia coming from condenser at day cycle and an evaporator where the materials for cooling were kept. The absorption system operated in a day/night cycle, generating distilled ammonia during the daytime and reabsorbed it at night. During the day cycle the valve on the storage tank was opened, the valves at the bottom of the storage tank and outlet of the evaporator remained closed. Ammonia vapor condensed in the condenser coil and dripped down into the storage tank .About 100 degrees centigrade, six of the eight ammonia molecules bound to each salt molecule were available [9]. At night cycle the valve on the storage tank was kept closed and the valves at the bottom of the storage tank and outlet of the evaporator were kept opened. The liquid ammonia from the storage tank passed through the evaporator coils and got vaporized after taking heat from the evaporator box. As the pressure at the generator remained low at night cycle the ammonia vapor went toward the generator and reabsorbed in the calcium chloride. The total working cycle of the system is shown by the following diagram-

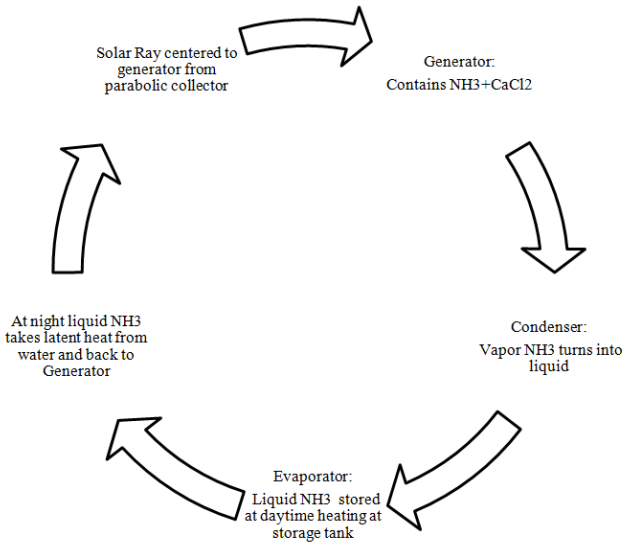

Fig 2.0 Working cycle of vapor absorption system

The ammonia gas is toxic and highly corrosive to brass so the pressure gauge, elbow, valve, T-section, union and the tube for piping were made of stainless steel. Another concerning thing of the project was the sustainability of high pressure. The system was made in such a way that can sustain about 1.7MPa pressure because the ammonia expands greatly. The main components of the system were designed as follows:

The system used a parabolic solar collector. A cylindrical parabolic shape reflector was designed to use as a reflector in this project. Firstly a parabola was drawn in a paper and then drawn parabola was used to construct the structure of the reflector. Reflector had two parts: structure for parabola and reflecting sheet. GI square bar was used for structure of the parabola due to its low weight and high strength to hold the structure. S .S. magnet sheet was used as reflector. PVC sheet was used for supporting the reflector. The structure of the reflector was made by welding. The reflector and PVC sheet were attached with the structure by screws. The reflector size was 2.2 x 1.59 m. The entire reflector was stood by shaft which was nearly passed through the centre of gravity of the reflector and receiver.

The proposed generator was a tube made of stainless steel which was 2.45m long, 76.2mm in diameter and 1.5 mm in thickness. The generator in this system also acts as receiver. It contained the mixture of Calcium Chloride and ammonia. The outer surface of the generator was black colored with black so that it can absorb maximum heat reflected from the solar collector. One end of the generator was closed and other end was open to the condenser through PVC pipe.

The condenser was a stainless steel tube which had 12 turns and the diameter of the condenser tube was 9.5mm. The condenser coil had a diameter of 29.2cm and the total length of the tube was 6m. The condenser was fixed into a cylindrical box containing water at the day cycle. At the night cycle there was no water into the condenser containing box. As the water got hotter after taking heat so hot water was brought out and cool water was supplied to the condenser box. The condenser box was surrounded by cork sheet box to ensure no other heating source of water except vapor ammonia.

The system used a stainless steel cylinder for the purpose of storage tank which was about 60.9cm long, 2 mm in thickness and 10.16cm in diameter. In the day cycle the liquid ammonia stored in the storage tank.

Here the proposed evaporator was a rectangular box made of galvanized sheet. The evaporator was surrounded by evaporator coil made of stainless steel pipe .The diameter of the evaporator coil was 9.5mm and thickness was 1mm. The evaporator was placed into a box made of cork sheet so that an even temperature can be maintained all over the box and also ensuring heat entrapment by keeping felt on the gap between the galvanized sheet box and cork sheet box.

Fig 3.0 Actual design of the whole intermittent vapor absorption refrigeration system

IV. RESULT AND DISCUSSION

The entire components were assembled and tested perfectly before taking observational data. Several measurements were taken at different days. Data were taken from 10.30 am to 4.00 pm with 30 minutes interval. Figure 4.0 describes the temperature variation of different component (generator tube, condenser, temperature of water surrounding the condenser coil) with time. The temperature of the generator tube fluctuated between 95^0C to 102^0C and the pressure range in the generator tube were 1.2MPa to 0.45MPa. The supplied water in and
out temperatures in condenser box were nearly 25^0C and 34^0C respectively. At the night cycle, several evaporator temperatures were taken and the minimum temperature in evaporator reached within about 6 hrs. The range was 4 ^{0}C to 8.5^0C.
It was assumed that the vapor generating from the generator was 100% pure ammonia vapor [10]. The thermal energy input was calculated by the equation (2) where collector efficiency was assumed 10 percent [11]and collector mirror surface area was 3.5 $m^{2,}$
Thermal energy input =Solar intensity × collector mirror surface ×collector efficiency [12]

Or ,Q_g= I×A×η……...……...……...…..(2)

Table 3.0 COP Calculation

No of days	Solar intensity I (W/m^2)	Generator temp (^0C)	Evaporator temp (^0C)	Thermal energy collected Q_g(kW)	Cooling Capacity Q_e(kW)	COP
01	740	102	4	0.259	0.0326	0.126
02	730	100	4.6	0.255	0.0318	0.125
03	715	99	5	0.250	0.0311	0.124
04	710	97	7	0.248	0.0280	0.112
05	700	95	8.5	0.245	0.0256	0.104

The variation of temperature of different components with time ,variation of COP with generator tube temperature and variation of solar intensity with time are shown in the following figures-

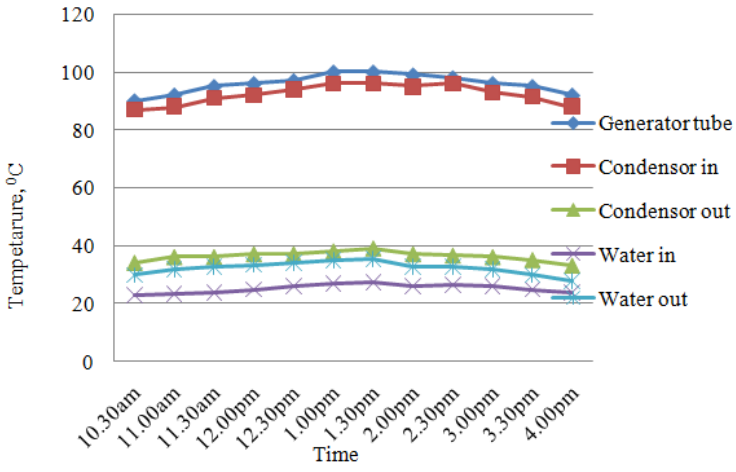

Fig 4.0 Variation of temperatures of different components with time

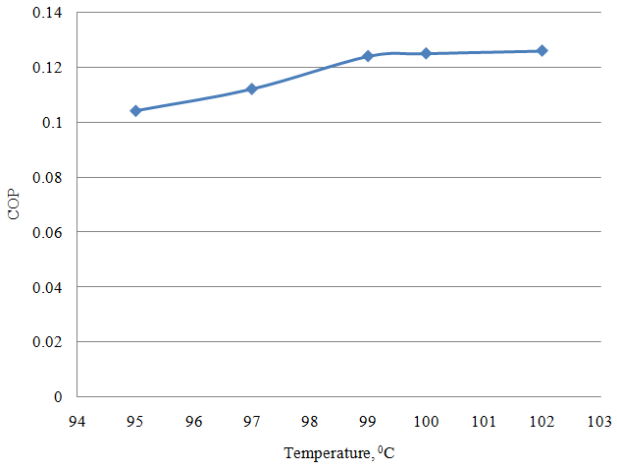

Fig.5.0 Variation of COP with generator tube temperature

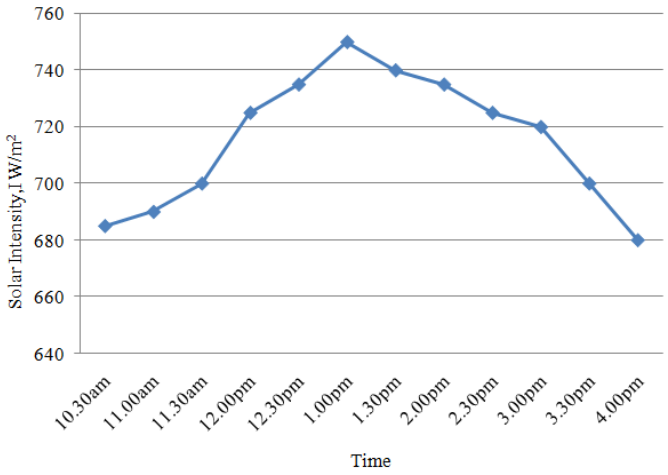

Fig 6.0 Variation of Solar Intensity with time.

Figure 5.0 describes the variation of COP with the generator tube temperature and figure 6.0 describes the solar intensity with time. From the observational data it is clear that for the first observation the COP was maximum (0.126) and evaporator temperature minimum (4^0C) because of high solar intensity, generator tube temperature as well as accumulating maximum amount of ammonia in storage tank. Again from the observation no 1 to 5, the generator tube temperature reduced gradually at different days, hence less amount of ammonia was accumulated in storage tank. As a result, high temperature (8.5^0C) was found in evaporator and COP reduced to (0.104).

The average coefficient of performance of the system was around 0.118 which was in agreement with some previously designed intermittent systems [13][14][15] .Again, the system would be more efficient (desired temperature at evaporator was 2^0C) if the desired amount of ammonia would be stored, pressure and insulation would be exactly maintained. Our system used felt but there was also some heat loss to the surroundings due to air filtration. Keeping the whole system sealed throughout the various pressure and temperature changes was very hard. As our system was a compact and built for small unit, so maintaining this high pressure was challenging task. So there might be some leakages through the measuring devices like thermocouple and pressure gauge.

V. CONCLUSION AND RECOMMENDATION

A small capacity intermittent vapor absorption refrigeration system was designed based on some correlations and formulae. The average experimental COP was 0.118 .It was observed that the accumulation of ammonia, solar collector efficiency, clearness of sky played great factor for overall efficiency. The present cost of the absorption unit together with its running cost is economically viable. Considering also the destruction of the ozone layer caused by the use of electric chillers, absorption units will offer a better environment, especially if some form of renewable or waste energy is used for their operation. It is recommended to use an expansion valve to increase the pressure difference which also effects on the increment of the refrigerant effect and use felt on the outside of the pipe it would be better for insulating the system with round insulated flexible duct.

REFERENCES

[1]CEF(Conserve Energy Future), http://www.conserve-energy-future.com/causes-and-solutions-to-the-global-energy-crisis.php
[2]Refrigeration, https://en.wikipedia.org/wiki/Refrigeration
[3] J.C. McVeigh , A. A. M Sayigh ,Ed., *Solar Air Conditioning and Refrigeration*, Pergamon; 1st edition ,May 1, 1992,pp 66-67
[4] W.F Stokers, J.W Jones, *Refrigeration & Air Conditioning*, Second Edition, McGraw-Hill International Editions-Sigapore,ISBN 0-07-066591-5, pp 328-330
[5] Jacob Buehn, Adam Hudspeth, Gary Villanueva, "Solar Ammonia Absorption Refrigerator Senior Design Project", Saint Martin's University, Department of Mechanical Engineering, Online Available-http://www.solaripedia.com/files/1113.pdf
[6]Satish Raghuvanshi, Govind Maheshwari , "Analysis of Ammonia –Water (NH3-H2O) Vapor Absorption Refrigeration System based on First Law of Thermodynamics", *International Journal of Scientific & Engineering Research Volume 2, Issue 8*, August-2011,ISSN 2229-5518.
[7] C P Arora, *Refrigeration and air conditioning*, 2nd edition Tata McGraw – Hill Publication company limited New Delhi).pp 428-429
[8]Iloeje O.C (1995) , "Treatments of Calcium Chloride for use as a Solid Absorber in Solar Powered Refrigeration", Technical Report No. SE-I, Oct 1982, Solar Energy Project, Univ. of Nigeria, Nsukka.
[9] J. Vanek, M. Green and S. Vanek, "A Solar Ammonia Absorption Icemaker", Home Power #53 • June / July 1996
[10]M. Umar and A. B. Aliyu ",Design and Thermodynamic Simulation of s Solar Absorption Icemaker", *Continental J. Engineering Sciences* 3: 42 - 49, 2008.

[11]Md. Saifullah-Bin-Ashraf, Md. Ruhul Amin, "Design, Construction and Performance Test of a Microcontroller Based Auto Tracking System for a Parabolic Solar Collector", unpublished.
[12] F. de Winter, Ed., *Solar Collectors, Energy Storage, and Materials* (MIT Press, Cambridge MA, 1990), ch.4, pp 116-117
[13]Prof. Dr. Adel A. Al-Hemiri and Ahmed Deaa Nasiaf, "The Use of Direct Solar Energy in Absorption Refrigeration NH3 – H2O System", *Iraqi Journal of Chemical and Petroleum Engineering* Vol.11 No.4 (December 2010) 13-21 ISSN: 12010-4884
[14]G. Moreno-Quintanar, W. Rivera, R. Best, "Development of a solar intermittent refrigeration system for ice production", *World Renewable Energy Congress* 2011-Sweden,8-13 May2011,Linkoping,Sweden.
[15]Thosapon Katejanekarn1, Teerasak Hudakorn1, "An Intermittent Solar Absorption Cooling System Using a Parabolic Trough", Department of Mechanical Engineering, Faculty of Engineering and Industrial Technology, Silpakorn University, Nakhon Pathom, 73000 Thailand.

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Effect of E-waste Aluminium with Fly ash composite for environment safety

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Abstract- The aluminium is a matrix material and the reinforcements are E-glass fiber and fly ash with various weight fraction the E-glass fiber is constant and the fly ash is varied 0,3,6,9 wt. % fabricate by using stir casting method. After the composite sample are subjected to examine the mechanical properties such as tensile, compressive, yield, % of elongation, hardness and toughness strength. From the test result the tensile strength of the four different wt.% composite sample is increased gradually adding with increasing the fly ash wt.% gradually (0,3,6,9 wt.%), the 9 wt.% fly ash sample is get higher tensile strength 199.698 N/mm^2 compared with other samples. The yield strength of the four composite sample was analyzed during the tensile strength test the yield end point of the specimen is called yield strength it was increased adding with increasing the fly ash wt.% gradually, the 9 wt.% of fly ash sample is get higher yield strength 182.55 N/mm^2 compared with other samples. The compressive strength of the four composite sample are increased gradually adding with increasing of fly ash wt.%, the 9 wt.% fly ash sample was get higher compressive strength 432.678 N/mm^2 compared with other samples. The % of elongation of the four composite samples was increased adding with increasing the fly ash wt.%, the 9 wt.% fly ash sample was get higher elongation 3.4% compared with other samples. The hardness of the composite samples was also increased adding with increasing the fly ash wt.%, the 9 wt.% of fly ash samples is get higher hardness strength 79.3 HBN compared with other samples. But only the third sample is get decreased in both hardness and % of elongation compared with second sample the decreasing ratio is 12 % of hardness and 13.04 % of elongation. The toughness strength of the composite sample was studied in impact charpy test was get decreased adding with increasing the fly ash wt.%, the 3 wt.% fly ash sample was suddenly get decreased 1 joule compred with 0 and 6 wt.% fly ash sample. For the above result the 6 and 9 wt. % fly ash sample was subjected to examine the microstructure analysis using scanning electron microscope. From the SEM image of 6 and 9 wt. % fly ash samples the 9 % fly ash sample was having good reinforcement. For the 6 wt. % fly ash sample is less performance compared with 9 wt. % sample. In this work yield way to reduce the E-waste amount by making new material.

Index Terms- Environmental impact assessment, e-waste, Heat Sink, e-glass fiber, fly ash, stir casting process, mechanical testing, microstructure analysis.

NOMENCLATURE

WEEE	-	Waste Electrical and Electronic Equipment	SiC	-	Silicon Carbide
E-waste	-	Electronic waste	Fe2O3	-	Ferric Oxide
MMC	-	Metal Matrix Composite	NaCl	-	Sodium Chloride
Mpa	-	Mega Pascal	MgO	-	Magnesium Oxide
Gpa	-	Gega Pascal	B2O3	-	Boron Oxide
g/cm2	-	Gram per centimeter square	Na2O	-	Sodium Oxide
No.	-	Number	K2O	-	Potassium Oxide
Al	-	Aluminium	MPa	-	Mega Pascals
RHA	-	Rice Husk Ash	UTS	-	Ultimate Tensile Strength
TV	-	Television	UCS	-	Ultimate Compressive Strength
SEM	-	Scanning Electron Microscope	PT	-	Tensile load
Wt.%	-	Weight percentage	σT		Tensile Strength
ASTM	-	American Society for Testing and Materials	A	-	Cross sectional Area
E/D	-	Edge distance to diameter ratio	PY	-	Yeild load
W/D	-	Width to Diameter ratio	σY	-	Yeild Strength
PCB	-	Printed Circuit Board	ΔL	-	Final Length, mm

SiO2	-	Silicon dioxide	L	-	Initial Gauge length, mm
Mg	-	Magnesium	mm	-	Milli Meter
Al2O3	-	Aluminium Oxide	Kg	-	Kilo Gram
CaO	-	Calcium Oxide	N	-	Newton
ASTM	-	American Standard Testing Method	J	-	Joule
SEM	-	Scanning Electron Microscope			

I. INTRODUCTION

In recent year there has been increasing concern about the growing volume of end-of-life (EOL).The electronic scraps and waste are enormous that couldn't be normally disposed in to the agricultural land or any land because this contains more valuable metals and non-metals. There are also large amount of toxic materials present in it. The electronic scrap is very important subject of concern. All over the world, large amount of e-waste has been generated, with china & Japan producing above 1000 million tons per year. At present the electronic wastes are subjected to recycling process adapting either mechanical process or chemical process. Recycling processes are carried out to recover the materials from e-waste and segregate the materials in to metals and non-metals. The chemical process yields high metal purity but involves high cost and need more safety. The mechanical process involves less cost, medium safety, but recovers high valuable metals, such as copper, aluminium, lead, cadmium, brominates and beryllium flame retardants. Aluminium alloy A356.2 matrix and reinforcement of rice husk ash and Silicon carbide added at equal ratio of 2,4,6,8 wt.% is fabricated by double stir casting process. While increasing of reinforcements wt.% the porosity, hardness, yield strength and ultimate strength was increased in the composite and the density is decreased[1]. Aluminium alloy (Al-Mg-Si), RHA and Alumina (Al_2O_3) reinforcement at used with various combinations to fabricate the composite such as 0:10, 2:8, 3:7, 4:6 wt.% by using double stir casting method. In this composite was investigated as showed percentage elongation and fracture toughness was increased of the 2:8 wt.% sample and it containing low hardness, ultimate tensile strength and yield strength while increasing the reinforcements. So that the single alumina reinforcement only got higher than others samples[2]. aluminium alloy (Al-Si-10Mg) and Rice Husk Ash reinforcement in ratio of 3,6,9,12 wt. % using stir casting method fabricate the composite material. The tensile strength, compression strength and hardness was increased and the ductility gets decreased with increase in RHA weight fraction reinforcements[3]. Aluminium alloy A359 and reinforcement with Al_2O_3 at different wt.% such as 2,4,6,8 wt.% was fabricated by electromagnetic stir casting method. The tensile and hardness strength of the composite was increased that increasing the reinforcement Al_2O_3% while comparing with unreinforcement alloys[4]. Waste e-glass fibre particles are utilized in cement concrete mixer inert fillers at different percentage and different ageing days such as 17, 27, 43 wt. % and 28, 91, 365 days. The e-glass fibre size is 38 to 300µm 40% of e-glass fibre is less then 150µm. Based on the properties the hardened concrete, optimum e-glass content was found to be 40-50 wt. % and having excellent chloride –ion penetration resistance[5]. Aluminium 7075 matrix and reinforced with Fly ash and E-glass Short fibres composite is fabricated by stir casting at various weight fraction like E-Glass fibre 1%,3%,5% constantly with each ratio of fly ash (2,4,6,8%). The test result the 8% of fly ash and 5% of e-glass fibre sample was get high tensile and compressive strength. So the reinforcement Wt. % is increasing the properties is increased[6]. Aluminium alloy 6061 and reinforced with flyash was fbricated the composite by using stir casting method at different particle size and different percentage in weight fraction such as (4-25, 45-50, 75-100 µm) and (10, 15, 20 wt.%). The particle size is increased the tenisle and compressive strength is decreased. The wt.% percentage of fly ash is increased the tensile and compressive strength is increased at the same time the ductility is decreased[7]. Aluminium 7075 matrix and reinforced with Fly ash and Magnesiun composite is fabricated by stir casting at four various weight fraction like S1,S2,S3,S4. The samples are subjected to mechanical testing the S2 sample was higher strength at toughness, tensile, hardness strength and the grain size was decreased. So the amount of fly ash is increased up to S2 weight, that properties is increased[8]. The effect of reinforcement (Zirconia + Flyash) with aluminium alloy 6061 matrix is fabricated at fixed percentage of flyash (10%) and varying percentage of Zirconia (5% and 10%) in weight fraction by using stir casting method. From the result (fly ash10% + zirconia 10%) containing sample was having high tensile and hardness strength and the percentage elongation was decreased while comparing unreinforced alloy[9]. The wastage of fly ash is utilized in MMCs at aluminium matrix is fabricated at stir casting method at different weight fraction (flyash 5%,10%,15%,20%). The 20% of flyash sample is got high hardness and decreased in frictional forces and wear rates. So they increasing of fly ash % that the hardness is increased[10]. Aluminium 6061 is a matrix and the reinforcements are e-glass fibre and fly ash is fabricated by liquid metallurgy method at various weight percentage such as the fly ash is 2,4,6,8 wt.% and the e-glass fibre as 2 and 4 wt.% is constant at all. This sample was prepared and machined as per the ASTM standards subject to evaluated the mechanical properties like tensile, compressive and hardness strength. Finally the fly ash wt. % increased significantly improved the tensile, compressive and hardness strength and it is compared with unreinforced matrix materials[11]. In the metal matrix composite Al 6061 and the reinforcements is fly ash and e – glass fibre by stir casting method at various wt. %. The e-glass fibre is 2, 4 and 6 wt.% and the fly ash is constant at 5, 10, 15 wt.% is fabricated and machined as per the ASTM standard and subjected to evaluated the mechanical properties such as tensile, compressive, hardness strength and microstructure of the sample was observed to study the bonding of reinforcements in the Al 6061 alloy finally the fly ash increased up to 10 % and e-glass fibre 6 % sample is improved the tensile and compressive strength compared with other sample. The hardness is increased from 47.53 BHN to 68.48 BHN with adding of fly ash and E-glass fibre[12].

II. MATERIALS AND METHODS

A.Heat Sinks:

In electronic systems, a heat sink is a passive heat exchanger that cools a device by dissipating heat into the surrounding medium. In computers, heat sinks are used to cool the PCB. Heat sinks are used with high-power semiconductor devices such as power transistors and optoelectronics such as lasers and light emitting diodes (LEDs), where the heat dissipation ability of the basic device is insufficient to moderate its temperature. The heat sinks are found in all electronic and automation systems (i.e.) TV, DVD Player, Washing Machine, CPU…etc. The electronic equipments and systems containing large size heat sink is made by aluminium alloy material using casting process. Heat sink is majorly placed in the PCB`s (PRINTED CIRCUIT BOARDS) to reduce heat and cool the circuit boards with the help of fans. Heat sinks are the heat exchangers such as those used in refrigeration and air conditioning systems.

Heat Sink Cutting process*:* The heat sinks are large sizes it is contains little amount in the crucible either it is cut a small pieces the crucible contains large amount of heat sinks.

Figure.1 Heat Sinks (Aluminium alloy)

Table.1 chemical composition of heatsink(aluminium alloy)

Si	**Fe**	**Cu**	**Mn**	**Mg**	**Zn**	**Ti**	**Cr**
0.29%	0.073%	0.0002%	0.006%	0.49%	0.015%	0.019%	0.0002%
Ni	**Pb & Sn**	**Na**	**Ca**	**B**	**Zr**	**V**	**Be**
0.0001%	0.002%	0.0002%	0.00003%	0.0005%	0.0003%	0.002%	0.00004%
Sr	**Co**	**Cd**	**Sb**	**Ga**	**P**	**Li**	**Al**
0.00003%	0.006%	0.0003%	0.002%	0.008%	0.002%	0.00002%	**99.0%**

Figure.2 Heat Sink cutting Process

B.E-glass fiber:

Fiber reinforced composite materials consist of fibers of high strength and modulus embedded in or bonded to a matrix with distinct interfaces between them. In this form, both fibers and matrix retain their physical and chemical identities, yet they produce a combination of properties that cannot be achieved with either of the constituents acting alone. E-Glass or electrical grade glass was originally developed for standoff insulators for electrical wiring. It was later found to have excellent fiber forming capabilities and is now used almost exclusively as the reinforcing phase in the material commonly known as e-glass fiber. It was low cost, high strength, good reinforcement and easily available in the market.

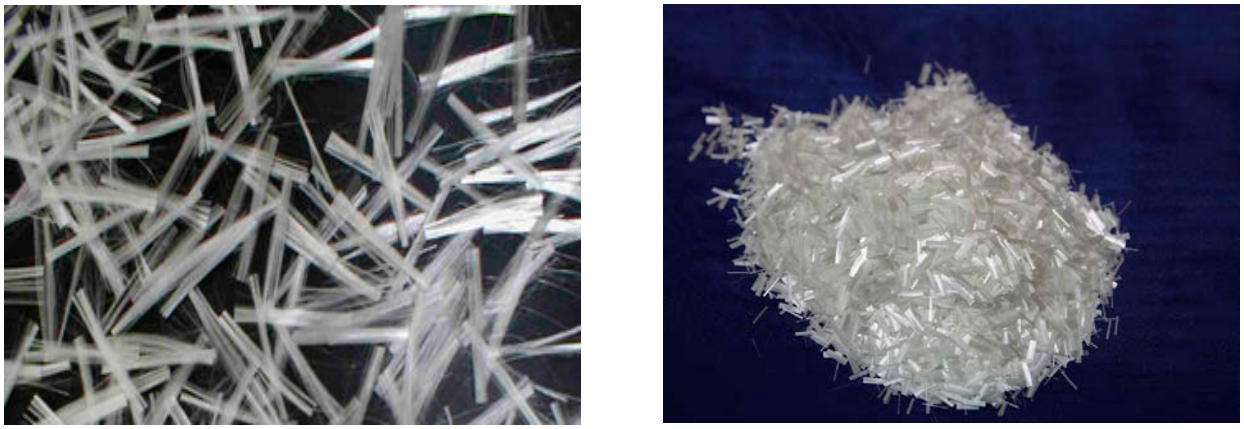

Figure.3 E-glass fiber

C. Fly ash:

Fly ash is a waste product from the combustion of pulverized coal in electricity power plants. Fly ash, also known as flue-ash, is one of the residues generated in combustion, and comprises the fine particles that rise with the flue gases Ash which does not rise is termed bottom ash. In an industrial context, fly ash usually refers to ash produced during combustion of coal. Fly ash is generally captured by electrostatic precipitators or other particle filtration equipment before the flue gases reach the chimneys of coal fired power plants, and together with bottom ash removed from the bottom of the furnace is in this case jointly known as coal ash. Here are two classes of fly ash are defined by ASTM C618: Class F fly ash and Class C fly ash. The main difference between the class types is the amount of calcium Oxide, silica, alumina, and iron content in the ash. The CaO wt. % is less than 20% ash is called class F type fly ash and more than 20% ash is called class C type fly ash. The below 63 micron grain size fly ash was only used in the composite preparation.

F Class type **C Class type**

Figure.4 Class F type and class C type fly ash

Table. 2 Chemical composition of Fly ash

SiO_2	31.0%	MgO	2.8%
Al_2O_3	9.0%	Fe	5.7%
Fe_2O_3	8.15%	Na_2O	0.30%
CaO	**6.0%**	K_2O	0.20%

D. Stir Casting:

Stir casting is a liquid metallurgy method of composite material fabrication, in which a dispersed phase (ceramic particles, short fibers) is mixed with a molten matrix metal by means of mechanical stirring. The stir casting arrangements is shown in figure 5. It is effectively mixing the reinforcements with the matrix material (Al alloy) and doesn't damaged the reinforcements while stirring.

Figure.5 Stir casting arrangements

E. Composite Fabrication Procedure:

This project focused on how to reduce the e-waste in earth and save the environment in this work the e-waste devices are collected and remove the materials, devices, equipments separately. The removed devices are segregated metals, non-metals and plastics. From this non-metals the aluminum, copper,

brass are recovered. The recovered materials are selected based on the literature this project was used the aluminum. The aluminiumas placed in this e-waste mostly in the heat sink it was collected and cutted to the small pieces. These materials as a matrix material it is melted at liquid state at 750ºC to 800ºC in the stir casting method after that the selected reinforcements are E-glass fiber and fly ash mixture added with preheating of 400ºC at 30 minutes at required wt.% after the stirrer is drop down and stirring for 930 rpm at 5-7 mins. After stirring the composite mixture was pouring in to the die and preparing the composite sample. The prepared samples are machining as per the ASTM standards convert the test specimen. The specimens are induced the mechanical properties examination. This process is continued at all specimens. Based on the test result the optimum strength composite was used to fabricate machine components.

F. Composite Material composition:

The composite material composition was constructed based on the literature study. In this project work focused the e-waste aluminiumis a matrix material and the reinforcements are e-glass fiber and fly ash. The existing works the reinforcements rice husk ash and SiC both 2,4,6,8 wt.% remaining aluminium 356[1], Aluminium alloy (Al-Mg-Si), RHA and Alumina (Al_2O_3) reinforcement at used with various combinations to fabricate the composite such as 0:10, 2:8, 3:7, 4:6 wt.%[2], aluminium alloy (Al-Si-10Mg) and Rice Husk Ash reinforcement in ratio of 3,6,9,12 wt. %[3], the effect of reinforcement (Zirconia + Flyash) with aluminium alloy 6061 matrix is fabricated at fixed percentage of flyash (10%) and varying percentage of Zirconia (5% and 10%) in weight fraction[9], the wastage of fly ash is utilized in MMCs at aluminium matrix is fabricated at stir casting method at different weight fraction (flyash 5%,10%,15%,20%)[10]. According to the following literature studies we prepared the composite materials samples at various wt. %. The composite material composition is shown in the table.3

Table (3) composition of composite materials

Sample	Aluminium alloy (wt %)	E-glass Fibre (wt %)	Fly ash (Wt %)
1	97%	3%	0%
2	94%	3%	3%
3	91%	3%	6%
4	88%	3%	9%

III. SAMPLE PREPARATION

The e-wasted heat sinks is collected at require amount in Kg and segregation, cutting, is a primary process of the experimental work. The secondary process of the project is the small pieces of heat sink is melted in stir casting furnace at 750ºC to 800ºC at 1 hr by crucible and the stirrer is set inside the melted aluminium and add the reinforcements e-glass fiber and fly ash was preheated in pre-heating furnace at 400ºC for 30 minutes. After adding the reinforcements with the degassing tablet powder (HEXACHLORA ETHANE TBLET) and stirrer is switch on rotated at 800 to 900 rpm at 5-7 minutes. After stirring it is lifted in to the furnace and crucible is take out in to the furnace and pouring in to the die and fabricate the composite materials samples this process is followed at remaining samples.

Figure.6 Composite Materials Fabrication Process

IV. RESULTS AND DISCUSSIONS

Mechanical properties testing:

A. Tensile Strength:

The tensile strength is an ability of the materials it is tested by Universal Testing Machine - 40 ton capacity machine modal TUE – C – 400. The test specimen is prepared by as per the ASTM E8M-13a dimension gauge length 30 mm, gauge diameter 6 mm fillet radius 6 mm, grip diameter 10mm and grip length 20 mm is conducted at room temperature 28ºC. The tensile strength of the composite materials samples results is shown in figure 11.

Figure . (7) Tensile test specimen Sample 1 - (Aluminium 97%, E-glass fibre 3%)

Figure . (8) Tensile test specimen Sample 2 - (Aluminium 94%, E-glass fibre 3%, Fly ash 3%)

Figure . (9) Tensile test specimen Sample 3 - (Aluminium 91%, E-glass fibre 3%, Fly ash 6%)

Figure . (10) Tensile test specimen Sample 4 - (Aluminium 88%, E-glass fibre 3%, Fly ash 9%)

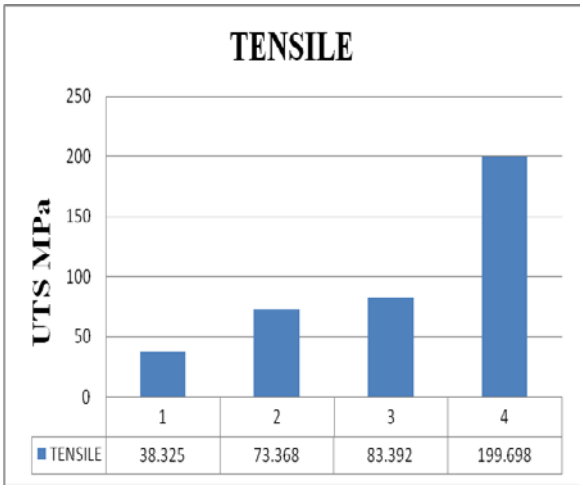

Figure. (11) Tensile Strength test result

The ASTM standard dimensions are Specimen diameter is D = 6 mm, Initial Gauge length G = 30 mm, Radius of fillet R = 6 mm, Grip diameter d = 10 mm , Grip length L = 20mm, Cross sectional area = 28 mm.

Tensile Strength (σ_T) = [Tensile Load / Cross sectional Area] (or) [P_T / A] N/mm^2

Difference between samples in % = [(Maximum strength – Minimum strength) / Maximum Strength] x 100

The fly ash wt. % is increased the tensile strength was increased gradually at all the four samples. In the first sample is reduced from the second sample at 47.76% and it compared with third sample which increased 12.02%, the third sample was decreased then fourth sample at 58.24%. From this above result the tensile strength was identified and compared with theoretical value of the composite is shown in the table. (4) it's come nearest strength.

B. Yield Strength and % of elongation:

The yield strength is an ability of the materials it is tested during the tensile test the yield load was applied on the specimen the yield point or before breaking point is a yield load is used to calculate the yield strength of the composite materials. The yield strength of the all four samples results are shown in figure 12. From the result the yield strength was increased which increasing of the fly ash wt. % in the second sample in increased at 53.837 %, the third sample is increased then second sample at 12.699 % and the fourth sample also increased then the third sample is 60.73%.

Yeild Strength (σ_Y) = [Yeild Load / Cross sectional Area] (or) [P_Y / A] N/mm^2

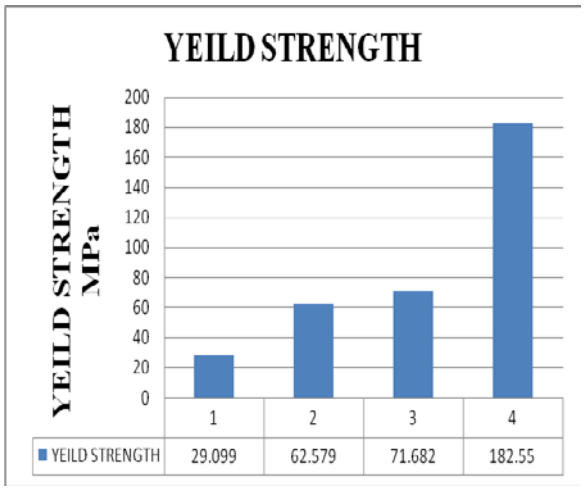

Figure. 12 Yield Strength test results

The % of the elongation is a enlarging length of the specimen for applying tensile load it is used to calculated % of elongation. The % elongation of the all four samples results are shown in figure 13. The % of elongation also increasing from first sample to second sample at 56.52% and the fourth sample is increased then the third sample is 39.29% only the third sample is get decreased then the second sample .

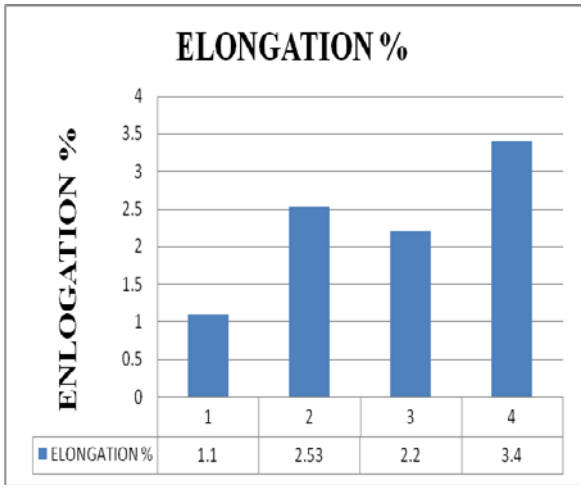

Figure.13 % of Elongation test results

Percentage of elongation in length= ΔL / L

C. Compressive Strength:

The compressive strength is an ability of the materials it is used to analyze the compressibility of the materials. It is conducted in UTM – Universal Testing Machine the machine model was TUE – C – 400. The compressive load was applied on the specimen the specimen is deformed is called compressive strength of the materials. The deformation stage load is a compressive load is used to calculate the compressive strength and the test specimen is prepared as per the ASTM-E9 standards. The compressive strength of the composite materials samples are shown in figure 18. From the compressive strength result is increased for increasing the fly ash wt. %. The second sample was increased 1.685 %, the third sample is increased then the second sample yet 10.56 % and the fourth sample also increased then the third sample at 9.646%.

Figure.14 Compressive test specimen Sample 1 - (Aluminium 97%, E-glass fiber 3%)

Figure.15 Compressive test specimen Sample 2 - (Aluminium 94%, E-glass fiber 3%, Fly ash 3%)

Figure.16 Compressive test specimen Sample 3 - (Aluminium 91%, E-glass fiber 3%, Fly ash 6%)

Figure.17 Compressive test specimen Sample 4 - (Aluminium 88%, E-glass fiber 3%, Fly ash 9%)

Compressive Strength σ_C = Compressive Load / Cross Sectional Area (or) P_C / A
$A = \pi r^2$
Here d = Diameter of the specimen = 9 mm, r = Radius of the specimen = 4.5 mm

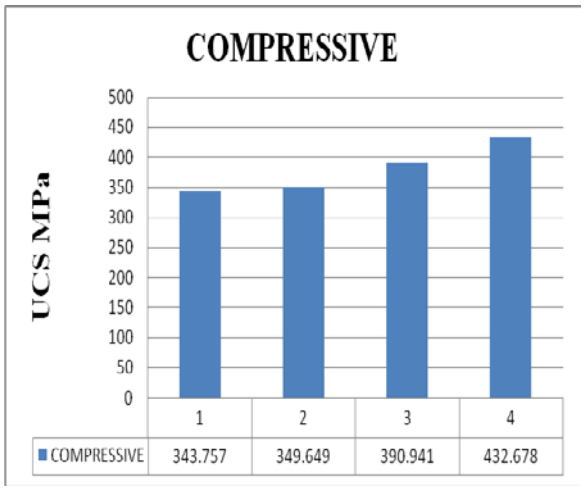

Figure.18 Compressive Strength test results

D. Hardness strength:

The hardness strength is an ability of the materials it is tested by hardness testing machine there are three types of hardness tester such as Brinell, Rockwell, and Vickers hardness. The test specimen is prepared as per the ASTM standard. In this project the Brinell hardness testing machine is used to analyze the hardness strength the ball type indenter tool was used. The hardness strength of composite materials result is shown in figure 23. The hardness strength of the second sample was increased then the first sample at 19.3% and the fourth sample is increased then the third sample at 20.80 % only the third sample is decreased then the second sample.

Figure.19 Hardness test specimen Sample 1 - (Aluminium 97%, E-glass fibre 3%)

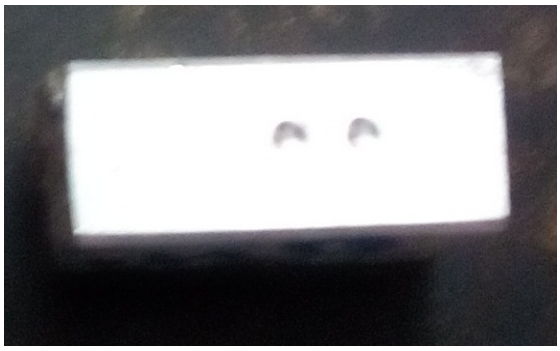

Figure.20 Hardness test specimen Sample 2 - (Aluminium 94%, E-glass fibre 3%, Fly ash 3%)

Figure .21 Hardness test specimen Sample 3 - (Aluminium 91%, E-glass fibre 3%, Fly ash 6%)

Figure.22 Hardness test specimen Sample 4 - (Aluminium 88%, E-glass fibre 3%, Fly ash 9%)

BHN = Load Applied (P) (kgf.)/ Spherical surface area indentation (A)
Area of indentation $A= \pi \times D /2(D-\sqrt{D^2} - d^{2)}$

D = Diameter of the ball,

d = Indentation diameter

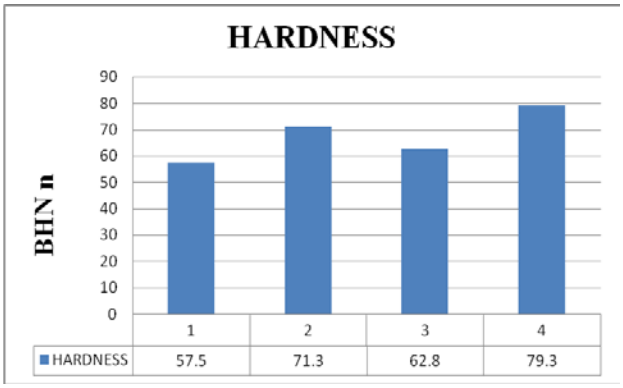

Figure.23 Hardness Strength test results

E. Impact Strength:

The Impact strength is an ability of the materials it is used to analyze the toughness of the materials it is tested two types Charpy and Izard test. By this project the Charpy test is carried out in the impact testing machine with V-notch. The test specimen was prepared as per the standard dimensions 10x55x7.5 mm. The impact strength of the composite materials samples result is shown in figure 28. From the test result the second sample is decreased then the first sample and the third sample was increased then the fourth sample here having some error in the impact strength of the composite.

Figure. 24 Impact charpy test specimen Sample 1 - (Aluminium 97%, E-glass fibre 3%)

Figure.25 Impact charpy test specimen Sample 2 - (Aluminium 94%, E-glass fibre 3%, Fly ash 3%)

Figure.26 Impact charpy test specimen Sample 3 - (Aluminium 91%, E-glass fibre 3%, Fly ash 6%)

Impact strength (Charpy) = Absorb energy / Effective cross section area (J/mm^2)
Absorb Energy = $E_2 – E_1$

Figure. 27 Impact charpy test specimen Sample 4 - (Aluminium 88%, E-glass fibre 3%, Fly ash 9%)

Table.4 Specifications of the impact test

S.NO	DESCRIPTION	VALUES
1	Impact capacity	300joule
2	Least count of capacity (dial) scale	2joule
3	Weight of striking hammer	18.7 kg.
4	Swing diameter of hammer	1600mm.
5	Angle of hammer before striking	160°
6	Distance between supports	40mm.
7	Striking velocity of hammer.	5.6m/sec
8	Specimen size	55x7.5x10 mm
9	Type of notch	V-notch
10	Angle of notch	45°

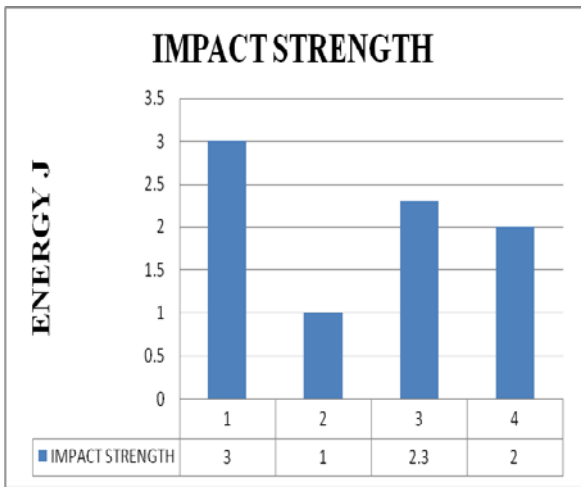

Figure.28 Charpy test results

SAMPLES	*1*		*2*		*3*		*4*	
PROPERTIES	Practical value	Theoretical value	Practical value	Theoretical value	Practical value	Theoretical value	Practical value	Theoretical value
Tensile, (N/mm^2)	38.325	39.425	73.368	74.354	83.392	94.03	199.698	210.08
Yield, (N/mm^2)	29.099	29.88	62.579	65.567	71.682	73.56	182.55	187.56
Elongation (%)	1.10	-	2.53	-	2.20	-	3.40	-
Compressive(N/mm^2)	343.757	347.76	349.649	350.65	390.941	395.69	432.678	435.676
Hardness	57.5	58	71.3	73	62.8	65	79.3	82
Impact (J)	3.0	-	1.0	-	2.3	-	2.0	-

Table 5 Test results of the MMCs sample

V. Micro Structure Analysis

Micro structural examination is carried out only at third sample (Al – 91%, E-glass fibre – 3%, fly ash – 6%) and fourth sample (Al – 88%, E-glass fibre – 3%, fly ash – 9%) composite was subjected to scanning electron microscope. Because in the third sample only was get low hardness strength and % of elongation while increasing the fly ash wt%. The micro structure image magnification was taken at 1500X (10µm) in both samples. From the fourth sample microstructure image the e-glass fibers and fly ash are effectively located at most of them places in the composite sample. Become a third sample the both fly ash and e-glass fibers are located at one are two places in the corresponded composite sample.

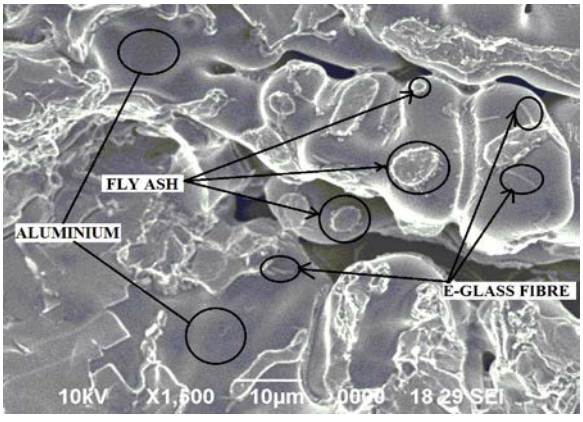

Figure.29 Microstructure image of sample 4 (Aluminium - 88%, E-glass fiber – 3%, Fly ash – 9%)

The microstructure of 9 wt. % sample is clearly shown how the reinforcements are bonded in the aluminium composite such as fly ash and e-glass fiber in the composite sample it was shown in the microstructure image of the 10 µm size is shown in the figure 29. This sample the fly ash wt. % is improved the mechanical properties tensile, yield, % elongation, compressive and hardness strength only the impact strength is decreased. Figure.(30) Micro structure image of sample 3 (Aluminium–91%, E-glass Fiber – 3%, Fly ash – 6%) sample microstructure image the reinforcement E-glass fiber and fly ash are less than the 9 wt. % sample it is shown in the figure 30. So the 6 wt. % sample mechanical properties are tensile, compressive, yield strength and charpoy test (impact strength) increased and the hardness strength and % of elongation only decreased. From the 6 wt. %

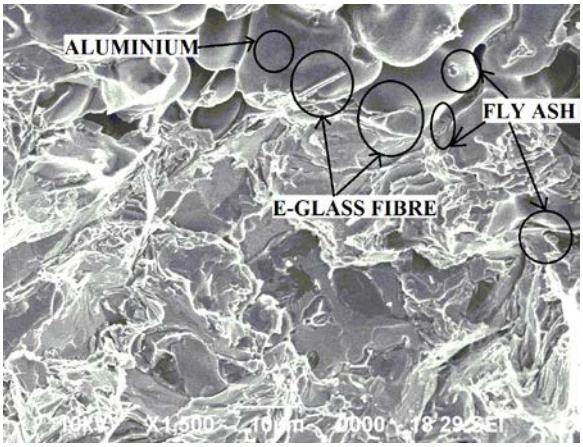

Fig ure. (30) Micro structure image of sample 3 (Aluminium – 91%, E-glass Fibre – 3%, Fly ash – 6%)

VI. CONCLUSION

The amount of E-waste production is globally challenged. In this work the new metal matrix composite was developed by using e-waste aluminium collected from the heat sink. The E-waste contains most valuable metals, non-metals and other particles. The e-waste materials are not recycled properly in the industry during any heating process the E-waste are produces the toxic gasses it was dangerous to the living things. Now the project work focused a innovative think the e-waste materials are added with composite with selected reinforcements for useful work. The e-waste aluminium is used in this as a matrix materials adding with selected reinforcements such as fly ash and e-glass fiber with various weight fraction was successfully fabricated using stir casting method. After the composite sample are subjected to examine the mechanical properties such as tensile, compressive, yield, % of elongation, hardness and toughness strength. From the test result the tensile strength of the four different wt.% composite sample is increased gradually adding with increasing the fly ash wt.% gradually (0,3,6,9 wt.%), the 9 wt.% fly ash sample is get higher tensile strength 199.698 N/mm^2 compared with other samples. The yield strength of the four composite sample was analyzed during the tensile strength test the yield end point of the specimen is called yield strength it was increased adding with increasing the fly ash wt. % gradually, the 9 wt.% of fly ash sample is get higher yield strength 182.55 N/mm^2 compared with other samples. The compressive strength of the four composite sample are increased gradually adding with increasing of fly ash wt.%, the 9 wt.% fly ash sample was get higher compressive strength 432.678 N/mm^2 compared with other samples. The % of elongation of the four composite samples was increased adding with increasing the fly ash wt.%, the 9 wt.% fly ash sample was get higher elongation 3.4% compared with other samples. The hardness of the composite samples was also increased adding with increasing the fly ash wt.%, the 9 wt.% of fly ash samples is get higher hardness strength 79.3 HBN compared with other samples. But only the third sample is get decreased in both hardness and % of elongation compared with second sample the decreasing ratio is 12 % of hardness and 13.04 % of elongation. The toughness strength of the composite sample was studied in impact charpy test was get decreased adding with increasing the fly ash wt.%, the 3 wt.% fly ash sample was suddenly get decreased 1 joule compared with 0 and 6 wt.% fly ash sample. For the above result the 6 and 9 wt. % fly ash sample was subjected to examine the microstructure analysis using scanning electron microscope. From the SEM image of 6 and 9 wt. % fly ash samples the 9 % fly ash sample was having good reinforcement performance in the composite sample. For the 6 wt. % sample is less performance of e-glass fiber and fly ash compared with 9 wt.% fly ash sample. This work is developing the new materials and save earth from the E-waste.

REFERENCES

[1] Dora Siva Prasada, Chintada Shobab, (2014) "Investigations on mechanical properties of aluminiumhybrid composites", Journals of Materials Research and Technology, vol.3 (1), pp: 79 – 85.

[2] Kenneth Kanayo Alaneme, Peter Apata Olubambi, (2013) "Corrosion and wear behavior of A-Mg-Si alloy matrix hybrid composites reinforced with rice husk ash and silicon carbide" Journal of Materials and Research and Technology, vol. 2(1), pp: 60 – 67.

[3] Saravanan.S.D, M.Senthil Kumar, (2013) "Effect of mechanical properties on RHA reinforced aluminium alloy (Al Si 10Mg) material composites" Procedia Engineering, vol.64, pp: 1505 – 1513.

[4] Abhishek Kumar, Shyam Lal, Sudhir Kumar, (2013) "Fabrication and characterization of A359/Al2O3 metal matrix composite using

electromagnetic stir casting method" Journal of Materials Research and Technology, vol. 2(3), pp: 250 – 254.

[5] C.H. Chen, R. Huang, J.K. Wu, C.C. Yang, (2006) "Waste E-glass particles used in Cementitious mixtures" Cement and Concrete Research, vol. 36, pp: 449 – 456.

[6] Prabhakar Kammer, (2012) "Experimental studies on mechanical properties of E-Glass short fibres and fly ash Reinforced AL 7075 Hybrid metal matrix composites" International Journal of Mechanical and Industrial Engineering, vol. 1, pp: 111 – 115 .

[7] Anilkumar. H.C., (2011) "Mechanical properties of fly ash reinforced aluminium alloy (AL6061) composites" International Journal of Mechanical and Materials Engineering, vol. 6(1), pp: 41 – 45 .

[8] Deepak Singla, (2013) "Evaluation of mechanical properties of AL 7075-fly ash composite material" International Journal of Innovative Research in Science, Engineering and Technology, vol. 2(4), pp: 951 – 959.

[9] Sachin Malhotra, Ram Narayan, (2013) "Synthesis and characterization of aluminium 6061 alloy – fly ash & zirconia metal matrix composite" International Journal of Current Engineering and Technology, vol.3(5), pp: 1716 – 1719.

[10] Vivekanandan.P, Arunachalam.V.P, (2013) "The experimental analysis of stir casting method on aluminium-fly ash composites" International Journal of Current Engineering and Technology, vol.3 (1), pp: 215 – 219.

[11] Arun Kumar.M.B, Swamy.R.P (2011) "Evaluation of mechanical properties of AL6061 fly ash and E-glass fibre reinforced hybrid metal matrix composites" ARPN journal of Engineering and Applied Sciences, vol. 6 (5), pp: 40 – 44.

[12] Santhosh Kumar.V. Prajit.R, (2014) "of mechanical properties of AL6061 fly ash reinforced with E-glass fibre composites" IOSR Journal of Mechanical and Civil Engineering, vol. 11 (1), pp: 33 – 39.

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Implementing the User Defined Function to Configure Serial Parameters of the Modbus Based System

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Abstract- Modbus Remote Monitoring and Control usually uses RS-485 and RS-232 transport for collecting data from Modbus slaves using established protocols. Of the two, Modbus RS-485 is more common due to its support for multi-drop communication. In this research the user defined function is analyzed, which can efficiently configure the serial parameters like buadrate, parity and slave address, of the any Modbus slave connected to modbus master in multi-drop network. With this function data switching work can be done in more flexible ways with configurable serial parameters. For better commercial usage of the modbus, the master should efficiently communicate and configure the any modbus slave attached to the multi-drop network. This user defined function is more fast and economical way to configure serial parameters than traditional way which consumes more time and money. It is encouraged the effective use of function in the multi-drop system platforms.

Index Terms- Modbus, Multi-drop networks.

I. INTRODUCTION

A short time ago, analog and purpose built communications systems use to be predominant technologies on industrial plants. It was not common to find either interoperability (Interoperability describes the extent to which systems and devices can exchange data, and interpret that shared data. For two systems to be interoperable, they must be able to exchange data and subsequently present that data such that it can be understood by a user) or compatibility among them. Later communication Networking began to be used in Direct Digital Control. Today MODBUS protocols are used in different industrial system widely, according to a study MODBUS was the world widespread protocol and involved on the control of lots of different kind of industries, including critical infrastructures. The protocol was primarily designed to lay over serial communication protocols so extensive usage of the modbus protocol was on the serial communication networks. Modbus is a protocol that traditionally uses serial communication lines. These serial lines connect the modbus master to modbus slave devices for collecting register and coil information. Modbus over traditional serial networks is still found in many industrial applications. Modbus Remote Monitoring and Control usually uses RS-485 and RS-232 transport for collecting data from Modbus slaves using established protocols. Of the two, Modbus RS-485 is more common than RS-232 due to its support for multi-drop (The term multi-drop describes an interface in which there are several receivers and one transmitter) communication. As being in multi drop network, the modbus master should efficiently communicate and configure the modbus slave attached to it. The good serial communication is determined by the various serial parameter that need to be set for appropriate communication between two nodes e.g. buadrate, slave address and parity. Here the discussed user defined function can efficiently help master to configure the serial parameters like buadrate, parity and slave address, of the any Modbus slave connected to that master in multi-drop network & data switching work can be done in more flexible ways with configurable serial parameters. A Modbus master can communicate with up to 247 Modbus Remote Telemetry Units (RTUs) or Intelligent Electronic Devices (IEDs). It uses a unique Modbus address assigned to each RTU. E.g. Modbus master want to configure the slave who is currently having slave address (0x09) to new slave address (0x05) this will be possible with the user defined function. This user defined function is more fast and economical way to configure serial parameters than traditional way which consumes more time and money, and also the proposed function will not disturb the communication flow means after the correct response is sent by the slave, the slave will restart its system and will get initialized with new serial parameters mentioned in query and further communication will happen according to the new serial parameters requested in the previous query.

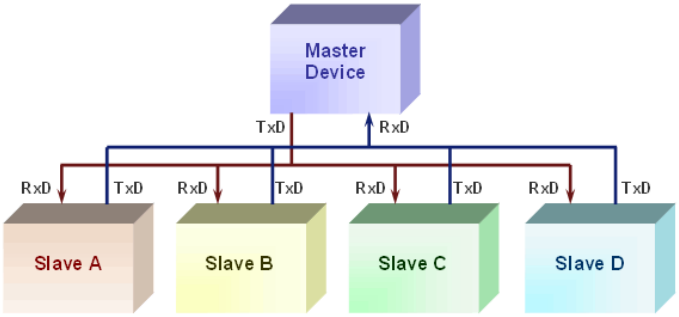

FIGURE 1: Multi-drop network

II. MODBUS PROTOCOL ANALYSIS

MODBUS is the most popular industrial protocol being used today, for good reasons. It is simple, inexpensive, universal and easy to use. The main reasons for the use of Modbus in the industrial environment are, it is developed with industrial applications in mind, openly published and royalty-free, easy to deploy and maintain, moves raw bits or words without placing many restrictions on vendors. Even though MODBUS has been around since the past century early 30 years almost all major industrial instrumentation and automation equipment vendors continue to support it in new products. Although new analyzers,

flow meters and PLCs may have a wireless, Ethernet or field bus interface, MODBUS is still the protocol that most vendors choose to implement in new and old devices. Another advantage of MODBUS is that it can run over virtually all communication media, including twisted pair wires, wireless, fiber optics, Ethernet, telephone modems, cell phones and microwave. This means that a MODBUS connection can be established in a new or existing plant fairly easily. In fact, one growing application for MODBUS is providing digital communications in older plants, using existing twisted pair wiring. OSI reference model is a seven-layer's structure, which can support a strong network communication. When achieving communication between the workshop level in the industrial field, the designer should consider the following factors: First, to constitute a real open interconnection system, how to create and choose the proper network Communications reference model, whether Open Systems Interconnection model meets the conditions of the special status of industry or not, and simplifying it still meets the control network or not. According to different application areas, communication protocols were carried out to integrate and simplify, therefore, data can communicate only requires simple interface. According to the international OSI 7 layer network model, the standard Modbus protocol defines the communication physical layer, link layer and application layer. Physical Layer is the asynchronous serial communication standard of RS232 and RS485; Link Layer provides the number identification based station, master / slave mode of medium access control, Application Layer provides the information specification (or message format) and communication services; There are two communicate modes about Modbus protocol ASCII mode and RTU (Remote Terminal Unit) mode. ASCII mode is a byte of two ASCII characters to send, while RTU mode is in hexadecimal form of data, a byte is one frame, so efficiency of data transmission is more than ASCII mode, the majority of industrial controllers are using RTU mode. In the same network, regardless of the master or slave, must use the same communication patterns and the same transmission rate. At present, commonly transmission rate of Modbus protocol is 1200 bit/s ~19200 bit/s. During communications on a Modbus network, the protocol determines how each controller will know its device address, recognize a message addressed to it, determine the kind of action to be taken, and extract any data or other information contained in the message. Controllers communicate using a master/slave technique where only one device, the master, can initiate transactions or queries. The other devices, slaves, respond by supplying the requested data to the master or by taking the action requested in the query. Typical master devices include host processors and programming panels. Typical slaves include programmable controllers.

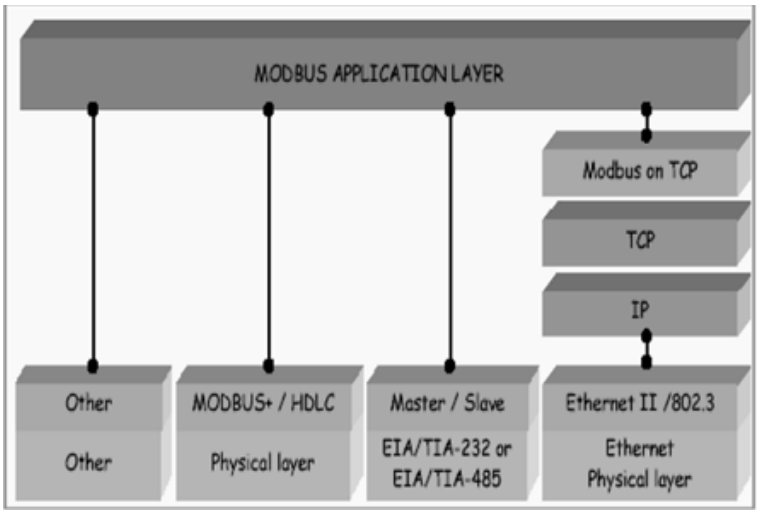

FIGURE2: Modbus Protocol Stack

Reading ASCII and RTU Modbus Devices via RS232, RS422, RS485 or TCP/IP

In Modbus systems, a master or client initiates queries to a slave or server (the measurement device). The slave/server responds either by supplying data or taking an action. Slaves only respond to queries from the master. The Modbus protocol defines two modes of transmission: ASCII and RTU (Remote Terminal Unit). Windmill supports both modes. In ASCII mode each 8-bit byte in a message is sent as two ASCII characters. It allows intervals of up to 1 second between characters, without causing an error. Messages start with a colon and end with a Carriage Return followed by a Linefeed. The advantages of ASCII mode is that it allows intervals of up to a second to occur between characters without causing an error. ASCII mode is only used over serial (RS232, RS422 and RS485) lines.

The RTU mode uses binary coding. Each 8-bit byte in a message contains two 4-bit hexadecimal characters. Greater character density allows better data throughput than ASCII for the same baud rate. Each message is transmitted in a continuous stream. The final part of a serial RTU message is a cyclic redundancy check, CRC. This calculates its value based on all earlier bytes in the message, it then adds its 2 bytes into the message. The computer therefore knows when it has received a corrupted message and can ask the instrument to resend its data. RTU mode is used over serial and network (TCP/IP) lines

III. USING MODBUS PROTOCOL IN SERIAL LINE

Modbus Serial protocol messages are transmitted between a master and slave devices over serial lines using the ASCII or RTU transmission modes.

The messages have three components:
(i) Slave address.
(ii) Modbus application protocol data unit (PDU).
(iii) An error checking field. (CRC or LRC)

The slave address in a request message identifies the recipient; the corresponding address in a response message

identifies the responding slave. A unicast message has an address in the [1, 247] range that identifies an individual slave. A broadcast message uses a slave address of zero. Values in the [248, 255] range are reserved addresses. The Modbus PDU has two fields, a one-byte function code and function parameters (maximum 252 bytes). The function code field in a request message specifies the operation requested by the master; the corresponding field in the response message is used to convey status information to the master (e.g., error information when an exception occurs in the slave device). The function parameters field contains data pertaining to functions invocation (request messages) or function results (response messages). Modbus function codes specify read and write operations on slaves, diagnostic functions and error conditions.

Modbus has three types of function codes:

A] Public codes,

B] User defined codes

C] Reserved codes.

Public codes correspond to functions whose semantics are completely defined in the Modbus standard. Valid public codes fall in the noncontiguous ranges: [1, 64], [73, 99] and [111, 127]. User-defined codes in the [65, 72] and [100, 110] ranges are not considered in the Modbus standard; their implementations are left to vendors. Reserved function codes are public codes that may be used to ensure compatibility with legacy systems. Function code values in the unused range [128, 255] indicate error conditions in response messages. Response messages have the same structure as request messages. The Modbus specification defines positive and negative responses to request messages. A positive response informs the master that the slave has successfully performed the requested action; in this case, the function code of the request message is included in the response message. A negative or exception response notifies the master that the transaction could not be performed by the addressed slave. The function code for a negative response is computed by adding 128 to the function code of the request message; thus, function codes in the [128, 255] range denote error conditions. A negative response also includes an exception code as a function parameter, which provides information about the cause of the error. The Modbus specification defines nine exception responses whose format and content depend on the issuing entity and the type of event producing the exception.

Reading ASCII and RTU Modbus Devices via RS232, RS422, RS485 or TCP/IP

In Modbus systems, a master or client initiates queries to a slave or server (the measurement device). The slave/server responds either by supplying data or taking an action. Slaves only respond to queries from the master. The Modbus protocol defines two modes of transmission: ASCII and RTU (Remote Terminal Unit). Windmill supports both modes. In ASCII mode each 8-bit byte in a message is sent as two ASCII characters. It allows intervals of up to 1 second between characters, without causing an error. Messages start with a colon and end with a Carriage Return followed by a Linefeed. The advantages of ASCII mode is that it allows intervals of up to a second to occur between characters without causing an error. ASCII mode is only used over serial (RS232, RS422 and RS485) lines.

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Modbus messages sent over Serial Lines: RS232, RS422 and RS485

Each message comprises four parts: device address, function code, data, and error check. The Device or Slave Address identifies your instrument. It contains one byte of information. In ASCII it is coded with two hexadecimal characters, in RTU with one byte. Valid addresses are between 0 and 247. The Function Code specifies the type of message. It contains one byte of information. In ASCII it is coded with two hexadecimal characters, in RTU with one byte.

Modbus RS-232 Allows Concurrent, Two-Way Flow of Data.

Modbus via RS-232 sends data in the form of time-series of bits. It is a standard for communication between data terminal and data circuit termination equipment. Transmission (Tx) and receipt (Rx) for data occurs on different circuits when using Modbus RS-232 lines. That means that data is able to flow both ways at the same time.

Modbus RS-485 Indicates Values Using Differences in Voltage.

RS-485 is similar, but distinct, from RS-232. The two wires, multipoint connection communicates data by indicating values by sending different voltages across the two wires. These differences between these voltages are related to one and zero values, which make up the Modbus RS-485 communications.

Modbus Com Port Settings

ASCII

Start Bit=1

Data Bits=7

If Parity is even or off then Stop Bits = 1

If Parity is none then Stop Bits = 2

RTU

Start Bit = 1

Data Bits=8,

If Parity is even or off then Stop Bits = 1

If Parity is none then Stop Bits = 2

4. Parsing User Defined function

Modbus function codes are in the range 1-127 (decimal), as 129(1+128)- 255(127+128) represents the range of error codes.

Public

Are guaranteed to be unique and specify well defined

functions that are publicly documented. These are validated by the community and a conformance test exists.

User-Defined

Are available for user-defined functions, thus their codes might not be unique. The specification defines the code ranges 65-72 and 100-110 for user-defined functions.

Reserved

These are currently used by some companies for legacy products and are not available for public use (these are not discussed any further in the specification).

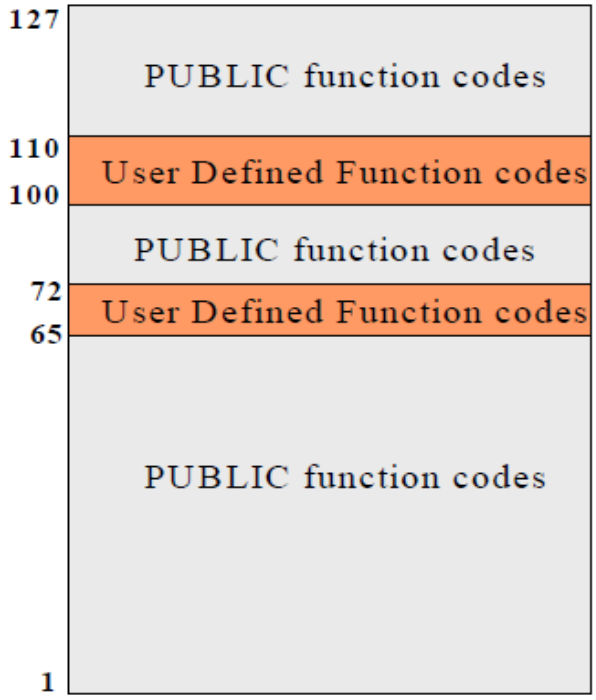

FIGURE 3: Modbus Function Code Categories

There are two ranges of user-defined function codes, i.e. 65 to 72 and from 100 to110 decimal. User can select and implement a function code that is not supported by the specification. There is no guarantee that the use of the selected function code will be unique if the user wants to re-position the functionality as a public function code, he must initiate an RFC (RESERVED FUNCTION CODE) to introduce the change into the public category and to have a new public function code assigned. MODBUS Organization, Inc expressly reserves the right to develop the proposed RFC.

This user defined function is intended to be similar as the Write Multiple holding register which writes particular values in particular values of the holding register. When Slave processes the query of this user defined function code, it sends the proper response to the requested query first then it restarts the system with new mentioned serial parameter.

E.g. If master wants to communicate with slave currently having the slave Id 0x09 and current buadrate 19200 (0x4B00) and parity none (0x00), but master wants to change this slave address to 0x05 with new buadrate 9600 (0x2580) and to new parity Odd (0x02). (None – 0x00, Even – 0x01, Odd-x02). Then Function Code is 100 (0x64) then PDU of Proposed User defined query will looks like:

REQUEST QUERY

SLAVE ID	0x09
FUNCTION CODE	0x64
NEW SLAVE ID	0x05
BUAD RATE HIGH	0x25
BUAD RATE LOW	0x80
NEW PARITY	0x02
CRC HIGH	0xE7
CRC LOW	0x98

RESPONSE Form Slave

SLAVE ID	0x09
FUNCTION CODE	0x64
NEW SLAVE ID	0x05
BUAD RATE HIGH	0x25
BUAD RATE LOW	0x80
NEW PARITY	0x02
CRC HIGH	0xE7
CRC LOW	0x98

After the correct response is sent by the slave, this slave will restart its system and will get initialized with new serial parameters mentioned in query and further communication will happen in that manner.

IV. CONCLUSION

MODBUS is popular serial communication protocol widely accepted over all Industrial sectors and enormously used in world. In Multi-Drop networks it is very necessary to manage network attributes within less time and with cost-effective manners. This user defined function is reliable approach, which can efficiently configure the serial parameters like buadrate, parity and slave address, of the any Modbus slave connected to Modbus master in multi-drop network & data switching work can be done in more flexible ways with configurable serial parameters and it is more fast and economical way to configure serial parameters than traditional way which consumes more time and money. For better commercial usage of the modbus it is encouraged the effective use of function in the multi-drop system platforms.

REFERENCES

[1] Thomas H. Morris, Bryan A. Jones, Rayford B. Vaughn, Yoginder S. Dandass ”Deterministic Intrusion Detection Rules for MODBUS Protocols” IEEE 2012.

[2] Javier Jiménez Díaz, Robert Vandenbrink “Using SNORT for intrusion detection in MODBUS TCP/IP communications” December 7th, 2011.

[3] Caswell, B. Bealeand, J., Foster, J. and Faircloth, J. “Snort2.0 Intrusion Detection,” Syngress, Feb. 2003.

[4] Peterson, D. "Quickdraw: Generating Security LogEvents for Legacy SCADA and Control System Devices," Conference for Homeland Security, 2009.CATCH '09. Cybersecurity Applications & Technology, pp.227-229, 3-4

[5] "SCADA Network Insecurity: Securing Critical Infrastructures through SCADA Security Exploitation" Giovanni A. Cagalaban, Yohwan So, Seoksoo Kim. 2009

[6] "The Use of Attack Trees in Assessing Vulnerabilities in SCADA Systems" Eric J. Byres, Matthew Franz and Darrin Miller 2005

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Developing safety system for monitoring seat belt and controlling speed accordingly to avoid fatal injuries

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Abstract- Major causes of death in road accidents are carelessness in safety while driving. In 2012, more than half of all people who died on Utah's roadways weren't buckled [1]. Hence wearing seat belts might have reduced serious crash-related injuries and saved life.
Hence "Driver Assistive Safety System" (DASS) comprises of techniques which inculcate the mandatory safety precautions via alarm, visual indicator, ignition and speed control. This paper describes safety system which ensures that the driver and co-passenger wear safety seat belt while driving a car. The driver assistive safety system works on 'ignition interlocking" and "speed control" concept.

Index Terms: Driver assistive system, Ignition interlocking, Mandatory seat belt; System to avoid major injuries using seat belt;

I. Introduction

Research in the UK [2] has shown that wearing a seat belt reduces the risk of fatal injury to front seat passenger car occupants by 45%, and risk of moderate-to-critical injury by 50%. However as per Ontario Ministry of transportation [3], seatbelts are not required for the passengers engaged in work that requires them to exit from and re-enter the vehicle at frequent intervals (must travel less than 40kmph). Hence this paper includes city mode option which restricts the car at predefined minimum speed if person is not wearing seat belt.

TABLE 1: PROTECTION BY SEATBELTS [4]

Vehicle	Occupant	Protection Device	Effectiveness in Preventing Fatalities
Car	Driver	Lap/ shoulder belt	42 +/- 4%
Car	Right front passenger	Lap/ shoulder belt	39 +/- 4%
Car	Left rear passenger	Lap belt	19 +/- 10%
Car	Right rear passenger	Lap belt	17 +/- 9%

Despite of laws on the use of seat belts, a lot of people don't like wearing them due to various reasons. Following are the common reasons:

- Drivers and passengers think that wearing a seat belt is not that important, especially when driving in short distances or when the traffic is visibly light.
- Tends to forget to wear them, especially when they are on the rush.
- People don't make it a habit to wear seat belts.

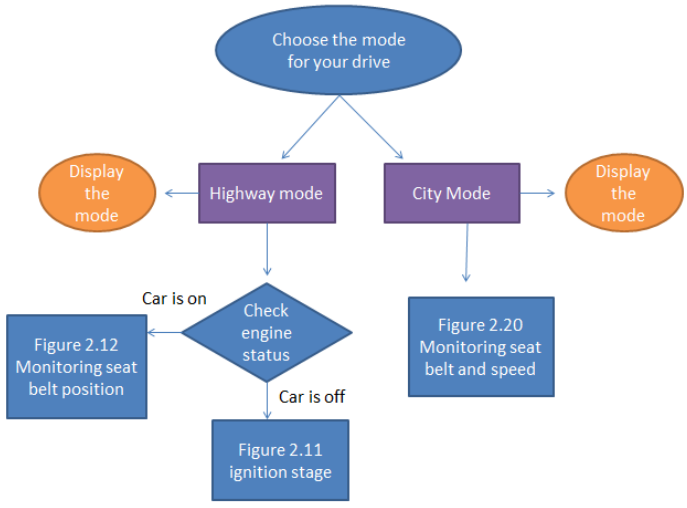
II. METHODOLOGY:

Impact force when car collides is given by:

$$F_{avg} = m*v^2/(2*d)$$

Where, F_{avg}: Impact force, m: Mass of vehicle, v: Velocity of vehicle, d: stopping distance

If seat belt is buckled up than the stopping distance of driver would be extended to amount of stretch of belt. Hence this would reduce the impact force.



At the beginning when passenger or driver enters the car, DASS asks to choose the mode. It would respond as per flow chart prescribed in figure 2.01
Figure 2.01: Flow chart for mode selection and execution

Inputs:
The whole DASS would be working on the DASS circuit shown in figure 2.02. Inputs to Arduino ATmega2560 microcontroller would be from load cell, photoresistor sensor and wheel speed sensor. After processing the inputs as shown in flow charts microcontroller would give different outputs. Microcontroller would be controlling and giving outputs to devices.

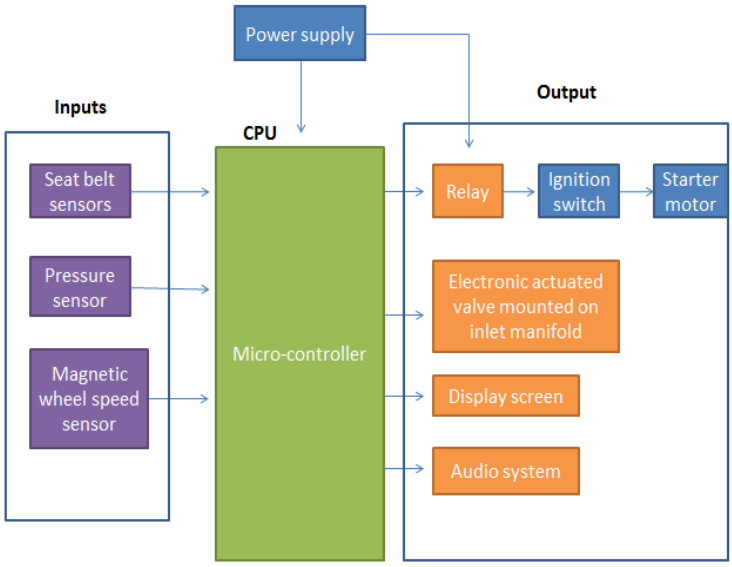
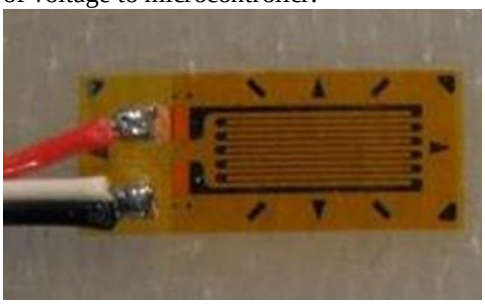
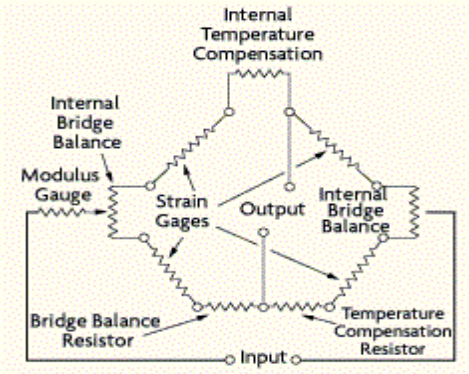


Figure 2.02: circuit of DASS

Figure 2.03 shows load cell. It is mounted below seat linings. Presence of co-passenger/s would give electric signal in form of voltage to microcontroller.



(a)



(b)

Figure 2.03: (a) load cell[6], (b) Wheatstone Circuit[7]

As shown in figure 2.04 wheel speed sensor would give speed of vehicle by calculating r.p.m of the wheel. For detecting whether seat belt is installed or not, photoresistor is placed. When person buckle up the seat belt, output is high, otherwise it is low. LEDs are installed in every circuit wherever sensor gives feedback. So it became easy to trace the faults.

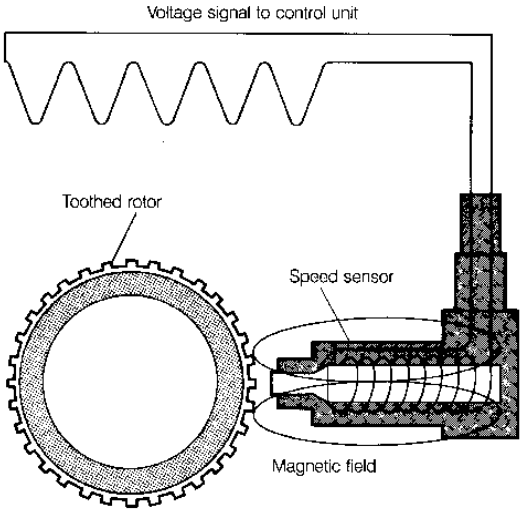


Figure 2.04: Wheel speed sensor [8]

Outputs
Electronic actuated motorized valve mounted on inlet manifold would be used to control the flow by quality or quantity governing. The microcontroller would be receiving feedback from different sensors. Other output devices are display screen and audio system.

2.1 HIGHWAY MODE:

System only allows car to get started if driver and co-passenger (if present) buckle up the seat belt in highway mode.

Figure 2.11 displays the flow chart of Highway mode when the engine is off. Initially the ignition circuit would remain open. The connection between starter motor and battery would be connected by relay which would idly keep circuit open. Relay would be operated by microcontroller. Microcontroller would be getting various inputs and would process as per flow chart shown in Figure 2.11. Driver would be only able to start the car if he/she and co-passengers (if present) wears seat belt.

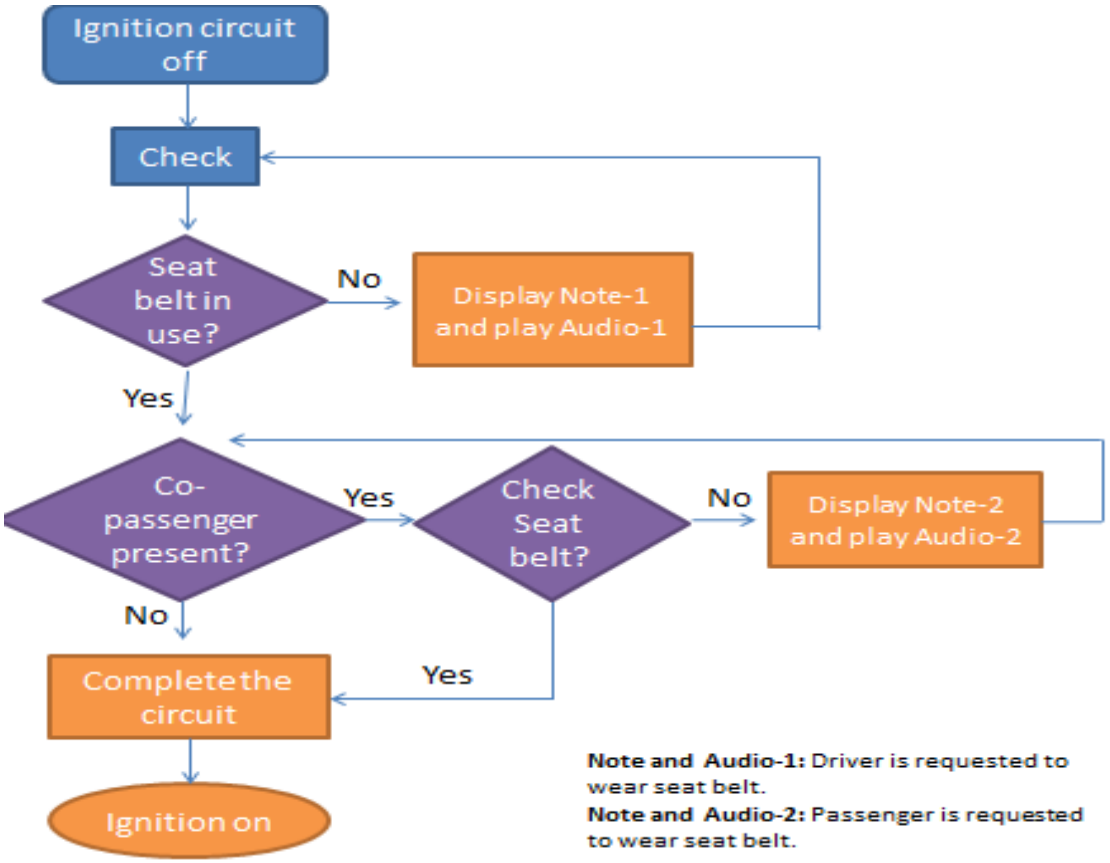


Figure 2.11: Flow chart of Highway mode when engine is off

To check the seat belt during running condition, DASS follows the flow chart as shown in figure 2.12. If they unbuckle the seat belt, DASS would alert driver through display screen and audio system. A timer of 60 seconds would be provided in which driver or co-passenger or both have to buckle up their seat belt. Failure to do so would result into limiting car's speed to specified speed of 20 km/hr [5] if found above it. The speed would be limited by actuating valve mounted on inlet manifold. Microcontroller would be getting feedback from speed sensor. Parking light would alert the surrounding vehicle about slowing down of car. Though driver tries to accelerate the car, motorized valve will automatically adjust the quality and quantity of fuel to keep car within limit.

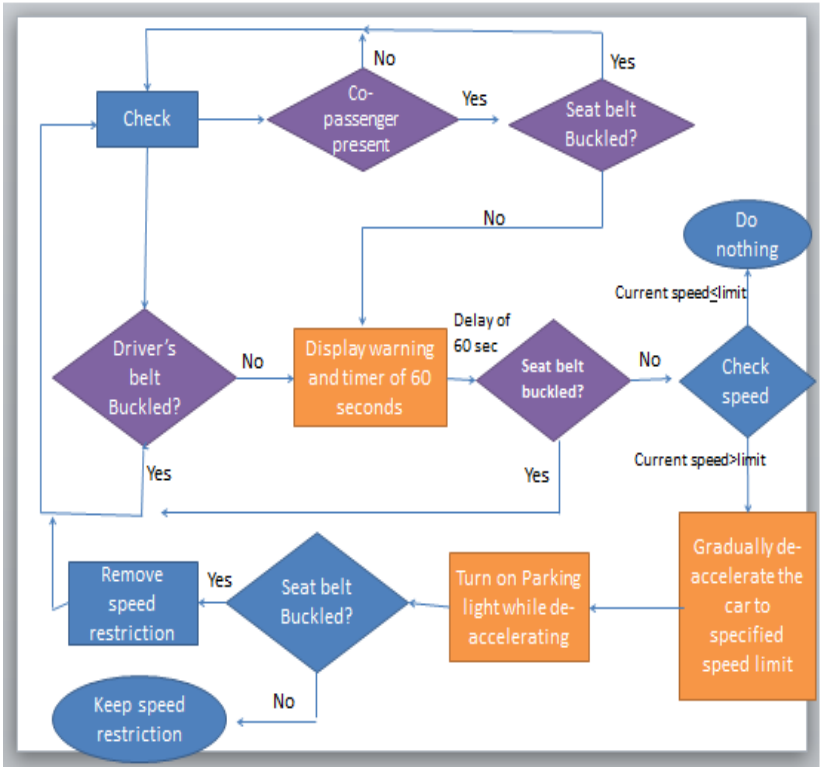


Figure 2.12: Flow chart during ignition stage

2.2 CITY MODE

In some case person have to travel short distance or have to frequently enter and exit the car, or travel in traffic areas. In the entire situation car is driven slowly. A study suggests [5] arm resisted motion reduces injuries of occupant rather than seat belt at low speed (20km/hr). Hence seat belt is not required at low speed. So Driver Assistive Safety System provides city mode.

City mode system limits the speed of the car to specified speed of 20 km/hr by controlling quality and quantity of fuel into engine. It allows car to start without buckling seat belt. Driver can shift to highway mode by buckling up the seat belt any time.

As shown in figure 2.20, microcontroller processes the signals. If passenger wish to speed up the car than he can put on the seat belt and highway mode option gets activated on the screen. So he can choose it and would be directed in highway mode.

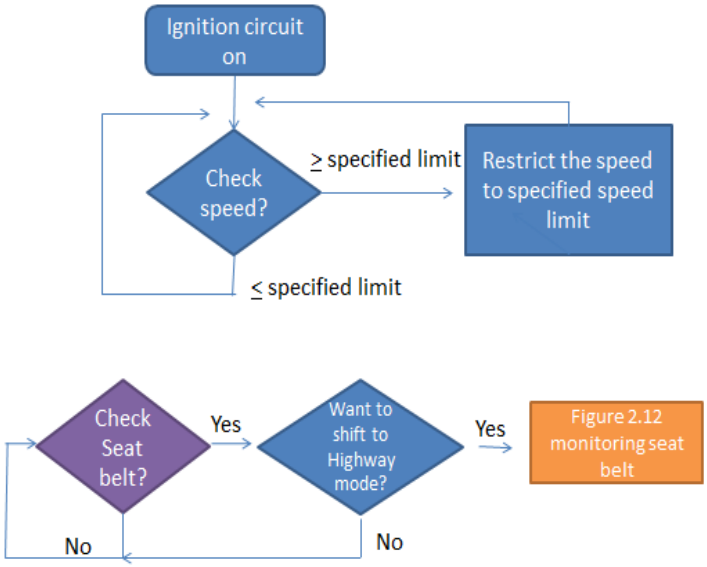


Figure 2.20: Flow chart of city mode

IV. ADVANTAGES:

- DASS can be installed in any existing car without making major changes.
- DASS consists of two modes which give flexibility to the driver and also overcomes few reasons of not wearing seat belt.
- DASS has warning system which alerts driver and give 60 seconds before taking any action. Hence it gives time to driver to take decision and doesn't abruptly takeover the control.
- While decelerating it switches on parking lights which indicate that car will be slowing down, hence would alert surrounding vehicles.
- It has continuously monitoring system, that monitor the conditions of seat belt, even during drive.
- It has the ability to shift between two modes.
- Apart from visual display, it also interacts through voice messages.
- System consists of troubleshooting, which displays the instructions and have backup for any failure.
- System is very simple and economical. It can be incorporated in any car.

V. CONCLUSION:

Seat belt as a safety feature reduces chances of major injuries or even loss of life in an accident, hence to make sure that people wear seat belt; Driver Assistive Safety System has been proposed. Considering type of traffic prone to accident, two mode of Driver Assistive Safety System have been devised.

VI. FUTURE SCOPE

ECU can be directly programmed replacing microcontroller in newly developed car which would further make system economical by removing requirement of motorized valve

REFERENCES:

[1] Statistics of Utah's roadway accident. http://ut.zerofatalities.com/prevention_buckling.php

[2] Article showing that seat belt reduces fatal injuries. http://timesofindia.indiatimes.com/india/Gopinath-Munde-Gopinath-Mundes-death-rear-seat-belts-Harsh-Vardhan/articleshow/36069870.cms? As per TOI article published on Jun 5, 2014.

[3] Ontario Ministry of transportation rules. http://www.mto.gov.on.ca/english/safety/safe-driving-practices.shtml

[4] Leonard Evans, "The Science of Traffic Safety", The Physics Teacher 26, October 1988, Page 431, Table I.

[5] Yongchul Kim, Chulhue Park, Youngil Youm, Sungchul Choi, Sungjun Han, Hanil Bae "BIOMECHANICAL MODEL OF HUMAN-LIKE ARM FOR A CRASH TEST"

[6] Image of load cell. http://engineeringsport.co.uk/2012/08/16/how-does-a-smart-floor-work/

[7] Image of load cell. http://www.omega.com/literature/transactions/volume3/load.html

[8] Image of speed sensor, http://picsant.com/314073083-magnetic-speed-sensors.html

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Spatial Evaluation of Pond Water Quality Using Gis: A Study from Athiyannoor Block Panchayath, Thiruvananthapuram, Kerala, India

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Abstract- Ponds play many vital roles in maintaining the hydro geological equilibrium of an area. In the present investigation, an attempt has been made to determine the water quality of Athiyannoor Block Panchayath by using GIS techniques and water quality index method. A total of thirteen parameters were analyzed of which nine were considered for calculating the WQI. Water Quality Index has been proved to be a useful technique for the overall assessment of the water quality of a water body. In this study, GIS was employed for obtaining the geospatial data of the study area with respect to the themes, Drainage, DEM, TIN and Relative Relief which in turn have significant implications on the water quality of the ponds. Site specific action plans has also been suggested for this study, which ensure the protection and conservation of these small water bodies.

Index Terms- GIS, Water quality, Physico-chemical parameters, Water Quality Index(WQI)

I. INTRODUCTION

The global water demand has increased tremendously in recent years, and ponds are one of the most reliable and economical sources of water. Ponds play a dual role of storing water on the surface and transmitting water to the subsurface, thus rejuvenating the surface and subsurface water environments in terms of quantity and quality. However pond may have been natural water sources exploited by man at different time to meet different needs or may have been created for a multitude of different purposes (Rajagopal et al., 2010). The present study proposes to determine the spatial variation in pond water quality of Athiyannoor Block Panchayath by using GIS techniques and water quality index method. Geographic Information System (GIS) has emerged as an effective tool for monitoring and the management of water quality and it also serves as a tool in delineating the water quality. Water Quality Index or WQI aim at giving a single value to the water quality of a source, reducing great amount of parameters in to a simpler expression and enabling easy interpretation of monitoring data (Singh et al. 2013). The quality of water may be described according to their physicochemical characteristics. The water quality was assessed and compared with the drinking water quality standards (BIS, 1992) to identify areas for potential pollution sources based on the WQI.

II. STUDY AREA

The study area selected for the present investigation is Athiyannoor Block Panchayath of Thiruvananthapuram district which is situated at 8^o 30' to 8^o 15' North latitude and 76^o 52' 30" to 77^o 7'30" East longitude, Kerala. A location map of the study area is shown in Figure 1. Drainage of this study area constitutes Neyyar River and its tributaries.

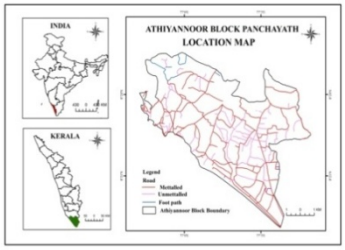

Figure 1: Location map of the study area

III. MATERIALS AND METHODS

Spatial analysis part of the study included generation of specific thematic maps of the study area using GIS. The materials used for the derivation were Survey of India Topographic sheets of No: 58H/3/NW, (1989-1990) of 1:25,000 scale. The software used for the processing was Arc GIS of version 9.3. The raster data was interpreted and digitized to generate the thematic maps of administrative boundary, transportation, drainage, DEM, TIN, etc.

The samples were collected from thirty seven ponds in Athiyannoor Block Panchayath. A map depicting the location of the water sampling sites is given as Figure 2. The sampling and analysis of various physico-chemical attributes were done following the standard procedures as detailed in APHA (1995) and by Trivedy and Goel (1984). WQI is a superior way for understanding water quality issues by integrating complex data and generating a score, which ultimately describes the water quality status (Tiwari et al., 1985, Singh, 1992, Rao, 1997, Mishra et al., 2001). Relative weight of physic-chemical parameters is shown in Table 1. WQI was calculated using the expression, WQI = $\sum_{i=0}^{n} Wiqi$. Water quality category, was determined on the basis of water quality index

Table 1: Relative weight of physic-chemical parameters

Parameter	Standard (BIS, 1992)	Weight (Wi)	Relative weight ($wi/\sum_{i=1}^{n} wi$)
pH	6.5-8.5	1	0.028
DO	5	1	0.028
TDS	500	3	0.085
Na	200	5	0.142
TH	300	5	0.142
Ca	75	5	0.142
Mg	50	5	0.142
Cl	250	5	0.142
K	200	5	0.142

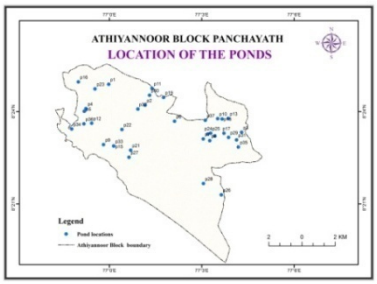

Figure 2. Location of sampling site

IV. RESULTS AND DISCUSSION

The present study assessed the spatial and hydrological variables in the study area.

Spatial Analysis:

In the present study DEM, TIN and Relative Relief is used to extract a wide variety of landscape features, conventionally associated with drainage and hydrological applications. TIN (figure 3) is a method of constructing surface from a set of irregularly space data points. In the present study area the elevation ranges from 10 to 90m. The DEM (Figure 4) generation is very useful for obtaining height information of the area. The highest points are identified on the Eastern and North Western part of the study area viz. Kanjiramkulam and Venganoor respectively. The relative relief (Figure 5) of this region gives a clear picture of nature and extent of local relief. In the study area, five relative relief classes were identified and high and Low relief of >40 and <25 respectively were also reported.

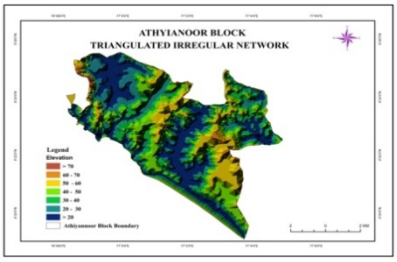

Figure 3: TIN of the study area

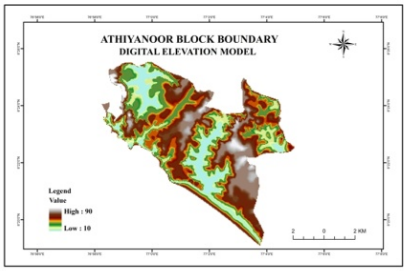

Figure 4: DEM of the study area

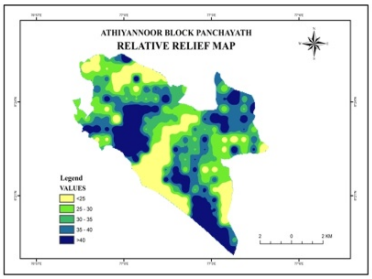

Figure 5: Relative Relief of the study area

Water quality

The study analysed variations in physico-chemical characteristics with respect to the following parameters the results of which are discussed below.

pH

In this study pH values were found in the range from 4.51 to 7.70. pH lower than 4 produce sour taste and higher value above 8.5, a bitter taste. This may be due to the enhancement of microbial activity, causing excessive production of CO_2 and reduced pH. The pH affects most of the biological processes and biochemical reactions in water body (Arya et al., 2011a, b).

Electrical Conductivity

In the present study area, the maximum value of EC 517 µS /cm was found in pond P9 and minimum was found in pond P14. The pond P9 (517.7 µS), P36(260 µS), P34(313 µS), P37(279 µS) is deviating from the standards (225 µS /cm) prescribed for drinking Water Quality (BIS, IS-10500, FAO) and other ponds within the permissible limit. It may be due to the presence of low amount of minerals. A sudden increase in conductivity indicates addition of some pollutants to it (Trivedy and Goel, 1984).

Total Dissolved Solids

The TDS concentration in the present study area ranged from 25.44 (P 25) – 486.8 (P 9) mg/L. The permissible value recommended for TDS is 500 mg/1 prescribed by IS 10500 and BIS, FAO. All ponds are observed within the permissible limit. The pond P9 (486.8) shown very high TDS. Most pond water samples are observed in low TDS so it indicates the water is less mineralized and comparatively contains lesser pollutants.

Dissolved Oxygen

Measurement of dissolved oxygen is a primary parameter in all pollution studies. The minimum DO was recorded as 0.62mg/L in the pond P9 and the maximum was recorded as 10.96 in the pond P37. The permissible value recommended for DO is 5mg/L as per Indian standard. Low value of DO is observed due to the high rate of oxygen consumption by oxidisable matter. In the present study, most of the ponds shows high DO which may be due to the increased solubility of oxygen at lower temperature.

Salinity

The NaCl concentrations in the study area ranges between 27.99 (p14) to 260.5 (P9) ppm which are well within the drinking water quality standards.

Temperature

Temperature is one of the most important factors in the aquatic environment (Dwivedi et.al, 2002). The temperature variation in the study area ranges between 26.5^{o}C (P18) and 29.6^{o}C (P28).

Sodium and Potassium

Na and K concentration varied from 2(P26) to 67(P33) mg/L and 0 to 10mg/L respectively. The maximum value was observed in pond P28. The present study indicates that the Na and K values are within the permissible limit (200mg/L) as per Indian standards.

Chloride

In the concentration of chloride ranges from 6.75 (P6) to 42.6(P34) ppm. 250 mg/1 being the desirable limit for chlorides, concentration greater impart a salty taste to water.

Total Hardness

Hardness concentration values ranged from 15 to 105 ppm. The maximum value was observed in the pond P9. The minimum concentrations were observed in the ponds P6, P7, P14, P11, P15. Hence in the study area, pond water is considered as moderately soft water. According to the APHA (1998), the desirable limit for total hardness is 300 mg/l.

Calcium and Magnesium

Ca and Mg values varied from 0 to 28.6 ppm and 0 to 10.89ppm. Magnesium is often associated with calcium in all kind of water, but it's concentration remain generally lower than the calcium (Venkatasubramani et al., 2007).

Alkalinity

The permissible value of alkalinity as recommended by the Indian standards is 250 mg/L as $CaCo_3$. In the study area, alkalinity varied from10 (p22) to 100 (P9) mg/L.

Water quality index

In this study, the water quality index of pond water samples are found in the range of 3.86 to 38.11. This shows that almost 91% of water sample is belonging to excellent category whereas the rest falls in good category (ie. P10, P34, P37). Different levels of Water quality index and their respective water quality status are shown in Table 2. . WQI classification for individual sample (Table 3) is categorized by using this expression. As per the water quality rating, the status of water body is suitable for the human use since it falls under excellent to good conditions. However, the three ponds which do not fall in the excellent category (P37, P34, and P9) undoubtedly has issues as far as certain parameters are concerned. The values of parameters, pH (figure 6), DO (figure 7) and EC (figure 8) found to be exceeding the limits prescribed for drinking water standards (BIS, 1992). Hence the study identifies three critically polluted sites in the study area viz. Pond, 39, 34 and 9, the reason for which can be attributed to high inhabitation and human influences such as disposal of wastes, washing of clothes and cattles by the local people.

Table 2: Water Quality Index (WQI) and water quality status

WQI	Water Quality Status
0-25	Excellent water quality
26-50	Good water quality
51-75	Poor water quality
76-100	Very poor water quality
>100	Unfit for drinking

Table 3: WQI of pond water samples in Athiyannoor Block

Pond no	WQI index	Status
P1	13.95	Excellent
P2	15.98	Excellent
P3	12.72	Excellent
P4	13.94	Excellent
P5	16.61	Excellent
P6	6.26	Excellent
P7	6.47	Excellent
P8	10.82	Excellent
P9	38.11	Good
P10	11.15	Excellent
P11	14.67	Excellent
P12	18.58	Excellent
P13	8.50	Excellent
P14	3.86	Excellent
P15	5.66	Excellent
P16	20.58	Excellent
P17	10.34	Excellent
P18	13.91	Excellent
P19	17.40	Excellent
P20	7.88	Excellent
P21	8.40	Excellent
P22	15.11	Excellent
P23	16.88	Excellent
P24	13.27	Excellent
P25	5.06	Excellent
P26	13.41	Excellent
P27	18.32	Excellent
P28	22.06	Excellent
P29	12.82	Excellent
P30	9.79	Excellent
P31	16.17	Excellent
P32	11.91	Excellent
P33	20.25	Excellent
P34	30.77	Good
P35	11.03	Excellent
P36	25.56	Excellent
P37	29.01	Good

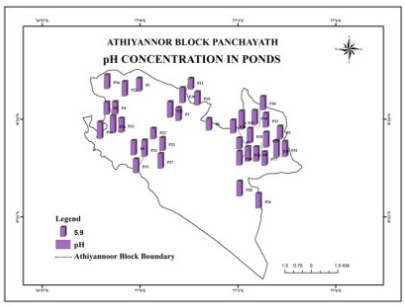

Figure 6: pH variation in the study area

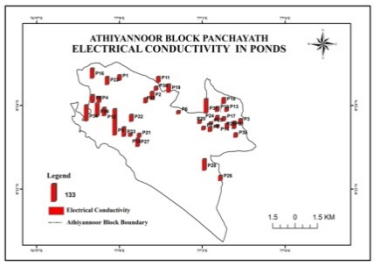

Figure 7: EC variation in the study area

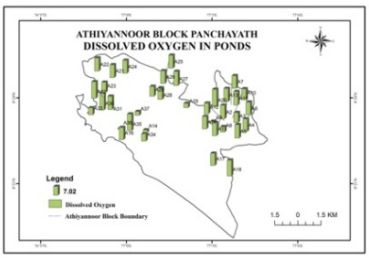

Figure 8: DO variation in the study area

V. CONCLUSION

In this study GIS was employed for obtaining the geospatial data of the study area viz. Drainage, DEM, TIN and Relative Relief which in turn have significant implications on the water quality of the ponds in the study area. The present findings indicate that water quality of the majority ponds in Athiyannoor Block are in excellent condition and hence suitable for drinking and domestic purposes. Stringent rejuvenation and reconstruction methods need to be adopted for the said sites since these are used as domestic sources of drinking water. The study has thus proved the application of Water Quality Index as a useful technique for the overall assessment of the water quality of a water body.

REFERENCES

[1] APHA, "Standard Methods for the Examination of water and wastewater", American Public Health Association, Washington D. C., 1000p, 1998.

[2] BIS, "Indian standard specification for drinking water", BIS 10500, 1992.

[3] P.C. Mishra and R.K Patel, "Study of the pollution load in the drinking water of Rairangpur, a small tribal dominated town of North Orissa", Indian J. Environment and Ecoplanning, 5(2): 293-298, 2001.

[4] T.Rajagopal, A.Thangamani, S.P.Sevarkodiyone, Sekar M. and G. Archunan ," Zooplankton diversity and physicochemical conditions in three perennial ponds of Virudhunagar district, Tamilnadu", Journal of Environmental Biology 31:265-272, 2010

[5] N.S Rao, "Studies on Water Quality Index in Hard rock Terrain of Guntur District, Andhra Pradesh, India", National Seminar on Hydrogeology of Precambrian Terrains and Hard Rocks Areas, Dharwad, 129-134, 1997.

[6] D.F Singh, "Studies on the water quality index of some major rivers of Pune, Maharashtra" Proceedings of the Academy of Environmental Biol., 1(1), 61-66, 1992.

[7] P.K. Singh, A.K. Tiwari and M.K.Mahato, "Qualitative assessment of surface water of west Bokaro Coalfield, Jharkhand by using Water Quality Index method" Inter National journal of chem. Tech Research, 5(5), 2013.

[8] T.N. Tiwari, and M.A. Mishra, "A preliminary assignment of water quality index of major Indian rivers", Indian J. Environmental Protection, 5: 276-279, 1985.

[9] A.K. Trivedy and P.K. Goel, "Chemical and Biological methods for pollution studies". Environmental studies, Karad, India, 1984.

[10] R.Venkatasubramani and T.Meenambal, "study of subsurface water quality in mattupalayam Taluk of Coimbatore district Tamil Nadu", Nat. Environ. Poll. Tech 6,307-310. 2007

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Simple and efficient esterification reaction catalyzed by Zinc chloride ($ZnCl_2$)

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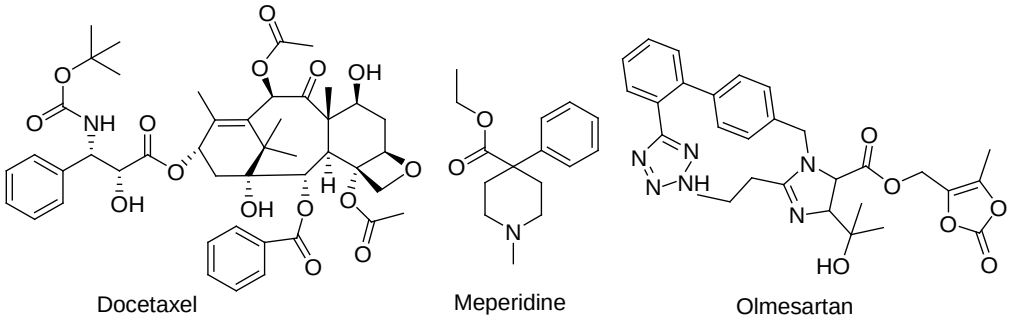
Abstract- A simple and efficient method is developed for the synthesis of phenyl benzoates (esters) by the condensation of various carboxylic acids with substituted phenols in the presence of anhydrous $ZnCl_2$ in $POCl_3$ .This Lewis acid catalyzed esterification reaction gives good to excellent yields of the corresponding phenolic esters.

Index Terms- Aromatic carboxylic acids, Phenols, Lewis acid, $POCl_3$ and Phenyl benzoates.

I. INTRODUCTION

The esterification reaction is one of the most fundamental organic transformations, and more environmentally benign alternative approaches to those currently used by the chemical industry are in strong demand.[1] The ester moiety is an important functional group that has found wide occurrences in polymers, pharmaceutical agents and biologically relevant natural products (**fig-1**), but are also used as protecting groups in synthesis.[2,3]

Fig-1: Representative biologically active molecules.

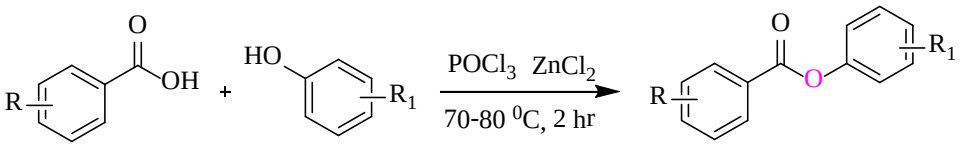


The carboxylic group can be converted to corresponding ester by reacting it with an alcohol in the presence of various homogeneous as well as heterogeneous catalysts. These subsumes conc. H_2SO_4, HCl, $SOCl_2$,[4] alkylchloroformate and Et_3N,[5] $C_6H_5OP(O)Cl_2$,[6] DCC and aminopyridine,[7] $SiO_2/NaHSO_4$,[8] amberlyst-15,[9] USY-zeolites,[10] MoO_3/ZrO_2,[11] $MgSO_4/H_2SO_4$,[12] salycilic resin/$FeCl_3$,[13] SiO_2,[14] celite/CsF,[15] dowex 50WX2,[16] β-zeolite,[17] Kaolinite clay,[18] H_3PO_4/TiO_2-ZrO_2,[19] etc. Besides the practical utility of heterogeneous catalysts, solubility of HPA in polar solvents and rapid catalyst deactivation of SiO_2, zeolites limit their use. Similarly though some catalysts have higher reactivity, the high operation temperature always gives a mixture of products. Generally, the use of stoichiometric amounts of multiple reagents limit the application of modern coupling reagents for esterification reaction.[20-31] All these and some more limitations encountered with many of the synthetic protocols triggered our interest to develop a new method. As part of our research program in developing synthetic methods,[32] herein we report, the synthesis of esters using zinc chloride as a catalyst. The catalyst zinc chloride is known in the literature for various organic transformations.[33]

II. RESULTS AND DISCUSSION

A mixture of the benzoic acid (1mmol), substituted phenols (1mmol), zinc chloride ($ZnCl_2$) (1 mmol) in phosphorousoxychloride ($POCl_3$, 2 vol.) was taken in to round bottom flask. Then mixture was stirred at 70-80 °C the reaction was completed within 1-2 hour to afford the corresponding product substituted benzoates (**3a**) in good yields as shown in (Scheme-1)

Scheme 1: Esterification of carboxylic acid and alcohols in presence of $ZnCl_2$, $POCl_3$.



R = F, Cl, NH_2, NO_2 R_1 = F, Cl, Br, CN, OCH_3, NH_2, NO_2

Scheme 1: Esterification of carboxylic acid and alcohols in presence of $ZnCl_2$, $POCl_3$

We have examined the effect of temperature on reaction rate and the amount of catalyst used in the reaction and the results were summarized in the table-1. There was no product formation in $POCl_3$ at room temperature, and at reflux condition partially product formation was observed even after 24 hours. The product was observed in presence of catalyst at room temperature after 24 hours. It was found that the ideal reaction conditions were 1.0eq of $ZnCl_2$ in $POCl_3$ at 75-80 °C.

Table 1: Optimization of reaction conditions for the synthesis of phenyl benzoates using zinc chloride:

S. No	Solvent	$ZnCl_2$ (eq)	Temperature (^{0}C)	Time (h)	Yield (%)
1	$POCl_3$	0	25-30	24	No conversion
2	$POCl_3$	0	75-80	24	20
3	$POCl_3$	0.5	25-30	24	33
4	$POCl_3$	0.5	75-80	5.0	70
5	$POCl_3$	1.0	75-80	1.0	88

Encouraged by the results obtained with carboxylic acid and phenols at established reaction conditions, we have applied this methodology to various substrates. The results are summarized in table 2. Interestingly, the esterification with substituted phenols worked well at reflux temperature. This methodology is successfully applied to carboxylic acids; the carboxylic acids having different substitution on ring system (electron withdrawing and donating groups) were used for the condensation reaction without any difficulty. In general, all the reactions were carried out in $POCl_3$ at reflux, in the presence of $ZnCl_2$ as a catalyst using (10 mol %), the reaction was completed within 1 to 2 hours and the yields obtained varied from 75-90%. All the products were confirmed by their proton nuclear magnetic resonance (1H-NMR), infrared (IR) and Electron Impact ionization Mass Spectrometry (EIMS) data.

III. EXPERMENTAL SECTIONS

General Methods: Melting points were recorded on Buchi R-535 apparatus and are uncorrected. IR spectra were recorded on a Perkin-Elmer FT-IR spectrophotometer using KBr discs. The reactions were monitored by TLC plates Merck Silica Gel 60, F254 and visualization with UV light (254 and 365nm) 1H NMR spectra were recorded on Bruker-400 spectrometer in $CDCl_3$ using TMS as internal reference. Mass spectra were recorded at ionization energy 70 eV on API Q Star pulsar spectrometer using elctrospray ionization.

General procedure: A mixture of the appropriate aromatic carboxylic acids (1mmol), substituted phenols (1mmol), zinc chloride ($ZnCl_2$) (1.0mmol) and phosphorousoxychloride ($POCl_3$, 2 vol.) was taken in to round bottom flask. Warm to 75-80 °C Then mixture was stirred for 2h at same temperature. The progress of reaction was monitored by TLC. Reaction mixture cooled to room temperature and added ice cold water lot-I (10 vol.) and stir for 30-60 min at 25-30 °C. The separated solid by filtration and washed with water lot-II (10 vol.) and dried the obtained material under vacuum, furnish the corresponding phenyl benzoates in good yields. (75-88%). All the products were characterized by their 1H NMR, IR and mass spectral data.

Table-2: Direct esterification of carboxylic acids with phenols catalyzed by $ZnCl_2/POCl_3$.

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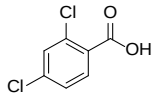
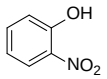
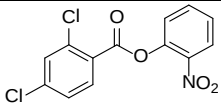
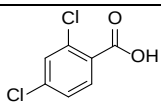
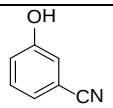
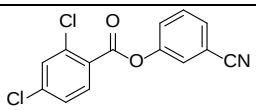
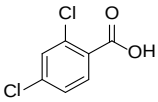
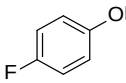
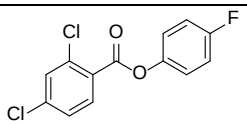
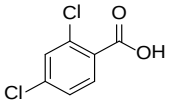
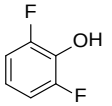
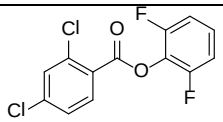
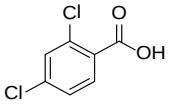
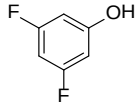
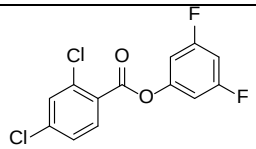
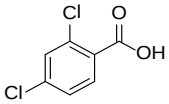
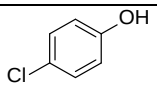
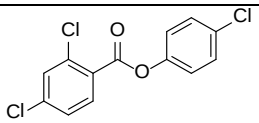
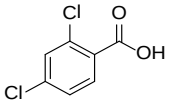
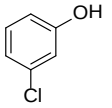
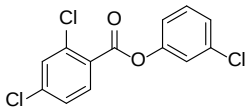
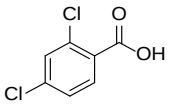
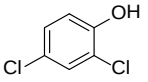
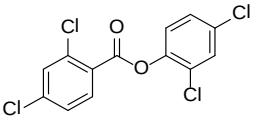
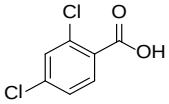
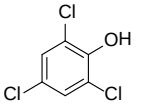
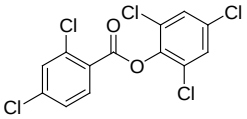
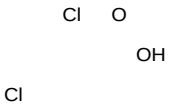
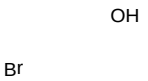
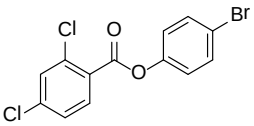
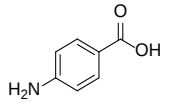
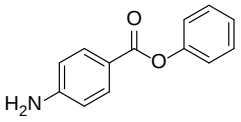
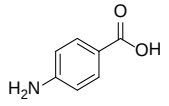
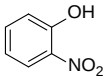
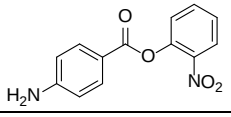
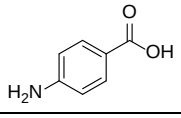
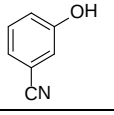
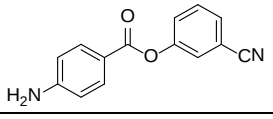
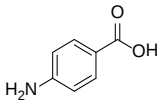
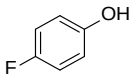
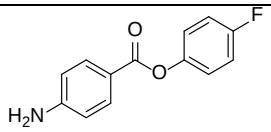
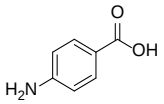
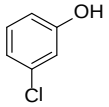
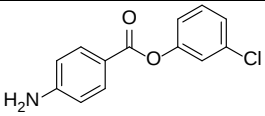
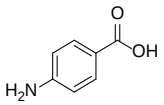
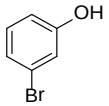
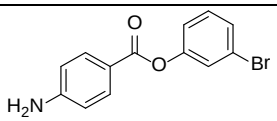
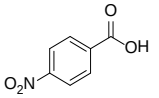
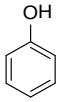
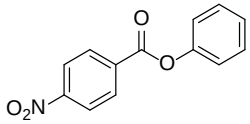
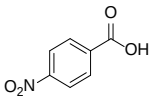
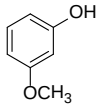
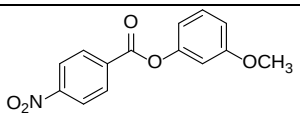
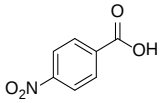
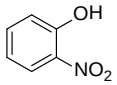
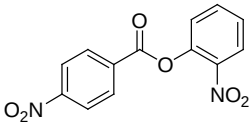
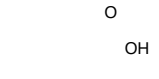
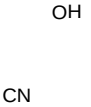
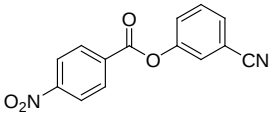
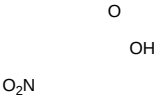
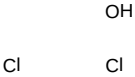
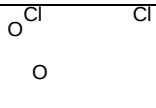
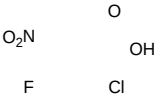
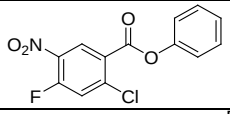
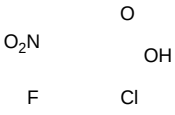
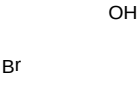
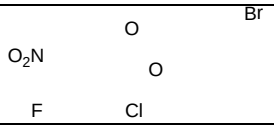
a				2	75
b				1	90
c				1.5	80
d				2	72
e				2	77
f				1.5	82
g				2	70
h				1	91
i				1.5	78
j				1	90
k				1.5	78
l				1.5	81
m				2.0	68

n				1.5	80
o				2.0	93
p				2.5	65
q				1.5	82
r				2	82
s				1	90
t				1.5	86
u				1	89
v				1.5	89
w				1.0	88

2-Nitrophenyl 2, 4-dichlorobenzoate (3a): IR (KBr): υ 3102, 2867, 1748, 1584, 1518, 1471, 1353, 1208, 1085, 1021, 733 cm.-1; 1H NMR (400 MHz, DMSO-d6): δ 8.24 (dd, J1 = 1.6 Hz, J2 = 6.4 Hz,1H), 8.20 (d, J = 8.4 Hz, 1H), 7.93-7.89 (m, 2H), 7.72-7.67 (m, 2H), 7.65-7.61 (m, 1H).;EI-MS, m/z (%): 310 (M-2, 80), 138 (100).

3-Cyanophenyl 2, 4-dichlorobenzoate (3b): IR (KBr): υ 3101, 2231, 1741, 1582, 1482, 1276, 1237, 1152, 1093, 1042, 785 cm.-1; 1H NMR (400 MHz, DMSO-d6): δ 8.18 (d, J = 8.4 Hz, 1H), 7.94 (s, 1H), 7.89 (d, J = 1.6 Hz, 1H) 7.85 -7.82 (m, 1H), 7.74-7.72 (m, 1H), 7.72-7.7 1 (m, 1H), 7.68 (dd, J1 = 2.0 Hz, J2 = 8.0 Hz, 1H).; EI-MS, m/z (%): 290 (M-1, 100), 212 (25), 136 (40), 113 (70).

4-Fluorophenyl 2,4-dichlorobenzoate (3c): IR (KBr): υ 3101, 3081, 1741, 1582, 1507, 1417, 1373, 1234, 1182, 1091, 1035, 872 cm.-1; 1H NMR (400 MHz, CDCl3): δ 8.00 (d, J = 8.0 Hz, 1H), 7.55 (d, J = 2.0 Hz, 1H), 7.38 (dd, J1 = 1.6 Hz, J2 = 8.4 Hz, 1H) 7.26 -7.18 (m, 2H), 7.13-7.09 (m,1H).; EI-MS, m/z (%): 283 (M-2, 20), 221 (25), 191 (70), 189 (100), 133 (30), 125 (35), 113 (25).

2, 6-Difluorophenyl 2,4-dichlorobenzoate (3d): IR (KBr): υ 3377, 3278, 3105, 1762, 1663, 1619, 1583, 1481, 1292, 1266, 1231, 1156, 1082, 1028, 876 cm.-1; 1H NMR (400 MHz, CDCl3): δ 8.1 (d, J = 8.4 Hz, 1H), 7.57 (d, J = 2.4 Hz, 1H), 7.40 (dd, J1 = 2.0 Hz, J2 = 8.8 Hz, 1H), 7.25 -7.19 (m, 1H), 7.03 (t, J = 7.6 Hz, 2H).; EI-MS, m/z (%): 302 (M-1, 70), 300 (100).

3,5-Difluorophenyl 2,4-dichlorobenzoate (3e): IR (KBr): υ 3091, 1745, 1608, 1465, 1378, 1281, 1242, 1140, 1121, 1044, 991, 839 cm.-1; 1H NMR (400 MHz, CDCl3): δ 7.98 (d, J = 8.4 Hz, 1H), 7.55 (s, 1H), 7.38 (d, J = 8.4 Hz, 1H) 6.85-6.83 (m, 2H), 6.78-6.74 (m, 1H).; EI-MS, m/z (%): 301 (M-2, 100), 257 (10), 129 (25).

4-Chlorophenyl 2, 4-dichlorobenzoate (3f): Solid. Mp.124-125, IR (KBr): υ 3098, 1741, 1682, 1580, 1489, 1373, 1241, 1206, 1086, 1036, 874 cm.-1; 1H NMR (400 MHz, DMSO-d6): δ 8.11 (d, J = 2.1 Hz, 1H), 7.87 (d, J = 2.0 Hz, 1H), 7.66 (dd, J1 = 1.6 Hz, J2 = 8.4 Hz, 1H) 7.56 -7.54 (m, 2H), 7.39-7.37 (m, 2H).; EI-MS m/z (%): 301 (M+18, 30), 255 (40), 135 (100), 113 (65).

3-Chlorophenyl 2, 4-dichlorobenzoate (3g): Solid. Mp. 99-100, IR (KBr): υ 3073, 2925 1741, 1585, 1468, 1259, 1238, 1197, 1092, 1034, 881, 774 cm.-1; 1H NMR (400 MHz, DMSO-d6): δ 8.14 (d, J = 8.4 Hz, 1H), 7.88 (d, J = 1.6 Hz, 1H), 7.77 (dd, J1 = 1.6 Hz, J2 = 8.4 Hz, 1H), 7.54-7.50 (m, 2H), 7.42 (d, J = 7.6 Hz, 1H), 7.73 (dd, J1 = 1.2 Hz, J2 = 7.6 Hz, 1H).; EI-MS, m/z (%): 299 (M-2, 100), 191 (50), 189 (85), 147 (30), 145 (35).

2,4-Dichlorophenyl 2, 4-dichlorobenzoate (3h): IR (KBr): υ 3069, 2895 1739, 1523, 1468, 1262, 1230, 1201, 1108 ; 1H NMR (400 MHz, CDCl3): δ 8.11-8.09 (m, 1H), 7.56 (s, 1H), 7.50 (d, 2H), 7.72-7.67 (m, J = 1.2 Hz, 2H), 7.65-7.61 (m, 1H), 7.40-7.38 (m, 1H), 7.33-7.30 (m, 1H), 7.25-7.21 (m, 1H).; EI-MS, m/z (%): 338 (M+2, 45), 155 (100).

2, 4, 6-Trichlorophenyl 2, 4-dichlorobenzoate (3i): IR (KBr): υ 3110, 2242, 1749, 1589, 1488, 1269, 1242, 1154, 1093; 1H NMR (400 MHz, CDCl3): δ 8.14 (d, J = 8.4 Hz, 1H), 7.58 (s, 1H), 7.43-7.39 (m, 3H).; EI-MS. m/z (%): 369 (M-1, 10), 265 (30) , 195 (40), 135 (45), 113 (100); m/z (%): 371.41 (M+1, 61), 184 (100).

4-Bromophenyl 2, 4-dichlorobenzoate (3j): IR (KBr): υ 3095, 3075, 1742, 1580, 1484, 1373, 1260, 1241, 1201, 1162, 1090, 1065, 873 cm.-1; 1H NMR (400 MHz, CDCl3): δ 8.01 (d, J = 8.8 Hz, 1H), 7.56 -7.54 (m, 3H), 7.39 (dd, J1 = 2.0 Hz, J2 = 8.4 Hz, 1H) 7.54 -7.11 (m, 2H).; EI-MS, m/z (%): 345 (M-1, 30), 343 (65), 325 (45), 311 (50), 279 (95), 265 (100), 241 (47), 171 (35).

Phenyl 4-aminobenzoate (3k): 169-171 IR (KBr): υ 3412, 3336, 3229, 3029, 1704, 1639, 1596, 1491, 1279, 1191, 1167, 1071, 742 cm.-1; 1H NMR (400 MHz, CDCl3): δ 8.01 (dd, J1 = 2.0 Hz, J2 = 6.8 Hz, 2H),7.42-7.38 (m, 2H), 7.25-7.21 (m, 1H), 7.70-7.17 (m, 2H), 6.70 (dd, J1 = 1.6 Hz, J2 = 6.8 Hz, 2H), 4.18 (brs, 2H (NH2).; EI-MS, m/z (%): 214 (M+1, 28), 161 (20), 148 (24), 145 (55), 131 (30), 106 (100).

2-Nitrophenyl 4-aminobenzoate (3l): IR (KBr): υ 3112, 2198, 1730, 1542, 1491, 1268, 1237, 1184, 1081; 1H NMR (400 MHz, CDCl3): δ 8.56 (d, J = 2.0 Hz, 1H), 8.26 (dd, J1 = 2.0 Hz, J2 = 8.8 Hz, 1H), 8.07 (d, J = 8.4 Hz, 2H), 7.60 (d, J = 8.8 Hz, 2H), 6.70 (d, J = 9.6 Hz, 2H), 4.3 (brs, 2H (NH2).; EI-MS, m/z (%): 259 (M+1, 30), 257 (20), 256 (88), 145 (55), 131 (25), 106 (100).

3-Cyanophenyl 4-aminobenzoate (3m): IR (KBr): υ 2955, 2188, 1741, 1509, 1454, 1330, 1242, 1236, 1140, 1021; 1H NMR (400 MHz, DMSO-d6): δ 8.00-7.96 (m 2H), 7.52- 7.46 (m, 4H), 6.71-6.68 (m, 2H).; EI-MS, m/z (%): 237 (M-1, 20), 154 (25), 119 (20), 118 (100). m/z (%): 338 (M+2, 45), 155 (100).

4-Fluorophenyl 4-aminobenzoate (3n): IR (KBr): υ 3105, 2228, 1732, 1595, 1491, 1268, 1240, 1162, 1085; 1H NMR (400 MHz, DMSO-d6): δ 7.79 (d, J = 8.8 Hz, 2H), 7.25 (s, 2H), 7.23 (s, 1H), 6.64 (d, J = 8.8 Hz, 2H), 6.15 (br, 2H (NH2).; EI-MS, m/z (%): 232 (M+1, 30), 210 (26), 181 (50), 132 (46), 106 (100).

3-Chlorophenyl 4-aminobenzoate (3o): IR (KBr): υ 3415, 2942. 2890, 1668, 1318, 1597, 1358, 1306, 1215, 1110, 869 cm.-1; 1H NMR (400 MHz, CDCl3): δ 7.98 (d, J = 8.0 Hz, 1H), 7.32 (t, J = 7.6 Hz, 1H), 7.25-7.21 (m, 2H), 7.11-7.09 (m, 1H), 6.69 (d, J = 8.4 Hz, 2H), 4.16 (brs, 2H).; EI-MS, m/z (%): 248 (M+1, 30), 164 (28), 143 (75), 131 (100), 117 (25).

3-Bromophenyl 4-aminobenzoate (3p): IR (KBr): υ 3424, 2930. 2901, 1721, 1308, 1602, 1312, 1255, 1124 cm.-1; 1H NMR (400 MHz, DMSO-d6): δ 7.74 (d, J = 8.4 Hz, 2H), 7.44-7.42 (m, 2H), 7.35 (t, J = 8.4 Hz, 1H), 7.20 (dd, J1 = 8.8 Hz, J2= 8.4 Hz, 1H), 6.60 (d, J1 = 8.4 Hz, 2H), 6.14 (brs, 2H).; EI-MS, m/z (%): 294 (M+2, 100).

Phenyl 4-nitrobenzoate (3q): Solid. Mp. 173-174, IR (KBr): υ 3465, 3110, 3085, 1741, 1607, 1527, 1407, 1268, 1027, 1013, 756 cm.-1; 1H NMR (400 MHz, CDCl3): δ 8.35 (q, 4H), 7.46 (t, J = 8.0 Hz, 2H), 7.31 (t, J = 7.6 Hz, 1H), 7.25-7.22 (m, 1H).; EI-MS, m/z (%): 244 (M+1, 100).

3-Methoxyphenyl 4-nitrobenzoate (3r): Solid. Mp. 121-122, IR (KBr): υ 3478, 3105, 3077, 2849, 1749, 1607, 1520, 1488, 1347, 1251, 1136, 1069, 1038, 713 cm.-1; 1H NMR (400 MHz, CDCl3): δ 8.39-8.34 (m, 4H), 7.35 (t, J = 8.0 Hz, 1H), 6.87-6.84 (m, 2H), 6.83-6.78 (m, 1H), 3.83 (s, 3H).; EI-MS, m/z (%): 273 (M-1, 80), 255 (30), 225 (50), 172 (90), 116 (100).

2-Nitrophenyl 4-nitrobenzoate (3s): Solid. Mp. 143-144, IR (KBr): υ 3466, 3108, 3079, 2859, 1740, 1607, 1590, 1607, 1522, 1347, 1321, 1273, 1271, 1089, 1072, 712 cm.-1; 1H NMR (400 MHz, CDCl3): δ 8.38-8.31 (m, 4H), 8.20-8.18 (m, 1H), 7.75 (t, J = 8.0 Hz, 1H), 7.50 (t, J = 8.0 Hz, 1H), 7.42-7.40 (m, 1H).; EI-MS, m/z (%): 289 (M+1, 20), 166 (100), 138 (90), 122 (20).

3-Cyanophenyl 4-nitrobenzoate (3t): IR (KBr): υ 3111, 3086, 2360, 2231, 1739, 1582, 1482, 1320, 1235, 1078, 799 cm.-1; 1H NMR (400 MHz, CDCl3): δ 8.38 (s, 4H), 7.64-7.59 (m, 3H), 7.57-7.51 (m, 1H). ; EI-MS, m/z (%): 269.2 (M+1, 100),

2, 4-Dichlorophenyl 4-nitrobenzoate (3u): IR (KBr): υ 3108, 3050, 2296, 1745, 1598, 1452, 1305, 1202, 1028 cm.-1; 1H NMR (400 MHz, CDCl3): δ 8.41-8.36 (m, 4H), 7.53 (d, J = 2.4 Hz, 1H), 7.35 (dd, J1 = 2.0 Hz, J2= 8.0Hz, 1H), 7.26-7.24 (m, 1H).; EI-MS, m/z (%): 313.2 (M+1, 20), 166 (100), 122 (25).

Phenyl 2-chloro-4-fluoro-5-nitrobenzoate (3v): IR (KBr): υ 3113, 3066, 1746, 1646, 1578, 1527, 1345, 1269, 1180, 1020, 777 cm.-1; 1H NMR (400 MHz, CDCl3): δ 8.88 (d, J = 8.0 Hz, 1H), 7.53 (m, 3H), 7.48-7.43 (m, 2H), 7.32 (t, J = 7.2 Hz, 1H), 7.25-7.23 (m, 2H).; EI-MS, m/z (%): 296.5 (M+1, 100).

4-Bromophenyl 2-chloro-4-fluoro-5-nitrobenzoate (3w): IR (KBr): υ 3119, 2924, 1749, 1618, 1586, 1531, 1483, 1346, 1271, 1194, 1066, 975, 801 cm.-1; 1H NMR (400 MHz, CDCl3): δ 8.86 (d, J = 7.2 Hz, 4H), 7.59-7.52 (m, 3H), 7.15 -7.13 (m, 2H).; EI-MS, m/z (%): 375 (M+1, 35), 371 (20), 357 (30), 354 (100).

IV. CONCLUSION

In conclusion, zinc chloride was found to be an efficient catalyst for the synthesis of esters in very good to excellent yields. This methodology offers several advantages: mild reaction conditions, enhanced reaction rates, easy isolation of products and operational simplicity. The scope and generality of this protocol was illustrated with respect to various aromatic carboxylic acids with phenol compounds.

V. ACKNOWLEDGEMENT

The author's are thankful to Osmania University

VI. REFERENCESS

[1] Otera, J. Chem. Rev. 1993, 93, 1449-1470; (b) Otera, J. Esterification; Wiley-VCH: Weinheim, Germany. 2003; (c) Otera, J. Acc. Chem. Res. 2004, 37, 288-296; (d) Grasa, G. A.; Singh, R.; Nolan, S. P. Synthesis. 2004, 971-985; (e) Hoydonckx, H. E.; De Vos, D. E.; Chavan, S. A.; Jacobs, P. A. Top. Catal. 2004, 27, 83-96; (f) Enders, D.; Niemeier, O.; Henseler, A. Chem. Rev. 2007, 107, 5606-5655; (g) Ishihara, K. Tetrahedron. 2009, 65, 1085; (h) Otera, J.; Nishikido, J. Esterification, 2nd ed., WILEY-VCH, Weinheim, 2010; (i) Haslam, E. Tetrahedron. 1980, 36, 2409-2433.

[2] Humphrey, J. M.; Chamberlin, A. R. Chem. Rev. 1997, 97, 2243

[3] Greene, T. W.; Wuts, P. G. M.; Protective Groups in Organic Synthesis; John Wiley& Sons: New York, 1991.

[4] Hosangadi, B.; Dave, R. Tetrahedron Lett. 1996, 37, 6375-6378.

[5] Kim, S.; Lee, J. I.; Kim, Y.C. J. Org. Chem. 1985, 50, 560-565.

[6] Neises, B.; Steglich, W. Angew. Chem. Int. Ed. Engl. 1978, 17, 522-524.

[7] Ueda, M.; Oikawa, H. J.Org. Chem. 1985, 50, 760-763.

[8] Das, B.; Venkataiah, P.; Madhusudhan, P. Synlett. 2000, 1, 59-60.

[9] Anand, R. C.; Milhotra, V.; Milhotra, A. J. Chem. Res. 1999, 6, 378-379.

[10] Wegman, M. A.; Elzinga, J. M.; Neeleman, E.; Rantwijk, F. V. Sheldon, R. A. Green Chem. 2001, 3, 61-64.

[11] Manohar, B.; Reddy, V. R.; Reddy, B. M. Synth. Commun. 1998, 28, 3183-3187.

[12] Wright, S. W.; Hageman, D. L.; Wright, A. S.; McLure, L. D. Tetrahedron Lett. 1997, 38, 7345-7348.

[13] Huirong, Y.; Yingde, L. B. C. Synth. Commun. 1998, 28, 1233-1238.

[14] Lami, L.; Casal, B.; Cuadra, L.; Merino, J.; Alvarez, A.; RuizHitzky, E. Green Chem. 1999, 1, 199-204.

[15] Lee, J. C.; Choi, Y. Synth. Commun. 1998, 28, 2021-2026.

[16] Saito, M.; Fujisaki, S.; Ishii, Y.; Nishiguchi, T. Tetrahedron Lett. 1996, 37, 6733-6736.
[17] Kirumakki, S. R.; Nagaraju, N.; Murthy, K.V.V.S.B.S.R.; Narayanan, S. Appl. Catal. A. 2002, 226,175-182.
[18] Konwar, D.; Gogoi, P. K.; Gogoi, P.; Borah, G.; Baruah, R.; Hazarika, N.; Borgohain, R. Ind. J. Chem. Technol.2008, 15, 75-78.
[19] Kalbasi, R. J.; Massah, A. R.; Barkhordari, Z. Bull. Korean Chem. Soc. 2010, 31, 236-2367.
[20] Fitzjarrald, V. P.; Pongdee, R. Tetrahedron Lett. 2007, 48, 3553-3557.
[21] Iranpoor, N.; Firouzabadi, H.; Khalili, D.; Motevalli, S. J. Org. Chem. 2008, 73, 4882-48887.
[22] Ishihara, K.; Kubota, M.; Kurihara, H.; Yamamoto, H. J. Org. Chem. 1996, 61, 4560-4567.
[23] Wakasugi, K.; Misaki, T.; Yamada, K.; Tanabe, Y. Tetrahedron Lett. 2000, 41, 5249-5252.
[24] Funatomi, T.; Wakasugi, K.; Misaki, T.; Tanabe, Y. Green Chem. 2006, 8, 1022-1027.
[25] Gacem, B.; Jenner, G. Tetrahedron Lett. 2003, 44, 1391-1393.
[26] (a) Ishihara, K.; Nakagawa, S.; Sakakura, A. J. Am. Chem. Soc. 2005, 127, 4168-4169; (b) Sakakura, A.; Nakagawa, S.; Ishihara, K. Tetrahedron. 2006, 62, 422-433.
[27] Otera, J.; Ioka, S.; Nozaki, H. J. Org. Chem. 1989, 54, 4013-4014.
[28] Sakakura, A.; Koshikari, Y.; Ishihara, K. Tetrahedron Lett. 2008, 49, 5017-5020.
[29] (a) Manabe, K.; Sun, H. M.; Kobayashi, S. J. Am. Chem. Soc. 2001, 123, 10101-10102; (b) Manabe, K.; Iimura, S.; Sun, X. M.; Kobayashi, S. J. Am. Chem. Soc. 2002, 124, 11971-11978.
[30] (a) Maki, T.; Ishihara, K.; Yamamoto, H. Org. Lett. 2005, 7, 5047-5050; (b) Maki, T.; Ishihara, K.; Yamamoto, H. Tetrahedron. 2007, 63, 8645-8657.
[31] Houston, T. A.; Wilkinson, B. L.; Blanchfield, J. T. Org. Lett. 2004, 6, 679-681.
[32] Madhusudhan Raju, R.; Gurunadham, G. J. Chem. Pharm. Res. 2015, 7(7), 1080-1083.
[33] (a) Shaaban, E. S.; Saad, S.; Eldesoky, F.; Kandeel, E. Inter. J. Org. Chem. 2015, 5, 49-56; (b) Pawar, P. Satish, A.; Sunil, D.; Tekale, U.; Swapnil, R.; Sarda, W. N, Sudhakar, J.; Rajendra. R. B. ARKIVOC.2008, (xvii), 241-247.

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Seismic Soil Structure Interaction Effects on RC Bare Frames Resting on Pile-Grid Foundation

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Abstract- In the last few decades, it has been recognized that Soil Structure Interaction (SSI) altered the response characteristics of a structural system because of massive and stiff nature of structure and, often, soil softness. The present study makes an attempt to show the response of a structure in earthquake analysis by considering the effect of soil structure interaction. For superstructure G+7 simple square building is considered for seismic analysis. A study has to be carried out for buildings with the same geometry found on varying soil types over pile- grid foundation. An attempt has to be made to find the deformations under seismic loading in the structure and pile- grid foundation by incorporating the effect of soil-structure interaction which is further compared with those of fixed base condition. Influence of variation of the parameters such as, different soil conditions and number of stories are also considered for which the buildings are modelled by alternate approaches, namely, (1) bare frame with fixed supports, (2) bare frame with supports accounting for soil-flexibility using Ansys 14.5.

Index Terms- Soil Structure Interaction, RC Square Frames, Pile-Grid Foundation, Natural Period, Lateral Deflection, Soil Displacement, Static Analysis, Modal Analysis And Time History Analysis.

I. INTRODUCTION

Response of structure depends on the properties of soil, structure and the nature of the excitation. The process in which, the response of the soil influences the motion of the structure and vice versa, is referred to as Soil-Structure Interaction (SSI). Implementing soil-structure interaction effects enables the designer to assess real displacements of the soil-foundation structure system precisely under the influence of seismic motion. Present design practice for dynamic loading assumes the building to be fixed at their bases. Whereas, in reality supporting soil medium allows movement to some extent due to their natural ability to deform which decrease the overall lateral stiffness of the structural system resulting in the lengthening of lateral natural periods. Such lengthening of lateral natural periods does considerably change the seismic response of building frames.

Soil Structure Interaction is one of the most flourishing areas of research in Structural Engineering at present. It can be defined as the coupling between a structure and its supporting medium (bedrock or soil bed) during an earthquake. Aided by the revolution in computer technology, tackling such problems has become possible lately. Works done in the recent decade have shown the importance of structure-soil-structure interaction on dynamic response of key structures such as silos, storage tanks, and offshore structures. SSI calls for improvement in codal provisions for seismic design and communications between geotechnical and structural engineers.

Variation in dynamic response between fixed base and SSI model can be mainly attributed to (i) foundation stiffness and damping, (ii) foundation deformations and (iii) change in foundation input motion from free-field motion on account of kinematic and inertial interactions.

Most of the building frames are supported on combined footings, isolated footings, raft, pile foundations depending on the amount of load and the nature of supporting sub soil. Generally the multi-storied buildings constructed on week strata at shallow depth are supported on pile foundations. The problem of interaction becomes more complex when soil, foundation and structure have to be modeled with equal rigor.

The present study has been carried out for buildings with the same geometry found on varying soil types over pile-grid foundations subjected to El Centro (1940) earthquake ground motion in time domain. An attempt has been made to find the deflection, natural period and settlement under seismic loading in the structure and pile- grid foundation by incorporating the effect of soil-structure interaction which was further compared with those of fixed base condition. Influence of variation of the parameters such as, different soil conditions and number of stories were also considered in the present study for which the buildings were modelled by two alternate approaches, namely, (1) bare frame with fixed supports and (2) bare frame with supports accounting for soil-flexibility. Variations in natural period are also noted down for both base conditions and a comparative study has been done.

II. IDEALIZATION OF THE SYSTEM

i. Structural Idealization

To study the seismic soil structure interaction, building frames of 4, 6 and 8 storey was modeled in Ansys software. 3D models of square frame with 3 bays in both X and Y directions are modelled. The storey height and length of each bay of all building frames were chosen as 3m and 5m respectively which is reasonable for a residential building. The thickness of floor slab and roof were taken as 100mm. beam and column dimensions were as given in table 1. The grid dimensions and pile dimensions were calculated according to the axial load they have to carry. Square Pile of 550mm side dimension and 20m length, and grid beam with 1m width and 500mm depth were considered for the analysis (fig 2). The materials considered for design were M30 and Fe 415 steel.

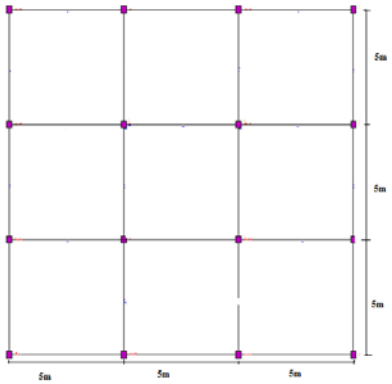

Fig.1 Plan of the building

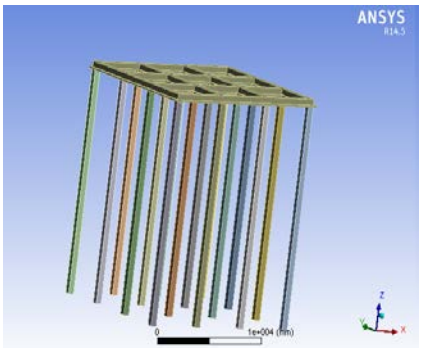

Fig 2: finite element model of pile grid

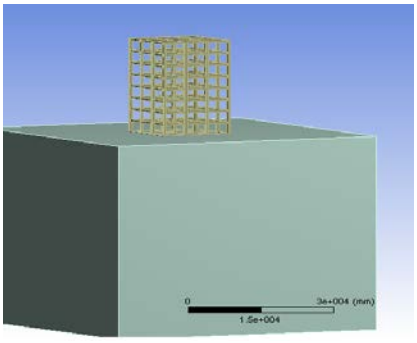

Fig.3: 3D model of structure-pile grid-soil system

Table 1: Details of the building

PARTICULARS	DETAILS
TYPE OF STRUCTURES	R.C.C RESIDENTIAL BUILDING
COLUMN	500 x 500 mm
BEAM	300 x 450 mm
SLAB THICKNESS	100 mm
FLOOR TO FLOOR HEIGHT	3000 mm
NO. OF BAYS IN X-DIRECTION	3
NO. OF BAYS IN Y-DIRECTION	3
CLEAR SPAN OF EACH BAY	5000 mm
INFILL WALL THICKNESS (URM)	200 mm
CONCRETE GRADE	M30
DEAD LOAD	AS PER IS 875 PART 1
LIVE LOAD	AS PER IS 875 PART 2
EARHTQUAKE LOAD	AS PER IS 1893 ; 2002
ZONE	III

ii. Idealization of Soil

The structures are assumed to be resting on two types of soil namely, loose and medium sand. The soil is assumed to be linear, elastic and isotropic in nature. Soil is discretised as solid. Modelling of infinite soil media in soil structure interaction plays a vital role. A finite soil body extracted from infinite soil field is the analysis object in the finite element analysis. But these artificial boundaries bring some error in dynamic analysis. To eliminate this taking into account the radiation damping of the system, some boundaries like viscous boundaries and transmitting boundaries are provided. According to Rayhani and Naggar (2008), horizontal distance between soil boundaries is assumed to be five times the structural width. As the most amplification occurs within the first 30 m of the soil profile, which is in agreement with most of modern seismic codes (e.g., ATC-40 1996, NEHRP 2003), here bed rock depth is assumed to be 60 m. these boundaries do not absorb energy but for the reduction of reflexive wave's effects, the distance between the structure and boundaries are increased.

The soil dimension considered are 75 x 75 m in both X and Y direction and 60m in Z direction. The soil boundary limit conditions have been postulated as zero displacement.

The analysis of the structures are done for two different soil conditions and then compared with fixed base condition. Loose sand and medium sand are selected with properties as given in Table 2.

Table 2: Details of soil parameters considered [7]

Soil type	Poisson's ratio (γ)	Density (kg/m^3)	Modulus of elasticity (MN/m^2)	Angle of friction
Loose sand	0.4	1600	108.752	30
Medium sand	0.35	1800	445.872	35

The modelling of the structure-pile grid-soil system was generated using Ansys work bench 14.5 and model for 8 storeyed frame is as shown in Fig. 3.

III. METHODOLOGY

Both static and transient analysis of 8, 6and 4 storeyed RC structures were performed for fixed base condition and soil structure interaction models for both loose sand and medium sand base conditions to examine the earthquake response of the structures. Transient analysis was done with the time history data of Elcentro ground motion. The soil is modelled as a homogeneous elastic material. The earthquake response of the building frames considering the flexibility of the soil is examined and the results are compared with fixed base condition. Model analysis is done to find out the natural frequencies and corresponding natural period of the structures.

The effect of soil structure interaction on the building frames for the whole study is carried out for Elcentro earthquake with peak acceleration 0.319g was selected for the study. The acceleration time history of Elcentro earthquake is shown in figure 4.

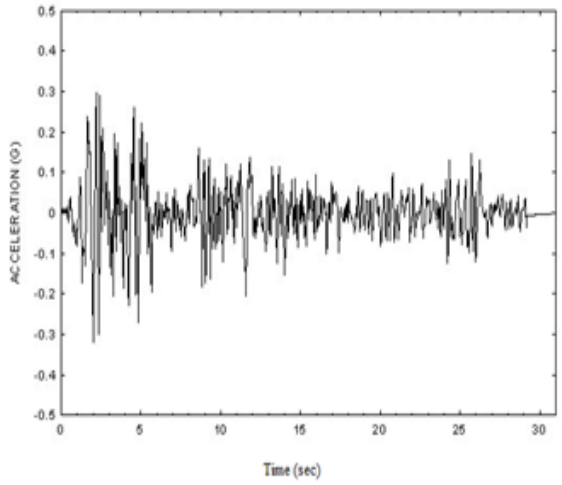

Fig.4 Acceleration time history of Elcentro earthquake with acceleration of 0.319g

The damping ratio of the entire system including soil and structure is assumed to be 5% of the critical. The corresponding α and β values are computed and given in the analysis [7].

IV. RESULTS AND DISCUSIONS

The seismic response of RC frames resting on pile grid foundation is investigated for the real earthquake excitations. The analysis is carried out for three cases namely fixed base condition, SSI models with loose and medium sand soil. Following section shows the changes in soil settlement, lateral deflection and natural period of three dimensional finite element modal of integrated soil - pile grid - RC frames accounting the effect of soil-structure interaction. The results are in the form of percentage variation, regarding the effect of soil-flexibility with that of the fixed base condition.

A. Effects of SSI under static and dynamic analysis

i. Roof displacement

Variation in roof displacement due to earthquake motions for various building models with different soil conditions has been studied. The values of roof displacement and its variations considering effect of SSI are studied and tabulated below.

Table 3: Lateral Roof Displacements

Storey level	**Base condition**	**BF**		**Variation due to SSI (%)**	
		static	**transient**	**static**	**transient**
G+7	**Fixed**	16.79	12.68	-	-
	Medium	27.37	33.93	82.7	167.6
	loose	35.89	48.76	113.8	284.5

The results show that roof displacement values are more in transient analysis than static. The percentage variation considering the effect of SSI increases with decrease in stiffness of soil and is more for transient than static analysis. A maximum of 284.5% increase is obtained for loose sand base condition in transient analysis.

ii. Soil settlement

Table 4. Soil settlement

Storey level	**Base condition**	**BF**	
		static	**transient**
G+7	**Fixed**	**0**	**0**
	Medium	22.24	25.10
	loose	70.68	89.12

From the results it has been observed that for loose soil settlement is more than that of medium soil and the settlement values obtained for transient is more than static analysis.

B. Effects of soil structure interaction under modal analysis

Modal analysis is done to determine natural period of the structures when no external loading is given. Modal analysis is done for all 4, 6 and 8 storeyed frames. The variations are

assessed in terms of percentage variation accounting the effect of SSI. The values obtained from the analyses are tabulated in Table 5.

From results obtained it has been observed that as the no. of storeys increases the natural period of frames considered slightly increases. But considering the effect of soil flexibility showed a large percentage variation in natural period. The percentage increase in natural period increases with decrease in soil stiffness and no. of storeys.

Table 5: Variation in Natural period

No. of storey	Base condition	Natural Period	Variation in natural period due to SSI (%)
4	Fixed	0.05	-
	Medium	0.18	280
	Loose	0.32	540
6	Fixed	0.08	-
	Medium	0.19	138
	Loose	0.33	312.5
8	Fixed	0.14	-
	Medium	0.2	42.9
	Loose	0.36	157.1

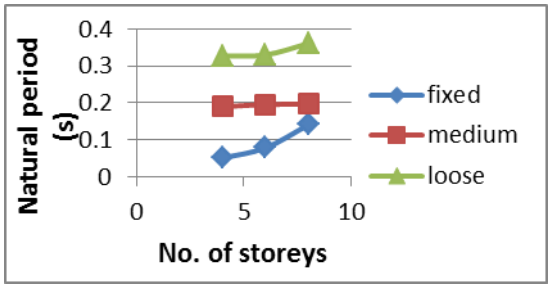

Fig 5: Variation in natural period with no. of storeys

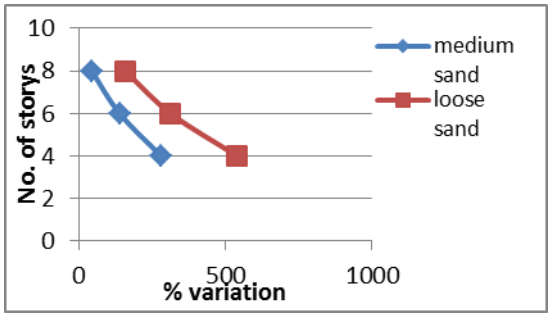

Fig 6: Percentage variation in natural period

C. Time history analysis

In the analysis acceleration time history of Elcentro earthquake ground motion is used. All the structures are analysed with three base conditions namely, without soil (fixed base) and with soil ranging from loose sand to medium sand. The variation of lateral floor deflection and soil settlement is studied considering the effect of soil structure interaction. The analysis is carried out for 4,6 and 8 structures. The results are noted down for each structure and compared with fixed base to account for soil flexibility.

i. Lateral roof displacement

Table 6: Variation in lateral roof deflection

Storey	Base	Roof Deflection (mm)	Variation in deflection (%)
4	**Fixed**	**2.90**	-
	Medium	**8.37**	**188.6**
	Loose	**14.4**	**396.55**
6	**Fixed**	**6**	-
	Medium	**13.30**	**121.7**
	Loose	**21.52**	**258.7**
8	**Fixed**	**12.69**	-
	Medium	**33.93**	**167.4**
	Loose	**48.76**	**284.2**

It has been observed that the lateral floor deflection increases with increase in floor levels. But the lateral floor deflection values are more when SSI effect is considered. For loose sand the deflection is more as compared with medium sand as its stiffness is less than the latter. It has also been observed that the percentage increase in lateral deflection is maximum for 4 storeyed frame which is same for loose and medium sand base conditions as compared with that of fixed base condition.

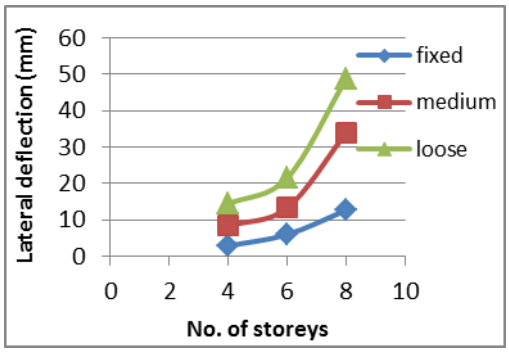

Fig 7: Variation of deflection with no. of storeys

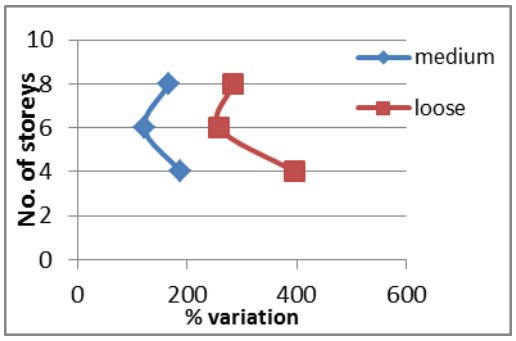

Fig 8: Percentage variation in deflection due to SSI

ii. Soil settlement

Table 7: variation in soil settlement

Storey level	Base condition	Soil settlement (mm)
4	medium	23.8
	loose	85.8
6	medium	24.3
	loose	87
8	medium	25.1
	loose	89.1

There is an increase in soil settlement as the no. of storeys increases due to the increase in weight of the frame.

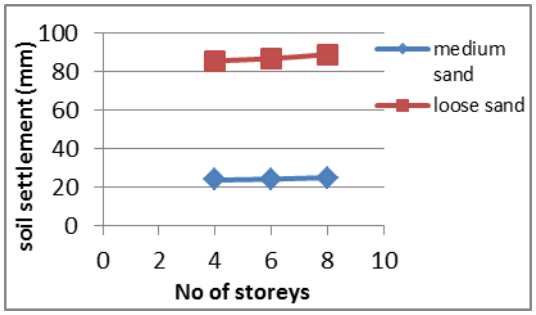

Fig 8: variation in soil settlement with no of storeys

V. Conclusion

With the present study an effort has been made to evaluate the effect of SSI on primary dynamic characteristics of bare frame of varying height resting over pile grid foundation founded on different soil types. The following are the conclusions drawn from the present study.

1. Both static and transient analyses follow the same trend for 8 storeyed structures. Both show that effects of seismic responses on structure increases with increase in soil flexibility.
2. From modal analysis, the natural period is found to be increasing with increase in soil flexibility and with number of storeys. The percentage variation in natural period increases with soil flexibility while it is found to be decreasing with increase in number of storeys.
3. From transient analysis it was observed that
   i. Roof displacement increases with increase in soil flexibility and number of storeys. While the percentage increase in lateral deflection decreases with increase in number of storeys.
   ii. Soil settlement also increases with increase in soil flexibility and number of storeys.

References

[1] Cai, Y. X., Gould, P. L. and Desai, C. S. "Nonlinear Analysis of 3D Seismic Interaction of Soil-Pile-Structure Systems and Application." Engineering Structures 22, 191-199,2000.

[2] Charles, W. W. Ng., Zhang, L. and Nip, D. C. N. "Response of laterally Loaded Large-Diameter Bored Pile Groups." Journal of Geotechnical and Geoenvironmental Engineering, Vol. 127, No. 8, August, 2001.

[3] Chore, H. S. and Ingle, R. K. "Interaction Analysis of Building Frame Supported On Pile Group." Indian Geotech. Journal, 38(4), 483-501, 2008 a.

[4] Chore, H. S., Ingle, R. K. and Sawant, V. A. "Building Frame-Pile Foundation-Soil Interaction Analysis." Interaction and Multi scale Mechanics, Vol. 2, No. 4, 397-411, 2009.

[5] Chore, H. S., Ingle, R. K. and Sawant, V. A. "Building Frame- Pile Foundation-Soil Interaction Analysis: A Parametric Study." Interaction and Multi Scale Mechanics, Vol. 3, No.1, 55-79, 2010.

[6] Deepa B. S., Nandakumar C.G., "Seismic Soil Structure Interaction Studies on Multistorey Frames."
International Journal of Applied Engineering Research and Development, Vol.2, Issue 1, 45-58, Mar 2012.

[7] B.R.Jayalekshmi,S.V.Jisha, 'Effects of Dynamic Soil-Structure Interaction on Raft of Piled Raft Foundation of Chimneys',Hindawi Publishing Corporation ISRN Civil Engineering, Vol 2014.

[8] J. Králik, "Probability And Sensitivity Analysis Of Soil-Structure Interaction Of High-Rise Buildings",Slovak journel of civil engineering, 2006/3 – 4 PAGES 23 — 32.

[9] Lewis Edgers, Masoud Sanayei &Joseph L. Alonge, "Modeling the Effects ofSoil-Structure Interactionon a Tall BuildingBearing on a Mat Foundation", civil engineering practice fall/winter 2005.

[10] Lu, X., Chen, B., Li, P., and Chen, Y. "Numerical Analysis of Tall Buildings Considering Dynamic Soil-Structure Interaction." J. Asian Archit. Build., 2(1), 1-8, 2003.

[11] R. R. Chaudhari, Dr K. N. Kadam, " Effect Of Piled Raft Design On High-Rise Building Considering Soil Structure Interaction", international journal of scientific & technology research volume 2, issue 6, june 2013.

[12] S. Hamid RezaTabatabaiefar, Behzad Fatah and Bijan Samali, "Lateral seismic response of building frames considering dynamic soil-structure interaction effects", Structural Engineering and Mechanics, Vol. 45, No.3 (2013) 311-321

[13] Shreya Thusoo, Karan Modi, Rajesh Kumar, Hitesh Madahar, "Response of Buildings with Soil-Structure Interaction with Varying Soil Types", International Journal of Civil, Structural, Construction and Architectural Engineering Vol:9, No:4, 2015.

[14] Sushma Pulikanti, Pradeep Kumar Ramancharla, "SSI Analysis of Framed Structures Supported on Pile Foundations : A Review", Frontier in Geotechnical Engineering (FGE) Volume 2 Issue 2, June 2013.

[15] Vivek, G., and Hora, M. S. "A Review on Interaction Behaviour of Structure-Foundation-Soil System." International Journal of Engineering Research and Applications, Vol. 2, Issue 6, November- December, 639-644, 2012.

[16] Yingcai, H. "Seismic Response of Tall Building Considering Soil-Pile-Structure Interaction", Earthquake Engineering and Engineering Vibration, Article ID: 1671-3664 (2002) 01-0057-08, June, 2002.

[17] IS 456:2000 Plain and reinforced concrete – code of practice,

[18] IS 2911 (Part 1/sec 2):2010 Design and construction of pile foundation-code of practice, Bureau of Indian Standards, New Delhi.

[19] IS: 875 (Part 1- Part 3) - 1987, 'Code of Practice for Design Loads (other than earthquake) for Building and Structure', Bureau of Indian Standards, New Delhi.

[20] Bowles J.E. (1998). 'Foundation Analysis and Design', McGraw Hill, New York.

[21] Pankaj Agarwal (2014) 'Earthquake Resistant Design of Structures',PH1 Learning Private Limited, Delhi.

[22] Nainan P Kurian (2009) 'Design of Foundation Systems', Narosa Publishing House, New Delhi.

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Cognitive Impairment in Euthymic Bipolar Affective Disorder Patients

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Abstract- Cognitive impairment is a replicable feature of Bipolar disorder with measurable changes being present both during episodes and in remission. An observational, cross-sectional clinical study was carried out to study the nature and frequency of cognitive impairment in Euthymic Bipolar Affective Disorder (BPAD) patients. Participants included 40 Euthymic BPAD patients as cases and 40 controls with no history of psychiatric illness. Current mood symptoms were assessed with Young Mania Rating Scale and Hamilton Depression Rating Scale, cognitive functions were assessed by Standardized Mini Mental State Examination (SMMSE), Trail Making Test Part-B (TMT-B) and Digit Symbol Substitution Test (DSST). There was significant difference between cases and controls in number of errors committed and the mean time taken to complete TMT-B and DSST ($p<0.01$). in within group analysis of cases there was higher mean time taken and more errors were committed in subjects in the age group of 40-60 years, substance use, lower socioeconomic status, lower educational status and longer duration of illness. The degree of cognitive dysfunction in BD increases with each significant mood episode The relationship of cognitive impairment to functional outcome in BD highlights its significance as a treatment target.

Index Terms- Cognitive Impairment, Bipolar Affective Disorder, Euthymia

I. INTRODUCTION

Bipolar disorder (BD) is characterized by episodic pathological mood alterations that can be manic, hypomanic, depressive or mixed.[1] An increasing number of studies have detected cognitive impairments in patients with bipolar disorders not only during acute phase but also during euthymic periods. Broad cognitive impairments were present even in early phase of illness and in unaffected relatives.[2] BD patients perform poorly on tests of visuomotor processing speed, verbal memory, sustained attention and executive functioning. Impairments of smaller effect size in visual and verbal memory, working memory, and sustained attention have also been rported.[3] There is a growing need for clarification regarding the magnitude, clinical relevance and confounding variables of cognitive impairment in bipolar patients. The impact of bipolar illness on cognition can be influenced by age of onset, pharmacological treatments, individual response, familial risk factors, and clinical features.[4] The most recent metaanalysis available used 45 studies comparing 1423 euthymic bipolar patients with 1524 healthy controls The results showed group differences with medium to large effect sizes for measures of executive function, verbal memory, psychomotor speed, and sustained attention. Cognitive deficits have an influence on social functioning and the course of the illness.[5] A recent review concluded that Patients with BD might exhibit a cognitive impairment that could be similar to Schizophrenia in terms of their profile, although patients with Schizophrenia may have more severe and widespread impairments.[6] The aim of present study was to evaluate the nature and frequency of cognitive impairment in Euthymic Bipolar Affective Disorder patients.

II. METHODOLOGY

The present study is an observational, cross-sectional and clinical study participants were recruited by purposive sampling who met inclusion and exclusion criteria. Cases for the study included 40 Bipolar Affective Disorder patients who met ICD-10 DCR criteria currently Euthymic (3 months), aged between 20 to 60 yrs, educated above primary school level. Those with preexisting neurodegenerative or significant medical disorders and individuals suffering from sensory impairment were excluded. Controls for the study included 40 individuals who had no history of psychiatric illness, aged between 20 to 60 yrs, matched to age and socioeconomic status to cases. Both cases and controls were recruited from out patient department of psychiatry in a tertiary care general hospital located in Mangalore, Karnataka, India. Study was conducted from March 2015 to August 2015.

Present mood symptoms were assessed with young mania rating scale.[7] (scores less than 7 denoting remission) and Hamilton depression rating scale.[8] (scores less than 8 denoting remission). Cognitive functions were assessed using Standardized Mini Mental State Examination. (SMMSE), Trail Making Test Part-B (TMT-B) and Digit Symbol Substitution Test (DSST). socioeconomic status was assessed using Socio Economic Status Schedule (SESS). The demographic and clinical variables were recorded in a specific proforma prepared for the study. A written informed consent was obtained from all the participants. The present study was approved by institutiuonal ethical committee. Statistical analysis was carried ouusing Chi-square test, Mannwhitney test and Pearson correlation coefficient.

III. RESULTS

Majority of subjects were from age group of 30 to 50 years, cases (62.5%), controls (60.5%), equal number of male and female gender in both the groups. Most of the participants were from rural area following hindu religion belonging to lower middle socioeconomic status. most of individuals in cases and control group were educated till high school. There was no statistical difference between the cases and controls in respect to socioeconomic and demographic variables. There was statistical significance between the cases and controls in mean time taken to complete TMT-B and DSST ($P < 0.01$), There was statistical significance between the cases and controls in committing more errors in TMT-B and DSST ($p < 0.01$). there was no significant differences between both the groups in mean SMMSE scores.

Within group analysis showed lower mean SMMSE scores in the age group of 51 to 60 yrs, more errors were committed and higher mean time take to complete TMT- B and DSST in individuals belonging to lower socioeconomic status, those with substance use and lower educational status. There was significant correlation between the total duration of the illness and time taken to complete both TMT-B and DSST, and commission of more errors ($p<0.01$)

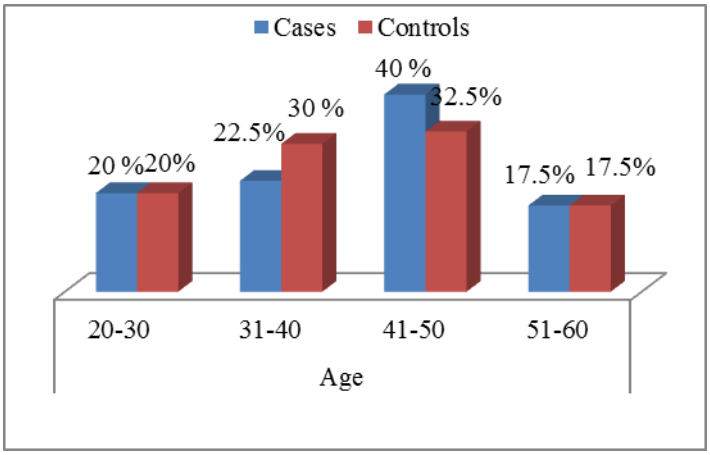


Figure 1: Age distribution of cases and controls

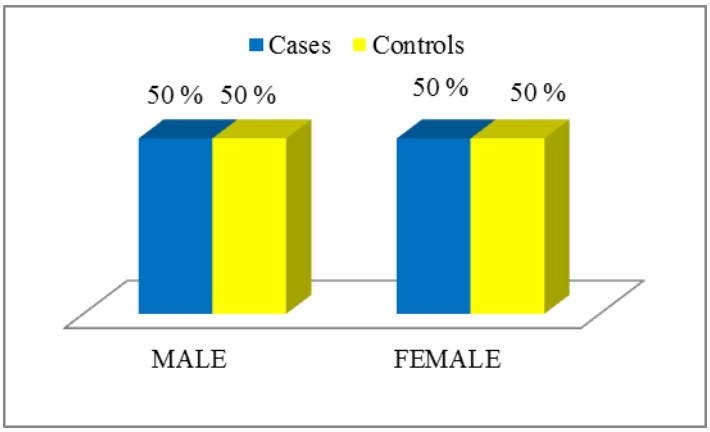


Figure 2: Gender distribution

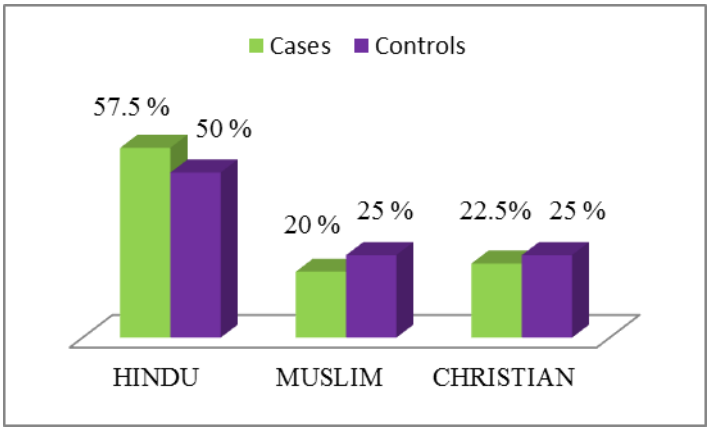
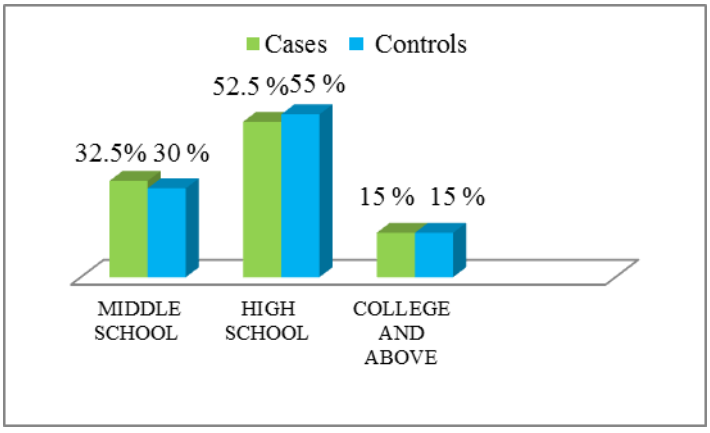


Figure 3 : Religion



. **Figure 4 : Educational status**

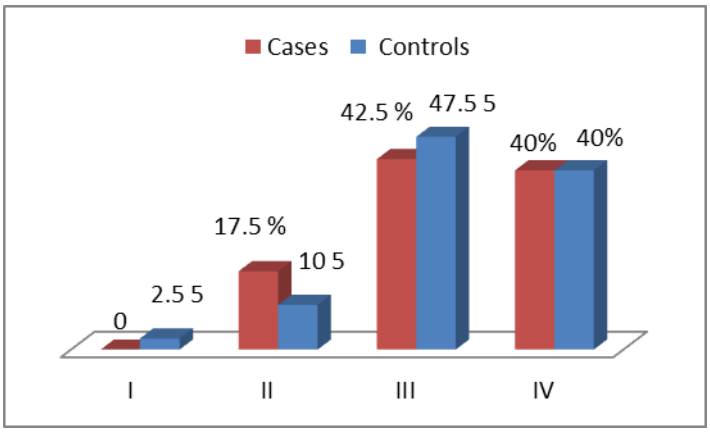


Figure 5 : Educational status

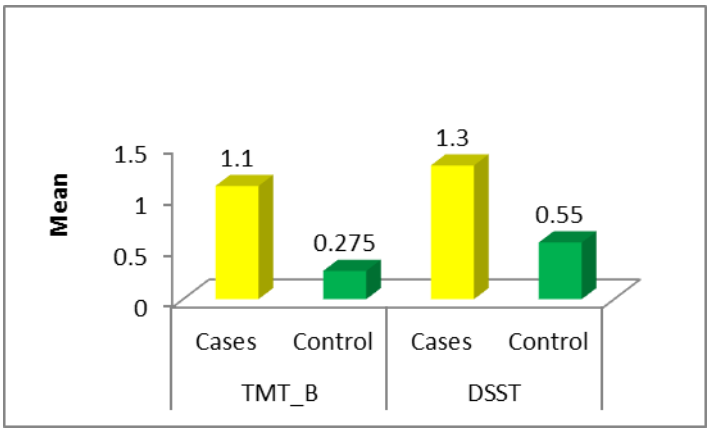


Figure 8 : Mean Errors committed in TMT-B and DSST

Variable	Chi-square test, p-value
Age	.851 (NS)
Gender	1.000 (NS)
Marital status	.849 (NS)
Religion	.785 (NS)
Domicile	.934 (NS)
Educational status	.792 (NS)
Socioeconomic status	.508 (NS)

Figure 6 : p value for the socio-demographic variables cases and controls

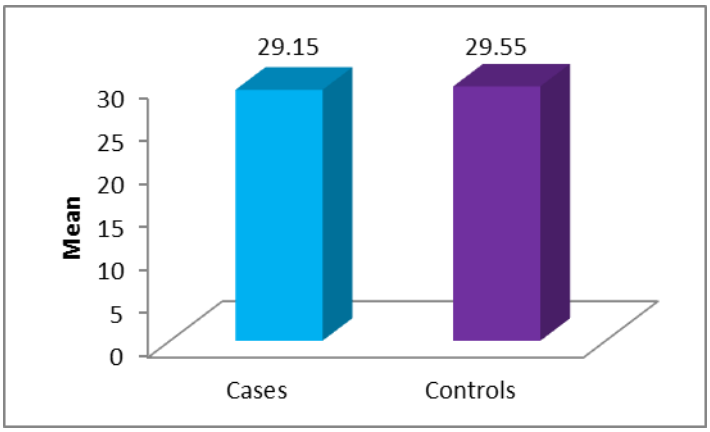


Figure 9 : Mean SMMSE scores between cases and controls

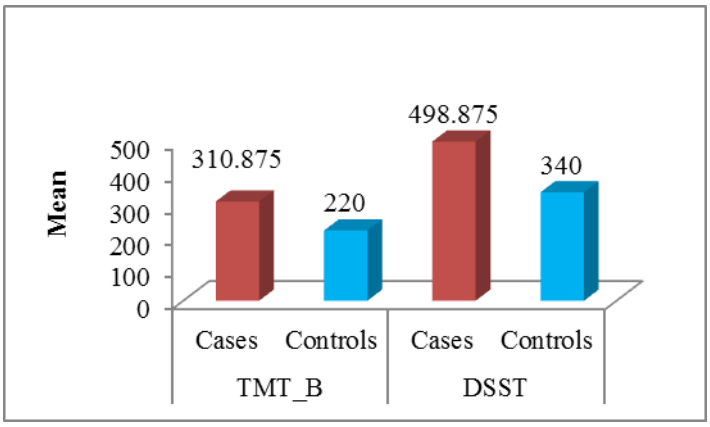


Figure 7 : Mean time taken to complete TMT-B and DSST

Group	Mean	SD	p- value
SMMSE CASES CONTROLS	 29.15 29.55	 1.231 .783	 .196 (NS)
TMT-B (TT) CASES CONTROLS	 310.88 220.00	 107.016 84.800	 p < 0.001 (HS)
TMT-B (E) CASES CONTROLS	 1.10 .28	 1.150 .599	 p < 0.001 (HS)
DSST (TT) CASES CONTROLS	 498.88 340.00	 166.046 124.895	 P< 0.001 (HS)
DSST (E) CASES CONTROLS	 1.30 .55	 1.436 1.085	 P= 0.004 SIG

Figure 9: TT- Total time taken
E - Errors committed

	Age at illness onset		Duration of illness		Euthymic (months)	
	Pearson correlation	p	Pearson correlation	p	Pearson correlation	p
SMMSE	-.365	0.020	-.430	<0.01	.o8	.962
TMT-BTT E	.198 .017	.222 .918	.619 .497	<0.01 <0.01	.178 .117	.273 .472
DSSTTT E	.175 .126	.280 .438	.629 .521	<0.01 <0.01	.357 .240	.024 .137

Figure 10: Correlation Between Cognitive Functions And Disease Variables

IV. DISCUSSION

The present study revealed that there is statistically significant cognitive imapairment in bipolar affective disorder patients who are in remission compared to healthy controls who are matched to socio-demographic variables. We found statistically significant differences in time to taken to complete the tests by the BPAD group compared to healthy controls, and also subjects in cases group committed more errors in the tests. Within group analysis showed a significant cognitive impairment in subjects with longer duration of the illness, those with the substance use, individuals from lower socioeconomic status and those with lower educational status.

In BPD, the cognitive dysfunction probably has a multifactorial aetiology involving a gene environment interaction. Results of recent meta-analytic studies have documented the existence of cognitive deficits in all phases of BPD, which are apparently independent of the affective state.These involve selective attention/processing speed, concentration, immediate episodic memory, attentional deviance, strategic thinking ,abstraction, verbal learning/immediate memory/planning, and perseveration. Also, the deficits in executive function are probably related to dysfunction of the prefrontal cortex and may be responsible for reducing the patient's coping abilities, making individuals more vulnerable to recurrence of symptoms.[9] In a longitudinal study Individuals with bipolar disorder showed consistent impairment on speed of processing and attention over time, despite significant changes in mood.[10] A study compared cognitive impairment in older BD patients and patients with major depressive disorder, which found more cognitive imapairment in BD patients.[11] Patients with co-occurring BD and alcohol dependence may suffer from more severe cognitive dysfunction and less favorable recovery of cognitive deficits than patients without SUD over the course of remission from a mood episode.[12] present study is consistent with previous literature which have noted cognitive impairment in euthymic BD patients.

The possibility that cognitive decline is associated with the onset of syndromal disease highlights the value of early recognition and intervention in BD. Furthermore, as existing research suggests that the degree of cognitive dysfunction in BD increases with each significant mood episode early intervention in BD should be viewed as a key priority for service development. The relationship of cognitive impairment to functional outcome in BD highlights its significance as a treatment target.[1] the present study has some limitations, the effect of medications were not assessed which would affect cognitive functions, not all domains of cognitive functions were assessed, relatively small sample size. Despite the limitations the present study shows BD patients perform poorly on tests of attention, visual scanning, executive function, psychomotor performance when compared to healthy controls.

V. CONCLUSIONS

The relationship of cognitive impairment to functional outcome in BD highlights its significance as a treatment target, it also directs attention to the potential neuroprotective effects of existing medication, such as lithium, and encourages the development of new pharmacological and psychological interventions.

REFERENCES

[1] Kumar CTS, Frangou S. Clinical implications of cognitive functions in bipolar disorder. Ther Adv Chronic Dis.2010;1(3):85-93.

[2] Hyon HT, Kim SJ, Chang SJ, et al., verbal and visual memory impairments in bipolar I and II Disorder. Psychiatry Investig. 2012;9:339-346.

[3] Bauer IE, Keefe RSE, Snanches M, Suchting R. et al., evaluation of cognitive functions in bipolar disorder using the brief assessment of cognition in affective disorder (BAC-A). Journal Of Psychiatric research.2015;60:81-86.

[4] Latalova, Prasako J, Diveky T, Velartova H. cognitive impairment in bipolar disorder. Biomed pap med. 2011;155(1):19-26.

[5] Latalova, Prasako J, Diveky T, Velartova H, Kamardova D. cognitive dysfunction, dissociation and quality of life in bipolar affective disorders in remission. Psychiatria Danubina.2010;22(4):528-534.

[6] Vohringer PA, Barroilhet SA, Amerio A, Reale ML. et al.,cognitive impairment in bipolar disorder and schizophrenia; a systemic review. Frontiers in Psychiatry.2013;4(87):1-11.

[7] Young RC.,Biggs JT.,Ziegler VE.,Meyer DA. A rating scale for mania: reliability,validityandsensitivity.Br.J.Psychiatry.1978;133:429–435.

[8] Hamilton M. Arating scale for depression. J .Neurol . Neurosurg. Psychiatry.1960; 23:56–62.

[9] Lopez R, Fernandes L. Bipolar Disorder: clinical perspectives and implications with cognitive dysfunction and dementia. Depression Research and Treatment.2015:1-11.

[10] Chaves OC. et al., Association of clinical symptoms and neurocognitive performance in bipolar disorder: A longitudinal study. Bipolar Disord 2011;13(1):118-123.

[11] Gildengers AG. et al., cognition in older adults with bipolar disorder versus major depressive disorder . Bipolar Disorder.2012;14(2):198-205.

[12] Levy B, Manovea E, Weiss RD. Recovery of cognitive functioning in patients with co-occurring bipolar disorder and alcohol dependence during early remission from an acute mood episode. Ann Clin Psychiatry. 2012

May ; 24(2): 143–154.

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Seed Transmission Studies on Seedborne Fungi of Soybean

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Abstract- The present investigation was undertaken with the main objective to determine studies on seedborne fungi of soybean were conducted at DSST and Plant Pathology, College of Agriculture, Rajendranagar, Hyderabad. A total of 120 representative soybean seed samples (cv. JS - 335) were collected from major soybean growing districts of Andhra Pradesh *viz.*, Adilabad (60 samples) and Nizamabad (60 samples) during *Rainy* season 2012. Per cent total incidence of seed mycoflora in Nizamabad and Adilabad districts ranged from 30 to 49.2 % and 23.6 to 45.0 % by blotter method, 14.8 to 28.1% and 11.6 to 22.1% by 2, 4 - D blotter method, 11.8 to 19.3 % and 9.5 to 16.2 % by deep freeze blotter method, 13.1 to 37% and 15.4 to 26.4 % by agar plate method, respectively. Out of nine fungal species recorded, *Macrophomina phaseolina* was found predominant in the samples analysed from two districts (8.5 to 28.5 %), while the occurrence of *Cladosporium* sp. (0.3 to 0.5%) was least. Seed transmission of *M. phaseolina* in apparently healthy soybean seeds (cv. JS 335) was 6 % and 8 % and in artificially inoculated soybean seeds (38.5 % and 49 %) and in naturally infected soybean seeds (32 % and 43.1 %). Germination in the above seed samples ranged from 75% to 72%, 55% to 46% and 59.3 % to 50.5 % in test tube water agar method (*in vitro*) and in glasshouse conditions.

Index Terms- Soybean, Fungi, Seed mycoflora, Seed samples and Seed transmission.

I. INTRODUCTION

Soybean (*Glycine max* (L.) Merrill) the "golden bean" is one of the fore most important oil seed crop known for its excellent protein (42-45%), oil (22%) and starch content (21%). It is good source of vitamin - B complex, thiamine and riboflavin. Soybean protein is rich in valuable amino acids like lysine (5%) in which, most of the cereals are deficient. Soybean can substitute for meat and to some extent to milk (Endres *et al.*, 2013)[1]. Inspite of phenomenal increase in area and soybean production, its productivity remains low because of lack of quality seeds. Low yield and productivity of soybean in India is mainly due to various diseases and pests occurring in the field and causing yield losses. One of the major constraints in the endeavour of increasing productivity of soybean is its susceptibility to a large number of diseases caused by fungi, bacteria, viruses and nematodes. In India, although 40 fungal pathogens have been identified in soybean crop, but only a few of them are economically important (Sarbhoy and Agarwal, 1983)[2]. Seeds of soybean are known to harbour several species of seed borne fungi *viz*., *Cercospora kikuchi, Alternaria alternata, Aspergillus flavus, Aspergillus niger, Chaetomium globosum, Colletotrichum dematium, Curvularia lunata, Fusarium oxysporum, Macrophomina phaseolina, Penicillium* sp. and *Rhizopus stolonifer* were found in germinating seeds and seedlings of soybean (Shovan *et al*., 2008)[3]. Disease free quality seed production in soybean is utmost important to sustain the productivity and maintain the quality of the crop**.** The infected seeds failed to germinate or seedlings and plants developed in the field from infected seeds may escape the early infection but often may be infected at the later stages of the crop growth. Besides, pathogens can spread over a longer distance and uninfected field may be infected by the seeds in which different pathogens are present. The frequency in occurrence of such potentially pathogenic fungi on soybean cultivars poses a potential threat in crop production programme.Transmission of the pathogen through seed is also known as a means of spread of disease into new areas and new countries. *M. phaseolina* in soybean transmits from seed to seedlings in a systemic manner. The reduction in seed germination and increase in seed rot and seedling mortality were noticed. Another adverse effect of seed borne pathogens is that it contaminates the areas which were disease free previously. So, it necessitates the eradication of seed borne inoculum through various seed treatments and through the enforcement of proper domestic and international quarantine acts and procedures (Arya *et al*., 2004)[4]. Keeping this in view, the present investigation was taken up.

II. MATERIALS AND METHODS

Scope of the Study

The present experiment was carried out at Department of Seed Science and Technology and Plant Pathology, Rajendranagar, Hyderabad during *rainy* season, 2012. Soybean seed samples (cv. JS - 335) collected from different soybean growing districts of Andhra Pradesh *viz.*, Nizamabad and Adilabad districts of Andhra Pradesh.

Collection of soybean seed samples

One hundred and twenty soybean seed samples were collected from the major soybean growing districts of Andhra Pradesh *viz.*, Adilabad (60 Nos) and Nizamabad (60 Nos) for

assessment of seed mycoflora. The collected seed samples were shade dried and stored in paper bags at ambient storage temperatures of 28 + 2 ºC for further studies.

Isolation of seed mycoflora

Four different seed health testing methods *viz.*, standard blotter method, 2, 4 -D blotter paper method and agar plate method as described by ISTA (1996)[5], and deep freeze blotter method developed by Limonard (1968)[6] were employed for estimation of seed mycoflora associated with soybean seed samples. Four hundred seeds were tested in different detection methods.

Data analysis

The data were statistically analyzed by using Completely Randomized Design (CRD) as suggested by Gomez and Gomez (1984)[7]. The data pertaining to percentage were angular transformed wherever necessary.

III. Results And Discussion

Isolation of the pathogen

Different seed health testing methods *viz.,* standard blotter paper method, 2, 4 - D blotter paper method, deep freeze blotter paper method and agar plate method were employed to detect the predominant seed borne fungi from soybean seed samples. Among the seed borne fungi, *M. phaseolina* was found predominant and it was used as test pathogen for further studies. The pathogen appeared as greyish mycelial growth on incubated soybean seeds in different detection methods.

Seed Inoculation of *Macrophomina phaseolina*

Seeds of soybean (cv. JS – 335) were artificially inoculated with conidial suspension (^{106} conidia ml^{-1}) of *M. phaseolina* exhibited the symptoms of seed rot and seedling blight. First symptoms were noticed in the form of seed rot (5 days) and seedling blights and charcoal rot 15 days after sowing. More than 90 to 95 % seedling mortality was observed. Control pots kept with healthy seeds in sterilized soil in isolation did not exhibit any symptoms up to 15 days after sowing. Similar observation was made by Kunwar *et al*. (1986) [8] and Arya *et al*. (2004)[4] who reported that similar type of symptoms on soybean seedlings inoculated with *M. phaseolina.* It was also confirmed earlier by Raut (1985)[9] in sunflower seeds due to *M. phaseolina*

Seed transmission studies were carried out by test tube water method (seedling symptom test) under *in vitro* conditions and also in pot culture under glasshouse conditions.

Seedling symptom test (TWA)

Seeds of soybean cv. JS - 335 were tested by test tube water agar method under laboratory conditions. The results indicated (Table 1) that artificially inoculated soybean seeds with *M. phaseolina* showed reduction in seed germination (55 %) and increased in seed rot and seedling blight (18 % and 20.5 %), respectively. Whereas naturally infected soybean seed samples recorded germination of 59.3 %, seed rot of 15.5 % and seedling blight of 16.5 %. On the contrary, apparently healthy seed samples recorded high germination (75 %), less seed rot (2.5 %) and seedling blight (3.5 %). The germinated seedlings from the infected seed sample exhibited the symptoms of seed rot, seedling blights, discolouration of roots and production of spots on cotyledons and true leaves after 15 days of incubation. Similar findings were reported earlier by Arya *et al*. (2004)[4] in soybean and Raut (1985)[9] in sunflower.

Seed transmission studies in pot culture under glasshouse conditions

The results indicated (Table 2) that artificially inoculated seeds of soybean cv. JS - 335 with seedborne *M. phaseolina* exhibited reduction in seed germination (46 %) and increased seed rot and seedling mortality (25.8 % and 23.2 %), respectively. Whereas naturally infected soybean seed samples recorded germination (50.5 %), seed rot (24 %) and seedling mortality (19.1 %). On the contrary apparently healthy seed samples recorded high germination (72 %), less seed rot (4.2 %) and seedling blight (3.8 %), respectively. Seedlings raised from naturally infected and artificially inoculated seeds recorded seed rot and seedling blights and discoloration of basal stem at the above soil level with the numerous production of sclerotial bodies on the stem surface. The present findings are inconformity with the earlier findings of Arya *et al*. (2004)[9] in soybean who reported that *M. phaseolina* transmits from seed to seedling in a systemic manner. The germination in naturally infected soybean seeds was 52 % and 45%, respectively as against 75 % and 72 % germination in healthy seeds under laboratory and glasshouse conditions, respectively. In naturally infected seeds, 30 % and 25 % seed rot, 18 % and 8 % seedling mortality were recorded in laboratory and glasshouse conditions, respectively. Similar findings was reported earlier by Kunwar *et al*. (1986)[8] in sunflower, Anwar *et al*. (1995)[10] and Mandhare *et al*. (2009)[11] who reported that *M. phaseolina* causing charcoal rot in soybean transmits from infected seed to seedlings.

IV. Conclusion

Seed transmission of *M. phaseolina* in soybean (cv. JS - 335) was found high in artificially inoculated and naturally infected seeds over apparently healthy seeds in test tube water agar and under glasshouse conditions revealed that significant differences in seed rot, seedling blight and per cent emergence of seedlings was observed at 35 days after sowing. Studied the transmission process of *M. phaseolina* from root to upward growth of the soybean and development of fungus *M. phaseolina* established in the seedlings within 48 hours of entering in the host tissue. At cotyledon stage, seedling gets infected 3-7 days after sowing. Variation of host in disease severity is due to genetic variation, geographical origin or source of the isolate. Due to high degree of genetic variation in the pathogen, cultivation of resistant varieties is the most economical and practical approach.

Acknowledgements

I am very thankful to Acharya NG Ranga Agriculture University, Rajendranagar, Hyderabad for providing me stipend during my research work.

References

[1] Endres, J., Barter, S., Theodora, P and Welch, P. 2013. Soybean enhanced lunch acceptance by preschoolers. Journal of American Dietetic Association. 103: 346-351.

[2] Sarabhoy AK and Agarwal DK. (1983). Fungal diseases of soybean and their management. Int. J. Trop. Pl. Diseases. 1:13-19.

[3] Shovan, L.R., Bhuiyan, M.K.A., Sultana, N., Begum, J.A and Pervezi, Z. 2008. Prevalence of fungi associated with soybean seeds and pathogenecity tests of the major seed borne pathogens. International Plant Protection. 72-75.

[4] Arya, V.K., Vishunavat, K and Himanshu, N. 2004. Detection, location and transmission of seedborne inoculums of Macrophomina phaseolina in charcoal rot in soybean. Journal of Mycology Plant Pathology. 34: 319-328.

[5] ISTA. (1996). International rules for seed testing rules. Seed Science and Technology. 13: 299-513.

[6] Limonard J. (1968). Ecological aspects of seed health testing. International Proceedings of Seed Testing Association. 33: 1-8

[7] Gomez KA and Gomez AA. (1984). Statistical procedures for agricultural research (second edition) John Wiley and Sons, New York.

[8] Kunwar, I.K., Singh, T., Mechado, C.C and Sinclair, J.B. 1986. Histopathology of soybean seed and seedling infection by Macrophomina phaseolina. Phytopathology. 76: 532-535.

[9] Raut, J.G. 1985. Transmission of seed borne Macrophomina phaseolina in sunflower. Seed Science and Technology. 11: 807 – 814.

[10] Anwar, SA, Abbas SF, Gill MM, Rouf CA, Mahamood S and Butta AR. (1995). Seed borne fungi of soybean and their effect on seed germination. Pakistan J. Phytopathology. 7: 184-190.

[11] Mandhare, V.K., Gawade, S.B and Suryawanshi, A.V. 2009. Detection and transmission of seed borne infection of Macrophomina phaseolina causing charcoal rot in soybean. Journal of Plant Disease Sciences. 4:130-131.

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Table 1: Seed transmission of *M. phaseolina* in soybean (cv. JS – 335) by test tube water agar method (TWA)

S.N.	Treatment	*Germination (%)	*Seed rot (%)	*Seedling blight (%)
1	**Apparently healthy seed sample**	75.5 (59.9)	2.5(9.09)	3.5(10.7)
2	**Naturally infected seed sample**	59.3 (50.3)	15.5 (23.1)	16.5 (24.1)
3	**Artificially inoculated seed sample**	55.0(47.8)	18.0 (25)	20.5 (26.9)
	S.Em (±)	**0.62**	**0.18**	**0.22**
	CD at 5%	**2.19**	**0.64**	**0.80**

Figures in parentheses indicate angular transformed values. * Average of three replications

Table 2: Seed transmission of *M. phaseolina* in soybean (cv. JS – 335) under glasshouse conditions

S.N.	Treatment	*Germination (%)	*Seed rot (%)	*Seedling blight (%)
1	**Apparently healthy seed sample**	50.5 (45.2)	24.0 (29.3)	19.1 (25.9)
2	**Naturally infected seed sample**	46.0 (42.6)	25.8 (30.5)	23.2 (28.7)
3	**Artificially inoculated seed sample**	46.0 (42.6)	25.8 (30.5)	23.2 (28.7)
	S.Em (±)	**0.38**	**0.35**	**0.36**
	CD at 5%	**1.34**	**1.25**	**1.30**

Figures in parentheses indicates angular transformed values. * Average of three replications

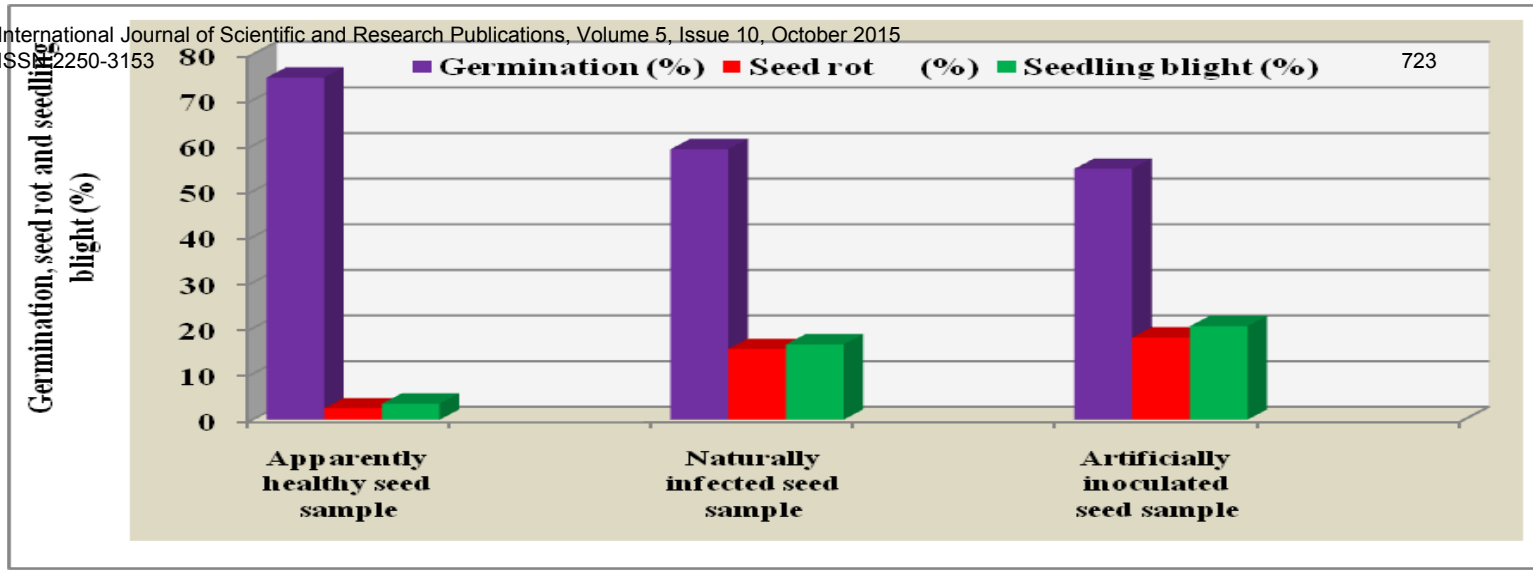


Figure1. Seed transmission of *M. phaseolina* in soybean cv. JS-335 by test tube water agar method (TWA)

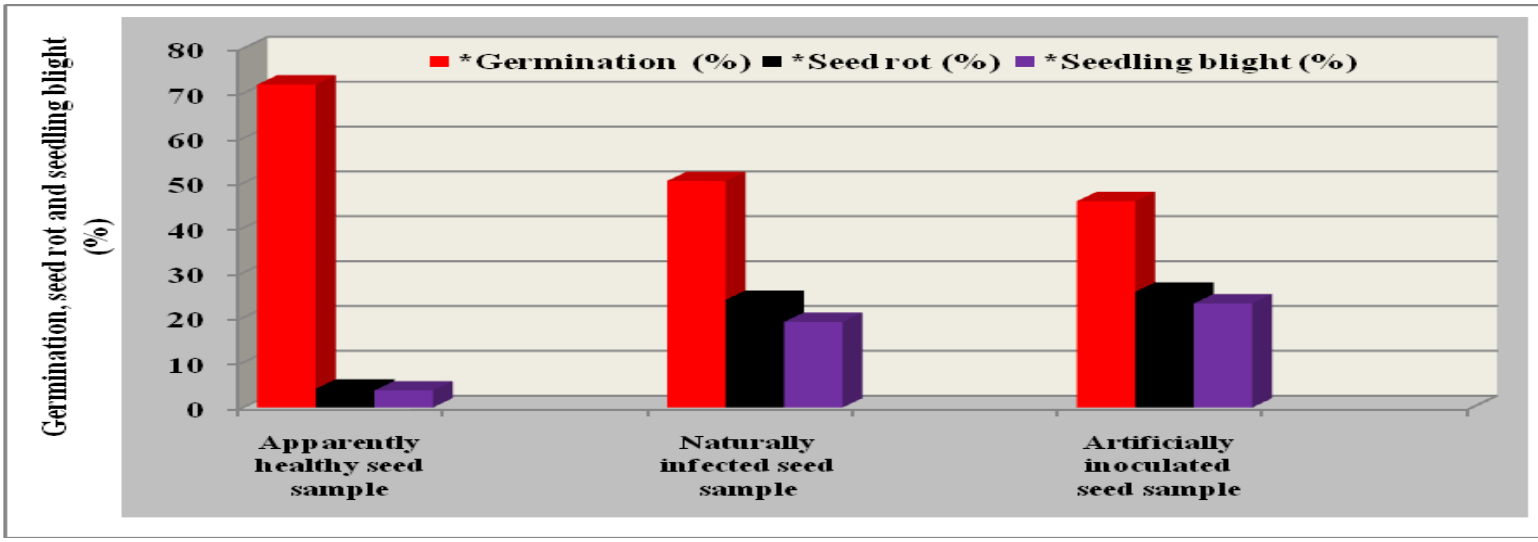
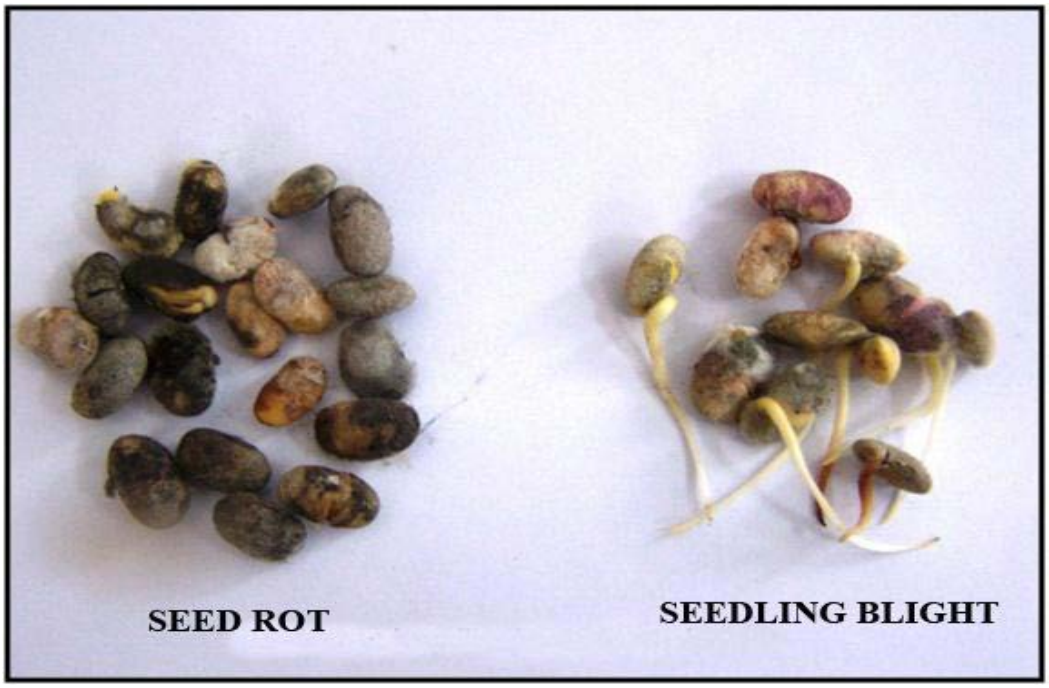


Figure 2. Seed transmission of *M. phaseolina* in soybean cv. JS-335 under glass house conditions

Plate 1: Seed rot and seedling blight of soybean cv. JS-335 due to *M. phaseolina*



The Combined Use of Organic and Inorganic Fertilizers for Improving Maize Crop Productivity in Nigeria

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Abstract: Recent studies have revealed that the integrated use of organic and inorganic fertilizers on crop has not received adequate research attention. In this paper, maize is considered among the most important cereal crops in Nigeria and all over the world that has high requirement for organic and inorganic nutrients in order to obtain good quality and high yields. The application of inorganic fertilizer for instance has been found to increase maize performance and chemical properties of soil such as pH, total nutrient content and nutrient availability. On the other hand, its continuous use could cause nutrient imbalance, soil acidity, more so, heavy fertilization in crop production systems could exceed what maize pants are able to utilize and can be a major source of excessive nitrate leaching. Similarly, organic fertilizers are faced with the problems of scarcity, slow nutrient release and difficulty in transportation. In view of these constraints, the combined use of organic and inorganic fertilizers in improving maize crop productivity was reviewed and it was found that the total dependence on organic or inorganic fertilizers does not provide the panacea for enhanced and sustainable maize crop production in Nigeria. Therefore, the combined use of organic and inorganic fertilizers appears to be the last option and recommendation of the paper for sustaining productivity as well as enhancing the farmers' level of maize production in Nigeria.

Key Words: Organic, Inorganic, Fertilizer and Maize Crop

I. INTRODUCTION

In most parts of Africa including Nigeria, traditional method of maintaining soil fertilizer and productivity has been bush-fallow system where the arable land is allowed to revert to fallow after 3 – 4 years of continuous cultivation. However, due to the growing population and other socio-economic pressures, the fallow period had been reduced from 7 – 10 years now to almost no fallow now in order to accommodate the increasing high demand for food (Asadu and Unagwu, 2012).

The use of both organic and inorganic fertilizer by farmers has been reported to increase yield and sustain soil productivity (Chukwu *et al*, 2012). Many research works showed that the use of several organic materials especially cow dung, poultry droppings and farm yard manure as soil amendments is suitable for increasing crop production particularly among subsistent farmers in West Africa (Asadu and Unagwu, 2012). The uses of fertilizers are highly needed to replenish nutrients taken out from the soil by harvest crops and to supplement more nutrients to boost yield (Olatunji and Ayuba, 2012).

Organic fertilizer can be used to improved soil characteristics and obtain high crop yields in addition with inorganic fertilizer (Cezar, 2004). In organic fertilizer use, production of crops free from heavy metal contamination will be guaranteed (Asadu and Unagwu, 2012). The addition of organic amendments to manage the current trend of soil physical, chemical and biological degradation has been recommended by Chukwu *et al*, (2012). Organic and inorganic fertilizers have their merits and demerits. For instance, organic fertilizers are slow release nutrient sources. This implies that crops can suffer initial starvation from nutrient immobilization prior to mineralization. They are also required in large quantities which may not be readily available to small scale farmers (Agbede, and Kalu, 1995; Okigbo, 2000; Adekiya *et al*, 2012).

On the other hand, while inorganic fertilizers ensure quick availability of nutrients to crops they have limited residual effect of the applied nutrients (Okigbo, 2000) and their reckless use can create nutrient imbalance that limits the uptake of other essential nutrients and cause soil acidity leading to low crop yields. In addition, they are expensive and may not be readily available. Maize (*Zea mays* L.) is a very high nutrient – demanding crop, requiring adequate nutrition for maximum performance (Rashid and Ryan, 2004). Among the several other factors which causes decline in maize yield is soil degradation for intensive cultivation and continuous application of the rates of NPK fertilizers which may cause nutrient imbalance and limit the uptake of other essential nutrients, thus limiting the crop performance (Rashid and Ryan, 2004; Chukwu *et al*, 2012).

II. Justification

Nearly all attempts to maintain continuous crop production with inorganic fertilizers alone have failed in the country, hence there is need to adopt alternative reduced “chemical” or “ion-input” production systems involving a partial reduction in the use of chemicals. The combined use of organic and inorganic fertilizers has proven a sound soil fertility management strategy in many countries such as Tanzania, India and Central African Republic. The tendency to supply all nutrients through chemical fertilizers has to be avoided as this has deleterious effect on soil productivity (Ojeniyi, 2000).

Studies carried out in southwest Nigeria (Eneji *et al*, 1997 and Ojeniyi and Adeniyan, 1999) have recommended combinations of farmyard manure and NPK fertilizer for sole and intercropped maize. According to these authors, Nigeria and indeed other tropical countries must not assume that the soil can be rendered productive by fertilizer alone, but plus appropriate soil management and farming techniques that build up soil organic matter. According to Ojeniyi (2000), since almost all attempts made to maintain continuous crop production with inorganic fertilizer alone in Nigeria have failed, the need to evolve production systems that will utilize the combined use of organic and inorganic fertilizers for improving maize crop productivity in Nigeria cannot be over-emphasized.

The objective of this paper is to highlight on the effects of complementary applications of organic and inorganic fertilizer on the production of maize in Nigeria.

III. Fertilizers and Crop Productivity in Nigeria

The importance of fertilizer as an agricultural input cannot be over emphasized particularly in the tropics where the nutrient levels of soils in most areas are low. Maize crop requires fertilizers in sufficient amount to give the maximum economic returns. There are two main types of fertilizer for improving crop productivity in Nigeria, inorganic (or chemical or synthetic fertilizers) and organic fertilizers.

Inorganic fertilizer is an artificially prepared manure with a variable concentration of plant food and are available in the form of single fertilizer, incomplete fertilizer and complete fertilizer. Single fertilizer contain only one fertilizer element e.g. Ammonium sulphate (N), urea (N), super phosphates (P_2O_5), muriate of potash (K_2O), etc. incomplete fertilizer contain two fertilizer elements. A typical example is Ammonium sulphate (N + S) while complete fertilizers contain all three elements (NPK) which are the focus of attention in fertilizer formulation (Cooke, 1982).

Organic fertilizer are available in large quantities all over the world in Nigeria, waste from brewery fertilizers like molasses, waste from other industries can be considered as sources of organic fertilizers, other sources include materials such as cocoa pods, rice bran, bean pod, sorted town refuse, sewage and city waste, poultry droppings, animal dung, human feaces and urine. It also includes yam peelings, cassava peelings, and straws of rice, maize, millet, sorghum and sugar cane leaves. Inorganic fertilizer differ from organic fertilizers in that they usually consist of relatively simple chemical compounds of known composition and that they contain weight, much higher percentages of fertilizer elements (Lockeretz, 1995).

IV. Use of Inorganic Fertilizers for Maize Crop Production

Ojeniyi (2002) reported that there are abundant evidences that inorganic fertilizers can improve yield of maize crop significantly. Cooke (1982) stated that fertilizers allow us to raise soil fertility so that the yield of crops need no longer be limited by the amounts of plant nutrients that the natural system can supply and factors other than nutrition then set the limit to productivity. The advent of inorganic fertilizer has thus revolutionalized maize crop production through its provision of plant nutrients for improved maize crop productivity in Nigeria.

Total dependence on inorganic fertilizers however does not provide the panacea to soil management and crop productivity problems in Nigeria. According to Ojeniyi (1995) cited in Ojeniyi (2002) there are problems that arise with continuous use of inorganic fertilizers. Most farmers apply fertilizer without soil test, thus wrong amount and type may be applied. Deficiency of secondary and micronutrients occur in soil and crop, if the common NPK type is consistently used. Ojeniyi (1981) reports that total dependence on inorganic fertilizers may be accompanied by fall in soil organic matter, increased soil acidity and degradation of soil physical properties and structure and increased erosion.

The National Research Council (1989) cited in Lockeretz (1995) stated that in the past two decades, there has been increasing concern about agricultural damage to the environment and its consumption of non-renewable resources especially through synthetic pesticides and fertilizers. Agricultural chemicals have contaminated ground and surface waters, harmed fish and wildlife and greatly increased agricultural dependence on fossil fuel resources. The fore-going underscores the need to evolve alternative “reduced chemical” or “low-input” production systems involving a partial reduction in the use of chemicals.

V. Use of Organic Fertilizers in Maize Crop Production

The use of organic materials is an important component for sustainable agricultural production as when such materials are applied to agricultural land they promote sustainability because of:

1. Their long term position effects on soil chemical and physical properties.
2. The possibility of recycling plant nutrients within a farm (e.g. feeding harvested fodder to livestock and then applying farmyard manure from these animal back to the land).
3. The possible substitution of readily available organic inputs for chemical fertilizer, and therefore a decreased dependence on external sources for costly fertilizer.
4. The general improvement in maize crop yield and quality obtained when adequate rates of organic soil amendment are incorporated into the soil. (Motavilli *et al*, 1994).

Plant wastes such as wood ash, spent grain, rice bran, and sawdust were effective as fertilizers (Ogbalu, 1999). Effect was enhanced by amendment with pig, goat, cattle and poultry manure. The residue increased soil organic matter, N, P, Ca, Mg and pH and reduced soil bulk density. Chemical analysis showed that the residues contained N, P, K, Ca, Mg, Fe, Mn, Cu and Zn (Folorunso, 1999) and the manures increased soil pH, nutrient contents, growth and yield of maize and okra. Odiete *et al*, (1999) found that goat manure increased soil P and K yield of okra and amaranths. In the tropical world, plant- derived ash is regarded as a suitable manure and liming material (Ogbalu, 1999, Obi and Ekperigin, 2001).

In southeast Nigeria, planting of pepper and other vegetable at household levels is sustained by the use of chicken droppings, cow dung, wood ash and plant residues (compost) as sources of improving fertility of apparently depleted soil. According to Ogbalu (1999) these traditional sources of nutrients are accessible to farmers and the use of chemical fertilizers by villagers is not common. Apart from their direct effect as fertilizers, plant residues improve soil physical properties and fauna population. Recycling of plant residues will replace 40 to 50% of N exported by a crop, 25 to 40% of the P and 70% of the K. In the Nigerian savanna, about 3.1 million tones of crop residues are produced annually in form of sorghum, millet, cotton, maize, groundnut and cowpea. About 45% N, 40% P, 86%K, 92% Ca and 72% Mg removed from soil by crop are contained in the residues (Ogbalu, 1999). Therefore, recycling of agro wastes can be a good alternative to bush fallow. Unlike in case of chemical fertilizer, soil is physically and biologically built up, acidity is controlled and erosion is controlled.

The major constraints to the use of organic materials for maize crop production are competing alternative uses, bulk, time and the quality of organic materials. In addition to incorporation and as much as mulch, plant and animal remains are also used by farmers for fuel, housing, fencing, animal feed and for industrial purposes. This alternative uses invariably reduce the quantity of waste and residues being returned into the soil. The amount of organic matter needed to achieve most optimum maize crop productivity is enormous. Apart from the problem of returning the crop residue into the soil farmers often do not produce the quantity sufficient to maintain soil fertility and conserve the soil. The farmer must allow appropriate time between incorporation and planting to enable the maize crop to benefit from nutrient released from the organic matter. Failure to synchronize the time mineralization with crops needs will lead to waste of the nutrients. There may also be injury to the crops following heat on decomposition of freshly incorporated organic matter.

For crops to drive nutritional benefits from incorporated organic matter, it must be of high quality. That is, the carbon/nitrogen ratio of the organic matter being incorporated in the soil must be below 20:1 -25:1. The foregoing shows that to drive maximum benefit of organic materials incorporation, it may be necessary to accompany it with application of inorganic chemical fertilizer. This underscores the need for combined use of chemical and organic fertilizers for sustainable soil productivity under intensive continuous cultivation of maize crop in Nigeria.

The Combined Use of Organic and Inorganic Fertilizers for Improving Maize Crop Productivity

The problems associated with the single approach application of organic or inorganic fertilizers have made a combination of organic and inorganic fertilizers a viable option in improving maize crop productivity in the Nigeria. Total dependence on inorganic fertilizers which may be accompanied by fall in soil organic matter, increase in soil acidity, degradation of soil physical properties and structure and increase erosion has to be avoided while on the other hand total dependence on organic fertilizer may be restricted in use due to competing alternative uses, bulk i.e. the amount needed to achieve optimum crop productivity, slow release of nutrients and the quality of organic matter.

However, the combined use of organic and inorganic fertilizers will ensure that the problems associated with the use of either organic or inorganic fertilizers are greatly reduced as the combination of organic and inorganic fertilizers complement each other. Ojeniyi (2002) reports that nearly all attempts to maintain continuous crop production with chemical fertilizers alone in the tropics have failed. It has been abundantly shown that combined use of organic and inorganic fertilizers is required for sustainable soil productivity under intensive continuous cultivation in Nigeria (Adepetu, 1997). The combined use of organic and chemical fertilizers has proved a sound soil fertility management strategy in many countries such as Tanzania, India and Central African. The tendency to supply all nutrients through chemical fertilizers has to be avoided as this has deleterious effect on soil productivity. Studies carried out in southwest Nigeria (Eneji *et al*, 1997; Ojeniyi and Adeniyan, 1999) have recommended combinations of farmyard manure and NPK fertilizer for sole and inter cropped maize.

According to Obi and Ebo (1995) low soil organic matter contents results in high soil bulk density, low macro porosity reduces water infiltration transmission and availability. For the Ultisols of southeast Nigeria, it has been submitted that inorganic fertilizer alone will not ensure sustainability of production under the prevailing intense rainfall with increased leaching of nutrients. The addition of organic amendment to soil is not only an economic imperative but also a management necessity if the trend of soil degradation in Nigeria is to be revised.

VI. Other Related Research Works

Eneje and Uzoukwu (2012) conducted an experiment at the Michael Okpara University of Agriculture, Umudike on the "*Effects of rice mill waste and poultry manure on some soil chemical properties and growth and yield of maize"*. The results showed that the addition of the organic materials have improved the soil chemical properties with the poultry manure alone giving the highest value for all the parameters analyzed, which included soil pH, available phosphorus and organic carbon. However, the use of rice mill waste in combination with poultry manure and NPK were recommended for improvement of soil fertility and pH to the optimum value required by most tropical crops, especially maize.

Chukwu *et al*, (2012) also carried out research work on the *"Effects of poultry and NPK fertilizer on soil properties and nutrient uptake of maize (Zea mays* L.*) Plants grown in an ultisol"*. In their research work conducted at the National Root Crops Research Institute, Umudike, Research Farm, application of one type of fertilizer alone did not significantly improve the uptake of the macro and micro nutrients by the maize crop. The results also showed that soil available P, exchangeable K, Ca and Mg as well as effective cation exchange capacity (ECEC) were significantly improved by the combined application of organic and inorganic fertilizers.

Asadu and Unagwu (2012) carried out a study on the *"Effect of Combined poultry manure and inorganic fertilizer on maize performance in an ultisol of southeastern Nigeria"*. Their results also indicated that the combined use of organic and inorganic fertilizers is required for sustainable maize crop productivity in Nigeria.

Olatunji and Ayuba (2012) studied on the "*Effects of combined applications of poultry manure and NPK 20 – 10 – 10 fertilizer on soil chemical properties and yield of maize (Zea mays* L.)" They carried out filed experiments at the University of Agriculture, Makurdi, Nigeria, during the 2008 and 2009 cropping season. The results showed that the poultry manure, NPK and their combinations increased soil nutrient elements such as N, P, K, Ca, ECEC over the control. It was concluded that the combination of 4t/ha poultry with 60kg/ha NPK 20 – 10 – 10 fertilizer with the highest grain yield be used for production of maize in the study location. .

Ukem, (2012) carried out a study on the *"Yield of maize (Zea mays* L.) *as affected by Algifol nutrient solution and inorganic fertilizer in Northern Guinea Savanna of Nigeria"*. The result showed that the combination of nutrient solution and NPK recorded significantly higher grain yield than sole application of either nutrient solution or NPK. The greater efficiency of the combined treatments on grain yield indicates the need for optimum nutrient balance for a sustainable maize cultivation in the northern guinea savanna of Nigeria.

Osemwota *et al*, (2012) also studied on the *"Effects of abattoir effluents and Sawdust on yield and yield components of maize (Zea mays* L.)". The study was conducted at Ambrose Alli University Teaching and Research Farm, Ekpoma, Nigeria. Results showed that maize plant height, leaf area, stem girth and number of leaves were significantly enhanced ($P < 0.05$). Optimum grain yield of 4.04t/ha of maize was obtained from the combined application of 4.0t/ha saw dust and 6,360 litres/ha abattoir effluent.

Awanlemhem and Ojeniyi (2012) carried out an investigation on the *"Effect of oil palm bunch ash on grain yield and nutrient availability to maize"*. In their research work, field experiments were conducted at Nigerian Institute For Oil Palm Research (NIFOR) and Ekiadolor in the Rain Forest Zone of Southern Nigeria on the effects of combined applications of Oil Palm Bunch Ash (OPBA)

and NPK (15 – 15 – 15) fertilizer on soil nutrient content, nutrient uptake and maize grain yield on slightly acidic sandy soils. The effects of OPBA, NPK and their combinations on soil OM, N, P, K, Ca, Mg, CEC and leaf N, P, K, Ca and Mg were significantly observed and consequently improved the yield of maize crop.

Onwuka *et al* (2012) studied on the *"Remediation of spent engine oil polluted soil using types of organic manure and their effects on maize growth"*. In their study, poultry manure, goat dung, composted cassava peel and composted *Chromolena odorate* were found to increase maize performance and improve soil physical, chemical and biological characteristics.

Olowoake *et al* (2012) investigated on the *"Influence of differently composted organic residues on the yield of maize and its residual effects on the fertilizer of an Alfisol in Ibadan, Nigeria"*. In their research work, the potential of differently composted organic residues on the growth and yield of maize (*Zea mays* L.) as well as its residual effects on the fertility were studied in two cropping seasons. The composted organic residues combined with NPK fertilizer had potential for increased soil fertility for maize production.

Lawal *et al* (2012) also conducted a study on the "*agronomic efficiency of maize (Zea mays* L.) *as influenced by compost rates in the rain forest savanna transitional zone of South West Nigeria"*. The study was conducted during the early and late-rain season of 2010 at the Teaching and Research Farm of University of Agriculture, Abeokuta Ogun State, Growth and agronomic efficiency of maize were investigated. Study indicated a significant variation in growth and yield parameters in response to varietals difference as a result of combined applications of fertilizers.

VII. Conclusion

From the different studies under this review, it can be summarized that complementary application of organic and inorganic fertilizers has been shown to reduce the application rates of each fertilizer type, increase the nutrient use efficiency of a plant, reduce leaching of nutrients, thereby ensuring nutrient availability to crops when needed and maintains soil structure which enhances root growth, exchange of gases, nutrient uptake, water availability and storage capacity as well as obviates the specific limitations of the two fertilizer types.

Many authors have suggested that in order to overcome some of the deficiencies inherent in the use of only one type of fertilizer to boost crop yield, adequate and effective use of mixture of organic and inorganic fertilizer will solve the problem of food scarcity in Nigeria and keep the soil in a much better condition than when only one fertilizer type is used.

VIII. Recommendations

1. The combined use of organic and inorganic fertilizers appears to be the last option and recommendation of the paper for sustaining productivity as well as enhancing the farmers' level of maize production in Nigeria.
2. It may also be recommended that more field trials, using different tones of organic and inorganic fertilizers be carried out to determine their efficiencies in promoting growth and yield of maize crop in Nigeria.

References

[1] Adekiya, A.O., Ojeniyi, S.O. and Agbede, M.T. (2012). Poultry manure effects on soil properties, leaf nutrient status, growth and yield of cocoyam in a tropical Alfisol. Nigerian Journal of Soil Science. 22(2) 30 – 39.

[2] Adepetu, J. A. (1997). Soil and Nigeria food security. Inaugural lecture series 119. OAU. Ile-Ife pp19.

[3] Agbede, O.O. and Kalu, B.A. (1995). Constraints of small-scale farmers in increasing crop yield: farm size and fertilizer supply. Nigerian Journal of Soil Science. 11:139 – 159.

[4] Asadu, C.L.A. and Unagwu, B.O. (2012). Effect of combined Poultry Manure and inorganic fertilizer on maize performance in an ultisol of southeastern Nigeria. Nigeria Journal of Soil Science. 22(1) 79 – 87.

[5] Awantemhen, B.E. and Ojeniyi, S.O. (2012). Effect of oil palm bunch ash on grain yield and nutrient available to maize. Nigerian Journal of Soil Science. 22 (2) 132-135

[6] Cezer, P.M. (2004). Organic fertilizer in rice: Myths and facts. A Public Education Series of the Asia Rice Foundation.1 (1).

[7] Chukwu, L.I., Ano, A.O. and Asawalam, D.O. (2012). Effects of Poultry Manure and NPK fertilizer on soil properties and Nutrient uptake of maize (Zea mays L.) plants growth in an ultisol. Proceedings of the 36th Annual Conference of the Soil Science Society of Nigeria (SSSN) on 7th – 11th March, 2012 University of Nigeria Nsukka.

[8] Cooke, G. W. (1982). Fertilizing for maximum yield. Third Edition English Language Book society/Collins. 457 pp.

[9] Eneje, R.C and Uzoukwu, I. (2012). Effect of rice mill waste and poultry manure on some soil chemical properties, growth and yield of maize. Nigerian Journal of Soil Science. 22 (1) 59-60.

[10] Eneji, A. E. Agboola, A.A. and Ibi, B.E. (1997). Effect of farmyard manure and NPK fertilizer on growth and yield of intercropped maize and sweet potato in southwestern Nigeria. Rivista di Agriculture subtropical tropical 91: 63-78.

[11] Folorunso, O.O. (1999). Use of plant residues for improving soil fertility and yield of Okra and Amaranthus. Unpublished Ph. D thesis. Federal University of Technology, Akure Nigeria. 395 pp.

[12] Lawal, O.I , Atayese, M.O., Oyekanmi, A. A. Sakariyawe O.S. , Aderibigbe, S.G. and Adeyemi. O. R. (2012). Agronomic efficiency of maize (Zea mays L) as influenced by compost rates in the rain forest: savanna transitional Zone of South west Nigeria. Book of Abstract for the Second Organic Conference. May 2nd – 4th Lusaka, Zambia.

[13] Lockeretz, W. (1995). Organic farming in Massachusetts: An alternative approach to agriculture in an urbanized state. Journal of soil and water conservation 50(6) 663-667.

[14] Motavalli, P.P., Singh R.P. and Anders, M. M. (1994). Perception and management of farmyard manure in the semi-Arid tropics of India. Agricultural systems. 46: 189-204.

[15] Obi, M.E. and Ebo, P.O. (1995). The effect of organic and inorganic amendments on soil physical properties and maize production on a severely degraded sandy soil in Southen Nigeria. Bioresources Technology 51: 117-123.

[16] Obi, O.A. and Ekperigin, J.(2001). Effect of wastes and soil pH on growth and grain yield of crops. African soils 33: 3-15.

[17] Odiete, I., Ojeniyi S.O., Akinola, O. M. and Achor, A. A. (1999). Effect of goat dung manure on soil chemical properties and yield components of okra, amaranthus and maize. Proceedings of 25th Annual Conference of Soil Science Society of Nigeria (SSSN). Benin pp 174-178.

[18] Ogbalu, O.K. (1999). The Effect of different traditional sources of nutrients on the paper fruit fly in Nigeria. Journal of Agronomy and crop science. 182: 65-71.

[19] Ojeniyi, S. O. (2002). Soil management, national resources and environment. Oke-Ado: Adeniran press. Pp 24.

[20] Ojeniyi, S.O. (1981). Effect of long term NPK application on secondary and micronutrient content of cofffea carephora. Plant and soil. 60: 477-480.

[21] Ojeniyi, S.O. and Adeniyi, M. O. (1999). Effect of poultry manure and NPK fertilizer on soil fertility and maize nutrient contents and yield at Akra southwestern Nigeria. Proceedings of 25th Annual Conference of Soil Science Society of Nigeria (SSSN). Benin. Pp 185-191.

[22] Okigbo, I (2000). Application of organic and inorganic fertilizers and the response of maize crop. Nigerian Journal of Soil Science. 18 (2). 22.

[23] Olatunji, O. and Ayuba, S.A (2012). Effect of combined applications of poultry manure and NPK 20-10-10 fertilizer on soil chemical properties and yield of maize (Zea mays L.). Proceedings of the 35th Annual Conference of the Soil Science Society of Nigeria (SSSN). 7th – 11th March, 2011, Federal University of Technology Minna.

[24] Oluwoake, A. A., Olabiyi, I. and Adeoye, G.O. (2012) Influence of differently composted organic residues on the yield of maize and its residual effect on the fertility of an Altisol in Ibadan, Nigeria. Book of Abstracts for the 2nd African Organic Conference. May 2nd -4th, Lusaka, Zambia.

[25] Onwukam, M. I., Chude, V.O. and Ogwuegbu, G.C. (2012). Remediation of spent engine oil polluted soil using types of organic manure and their effects on maize growth. Nigerian Journal of Soil Science. 22 (2) 248

[26] Osemwota, I.O., Isitekhale, H.H.E and Bakara, A. (2012) Effect of abattoir effluence and sawdust on yield and yield components of maize (Zea mays). Nigerian Journal of Soil Science. 22 (2) 58-62

[27] Rachid, R. and Ryan, I. (2004). Response of maize crop to different levels of organic and inorganic fertilizers application. Nigerian journal of Soil Science. 18 (2) 55

[28] Ukem, B.O. (2012) Yield of maize (Zea mays L.) as affected by Algifol nutrient solution and inorganic fertilizer in northern guinea savanna of Nigeria. Proceedings of the 35th Annual Conference of the Soil Science Society of Nigeria (SSSN), 7th – 11th March, 2011, Federal University of Technologsy Minna.

Assessment of Pediatric Nurses' Burnout in Al-Najaf Al-Ashraf City

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Abstract- Work is a significant source of stress in all occupations; a nationwide poll by the American Psychological Association (APA) showed that approximately 75% of Americans experienced substantial stress at work and nearly half noted that their work productivity decreased because of the stress. A descriptive study is conduct in AL-Najaf City from Dec. 2nd., 2014 to March 15th., 2015. To assess the pediatric nurses' burnout and to find out the relationship between the pediatric nurses burnout and their demographic data.

A Non-Probability (Convenience Sample) of (25) pediatric nurses were selected from pediatric unites at AL- Zahra Teaching Hospital.

Data are collect using the constructed questionnaire and interview technique with each study subjects. While the data analysis done by using the statistical package of social science (SPSS) Ver. (16), and the Microsoft excel (2007).

The study results indicate that majority of the pediatric nurses (84%) are sometimes burning due to their work place, and there is a high significant relationship between the pediatric nurses burnout and their years of experience and their years of experience in a given area.

According to the study findings and discussion, the study concluded that pediatric nurses are exposure to some burdens due to the practice environment.

The study recommend that an intensive comprehensive wide population-based (national level) studies can be conduct to assess the of pediatric nurses' burnout with nursing care. In addition, to assess the factors that improve the practice environment, as well as improve the nurses' job satisfaction and prevent their burnout, to improve the quality of care services and the patients' satisfaction with such services.

Index Terms- assessment , pediatric nurses , burnout

I. INTRODUCTION

Work is a significant source of stress in all occupations. According to a 2014 nationwide survey by the American Psychological Association (APA) and the American Institute of Stress (AIS), job pressure was the leading cause of stress, and other surveys have shown that approximately one-third of working Americans experience chronic work stress, with 37% saying they were excellent or very good at managing job work stress (American Psychological Association, 2015). High costs are associated with work-related stress in terms of absenteeism, decreased productivity, and employee turnover, as are a wide variety of physical conditions, from headaches and insomnia to cardiovascular and immune diseases (American Institute of Stress, 2014). Work-related stress that unaddressed has the potential to develop into burnout over a long period. The costs of burnout are even higher than stress and affect not only the well-being of the individual but also that of the individual's family, friends, and colleagues. Burnout has been more prevalent in the so-called helping professions, and high levels of burnout that documented in the healthcare professions, especially nursing.

Nursing is a stressful profession that deals with human aspects of health and illness (Abushaikha and Saca-Hazboun, 2009). Moreover, can ultimately lead to job dissatisfaction and burnout. Burnout is a mental condition defined as the body's response to the failure of the coping strategies that individuals typically utilize to manage stress at work (Marin and Campayo, 2010). The accumulation of stress exhausts individuals to the point where their energy resources are insufficient for their attempts to overcome the pressure of a situation in which they work with other people (Galanakis, 2009). The worker loses the interest and positive sentiments that he/she had for individuals assisted and develops a negative self- image (Lauvrud, et. al., 2009).

Nurses are especially vulnerable to the burnout, and this is of particular concern for several reasons (Maslach, 2003). First, nurses represent the largest faction of healthcare professionals, with more than 2.6 million nurses in the United States, and they are the frontline for direct patient care in hospitals. Second, job dissatisfaction and subsequent burnout have been attach to nursing turnover, which has led to the nursing shortage that began in the late 1990s (Lafer et al, 2012). This shortage remains ongoing, and estimates for the shortage by the year 2020 range from 340,000 to 1 million. Third, and most important, the inadequate nursing staffing levels caused by excessive turnover have been significantly associated with nursing errors and poorer patient outcomes (Ludwick and Silva, 2012). Thus, enhancing job satisfaction and avoiding burnout is crucial to maintaining an adequate population of nurses, and an adequate population of nurses is vital to maintaining high-quality patient care. After a discussion of the primary sources of work-related stress and burnout among pediatric nurses, several strategies for preventing burnout at the individual and organizational level are present.

The hospital nurse workforce is experiencing greater workloads resulting from shorter hospital stays, rising average patient acuity, fewer support resources, and a national nurse shortage. Higher nurse workloads are associated with burnout and job dissatisfaction, precursors to voluntary turnover that contribute to the understaffing of nurses in hospitals and poorer patient outcomes (Aiken, et. al., 2002).

Indeed, more than 40% of hospital staff pediatric nurses score in the high range for job-related burnout, and more than 1 in 5 hospital staff pediatric nurses say they intend to leave their hospital jobs within 1 year (Aiken, et. al., 2001).

The understaffing of nurses and the overwork of health professionals in hospitals were ranking by consumers as major threats to patient's safety. In addition, more patients are bringing their own caregivers to the hospital with them. Research on job-related burnout among human service workers, nurses in particular, suggests that organizational stressors in the work environment are important determinants of burnout and subsequent voluntary turnover. A largely separate research literature on patient satisfaction documents the importance of patients' satisfaction with nursing care in their overall ratings of satisfaction with their hospital care. This article examines the association between pediatric nurse burnout and demographics data, and explores whether the factors that account for nurse burnout. The findings are important to understanding how to simultaneously stem the flight of nurses from hospital bedside care and improve patient satisfaction with care (Vahey, et. al., 2004).

II. METHODOLOGY

Design of the Study:
A Descriptive study is conduct through the present study in order to achieve the early stated objectives. The period of the study is from Dec. 2nd, 2014 to March 15th, 2015.

ADMINISTRATIVE AGREEMENTS:
The researchers obtain an approval from the Nursing Specialties Department in the College of Nursing / University of Kufa. In addition, an official permission obtained from Al-Najaf Al-Ashraf Health Directorate/Al-Zahra Teaching Hospital, in order to interviewing each subject. Finally, subjects' agreement obtained from the nurses to answer the questionnaire questions.

SETTING OF THE STUDY:
The study conducts in Al-Najaf Al-Ashraf City/ Al-Najaf Al-Ashraf Health Directorate / Al-Zahra Teaching Hospital.

SAMPLE OF THE STUDY:
A Non-Probability (Convenience Sample) of (25) pediatric nurses are included in the present study.

STUDY INSTRUMENT:
An assessment tool adopted and developed by the researcher to assess the pediatric nurses' burnout
The final copy consists of the following parts:

1- Nurses' demographic data form.

Nurses' demographic data includes the nurses' residency, gender, age, and marital status, levels of education, years of experience, and years of experience in a given area.

2- Nurses' burnout form.

The nurses' burnout measured through application of the developed Maslach Burnout Inventory Scale (MBI).

DATA COLLECTION:
The data collected through the utilization of the developed questionnaire, and by means of structured interview technique with the subjects (nurses) who individually interviewed, by using the Arabic version of the questionnaire.

STATISTICAL ANALYSIS:
The following statistical data analysis approaches is used in order to analyze the data of the study under application of the statistical package of social sciences (SPSS) Ver. (16), and the Microsoft excel (2007):

1. Descriptive Data Analysis:

a- Tables (Frequencies, Percentages, and cumulative Percent).
b- Statistical figures (Bar Charts).
c- Cutoff point (66.66%) due to the three points Likert Scales with three levels of assessment for the nurses' burnout.

2. Inferential Data Analysis:
This approach used to accept or reject the statistical hypothesis, which includes Chi-Square test for testing the independency distribution of the observed frequencies, and for measuring the association between the studies variables according to its type.

III. RESULTS

Table (1): Nurses' Distribution According to their Demographic Data

Demographic Data	Rating And Intervals	Frequency	Percent	Cumulative Percent
Residency	Urban	20	80	80
	Rural	5	20	100
Gender	Male	18	72	72
	Female	7	28	100
Age / Years	<= 20.00	1	4	4
	25.00 - 28.00	9	36	40
	29.00 - 32.00	14	56	96
	33.00+	1	4	100
Marital Status	Single	10	40	40

	Married	15	60	100
Levels of Educations	Secondary Nursing School or Less Than	1	4	4
	Technical Institute of Nursing	19	76	80
	College of Nursing	5	20	100
Years of Experience	<= 1.00	9	36	36
	2.00 - 6.00	14	56	92
	7.00+	2	8	100
Years of Experience in a Given Area	<= 0.00	4	16	16
	1.00 - 2.00	16	64	80
	3.00+	5	20	100

N (25)

This table shows that most of the nurses are from urban residential area (80%), males (72%), within the age interval about 29-32 years old (56%), married (60%), technical institute graduated (76%), have 2-6 years of experience (56%), and have 1-2 years of experience in a given area (medical or surgical), (64%).

Table (2): Pediatric Nurses' Distribution According to their Overall Responses to the Nurses' Burnout Domain Items

Main Domain	Nurses' sense of burnout	Frequency	Percent	Cumulative Percent
Nurses' burnout	Always Burned	2	8	8
	Sometime Burned	21	84	92
	Never be Burned	2	8	100
	Total	25	100	

This table shows that majority of the pediatric nurses (84%) are sometime burned.

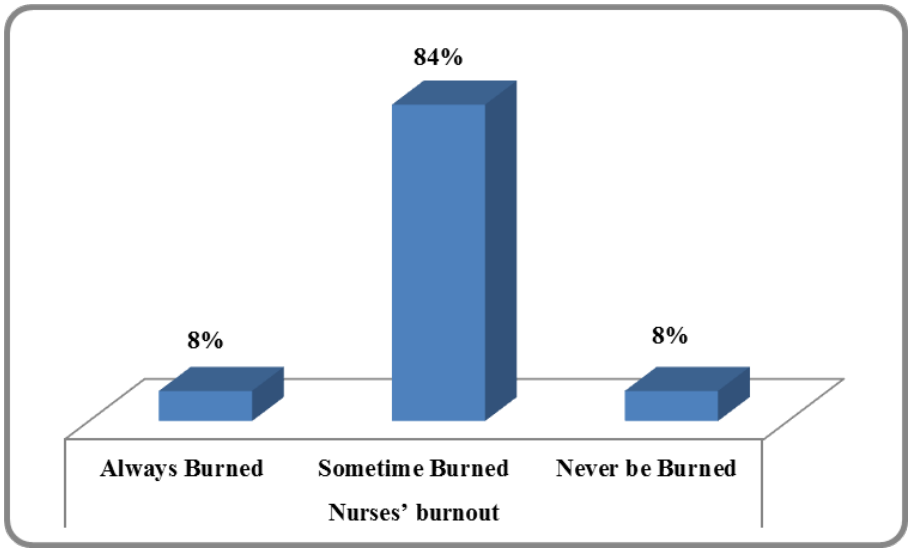

Figure (2) Pediatric Nurses' Distribution According to their sense of Burnout.

Table (3): Relationship between Pediatric Nurses' Burnout and their demographic data

Demographic Data	Chi-square value	d.f.	p-value
Age / years	**5.234**	**6**	**.514**
Gender	**1.143**	**2**	**.565**
Residency	**1.637**	**2**	**.441**
Marital status	**1.488**	**2**	**.475**
Levels of education	**1.504**	**4**	**.826**
Years of experience	**14.909**	**4**	**.005**
Years of experience in a given area	**16.713**	**4**	**.002**

This table shows that there is a high significant relationship between the pediatric nurses' burnout and their years of experience and years of experience in a given area (pediatric units at p-value less than 0.01.

IV. DISCUSSION

The hospital pediatric nurse workforce is experiencing greater workloads resulting from shorter hospital stays, rising average patient acuity, fewer support resources, and a national nurse shortage. Higher nurse workloads are associated with burnout and job dissatisfaction, precursors to voluntary turnover that contribute to the understaffing of nurses in hospitals and poorer patient outcomes.

The study results show that majority of the nurses are sometime burned the majority of the nurses. In addition, there is a highly significant impact of the nurses' years of experience and years of experience in a given area on their burnout levels. These results come because those organizational stressors in the work environment are important determinants of burnout. These results are supported by **Aiken, et. al., 2002,** they find that the majority of the nurses are sometimes burned. Also these results come because that the years of experience make the nurses able to adapted with the job related challenges and they will experience less burnout than those with less years of experience.

V. CONCLUSION

According to the study findings and discussion, the study concluded that nurses are exposure to some burdens due to the practice environment, and this make them burned.

VI. RECOMMENDATIONS

Based on the study conclusion, the study recommends the following:

An intensive comprehensive wide population-based (national level) studies conducted to assess of pediatric nurses' burnout with nursing care. In addition, to assess the factors that improve the practice environment, as well as improve the pediatric nurses' job satisfaction and prevent their burnout, to improve the quality of care services and the patients' satisfaction with such services.

REFERENCES

[1] Abushaikha, L. and Saca-Hazboun, H. (2009) Job satisfaction and burnout among Palestinian nurses. Eastern Mediterranean Health Journal, 15, 190-197.

[2] Aiken LH, Clarke SP, Sloane DM, et al. Hospital nurse staffing and patient mortality, nurse burnout, and job dissatisfaction. JAMA. 2002; 288:1987–1993.

[3] Aiken LH, Clarke SP, Sloane DM, et al. Nurses' reports on hospital care in five countries. Health Aff (Millwood), 2001; 20:43–53.

[4] American Institute of Stress. 2014 Stress Statistics. Available at http://www.stress.org/daily-life/. Last accessed February 12, 2015.

[5] American Psychological Association. Coping with Stress at Work. Available at http://www.apa.org/helpcenter/work-stress.aspx. Last accessed February 12, 2015.

[6] Galanakis, M. (2009) Factorial structure and psycho- metric properties of the maslach burnout inventory (MBI) in Greek midwives. Europe's Journal of Psychology, 4, 52-70. http://www.ejop.org .

[7] Lauvrud, C., Nonstad, K. and Palmstierna, T. (2009) Occurrence of post-traumatic stress symptoms and their relationship to professional quality of life (ProQoL) in nursing staff at a forensic psychiatric security unit: A cross- sectional study. Health and Quality of Life Outcomes, 7, 31. doi:10.1186/1477-7525-7-31

[8] Marin, M. and Campayo, G.A. (2010) a newer and broader definition of burnout: Validation of the "burnout clinical subtype questionnaire (BCSQ-36). BMC Public Health, 10, 302.

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Smart Home Automation based on different sensors and Arduino as the master controller

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Abstract- The popularity of home automation has been increasing vastly in recent years due to much higher affordability and simplicity. Being able to control aspects of our houses, and for having the feature to respond automatically to events, it is becoming more and more popular and necessary due to security and cost purposes. We propose to implement an integrated home automation and security system. Our project proposes a low cost solution using off the shelf components to reduce cost and open source software to get around licensing requirements of software. An Arduino controls sensors and actuators that monitor a defined location and take action based on specified parameters like ambient light, temperature etc. The Arduino can also send alerts if it detects an abnormality. The voice recognition schema allows the user to use voice commands to control his house.

Index Terms- Home Automation, Arduino, Voice Recognition, Graphical User Interface, Microsoft Visual Basic.

I. INTRODUCTION

Home automation systems are quickly emerging and becoming popular nowadays in the world and its end users are specifically the disabled and elderly but due to their complexity and cost it is not always accepted. Population ageing is taking place in nearly all the countries of the world. Ageing results from decreasing mortality, and most importantly, declining fertility. This process leads to a relative reduction in the proportion of children and to an increase in the share of people in the main working ages and of older persons in the population. The global share of older people (aged 60 years or over) increased from 9.2 per cent in 1990 to 11.7 per cent in 2013 and will continue to grow as a proportion of the world population, reaching 21.1 per cent by 2050. [1]

With rapid economic growth, living standard are also rising day by day. The modern society wants safe, economic, comfortable and convenient life which is ideal for every family.

"Home automation is a very promising area.

Its main benefits range from increased comfort and greater safety and security, to a more rational use of energy and other resources, allowing for significant savings. It also offers powerful means for helping and supporting the special needs of people with disabilities and, in particular, the elderly. This application domain is very important and will steadily increase in the future [2]."

Home automation is known as the automation of the home, housework or household activity. It commonly defines a residence that integrates technology and services through home networking to improve the quality of living. Home automation is not a new term for science society and has been around for a significant time. Home automation include mainly centralized control of lighting, temperature, appliances, and other systems, to provide improved comfort, convenience, efficiency and security. For disabled and elderly person home automation can be the substitute of institutional care.

Shepherd [3] has introduced the idea of using Bluetooth wireless technology as a cable replacement using the wireless interconnectivity which can be implemented using radio home automation system method. Sriskanthan et al. [4] explained an automated system based on Bluetooth wireless technology which allows the user to monitor and control different appliances that are connected over a Bluetooth network based on a mobile host controller. Maqsood, J. [5] implemented techniques and provided a viable solution to realize home automation system which constitutes Bluetooth control via Android app development for in-house control and GSM (Global System for Mobile Communication) technology for mobile control using Arduino. Cubukcu, A. et al [6] has implemented speech recognition-based remote control of home devices. Adriansyah, A. et al [7] designed a system able to monitor and control lights, room temperature, alarms and other household appliances.

As for this project, the proposed solution is to develop an economical smart home system without increasing the complexity and using off the shelf components to reduce the cost and open source software to get around licensing requirements of software. The sensors will be controlled with the help of Arduino, and the voice command part has been developed on Visual Basic, both of which are FOSS (Free Open Source Software) and the security system GUI is designed with the help of MATLAB 2013. Arduino is an open-source prototyping platform that provides easy-to-use hardware and programming environments. It is relatively inexpensive compared to other microcontroller-based platforms like Beagle Bone. Thus creating an economic and energy efficient system development.

In the next part we have described the hardware setup of our system. We had described the methodology in the Section III, while Section IV describes the experimental evaluation and the conclusion is presented in Section V.

II. HARDWARE PLATFORM

The hardware part mainly consists of a digital computer, an Arduino Uno board, Light Detecting Resistors, Temperature sensor (LM35), LPG and Smoke sensor (MQ2), Temperature and

Humidity sensor (DHT11), Webcam, DC Motor, which are being discussed along with their specific functions.

A. Arduino Uno

An Arduino board [8] consists of an Atmel 8-, 16- or 32-bit AVR microcontroller with complementary components which helps in programming and other circuit incorporation. This board has a 5 volt linear regulator and a 16 MHz crystal oscillator.

B. Light Detecting Resistors (LDR)

It is a special type of resistor that has a (variable) resistance that changes with the light intensity that falls upon it. This allows them to be used in light sensing circuits.

C. Temperature Sensor (LM35)

It is a precision integrated-circuit temperature sensing device with an output voltage linearly proportional to centigrade temperature. LM35 [9] device has an advantage over linear temperature sensors calibrated in Kelvin, as the user is not required to subtract a large constant voltage from output to obtain convenient centigrade scaling.

D. LPG and Smoke Sensor (MQ2)

This Grove - Gas Sensor (MQ2) [10] module is useful for gas leakage detection in home and industry. It can detect H2, LPG, CH4, CO, Alcohol, Smoke, and Propane. Based on its fast response time measurements can be taken as soon as possible. Also the sensitivity can be adjusted by the potentiometer. When the target combustible gas exist, the sensor's conductivity is higher along with the gas concentration rising.

E. Temperature and Humidity sensor (DHT11)

DHT11 [11] uses a capacitive humidity sensor and a thermistor to measure the surrounding air, and spits out a digital signal on the data pin (no analog input pins needed). It's fairly simple to use, but requires careful timing to grab data. The only real downside of this sensor is one can only get new data from it once every 2 seconds.

III. METHODOLOGY

In this paper our main aim is to propose model for home automation system. Proposed system architecture is shown in Figure 1.1

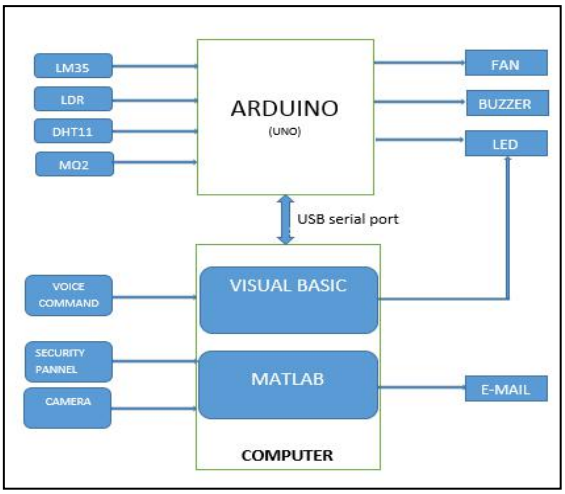

Fig 1.1.A block diagram representing the circuit developed

The home automation system consists of two main hardware components: the computer which runs the Matlab, Visual Basic, and the Arduino Uno microcontroller board which is flexible, inexpensive, offers a variety of digital and analog inputs, serial interface and digital and PWM outputs. A PC home server hosts the Matlab-GUI platform management and Arduino Uno controls the home appliances and also enables the user to access them through voice commands. The computer communicates with the Arduino Uno microcontroller board through USB data transfer cable. A number of appliances and sensors are connected to ports of the microcontroller board. The home Appliances can be monitored and accessed remotely.

A. Monitoring sensor reading

Arduino enables users to monitor various kinds of sensors such as thermometer and motion detectors in real-time. The analog and digital pins on the Arduino board can serve as general purpose input and output pins (GPIO). The ATmega328 microcontroller embedded on the Arduino board contains the analog-to-digital converter (ADC), which converts the analog input signal to a number between 0 and 1023.

The integer number is proportional to the amount of the voltage being applied to the analog input. Any sensor operating on 5 volts can be directly connected to the Arduino board. As a prototype for monitoring sensor readings with Arduino, we have implemented a simple setup to connect the analog sensor to the Arduino board.

B. Controlling actuators

The Arduino gateway can trigger actions (e.g., pushing notifications and turning on or off switches) while monitoring sensors in real-time. While reading the sensor data in real-time, the Arduino takes required actions like controlling the speed of fan, switching the LED, and turning ON/OFF the alarm accordingly.

In this proposal, two operating modes are designed. The first one is a manually– automated mode in which the appliance (lights) is monitored and accessed by voice command. The

selected appliances can be switched ON/OFF according to the suitable decision.

The other mode is a self-automated mode. In this case the microcontroller accesses the appliance automatically without returning back to the user decision. The user can monitor the action only.

The security panel is designed with Matlab-GUI platform. The designed Matlab-GUI platform can control the whole system and turns ON/OFF the system accordingly and also sends required information to the user.

C. Smart Home Temperature Sensing System

At this section we will control the home temperature automatically by using a special temperature sensor LM35. It has an output voltage that is proportional to the Celsius temperature. It has low self-heating capability, suitable for remote applications, low cost due to wafer level trimming, operates from 4 to 30v, low impedance output in this case. In this project we used this to sense the room temperature, the Arduino classifies the measured temperature as hot, normal or cold and then controls the speed of the fan accordingly by varying the duty cycle of the motor using the PWM technique. So if room temperature goes very high or low it can be automatically adjust the fan as per the temperature.

D. Smart Home Lighting Control Systems

In this section user will be able to control the light by LDR sensor automatically. In automatic light control system, Light Dependent Resistor (LDR) sensor is used to detect bright/medium/dim/dark conditions. The number of LED lit is controlled by the Arduino and depends on the lighting condition of the room and is inversely proportional with the brightness of the room. This application is important for saving the energy.

E. Humidity Sensing System

The humidity of the room is measured by using a DHT11 sensor. The DHT11 is a basic, ultra-low-cost digital temperature and humidity sensor. It uses a capacitive humidity sensor and a thermistor to measure the surrounding air, and spits out a digital signal on the data pin. The data is received by Arduino and the temperature and humidity is viewed on the computer screen.

F. LPG/Smoke Detecting System

The smoke sensor we used is the MQ-2. This is a cheap sensor that is not only sensitive to smoke, but also to flammable gas. The MQ-2 smoke sensor reports smoke by the voltage level as output. The more smoke is there, the greater the voltage output. The MQ-2 also has a built-in potentiometer to adjust the sensitivity to smoke. By adjusting the potentiometer, one can change how sensitive it is to smoke, so there is a form of calibrating it to adjust how much voltage it will give in relation to the smoke it is exposed to. We wired the MQ-2 to the Arduino so that the Arduino can read the amount of voltage output by the sensor and sound a buzzer and flashes a message “House on fire” on the computer screen if the sensor outputs a voltage above a certain threshold. This way, we will know that the sensor is detecting smoke and will sound a buzzer alerting the user.

G. Smart Home Security Systems

The security system is designed using the MATLAB GUI platform. A security system consists of a portable panel consisting of pushbuttons, a LCD screen and a camera. On start up the system requires a 4 digit password which was previously set up by the user. If the entered password matches the previously set up password then Matlab sends an affirmative message to the Arduino via USB cable so the door opens and the entire smart home system turns ON. If the password does not match, then the camera captures an image of the intruder and saves the image in the system and also e-mails the image to the user and the door remains locked.

H. Voice Control

At the end of our work we have introduced a special features for our smart home system which will be highly beneficial for elderly or differently abled person. The user will be able to turn on and control the brightness of lights (led) by giving voice commands. A program is written in visual basic to accomplish this action. Using this program, the system recognizes the voice command and sends a predefined message according to the command, to the Arduino. The Arduino turns ON/OFF the lights or control the brightness according to the message received.

IV. Experimental Evaluation

In order to implement and demonstrate the system developed theoretically, we created a prototype that represents different home appliances. Thus the whole system that is being developed is given below, (Fig. no: 2.1).

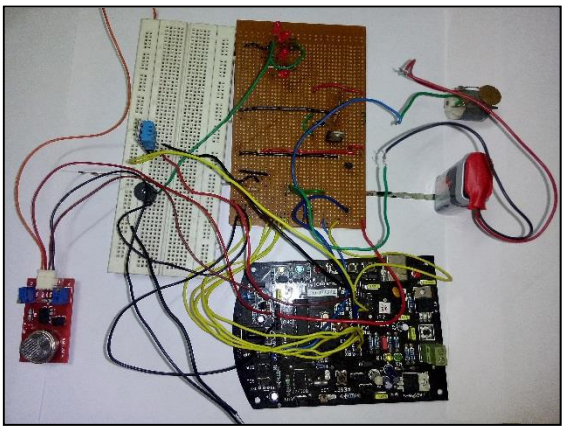

Fig. 2.1: Complete Circuit.

From this figure given here we can see different parts of the circuit board that is developed, which is connected with the Arduino`s digital and analog pins as required.

The image of the security panel designed by Matlab GUI is given above which consists of several pushbuttons and a camera screen

V. DISCUSSIONS AND CONCLUSIONS

A novel architecture for an economic smart home system is proposed and implemented in this paper. It gives basic idea of how to control various home appliances and provide a security

using Arduino Uno and Matlab GUI. The cost of smart homes technology is for some people an argument against the choice of such installations. This project uses low cost off the shelf components, and is based on Visual Basic and Arduino platform which both are FOSS (Free Open Source Software). So the overall implementation cost is very cheap and is affordable by a common person. This low cost system is designed to improve the standard living in home. The voice control function provides help and assistance especially to disabled and elderly. The security system designed in Matlab GUI also ensures the security of the home and provides a safeguard from possible intruders.

For future work, some recommendation can be made like adding motion sensors for automatic turning ON/OFF of lights, fans depending upon the position of user, wireless connectivity can be added to system, and schedulers can be added for controlling home appliances. The whole system can be fabricated as economic commercial hardware package. The concept of this home automation can also be used for grid automation in smart grids in power systems.

REFERENCES

[1] "World Population Ageing" Department of Economic and Social Affairs Population Division, United Nations, New York, 2013

[2] Renato J. C. Nunes, Jose C. M. Delgado, "An Internet Application for Home Automation", 10th Mediterranian Electrotechnical Conference. MEleCon 2000, vol 1, USA: IEEE 2000, pp. 298-301.

[3] R. Shepherd, "Bluetooth wireless technology in the home," Journal of Electronics and Communication Engineering, vol. 13, no. 5, pp. 195– 203, Oct. 2001.

[4] N. Sriskanthan and Tan Karand, "Bluetooth Based Home Automation System", Journal of Microprocessors and Microsystems, Vol. 26, pp.281-289, Elsevier Science B.V., 2002.

[5] Maqsood J, "Artificial Intelligence, Modelling and Simulation (AIMS)", 2014 2nd International Conference, Madrid, pp.109 – 114, 18-20 Nov. 2014.

[6] Cubukcu, A.; Kuncan, M.; Kaplan, K.; Metin Ertunc, H., "Development of a voice-controlled home automation using Zigbee module", Signal Processing and Communications Applications Conference (SIU), 2015 23th, Malatya, pp.1801 – 1804, 16-19 May 2015

[7] Adriansyah, A.; Dani, A.W., "Design of Small Smart Home system based on Arduino", Electrical Power, Electronics, Communications, Controls and Informatics Seminar (EECCIS), 2014, Malang, pp.121 – 125, 27-28 Aug. 2014

[8] Arduino [Online] Available: https://en.wikipedia.org/wiki/Arduino

[9] Texas Instruments- LM35 [Online] Available: http://www.ti.com/product/lm35

[10] Grove - Gas Sensor (MQ2) [Online] Available:http://www.seeedstudio.com/wiki/ Grove_-_Gas_Sensor%28MQ2%29

[11] DHT11 basic temperature-humidity ensor, Adafruit [Online] Available:http://www.adafruit.com/product/386

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Impact of Land Use Land Cover on Phosphate Concentration in Upper Lake Bhopal Using Remote Sensing and GIS Techniques

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Abstract- Non point source pollution needs special attention to control the surface water quality. Knowledge of critical buffer zone is of great importance for watershed management. For this study annual average of phosphate concentration, landsat image and ASTER DEM was used. Image was classified in four land cover classes using ERDAS Imagine software. buffer zones at radial distances of 100m, 200m, 500m, 1000m and 2000m from the discharge point of stream into the lake, were generated by Arc GIS software. Area of different classes was measured using FRAGSTAT software. Six spatial interpolation techniques were compared and best fitted technique (SK) was used to predict the phosphate concentration at all discharge points. Statistical analysis software SPSS was used to correlate area of land use and phosphate concentration. Area of agriculture and barren land in 500m buffer zone was found most effectively correlated with phosphate concentration.

Index Terms- Spatial interpolation, buffer zone, phosphate, Simple Kriging.

I. INTRODUCTION

Surface water can be polluted by anthropogenic activities in two ways: 1. by point sources, such as storm water runoff, sewage treatment discharge and industrial waste discharge; and 2. by non-point sources such as runoff from agricultural and urban areas. Natural catchment characteristics such as surface geology and topography can affect surface water quality. Despite the importance of natural characteristics, their influences are not usually included in the study of watershed management because they complicate the analysis considerably.

Studies of watershed management and catchment at different buffer scale have become more important in determining the impact of anthropogenic activities on water quality within the watershed. Study on the basins of Fish river, Alabama, USA developed a model to relate land use, land cover and water pollution in the stream. It was concluded that the size of critical buffer zone depends on the level of non point source pollution, geometrical characteristics of an area and standard level of water quality parameters (*Basnyat P. et.al., 1999).* Land use land cover in catchment area of river in Yamguchi Prefecture, western Japan and water quality parameter were used to present a mathematical model. This model can be used to predict the effect of proposed land use planning on water quality of the river *(AMIRI Bahman Gaborone et al. 2008).* The area adjacent to stream shows great influence on the nitrate level *(Basnyat P. et.al. 2000).* Although these studies were more common in the past few decades, they still leave a number of questions unanswered. For example, there is still a dispute regarding the effective buffer zone, which is more important in influencing the quality of water *(Delong and Brusven, 1991)* These uncertainties are still unrevealed because thorough investigations of catchment are extremely resource and time consuming. Analytical tools, such as multivariate statistics, geographical information systems (GIS) and patch analysis, are effectively able to deal with the problem. *(Alberti Marina et al.,2007, Guo QingHai et al., 2010).* However the accuracy of results depends upon the quantity and quality of data collected which may be sparse. One method of study of correlation between land use land cover of a watershed and its water quality is to use secondary data generated by government agencies at regular interval.

This study used such secondary data to determine the impact of land use land cover on the phosphate concentration in water of upper lake Bhopal. Phosphate concentration of upper lake was provided by the Environmental Planning and Co-ordination Organization (EPCO), Bhopal, India. This database was generated by EPCO having a basic monitoring objective, without any extensive study purpose hence it is limited spatially. Therefore, spatial interpolation techniques are required for the prediction of spatially continuous data of water quality parameters for the unsampled locations using data from the sampling point. A number of spatial interpolation methods are available. But these are data specific and their results depend on many factors *(Li and Heap, 2011).* It is very difficult to select an appropriate method for a given data set and study area *(Li and Heap, 2011).* In various research papers, comparison between stochastic and deterministic approaches of spatial interpolation has been published to estimate missing data. Six methods of spatial interpolation were used by (*Eischeid J. et al.,2000)* to create a serially complete daily precipitation and temperature data set for the united states.

The objectives of this study were: (1) to determine the effect of land use, land cover on the phosphate concentration of upper lake Bhopal; and (2) to determine the critical buffer zone influencing the phosphate concentration most effectively.

Method

Study Area

The study area Upper Lake is located in the western part of Bhopal, the capital of Madhya Pradesh, India. Upper lake is the major source of potable water for the city located at 23°12' - 23°16' N, 77°18' - 77°23' E. It is surrounded by urban area in

east, urban and agricultural land in the north, urban; rural; agriculture in the South and agriculture land in the west.

Image classification and Patch Analysis

Land cover data for 2011 were interpreted from Landsat Thematic Mapper ™ imagery for the Bhopal region. The Landsat TM image was reprojected to the UTM projection system. The classification procedure

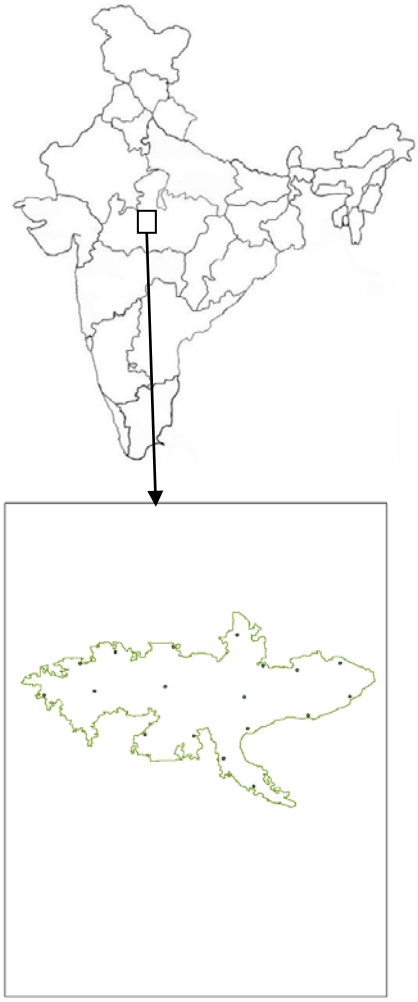

***Fig. 1. Location of study area and sampling stations providing observed data.*creates four class land cover system: Agriculture, Vegetation, Built up land and Barren land.**

Lake boundary and sub watershed boundary was generated using ASTER DEM for the month of Oct. 2011. A contour was identified as the lake boundary in contour map generated by DEM. In this study it is assumed that a stream is formed when minimum 100 cells drains to a point. Using flow accumulation grid stream network raster for threshold value of 100 pixels was created. Stream raster then converted to stream vector and point of intersection of stream and lake boundary identified as point of discharge of water in lake through each stream. Using basin hydrology tool in the Arc GIS boundary of a sub watershed was created. Vector map of buffer zone for each sub watershed was created for radial distance of 100m, 200m, 500m, 1000m, and 2000m. Landsat image was subsetted and classified using ERDAS Imagine to obtain land cover map for different buffer zones of each sub watershed.

Land cover map of each buffer zone was analyzed through FRAGSTAT to extract index of patches of all four classes. For this study class area (CA) was used to understand the correlation between land cover and phosphate concentration in upper lake Bhopal. Class area is the summation of area of all patches of the same class. (McGarigal K. et al., 1995).

Water Quality

Water quality data for 18 sampling stations: Kolans, Bhori, Betha, Bairagarh, Bairagarh east, Khanugaon, Karbala, Medical college, Kamla park, yacht club, Van Vihar, Spill channel, Bhadbhada, Stud farm, Bisenkhedi and three deeper zones were obtained from the website of Environmental Planning & Coordination Organization (*EPCO*) Bhopal. Twelve month Phosphate concentration for the month of June 2010 to July 2011 was averaged to obtain annual average data of phosphate at all sampling points. As the positions of sampling stations are selected by government agencies, we were missing data for this study. To overcome this deficiency of data, we used spatial interpolation technique to predict phosphate concentration at unmeasured locations.

Accuracy and comparison of spatial interpolation techniques have been investigated in a number of studies. The more reliable interpolation technique gives a better assessment of the spatial distribution of the data *(Robinson, T.P.et al., 2006; Shi. W. et al., 2009).* We compared six methods: Inverse Distance Weighting, Radial Basis Function, Local Polynomial Interpolation, Ordinary Kriging, Disjunctive Kriging, and Simple Kriging, for this study. Most suitable method with minimum root mean square error was used to predict phosphate concentrations at required location. Inverse Distance Weighted technique assumes that the value at any point is a distance-weighted average of the values at sampling stations within a well defined neighborhood surrounding the estimated point. This is an exact local deterministic interpolation method. IDW considers that the predicted value of parameter will be more affected by the points closer to the prediction location than points located farther away. Inverse distance weighting method is one of the most commonly compared method *(Li and Heap, 2011).* Radial Basis Functions include different basis functions. RBFs permit the prediction of points above and below the maximum and minimum measured value. Polynomial Interpolation method fits a mathematical function of the measured point. These mathematical functions range from first to higher order polynomials. Polynomial interpolation is of two types – global and local. Global polynomial fits a model based on all measured points to the entire surface while Local polynomial interpolation fits a number of polynomials using subsets of the measured points(ESRI, 2008). Kriging method assumes that the spatial variation of data is neither stochastic nor deterministic. Kriging methods are of two types: linear and nonlinear *(Moyeed R.A., Papritz A., 2002).* Simple kriging assumes statistical variation, a known constant mean and no underlying trend. While ordinary kriging assumes an unknown constant mean. Mean must be estimated using data. Disjunctive kriging is a general nonlinear method.

The results obtained using different interpolation techniques were compared and analyzed. The root mean square errors of predicted values were used to evaluate the performance of different methods using following formula:

$$\text{RMSE} = \sqrt{\frac{1}{N}\sum_{i=1}^{N}\left(Z(Xi) - \check{Z}(Xi)\right)^2}$$

Where $Z(Xi)$ and $\check{Z}(Xi)$ is the measured value and predicted value respectively and N is the number of samples. Smaller RMSE and ME values indicate less error (Xie et al, 2011).

Statistical Analysis

We used SPSS 17 to do correlation analysis. As the phosphate concentration data was normally distributed, Pearson correlation coefficient was used. Significance of the effects of the class area of Agriculture, Vegetation, Built up land and Barren land on phosphate concentration were tested using two-tailed hypothesis tests.

II. Results and Discussion

Spatial interpolation

The Local Polynomial Interpolation method is the least effective with the 0.231 mg/l error. The contrary, the method of the Simple Kriging is the most suitable method with Root Mean Square error 0.117 mg/l. Model parameters are the most important factor to obtain accurate simulation. In general IDW, LPI and RBF need a less parameter. In contrast OK, SK and DK have more complex calculation with more input parameters. More complex calculations and input parameters might be the reason of accurate prediction for SK. On the basis of best estimation method phosphate concentration was found at unmeasured location.

Correlation analysis

The relationship between percentage of land use and phosphate concentration at different scales are presented in table 1. Proportion of agriculture land had negative significant correlation with phosphate concentration within 100m (p = 0.03), 200m (p = 0.039) & 500m (p = 0.039) while the barren land had

positive relation within 100m (p = 0.007), 200m (p = 0.002) & 500m (p = 0.003). Proportion of vegetation was negatively correlated to the phosphate concentration within 1000m (p = 0.050) buffer only.Our results indicate that proportion of agriculture land had negative correlation with phosphate concentration while the barren land had positive impact on phosphate concentration within 100m, 200m and 500m buffer zones. This may be due to presence of phosphate in soil up to 500m distance. Plants of agriculture land utilize phosphate of soil, and hence reduce phosphate concentration in the water reaching lake. Barren land in the study area is the agriculture land without crop during study period. Agricultural waste and soil of barren land may be the source of phosphorus. Vegetation, the natural absorbent of phosphate contributes negatively to upper lake.

III. Conclusion

Through this study relationship between area of land use and phosphate concentration in buffers at different spatial scales was explored. We concluded that the effect of area of land use on phosphate concentration. The impact of land use on phosphate concentration is stronger in the effective buffer. Using buffer analysis effective buffer distance can be determined. This indicates that effective buffer zones could be helpful for management and planning of watershed.

Table1: Root Mean Square Error and Mean Error for six spatial interpolation methods

	DK	**SK**	**OK**	**LPI**	**RBF**	**IDW**
RMSE	0.210	0.117	0.179	0.231	0.172	0.198

Table 2: Pearson correlation coefficient and p value within 100m, 200m, 500m, 1000m and 2000m buffer zones.(Blank space indicates that relation was not significant)

		100m	200m	500m	1000m	2000m
PHOSPHATE	AGRICULTURE	-.390*	-.373*	-.393*		
		(0.03)	*(0.039)*	*(0.039)*		
	VEGETATION				-.414*	
					(0.050)	
	BUILTUP LAND					
	BARREN LAND	.475**	.537**	.537**		
		(0.007)	*(0.002)*	*(0.003)*		

* *Correlation is significant at the 0.05 level (2-tailed).*

** *Correlation is significant at the 0.01 level (2-tailed).*

REFERENCES

[1] Alberti Marina, Booth Derek, Hill Kristina, Coburn Bekkah, 2007,The impact of urban patterns on aquatic ecosystems: An empirical analysis in Puget lowland sub-basins. Landscape and Urban Planning, Vol. 80, pp. 345-361.

[2] AMIRI BahmanJabbarian, NAKANE Kaneyuki, 2008, Entire Catchment and Buffer Zone Approaches to Modeling Linkage between River Water Quality and Land Cover – A Case Study of Yamaguchi Prefecture, Japan.Chin. Geogra.Sci, Vol. 18, No.1, pp: 085-092.

[3] Basnyat P., Teeter L. D., Lockaby B. G., Flynn K. M., 1999, Relationships Between Landscape Characteristics and Nonpoint Source Pollution Inputs to Coastal Estuaries. Environmental Management Vol. 23, No. 4, pp: 539–549

[4] Basnyat P., Teeter L. D., Lockaby B. G., Flynn K. M., 2000, The use of remote sensing and GIS in watershed level analyses of non-point source pollution problems. Forest Ecology and Management Vol. 128, pp: 65-73.

[5] Delong D. D. and Brusven M. A., 1991, Classification and spatial mapping of riparian habitate with application towards management of streams impacted by nonpoint source pollution. Environmental Management Vol:15, no.:4, pp:565-571.

[6] Eischeid J., Pasteris P., Diaz H. Plantico M., Lott N., 2000, Creating a serially complete, national daily time series of temperature and precipitation for the western United States. Journal of applied Meteorology Vol: 39, No:9, pp: 1580-1591.

[7] Guo QingHai, Ma KeMing,Yang Liu, He Kate, 2010, Testing a Dynamic Complex Hypothesis in the Analysis of Land Use Impact on Lake Water Quality. Water Resource Management Vol.:24, pp:1313-1332.

[8] Li J., Heap A., 2011. A review of comparative studies of spatial interpolation methods: performance and impact factors. Ecol. Inform.Vol:6 (3-4), pp: 228-241.

[9] McGarigal K, Marks BJ (1995) FRAGSTATS: spatial pattern analysis program for quantifying landscape structure, Forest Science Department, Oregon State University, Corvallis.

[10] Moyeed R.A., Papritz A., 2002. An empirical comparison of kriging methods for nonlinear spatial point prediction. Mathematical Geology, Vol: 34, No.:4, pp: 365-386.

[11] Robinson, T.P., Metternicht, G., 2006. Testing the performance of spatial interpolation techniques for mapping soil properties. Comp. and Electronics in Agric. Vol.: 50 No.: 2, pp: 97-108.

[12] Shi. W., Liu. J., Du. Z., Song. Y., Chen. C., Yue. T., 2009, Surface modelling of soil pH. Geoderma Vol:150 No.:1, pp 113-119.

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Comparison of ML classifiers for Raga recognition

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Abstract- Indian classical music is categorized into two major forms: Hindustani music and Carnatic music which are performed and practiced in North and South India. Raga is the fundamental concept in Indian music on which whole melody of a performance is based and comprises of group of swaras (musical notes) ranging from 5-8 notes. The present work focuses on Hindustani raga identification. We perform raga recognition on a set of ragas and collected dataset of live performances of these ragas, both vocal and instrumental, and performed recognition using machine learning classifiers. A comparative analysis is done between these classifiers based upon their parameters like average accuracy, precision, recall, kappa statistic and results are being formulated. The result shows that K-star algorithm performs better with raga identification with an accuracy of 93.38%.

Index Terms- Raga Recognition; Machine learning; Classifiers; Precision; Recall; Kappa statistic;K-star

I. INTRODUCTION

Hindustani music is oldest form of music and have no predetermined beginning or end but flowing without interruption through the fingers of the composer-performer**:** the tuning of the instrument merges imperceptibly with the elaboration of the melody, which may spin itself out for two, three or more unbroken hours[1]. It achieves a complexity both melodically and rhythmically. Moreover, movements in Indian classical music are on a one-note-at-a-time basis. Indian classical music is defined by two basic elements - it must follow a Raga (classical mode), and a specific rhythm, the Taal. In Indian classical composition, the music is based on drone i.e. a continual pitch that sounds throughout the concert, which is tonic. This acts as a point of reference for everything that follows a home base that the musician returns after a flight of improvisation. The result is a melodic structure that is easily recognizable, yet infinitely variable i.e. Raga [2].The Indian *raga* chooses between five to eight swaras (musical notes) and it forms the musical foundation on which an musical performance is based. Classical Indian music is characterized by seven main musical notes called the **'saptak'** viz. Shadja, Rishab, Gandhar, Madhyam, Pancham, Dhaivat and Nishad along with five intermediate notes known as altered notes or 'vikrit swaras'. Further the swaras can be played in three octaves, the first or lower octave starting from 130Hz; then middle octave starting from 260Hz; and the upper octave from 520 Hz. Moreover, Indian classical music allows the artist to improvise over the definitions of a raga to create their own personal performance of the raga. Due to this, two performances of the same raga by different artists may sound strikingly different to the novice ears, though they still maintain the defining qualities of that raga [3]. Raga can be identified by various parameters i.e Choice of notes, Ascending and Descending sequences (arohana and avarohana pattern), nature of inflexion on different notes (gamaka/meend), characteristic phrases (pakad). They are described as below:

1. Choice of notes: They are basically the combination of notes (swaras) used from saptak. Each raga has different set of swaras that constitutes it. Vadi swara is the king swara on which maximum focus is given on a performance. It is also known as most frequently occurring swara in a particular raga. It is followed by Samvadi (next in importance), then Anuvadi. The swaras that are not allowed in a particular raga are known as Vivadi swaras (enemy notes).

2. Arohana-Avarohana: This refers to ascending (upward) and descending (downward) sequence of notes in a raga.

3. Pakad: It is a group of notes that acts as catchy phrase for raga identification It is sung by the artist repeatedly after a particular interval.

4. Gamakas: Gamakas are better known as ornamentations used in Hindustani music system. These are inflexions and rapid oscillatory movements taken across swaras.

The rest of the paper is organized as follows: Section II describes the relevant literature for identifying Hindustani classical raga. In section III, the proposed algorithm and different steps for raga recognition is described. Section IV and V provides results and conclusions respectively.

II. RELATED WORK

Raga is identified based upon its fundamental characteristics: Arohana-Avarohana, Pakad, Gamakas, Choice of swaras, Vadi, Time and Season etc. These characteristics help in analyzing and framing different computational techniques for raga identification.

Pandey et.al.[2] proposed a system, Tansen,for automatic identification of raga based on Hidden markov model enhanced with string matching algorithm.Rajshri Pendekar et.al.[3] identified the raga by segmentation of audio signal via spectral flux and thereby identified raga by using its pitch frequency. LM Chelpa[4] proposed a fuzzy set theory for generation of alap patterns and have therefore identified different level of abstractions for raga identification.Chordia et.al.[5] derived Pitch-class Distributions (PCD)along with the Pitch-class Dyad Distributions (PCDD) from Harmonic Pitch Class Profiles (HPCP) and used these distributions for classification by using SVMs. In [6] Sreedhar et.al. created a database of ragas and used the scale of the raga performance as the similarity metric. Within a scale, notes are matched with the existing sets of notes in the ragas in the database. The closest raga in the database is given as the output for the test raga. Gulati et.al.[7] proposed pitch

extraction procedure for carnatic music. Shetty et. al. [8] has identified raga based upon arohana-avorahana pattern on different ragas using neural network technique. Pranay et.al.[9] used scale independent raga identification using a Random forest classifier on swara histograms and achieved state-of-the-art results. Raga recognition is being done without the knowledge of the scale of the performance.

Inspired by the use of swara based feature for raga recognition, we analysed how these features extracted from different ragas are classified by different machine learning classifiers. The classifiers used for present study are K-star, C4.5, Random Forest and Bayesian network.

III. WORK DONE

There are no tentative methods for raga identification; usually there are well defined procedures by which experts recognize raga from a musical composition. It normally depends upon whether the person is trained or untrained. The untrained people usually associate two tunes for similarity and make their observations by comparing them whereas trained musicians perform raga identification based upon its fundamental characteristics. Even though professional musical veterans cannot perform this task of raga recognition with 100% accuracy.

Machine learning is a branch of artificial intelligence which deals with modeling of system to make predictions and behavior based on particular data. It comprises a complete set of classifiers which perform classification, prediction and regression based on different parameter. In this work, recognition is being performed on the four ragas i.e. Des, Bhupali, Yaman and Todi which are based on variation of ten basic Thaats, also known as musical scale using machine learning classifiers.Raga Des is under Bilawal thaat, Bhupali and Yaman are under Kalyan thaat and Todi is under Todi thaat. These four ragas are chosen for present analysis as they are fundamental ragas as suggested by musicians. Table I shows four ragas with their corresponding vadi swara, which is the most frequent note occurring in a particular raga.

Table I: Ragas and their vadi swara

S.no.	Raga	Vadi
1.	Des	R
2.	Bhupali	G
3.	Yaman	G
4.	Todi	D

Following are the sequence of steps in which raga recognition is being done.

A. Collection of Audio performances

Different vocal and instrumental performances are collected in four different ragas mentioned above and preprocessed for further analysis. Fifty live raga performances are taken for the present analysis.

B. Feature Extraction

The audio performances are converted into .wav (wave amplifier) extension and chroma features are extracted from them using MIR(Music Information Retrieval) toolbox in Matlab. A hop factor of 0.025 second is selected which gives 4719 frames. MIR is an open source toolbox which offers an integrated set of functions written in Matlab, dedicated to the extraction of musical features from audio files such as tonality, rhythm and other features like: Spectral Analysis, Chromagram analysis, Brightness, Centroid curve, Tempo, Pitch, Pulse etc.[12] Chromagram feature is being selected for the proposed scheme.

Chromagram is a visual representation of energies in the 12 semitones (or chromas) of the western musical octave namely C, C#, D, D#, E, F, F#, G, G#, A, A# and B. So, it basically depicts the distribution of energy in the twelve pitch classes From the chromagram, we extracted the semitone exhibiting maximum energy by using max function in MIR for each frame and get semitone sequences corresponding to that raga. Though these sequences of semitones might contain some identifying information about the raga, using them for raga identification is not sufficient since ragas are described by pattern of notes which might get overlapped with different western semitones which depends upon the musical scale selected by the musician. In our approach, we assume that we do not have information about scale selected for a particular raga performance. We must therefore find the mapping from the absolute frequency scale used by the chromagram to the corresponding scale of the musical piece, so that we can transcript the swara sequence. We will be taking the vadi (king swara) to convert our semitone sequence to a swara sequence [9].

C. Analysis of extracted features

Vadi swara, also known as king swara is selected for raga identification. Its magnitude and pitch frequency is relatively greater than notes (swaras).We had calculated magnitude of different notes in each frame of a chromagram. The note having the maximum magnitude in western scale is aligned with the vadi of that raga. One minute snippet of each raga is selected and the tabulated results are then analysed for further processing.

D. Classification using ML classifiers

The results tabulated in MS Excel sheet is imported in WEKA tool as .csv file. The WEKA tool provides a comprehensive collection of machine learning algorithms and data preprocessing tools to researchers. It allows comparisons between different machine learning methods on new data sets. Its modular, extensible architecture allows sophisticated data mining processes to be built up from the wide collection of base learning algorithms and tools provided. The workbench includes algorithms for regression, classification, clustering, association rule mining and attribute selection. WEKA has several graphical user interfaces like Explorer, Experimenter, Knowledge flow and simple Command Line Interpreter [12].

The data set of different ragas is classified using machine learning classifiers in WEKA. Classifiers used are Random forest classifier, C4.5, Bayesian network and K-star.They are described as below:

C4.5 classifier

C4.5 classifier builds decision trees from a set of training data using the concept of information entropy. Each training sample s_i consists of a p-dimensional vector $x_{1,i}$, $x_{2,i,\ldots..,}x_{p,i}$

where x_j represent attributes or features of the sample, as well as the class in which s_i falls. At each node of the tree, C4.5 chooses the attribute of the data that most adequately splits its set of samples into subsets enriched in one class or the other.

Bayesian classifier

A Bayesian network is a probabilistic graphical model that represents a set of random variables and their conditional dependencies via a directed acyclic graph (DAG).Each node is associated with a probability function that takes as input a particular set of values for the node's parent variables and gives the probability of the variable represented by the node.

Random Forest classifier

Random forests (RF) are a combination of tree predictors and uses random selection of features to split each node growing an ensemble of trees and letting them vote for the most popular class. To grow these ensembles, often random vectors are generated that govern the growth of each tree in the ensemble. After a large number of trees is generated, they vote for the most popular class.

K-star classifier

K-star or K* is an instance-based classifier. The class of a test instance is based on the training instances similar to it, as determined by some similarity function. The K-star algorithm uses entropic measure, based on probability of transforming an instance into another by randomly choosing between all possible transformations.

In the figures, we have taken raga Des as a sample raga. Figures 1, 2,3 and 4 shown below comprises of spectrogram, Frame decomposition,chromagram and chroma magnitude values in matrix form of raga Des respectively.MIR toolbox functions are applied on raga performances which give the following results as shown in figures.

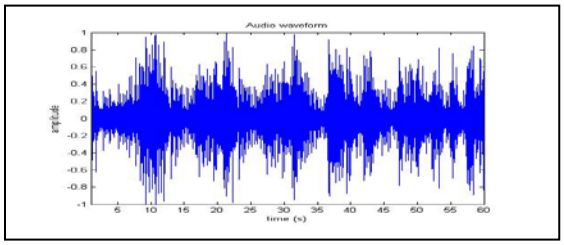

Fig. 1. Spectrogram of Raga Des

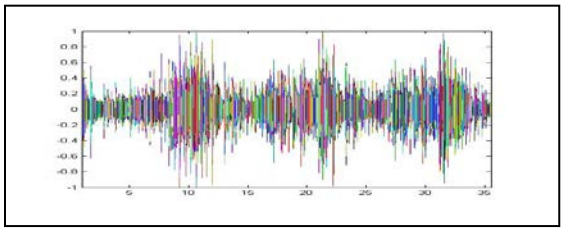

Fig. 2. Frame decomposition of Raga Des

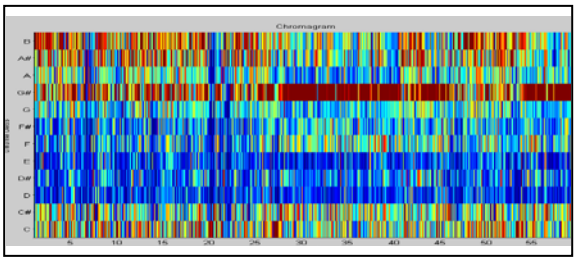

Fig.3. Chromagram of Raga Des

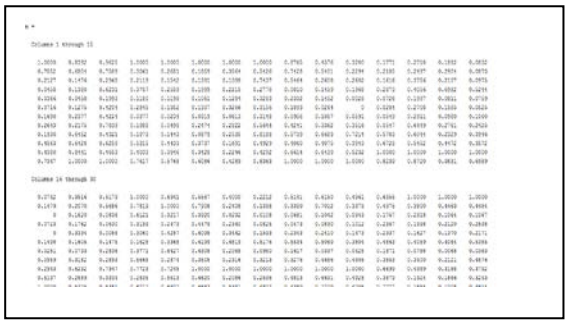

Fig.4.Chroma magnitude values of each frame

Fig.4.Chroma values of different frames of Raga Des

After performing chromagram analysis, magnitude and number of occurrences of different notes were found. We then calculated normalized frequency values by dividing the note values by total number of frames.

The above steps are performed on four ragas and results are tabulated. Fifty vocal and instrumental performances of each raga is taken for analysis purpose.

IV. RESULTS

After applying machine learning classifiers on the dataset of ragas, we performed analysis on its different parameters i.e. correctly and incorrectly classified instances, kappa statistics, mean absolute error etc. and accuracy achieved by each classifier. A comparative analysis was done among these classifiers based upon following parameter values. A ten fold cross validation is performed for testing, which means that on every tenth instance of the data set, testing is being performed. Table II and III shows comparative analysis among four machine learning classifiers with their corresponding parameter values.

Table II: ML Classifiers and their analysed parameter values for various ragas

S.no	Classifier	Average accuracy	Kappa Statistic	Mean absolute error
1.	C4.5	89.70	0.863	0.039
2.	Bayesian	86.76	0.826	0.054

3.	Random forest	92.64	0.90	0.051
4.	K star	93.38	0.912	0.023

The average accuracy is defined as the percentage of examples correctly classified over the total number of examples ,Kappa statistic measure the agreement of prediction with true class, True Positive (TP) rate is the proportion of examples which were classified as class x, among all examples which truly have class x, i.e. how much part of the class was captured. It is equivalent to Recall, False Positive (FP) rate is the proportion of examples which were classified as class x, but belong to a different class, among all examples which are not of class x, Precision is the proportion of the examples which truly have class x among all those which were classified as class x. The Frequency measure or F- measure is calculated by the formula: 2*Precision*Recall/ (Precision+Recall), which is a combined measure for precision and recall.

Table III: Detailed Accuracy of Classifiers by Class

S.no	Classifier	TP	FP	Precision	Fm
1.	C4.5	0.897	0.032	0.876	0.886
2.	Bayesian	0.868	0.036	0.861	0.851
3	Random Forest	0.91	0.029	0.888	0.876
4.	K star	0.934	0.017	0.934	0.934

After performing comparison of classifiers on ragas, it was observed that K star gives largest average accuracy of 93.38% on dataset of ragas, followed by random forest with 92.64%, then C4.5 with 89.70% and then Bayesian classifier with accuracy of 86.76%.Kappa statistic value in K * is 0.90, and hence denotes near to perfect classification. It was also observed that random forest classifier gives better accuracy as compared to K star when instances were less. But when the number of instances gets increased, K star performs better than random forest. However there is only a marginal difference between their accuracies. K star is an instance based learning classifier which uses entropy as a distance measure for classification problems. The distance function which determines how similar two instances are, and the classification function which specifies how instance similarities yield a final classification for the new instance. The computation of distance between two instances is motivated by information theory, according to which the distance between instances is defined as the complexity of transforming one instance into another.

The calculation of the complexity is done in two steps. First a finite set of transformations which map instances to instances is defined. A program which transform one instance (a) to another (b) is a finite sequence of transformations starting at a and terminating at b. The K star function can be calculated as:

$$K^*(y_{i,x}) = -\ln P^*(y_i, x) \quad (1)$$

where data instances, *x*, are assigned to the class that occurs most frequently amongst the k-nearest data points, y_j, where j = 1,2…k. P* is the probability of all transformational paths from instance *x* to *y* [13].K-star therefore performs raga recognition by mapping two instances of raga and measures their distance, which is the complexity of transforming one instance into another.

Since Hindustani musical ragas follows set of rules, hence similar raga compositions will be transformed easily as compared to different ones. But again, raga performances are highly improvised and complex, due to which distances calculated by classifier gets bigger even in case of similar instances which leads to misclassification errors.

V. CONCLUSION AND FUTURE WORK

In this paper, we empirically evaluated and compared four machine learning classifiers on normalized dataset of ragas. Real time recognition of raga has been done. We achieved highest accuracy of 93.38% in case of K star learning classifier. The whole raga structure is very complex and despite having well defined rules, a musician, whether vocal or instrumental performer never follows these rules exactly. Moreover, Hindustani music is highly improvised as performer enjoys full freedom for any movements in raga which leads to misclassification errors.Fluctuations in human voice while live performances are taken into consideration and this has affected the accuracy of our work. We achieved a misclassification error of 6.61% and this can again be attributed to the fact that actual musical performances are improvised and do not follow the raga rules strictly. Hence, there is a lot of scope for improvement in results.

Future work lies in proposing a well defined and robust machine learning technique for raga recognition which gives maximum accuracy as compared to other classifiers and performs identification in same manner as done by humans followed by expansion of our dataset to many more ragas.

REFERENCES

[1] O.Kholkar,"North Indian Classical Music", 2001

[2] G. Pandey, C. Mishra, and P. Ipe, "Tansen: A system for automatic raga identification" Proc. of Indian International Conference on Artificial Intelligence,2003, pp. 1350-1363.

[3] R.Pendekar,S.PMahajan and R.Mujumdar,,"Harmonim Raga Recognition,"International journal of Machine learning and Computing,vol.3,No.4, August 2013

[4] L.M.Chelpa,"A fuzzy set theoretic framework towards computer generation of alap in Hindustani music", NITR, Mumbai.

[5] P.Chordia and A.Rae,"Raag recognition using Pitch-class and pitch-class dyad distributions",Proc. of ISMIR,2007,pp. 431-436.

[6] R.Sridhar and T.Geetha,"Raga identification of carnatic music for music information retrieval",International Journal of Recent Trends in Engineering, vol.1,no.1,2009,pp.571-574

[7] S.Gulati and P.Rao,"A Survey of raag recognition techniques and improvement to the state of the art",Sound and Music Computing,2011

[8] S.Shetty and K.Achary,"Raga mining of Indian music by extracting arohana-avarohana pattern",International Journal of Recent trends in Engineering,vol.1,no.1,2009

[9] P.Dighe and H.karnick,"Swara histogram based structural analysis and identification of Indian classical music", ISMIR,2012

[10] H.Sahasrabuddhe,"Can mindware and software meet",Indian International Centre,1994,New Delhi

[11] Ram Avtar Vir, "Theory of Indian music",Pankaj Publications, New Delhi,1999

[12] O.Lartillot and P.Toiviainen, "A Matlab Toolbox for Musical Feature Extraction From Audio",International Conference on Digital Audio Effects, Bordeaux, 2007.

[13] R.Bouckaert and E.Frank,"Weka Manual for version 3-7-8", University of Waikato, New Zealand

[14] J.E Cleary and L.E Trigg,"K STAR: An Instance-based Learner Using an Entropic Distance Measure",University of Waikato, New Zealand

[15] F.Diniz and F.Milton,"A Facial Recognition System Based on Techniques of Principal Component Analysis and Autofaces with K-NN, K-Star and Random Forest Classifiers", Federal University Rural of Semiarid,2013

[16] H.Sharma and R.Bali," Raga Identification of Hindustani music using soft computing techniques",Proc. of RAECS, IEEE conference,Chandigarh,April 2014.

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Seasonal Variation in some Chemical Characteristics of the Soil under different Land Uses of Jhilmil Jheel Wetland, Haridwar-Uttrakhand, India

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Abstract- A study was conducted to investigate the seasonal changes of the nutrients in the soil under different land uses i.e., natural forest, plantation and grassland of Jhilmil Jheel wetland, situated in Haridwar district of Uttrakhand, India. It is a saucer shape swampy wetland where fragmented sections of swamp deer (*Cervus duvauceli duvauceli*) is present and happens to be the last refugee for this magnificent and highly endangered species. Soil samples were collected from the depth of 0-30 cm from all the three land uses during different seasons i.e., autumn, winter, spring and summer. The higher values of soil pH was observed in summer season and the least in autumn season under different land uses i.e., higher in grassland followed by plantation and least was under natural forest. The soil organic carbon content was higher in winter season followed by spring, autumn and the least was observed in summer season under different land uses. The organic carbon content was higher in the soils under natural forest followed by plantation and the least under grassland. Total nitrogen values were observed higher in winter season and the least was observed in summer season. The different land uses followed the same trend with the higher values of total nitrogen under natural forest soils followed by plantation and the least was under grassland. Available phosphorus content in the soils was observed higher in winter season under natural forest followed by plantation and least was under grassland. The least values of available phosphorus were observed during summer season with little fluctuation between autumn and spring season. Same seasonal and land use trend was followed by available potassium with the higher values in winter season under natural forest followed by plantation and least under grassland. The values of available potassium was found least in summer season. SPSS 16.0 model was used to analyse the data for one way ANOVA to observe the variations of the chemical properties in different seasons under different land uses at (P = 0.05 level).

Index Terms- wetland, pH, organic carbon, total nitrogen, available phosphorous and available potassium.

I. INTRODUCTION

Study of wetland is very important as they are highly productive and fragile ecosystem. Wetlands have also been called as "Biological Supermarkets" for the extensive food chain and rich biodiversity they support. They play major roles in the landscape by providing unique habitats for a wide variety of flora and fauna. Some common names for different types of wetlands are swamp, marsh and bog. Depending on the type of wetland, it may be filled mostly with trees, grasses, shrubs or moss. Wetlands in India occupy 58.2 million hectares, including areas under wet paddy cultivation (Directory of Indian Wetlands, 1993). Majority of the inland wetlands are directly or indirectly dependent on the major rivers like, Ganga, Brahmaputra, Narmada, Godavari, Krishna, Kaveri, Tapti. They occur in the hot arid regions of Gujarat and Rajasthan, the deltaic regions of the east and west coasts, highlands of central India, wet humid zones of suth peninsular India and the Andaman and Nicobar & Lakshadweep islands. According to Champion and Seth (1968), all the fresh water swamp forests in India comes under the category of 4C/FS1 and are mainly occur in the valleys of Western Ghats (Krishnamoorthy, 1960) and in the foot hills of Himalayas (Dakshini 1960; Ghildial and Srivastava, 1989).

Soil is a major source of nutrients needed by plants for growth. The three main nutrients are nitrogen (N), phosphorus (P) and potassium (K). Together they make up the trio known as NPK. One of the important factors to determine quality of soil and serves as sources of nutrients for improving physical and biological properties of soils in addition to productivity is Organic matter. The soil chemical environment is dynamic and reactions that maintain dilute solution of nutrient elements are indispensable for continual plant growth. The nutrient transformation and its availability in soils depend on pH, clay minerals, cation and anion exchange capacity (Reddy and Reddy, 2010). The presence of dense vegetation affords the soil adequate cover, thereby reducing the loss in macro and micro nutrients that are essential for plants growth and energy fluxes (Iwara *et al.*, 2011). Change in the soil chemical properties in the form of P mineralization-immobilization of organic P, are strongly influenced by seasonal variations in temperature, moisture, plant growth and root activity, and by organic matter accumulation from litter fall (Perrot *et al.*, 1990; Mc Grath *et al.*, 2000). Land cover changes also affects the soil properties and biogeochemical process (Ross *et al.*, 1999; Zeng *et al.*, 2000). Bodner *et al.*, (2008) discussed the impact of the rainfall intensity, soil drying and the frost on the seasonal changes of the soil hydraulic properties in the texture related range. The information of soil quality of Jhilmil Jheel wetlandis very important as no such work was carried out. Thus, the present investigation was an attempt to analyse and document the seasonal variations of the chemical properties under different land use. It is hoped that the study will provide useful knowledge in the future.

Study site:

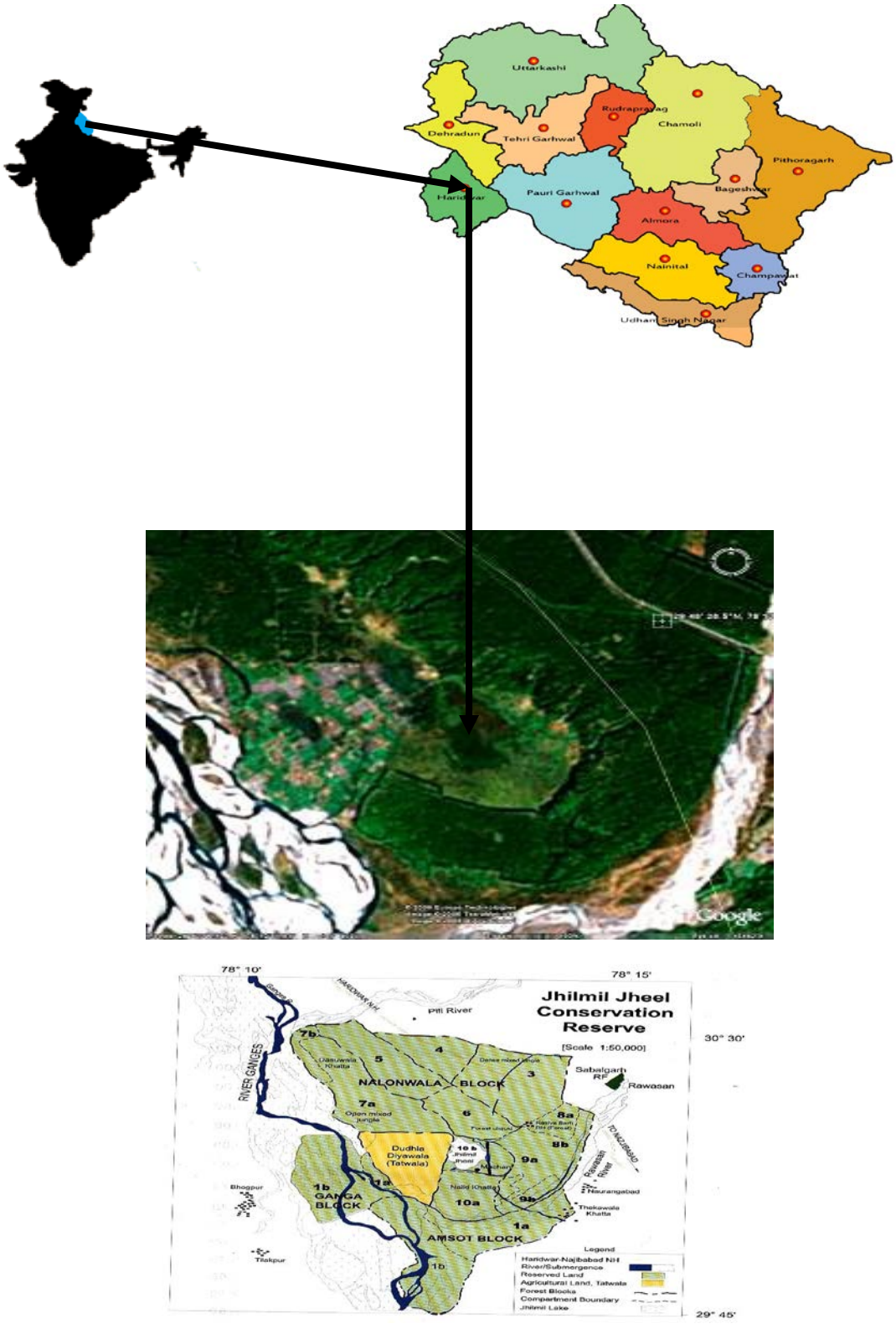

Figure 1. Map of the study area (source: unanimous)

II. STUDY AREA

Jhilmil Jheel is a saucer shaped wetland situated on the left bank of River Ganges between N 290 32' to 290 50' and E 780 to 78 0 15' covering an area of 3783.50 ha of Reserve Forest. The altitude of the area varies from 200 to 250 meters above mean sea level. It is located on the Haridwar – Highway and besides the natural course of the Ganges to the south of it in Chidiyapur Forest Range of Haridwar Forest Division, Uttarakhand. It is connected to River Ganga and is surrounded by Reserve Forest of Chidiyapur Range. The habitat is located at the junction of the Bhabhar and Terai formations representing a unique and species rich ecosystem which encompasses spectacular landscapes, tall grasslands, and tropical moist deciduous forests (Fig. 1).

III. MATERIAL & METHODS

Soil samples were collected randomly from 0-30 cm depth during each season i.e., autumn, winter, spring and summer and was brought into laboratory further analysis. Soil organic carbon was estimated by Walkley and Black (1934) method, total nitrogen by kjeldhal method (Misra, 1968), pH (Piper, 1950), phosphorus by colorimetric method and potassium by flame photometry (Jackson, 1973).

IV. RESULTS & DISCUSSION

pH: Soil pH influences plant growth by way of improving the soil physical condition and nutrients availability, whereas, high or low pH of nutrient medium has adverse effect on plant growth. The results in (Fig. 2) have shown that the value of the pH was nearly neutral. Soil pH under all the three different land uses followed the same pattern as it was observed higher in summer followed by spring, winter and the least was observed in autumn respectively. The result revealed that maximum pH was observed in summer season and the minimum was in autumn (rainfall) season. Soils become acidic because of warm temperature and high rainfall because under such conditions, soils weather quickly. Basic cations (e.g., Ca, Mg, K) which are essential to living organisms, are leached from soil profile, leaving behind more stable materials rich in Fe and Al oxides. This natural weathering process makes soil acidic and generally devoid of nutrients (Uchida and Hue, 2000). Shaikh (1996) also reported that the soil pH was maximum in summer and minimum in winter at Bilawali Tank Indore. The result also revealed that the grassland had the maximum pH values while natural forest had the minimum pH values. This may be due to high organic matter content and undisturbed nature of the natural forest soils as compare to plantation and grassland. The natural forest has low pH as compare to the grassland because organic matter in the form of plant litter, compost, and manure will decrease soil pH through the decomposition process (Brady & Weil, 2002). Robertson and Vitousek, (1981) and Adams and Sidle (1987) have also recorded low pH in undisturbed natural forest soils as compared to disturbed forest soils. It was reported that forest soils should be slightly acidic for nutrient supply to be balanced (Leskiw, 1998). Semwal *et al,* (2009) reported that the pH values were highly acidic in the undisturbed forest as compare to disturbed forest. High amount of humus in forest soils is responsible for low pH (Dimri, et al., 1987). Reduction in pH can be attributed to accumulation and subsequent slow decomposition of organic matter, which releases acid (de Hann, 1977).

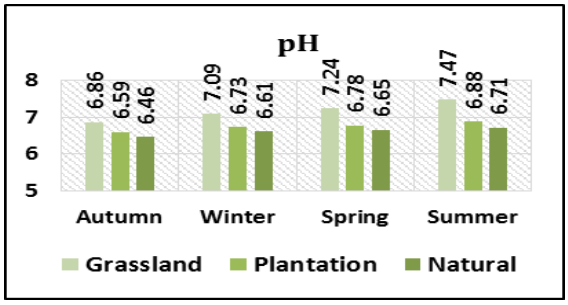

Figure 2

Organic Carbon: The level of soil organic carbon determines the multiplication of microorganisms and makes the system more dynamic. The results revealed in (Fig. 3) that the organic carbon content followed same trend under all the three different land uses i.e., higher in winter followed by spring, autumn and least was observed in summer. The results showed that the maximum percentage of OC was observed under natural forest during winter season and the minimum was observed under grassland in the summer season. Declining trend during the summer season may be because organic carbon content decreases with increase in temperature (Kirschbaum, 1995; Albrecht and Rasmussen, 1995), and decomposition rates (microbial respiration) doubles with every 10^{o}C increase in the temperature (Schlesinger, 1997; Hartel, 2005). Dick and Gregorich (2004) compared relative decomposition rates of organic matter in tropical (Nigeria) and cold dry climates (Canada), and found that decomposition rates were 10 times faster in the tropical site. Sevgi and Tecimen (2008) reported that higher organic carbon in the natural forest was due to production and return of higher amount of litter in natural forest. The release of nutrients from litter decomposition is a natural process in the internal biogeochemical cycle of an ecosystem, and decomposers recycle a large amount of carbon that was bounded in the plant or tree to the atmosphere. The results also revealed that natural forest soils had the maximum content of organic carbon in all the seasons and the minimum was observed under grassland in all the seasons. It may be because forests have grater canopies and provide the litter in larger quantity as compare to grasslands therefore, accumulation of carbon was higher. About 40% of the total SOC stock of the global soils resides in forest ecosystem (Bhattacharyya *et al.,* 2008).

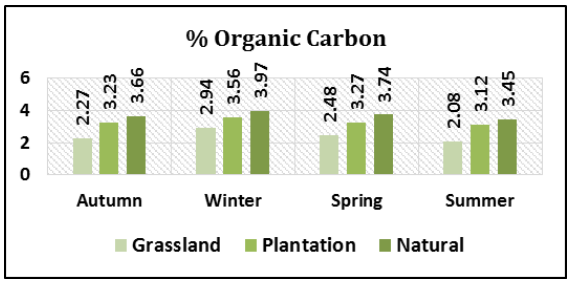

Figure 3

Total Nitrogen: Nitrogen is an important factor affecting soil fertility and plant strata. It is mostly present in the form of nitrates in the soil. The results revealed in (Fig. 4) that the total nitrogen in the soils under natural forest in autumn season was higher followed by winter, spring and the least as observed in summer respectively with same trend also followed under plantation. Total nitrogen in the soils under grassland was higher in autumn followed by spring, winter and least was observed in summer respectively. The results showed that total nitrogen was observed maximum in natural forest during autumn season and the minimum was observed in grassland in the summer season. The increased nitrogen contents during the rainy season could be best explained by the possible activity of nitrogen fixing microbes. Evidence exists to show that increased biological nitrogen fixation along with increased mineralization rates occur during the rainy season, which resulted in increased nitrogen content at this time (Bergeron *et al.,* 2002). Higher values of total nitrogen in the soil profile during rainy season reflects blue green algae fixation, rain water input and higher rate of release of mineral nitrogen through microbial decomposition (Birch 1958, Choudhri and Sharma 1975). Singh and Singh (2006) reported that during dry periods, plant uptake of nutrients is greatly reduced and the N-mineralization and nitrification are either immobilized in microbial biomass or accumulate in the soil as inorganic nitrogen.

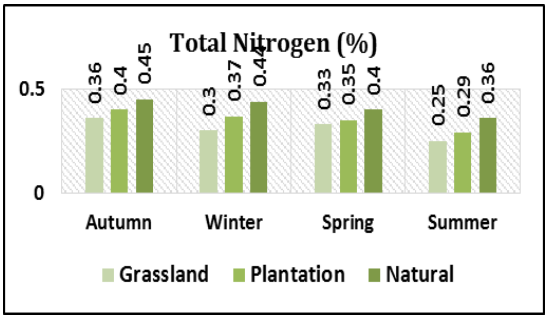

Figure 4

Available Phosphorous: The result revealed in (Fig. 5) that the available phosphorous under natural forest in winter season was higher followed by spring, autumn and the least was in summer respectively. Under plantation, it was higher in winter season followed by autumn, summer and least was in spring respectively. Under grassland, it followed the same trend as natural forest. The results showed that the maximum values of phosphorous was observed in natural forest during winter season and the minimum was observed under grassland during summer season. It may be due to more accumulation of minerals in winter season. The results showed that during winter season with less or no rain, there is no leaching of nutrients from the soil which results in the accumulation of high nutrients in winter after monsoon season. Less amount of available Phosphorus occur in autumn (rainy season) because of leaching due to rain and soil erosion. Ashraf *et al.,* (2012) reported that soil with maximum leaching are known to contain low amount of phosphorus as compared to the soil with minimum leaching. The result showed that there was maximum amount of organic carbon and phosphorus in winter season. (Fith and Nelson (1956) and Keogh *et al.,* (1972) in their studies also reported that when soil levels for phosphorus and percent organic matter are high, the amount of potential seasonal variation of phosphorus values tends to increase. Semwal *et al.,* (2009) reported in their study that the available phosphorus was found maximum in winter season and that the reason was because more accumulation of minerals takes place in winter season. Miller and Donahuer (2001) reported that the soil with high organic matter content have better supplies of organic phosphate for plant uptake than have the soils with low organic content. Phosphorus values trend higher in the winter and early spring months (Fine *et al.,* (1940) and Keogh *et al.,* (1972). Gupta and Sharma (2008) also reported that carbon and phosphorus were positively correlated because all these attributes were intimately linked with soil humus.

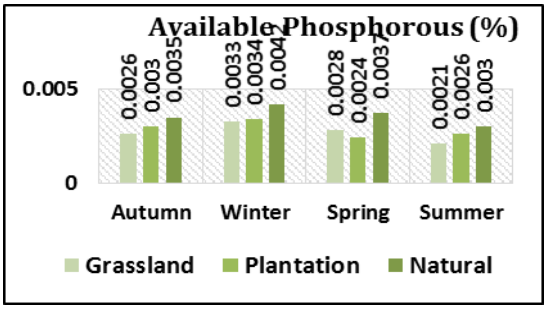

Figure 5

Available Potassium: The results revealed in (Fig. 6) that under natural forest, available potassium during winter season was higher followed by spring, autumn and least was in summer respectively. Under plantation, available potassium during winter was higher followed by autumn, spring and least was in summer respectively. Available potassium under grassland followed the same trend as natural forest. The results showed that the maximum value of available potassium was observed under natural forest during winter season and the minimum was observed under grassland in the autumn season. It may be due to the presence of dense vegetation affords the soil adequate cover, thereby reducing the loss in soil micro and macro nutrients that are essential for plants growth and energy fluxes as there is less vegetation cover in the grassland (Iwara *et al.,* 2011). Potassium values generally increase during the winter months because of shifts in soil equilibrium conditions due to freezing and thawing actions releasing fixed potassium from non-

exchangeable forms, depending upon the type of clay minerals present (Fine *et al.*, 1940; and Keogh, *et al.*, 1972). It was observed from the above results that more the organic matter, more is the accumulation of minerals in the soil. This was also reported by Chauhan (2001) that they found a positive co-relationship between organic matter and available potassium and that with the increase in organic matter tends to increase the accumulation of available potassium in the soil.

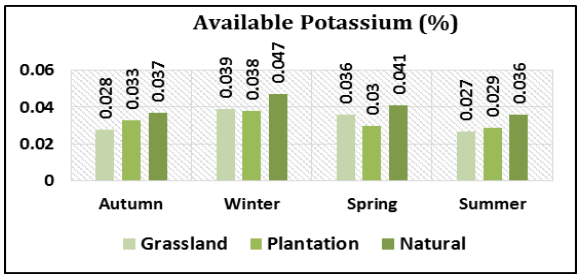

Figure 6

V. STATISTICAL ANALYSIS

SPSS 16.0 model was used to analyse the data for One-way ANOVA to compare the chemical characteristics in different seasons under different land uses at (P = 0.05 level).

Statistically significant mean difference on the basis of Tukey (HSD) of different chemical parameters in different seasons under natural forest *(Means for groups in homogenous subsets are displayed).*

Table 1.1 pH

Seasons	N	Subset for alpha = 0.05		
		1	2	3
Autumn	10	6.4570		
Winter	10		6.6060	
Spring	10		6.6450	6.6450
Summer	10			6.7070
Sig.		1.000	.589	.201

Table 1.2 Organic Carbon

Seasons	N	Subset for alpha = 0.05			
		1	2	3	4
Summer	10	3.4470			
Autumn	10		3.6620		
Spring	10			3.7390	
Winter	10				3.9710
Sig.		1.000	1.000	1.000	1.000

Table 1.3 Total Nitrogen

Seasons	N	Subset for alpha = 0.05		
		1	2	3
Summer	10	.3550		
Spring	10		.4030	
Winter	10		.4400	.4400
Autumn	10			.4460
Sig.		1.000	.105	.981

Table 1.4 Available Phosphorus

Seasons	N	Subset for alpha = 0.05		
		1	2	3
Summer	10	.003010		
Autumn	10	.003540	.003540	
Spring	10		.003720	.003720
Winter	10			.004200
Sig.		.058	.809	.100

Table 1.5 Available Potassium

Seasons	N	Subset for alpha = 0.05	
		1	2
Summer	10	.03600	
Autumn	10	.03670	
Spring	10	.04060	
Winter	10		.04680
Sig.		.159	1.000

The analysis showed (Table 1.1) that under natural forest, soil pH in autumn season showed significant difference. While no significant difference were observed between winter and spring season. Also, no significant difference were observed between spring and summer season. Organic carbon content showed (Table 1.2) significant difference between all the seasons. Total nitrogen showed (Table 1.3) significant difference against the rest of the seasons, while no significant difference were observed between spring and winter season. Likewise, no significant difference were observed between winter and autumn season. Available phosphorus showed (Table 1.4) no significant difference between summer and autumn season, autumn and spring season and between spring and winter season. Available potassium showed (Table 1.5) no significant difference between summer, autumn and spring season but winter season showed significant difference against the rest of the season.

Statistically significant mean difference on the basis of Tukey (HSD) of different chemical parameters in different seasons under plantation *(Means for groups in homogenous subsets are displayed).*

Table 2.1 pH

Seasons	N	Subset for alpha = 0.05		
		1	2	3
Autumn	10	6.5930		
Winter	10		6.7250	
Spring	10		6.7830	
Summer	10			6.8800
Sig.		1.000	.353	1.000

Table 2.2 Organic Carbon

Seasons	N	Subset for alpha = 0.05			
		1	2	3	4
Summer	10	3.1200			
Autumn	10		3.2260		
Spring	10			3.2720	
Winter	10				3.5600
Sig.		1.000	1.000	1.000	1.000

Table 2.3 Total Nitrogen

Seasons	N	Subset for alpha = 0.05		
		1	2	3
Summer	10	.2860		
Spring	10		.3480	
Winter	10		.3680	.3680
Autumn	10			.4010
Sig.		1.000	.591	.177

Table 2.4 Available Phosphorus

Seasons	N	Subset for alpha = 0.05	
		1	2
Spring	10	.002350	
Summer	10	.002560	
Autumn	10		.003030
Winter	10		.003350
Sig.		.580	.225

Table 2.5 Available Potassium

Seasons	N	Subset for alpha = 0.05	
		1	2
Summer	10	.02890	
Spring	10	.03030	
Autumn	10	.03270	.03270
Winter	10		.03780
Sig.		.222	.058

The analysis showed (Table 2.1) that under natural forest, soil pH in autumn season showed the same trend except that the summer season showed significant difference against the rest of the seasons. Organic carbon content (Table 2.2) and total

nitrogen (Table 2.3) showed same trend as natural forest. Available phosphorus showed (Table 2.4) no significant difference between spring and summer season, and between autumn and winter season. Available potassium showed (Table 2.5) no significant difference between summer, spring and autumn season. Likewise no significant difference were observed between autumn and winter season.

Statistically significant mean difference on the basis of Tukey (HSD) of different chemical parameters in different seasons under grassland *(Means for groups in homogenous subsets are displayed).*

Table 3.1 pH

Seasons	N	Subset for alpha = 0.05			
		1	2	3	4
Autumn	10	6.8560			
Winter	10		7.0850		
Spring	10			7.2370	
Summer	10				7.4710
Sig.		1.000	1.000	1.000	1.000

Table 3.2 Organic Carbon

Seasons	N	Subset for alpha = 0.05			
		1	2	3	4
Summer	10	2.0770			
Autumn	10		2.2260		
Spring	10			2.4820	
Winter	10				2.9360
Sig.		1.000	1.000	1.000	1.000

Table 3.3 Total Nitrogen

Seasons	N	Subset for alpha = 0.05		
		1	2	3
Summer	10	.2470		
Winter	10		.3020	
Spring	10		.3280	.3280
Autumn	10			.3560
Sig.		1.000	.369	.305

Table 3.4 Available Phosphorus

Seasons	N	Subset for alpha = 0.05		
		1	2	3
Summer	10	.002110		
Autumn	10		.002570	
Spring	10		.002770	
Winter	10			.003250
Sig.		1.000	.474	1.000

Table 3.5 Available Potassium

Seasons	N	Subset for alpha = 0.05	
		1	2
Summer	10	.02720	
Autumn	10	.02820	
Spring	10		.03580
Winter	10		.03860
Sig.		.965	.561

The analysis showed (Table 3.1) that under natural forest, soil pH in autumn season showed significant difference between all the seasons. Organic carbon content (Table 3.2) and total nitrogen (Table 3.3) showed same trend as natural forest and plantation. Available phosphorus showed (Table 3.4) no significant difference between autumn and spring season while summer and winter season showed significant difference with the rest of the season. Available potassium showed (Table 3.5) no significant difference between summer and autumn season. Likewise no significant difference were observed between spring and winter season.

ACKNOWLEDGEMENT

I want to thank my supervisor and co-supervisor for their help and guidance during my research work. I thank Rajiv Gandhi fellowship for the financial assistance during my research work.

REFERENCES

[1] Adams, P.W., and Sidle, R.C., (1987). Soil conditions in three recent landslides in southeast Alaska. For. Ecol. Manag, 18(2): 93-102.

[2] Albrecht, S.L., (1995). "Soil quality and soil organic matter", pp. 101 -104. In Columbia Basin Agricultural Research Annual Report. Spec. Rpt. 946. Oregon State University in cooperation with USDA-Agricultural Research Service, Pendleton, OR.

[3] Anonymous, (1993). Directory of Indian Wetlands. World Wildlife Federation, New Delhi

[4] Ashraf, M., Bhatt, G.A., Dar, I.D., and Ali, M., (2014). Physicochemical characteristics of grassland soils of Yusmarg Hill Resort (Kashmir, India), Eco. Balkanica, 4(1): 31-38.

[5] Bergeron, Y., Leduc, A., Harvey, B., and Gauthier, S., (2002). Natural fire regime: a guide for sustainable management of the Canadian boreal forest. Silva Fennica 36: 81-95.

[6] Bhattacharyya, T., (2008). "Soil carbon storage capacity as a tool to prioritize area for carbon sequestration", Current Science, 95 (4): 482 – 484.

[7] Birch, H.F., (1958). The effect of soil drying on humus decomposition and nitrogen availability. Plant and Soil, 10: 9-31

[8] Bodner, G., Loiskandl, W., Buchan, G., and Kaul, H.P., (2008). Natural and management-induced dynamics of hydraulic conductivity along a cover-cropped field slope. Geoderma. 146: 317-325.

[9] Brady, N., and Weil, R., (2002). The Nature and Properites of Soils. 13th ed.

[10] Champion, H.G., & Seth, S., (1968). A Revised Survey of the Forest Types of India. Manager of Publications, Government of India, Delhi - 6, India. 404 pp.

[11] Chauhan, J.S., (2001). Fertility status of soils of Birla Panchayat Samiti of Jodhpur district (Rajasthan). M.Sc (Ag.) Thesis, MPUAT, Udaipur.

[12] Choudhri, G.N., and Sharma, B.A., (1975). Study of nitrogen dynamics in salt affected (Usar) habitat near Varanasi. Trop Ecol., 16: 133-139.

[13] Dakshini, K.M.M., (1960). The vegetation of Mothronwala swamp forest. Bulletin of the Botanical Survey of India 2 (1-2): 57-59.

[14] De Hann, S., (1977). Humus, its formation, its relation with the mineral part of the soil and its significance for soil productivity. In: Organic matter studies, vol 1. International Atomic Energy Agency, Vienna, pp 21-30.

[15] Dick, W.A., (2004). "Developing and maintaining soil organic matter levels", pp. 103-120. In Managing Soil Quality: Challenges in Modern Agriculture. P. Schjønning, S. Elmholt and B. T. Christensen, Eds. CABI Publishing, CAB International. Cambridge, Massachusetts.

[16] Dimri, B.M., Singh, S.B., Baneriee, S.K., and Singh, B., (1987). Relation of age and dominance of tree species with soil chemical attributes in Kalimpong and Kurseong District of West Bengal. Indian Forester, 113: 307-311.

[17] Fine, L. O., Bailey, T.A., and Truog, E., (1940). "Availability of Fixed Potassium as Influenced by Freezing and Thawing." Soil Science Society Amer. Proc. 5: 183-186.

[18] Fith, J. W., and Nelson, W.L., (1956). "The Determination of Lime and Fertilizer Requirements of Soils through Chemical Tests." Advances in Agronomy Volume 8, Academic Press, N.Y.

[19] Ghildial., J.C., & Srivastava, M.M., (1989). The vegetation of Manu swamp - a tropical fresh water swamp forest. Indian Foresters, 115 (3): 183- 191.

[20] Gupta, M.K., and Sharma, S.D., 2008. Effect of tree plantation on soil properties, profile morphology and productivity index I. Poplar in Uttrakhand. Ann. For. 16 (2): 209-224.

[21] Hartel, P.G., (2005). "The soil habitat", pp. 26-53. In Principles and Applications of Soil Microbiology. 2nd edition. D. M. Sylvia, J. J. Fuhrmann, P. G. Hartel, and D. A. Zuberer, Eds. Pearson Prentice Hall. Upper Saddle River, New Jersey.

[22] Uchida, R., and Hue, N.V., (2000). Plant Nutrient Management in Hawaii's Soils, Approaches for Tropical and Subtropical Agriculture J. A. Silva and R. Uchida, eds. College of Tropical Agriculture and Human Resources, University of Hawaii at Manoa.

[23] Iwara, A.L., Ewa, E.E., Ogundele, F.O., Adeyemi, J.A., and Otu, C.A., (2011). Ameliorating effects of palm oil mill effluent on the physical and chemical properties of soil in Ugep, Cross river state, South southern Nigeria. International Journal of Applied Science and Technology, 1(5): 106-112.

[24] Jackson, M.L., (1967). Soil Chemical Analysis. Prentice Hall of India, New Delhi. 498 pp.

[25] Keogh, J. L., and Maples, R., (1972). "Variations in Soil Test Results as affected by Seasonal Sampling." Ark. Agr. Experimental Station Rpt. Series 777.

[26] Kirschbaum, M.U.F., (1995). "The temperature dependence of soil organic matter decomposition, and the effect of global warming on soil organic storage". Soil Biology and Biochemistry, 27: 753-760.

[27] Krishnamoorthy, K., (1960). Myristica swamps in the evergreen forests of Travancore. Indian Forester 86 (5): 314-315.

[28] Leskiw, L.a., (1998). Land capability classification for forest ecosystem in the oil stands region. Alberia Environmental Protection, Edmonton.

[29] Mc Grath, D.A., Comerford, N.B., and Durya M.L., (2000). Litter Dynamics and monthly fluctuations in soil phosphorous availability in an Amazonian agroforest. Forest Ecology and Management. 131: 167-181.

[30] Miller, R.W., and Donahuer, R.L., (2001). "Soils in our Environment". Seventh edition. Prentice Hall, Inc. Upper Saddle River, New Jersy.

[31] Misra, R., (1968). Ecology Work Book. Oxford and IBH Pub. Co., Culcutta.

[32] Perrot, K.W., Sarathchandra, S.U., and Waller, J.E., (1990). Seasonal storage and release of phosphorous and potassium by organic matter and microbial biomass in a high-producing pastoral soil. Austr. J. Soil Res. 28: 593-608.

[33] Piper, C.S., (1950). Soil and Plant Analysis. The University of Adelaide.

[34] Potash and Phosphate Institute. "Be a Top Yield Chaser Year-Round." Potash Newsletter N-1.

[35] Reddy, T.Y., and Reddy, G.H.S., (2010). Principles of Agronomy. Kalyani Publishers, New Delhi. 527.

[36] Robertson, G.P., and Vitousek, P.M., (1981). Nitrification in primary and secondary sucession. Ecology 62: 376-386.

[37] Ross, D.J., Tate, K.R., Scott, N.A., and Felthman, C.W., (1999). Land-use change: effects on soil carbon, nitrogen and phosphorous pools and fluxes in three adjacent ecosystems. Soil Biology & Biogeochemistry. 31: 803-813.

[38] Schlesinger, W.H., 1997. "Biogeochemistry: An Analysis of Global Change". 2nd ed. Academic Press. San Diego, California.

[39] Semwal, D.P., Uniyal, P.L., bahuguna, Y.M., and Bhatt, A.B., (2009). Soil nutrient storage under different forest types in a part of central Himalayas, India. Ann. For., 17(1): 43-52.

[40] Shaikh, R., (1996). Studies of moist bank community structure and production of Bilawali Tanks, Indore, Ph.D. Thesis, D.A.V.V. Indore.

[41] Sevgi, O., and Tecimen, H.B., (2008). Changes in Austrian Pine forest floor properties in relation with altitude in mountainous areas. J. Forest Science, 54: 306-313.

[42] Singh, A.N., and Singh, J.S., (2006). Experiments on ecological restoration coalmine spoil using native trees in a dry tropical environment, India: a synthesis. New Forest 25-39.

[43] Walkley, A., and Black, I.A., (1934). An Examination of degtjarefe method for determining soil organic matter and a proposed modification of chromic acid titration method. Soil Sci., 37: 28-35

[44] Zeng, D.H., Hu, Y.L., Chang, S.X., and Fan, Z.P., (2009). Land cover change effects on soil chemical and biological properties after planting Mongolian pine (Pinus sylvestris var. mongolica) in sandy lands in Keerqin, north eastern China. Plant and soil. 317: 121-133.

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Effect of Teachers' Morale on Standard Eight Pupils' Academic Achievement in Public Primary Schools in Marani Sub-County, Kenya

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Abstract- The purpose of this study was to investigate the effect of teachers' morale on standard eight pupils' academic achievement in public primary schools in Marani Sub-County, Kenya. The study utilized *ex-post facto* design. The target population was 320 standard eight teachers in 64 public primary schools. Simple random sampling technique was used to select teachers. The sample size was 100 teachers which represented 30% of the population. Questionnaire was used as data collection instrument. A standardized mock examination mean scores of standard eight pupils was obtained from the Sub-County education office. Data was analyzed using both descriptive (frequencies, percentages and means) and inferential statistics (Pearson coefficient of correlation). All null hypotheses tested at 0.05 alpha level were rejected and led to affirmation that there was a significant relationship between teachers' morale and pupils' academic achievement. Based on the results, it was recommended that teachers should be encouraged to prepare teaching-learning instruments, participate in internal quality assurance programmes and attend classes regularly. Teachers should also be motivated and supported by educational stakeholders for better academic achievement in schools.

Index Terms- Teachers' morale, Aspects of teachers' morale, pupils' academic achievement and public primary schools.

I. Introduction

Morale of teachers and pupils' academic achievement are key aspects which influence overall success in schools. Teachers' morale is important in the success of day-to-day routine teaching and learning process (Lester, 1953). According to Houchard (2005) and French (1988) morale is a difficult concept to describe however several authors have attempted to define it variously. Washington and Watson (1976) refer to morale as the feeling a worker has about his/her job based on how the worker perceives him/herself in an organization and the extent to which the organization is viewed as meeting the worker's own needs and expectations. Mendel (1987) defines morale as a feeling, a state of mind, a mental attitude, and an emotional attitude. Perumal (2011) also contends that morale is the state of the spirit of a person or a group as exhibited by confidence, cheerfulness, discipline, and willingness to perform assigned tasks. Bentley and Rempel (1980) as well describe morale as the professional interest and enthusiasm that a person displays towards the achievement of individual and group goals in a given job situation. Despite varying definitions of the term morale which have focused on feelings, attitudes, interest and state of spirit of a worker, it has proved to be useful in studying aspects of teachers' morale and how it affects pupils' academic achievement (French, 1988).

Hoy and Miskel (1987) posit that when a conducive school environment exists and teacher morale is high, teachers feel good about each other and at the same time they feel a sense of accomplishment of their work. Perumal (2011) as well contends that key to improving teacher morale is building a positive school atmosphere that reflects the physical and psychological aspects which provide the requisite conditions necessary for teaching and learning to take place. Canaya (2008) portends that when teachers' morale is high, teachers are happy even with a low compensation. Independent Schools Queensland (2012) also postulates that teacher morale is high when there is compensation which attracts and retains effective teachers. However, Bambi (2001) postulates that teachers' low morale hampers their work performance. According to Covington (2011) teachers' morale is low when there is stress stemming from the state and local demands, low pay, lack of administrative support, and heightened students' discipline problems. Similarly, Ravhudzulo (2012) argues that low teachers' morale is caused by inadequate management skills and capacities as well as a lack of teacher commitment towards work. Adelabu (2005) too indicates that teachers' low morale is caused by little motivation. Lumsden (1998) asserts also that decreased quality of teaching, depression, greater use of sick leave, efforts to leave the profession, and a cynical and dehumanized perception of students also lead to low teachers' morale at work.

In Kenya, various stakeholders are worried about the declining pupils' achievement and teacher performance (Odhiambo, 2008). According to National Education Sector Support Programme (NESSP)-Kenya (Department of Education, Republic of Kenya, 2013) and the Task force on the Re-alignment of the Education Sector to the Constitution of Kenya 2010 (Ministry of Education (MoE), Republic of Kenya, 2012a) dismal performance has been caused partly by high pupil/teacher ratio thus constraining effective teaching, inadequate teacher development, and irregular monitoring of teaching and learning competencies at various grades. A Policy Framework for Education: Aligning Education and Training to the Constitution of Kenya (2010) and Kenya Vision 2030 and Beyond (MoE, Republic of Kenya, 2012b) indicates that poor management and

lack of good governance; impropriety in financial management; weak accountability; high staff turnover; poor service delivery; and infrastructural decay as the reasons for poor performance in schools. Even so, the aforementioned polices had not indicated whether teachers' morale had a bearing on pupils academic achievement.

Studies carried out in Kenya in relation to teachers' welfare for instance by Kosgei, Mise, Odera and Ayugi (2013) argue that poor performance is attributed to inadequate number of teachers. Kirau (2013) opines that job security, teaching facilities, student interest, promotions, and administrative support are the most important factors in terms of teachers working morale. Wekesa and Nyaroo, (2013) points out that fair compensation has an effect on teachers' morale and their work performance. The studies focused on specific teachers' morale factors and their influence on performance yet this study attempted to establish the effect of teachers' morale on pupils' academic achievement in public primary schools in Marani Sub-County.

In Marani Sub-County, since the year 2009 up to 2014, pupils' performance in Kenya Certificate of Primary Education (KCPE) examination has been below average with accumulated mean standard score of 222.04 marks out of 500 marks (Marani Sub-County Education Office, 2014). A study conducted by Ogamba (2011) found out that understaffing and irregular supervision of teachers were some of the causes of poor performance in Marani division. Studies in human resource management have also shown that morale affects performance (Akintayo, 2012; Torrington, Hall and Taylor, 2008; and Beaumont, 1994). It is however not known how morale affects pupils' performance in education sector thus this study sought to establish the effect of teacher morale on standard eight pupils' academic achievement in public primary schools in Marani Sub-County. As a result, the study was guided by the following objectives;

(i) To establish the relationship between attitudinal aspect of teachers' morale and standard eight pupils' academic achievement in public primary schools in Marani Sub-County.
(ii) To find out the relationship between professional aspect of teachers' morale and standard eight pupils' academic achievement in public primary schools in Marani Sub-County.
(iii) To determine the relationship between motivational aspect of teachers' morale and standard eight pupils' academic achievement in public primary schools in Marani Sub-County.

II. RESEARCH ELABORATIONS

Leithwood (2006) carried out a study on teacher working conditions that matter as evidence for change and established that high morale is typically associated with hopeful attitudes, an optimistic view toward one's colleagues, and enthusiasm for one's work, whereas low morale is associated with cynicism, feelings of despair, and lack of enthusiasm. Further, he found out that teacher behaviour associated with low morale included less effective teaching performance, absenteeism, turnover and resistance to change. These findings considered issues of teacher morale and attitude thus creating room to investigate their effect on pupils' academic achievement. Ayeni and Afolabi (2012) contend that teacher tasks are statutory curricula functions that are performed by the teachers to enable learners achieve the set educational goals in schools. The performance of teachers' work is therefore manifested in their knowledge of the subject-matter, skills, and competences in the teaching and learning processes, which lead to the accomplishment of the stated educational goals. This suggests that teachers must possess qualities which are effective for teaching and learning within the school setting. Teachers need to discern what to teach, how to teach it and whom to teach it. Too, Kimutai and Kosgei (2012) concur with Ayeni and Afolabi (2012) by making assertion that quality of teachers' work has a significant impact on pupils' academic achievement and to ensure quality oriented teaching and learning processes, the teachers are expected to have in-depth knowledge of the pedagogy in their subject areas. These authors had focused more on teachers' work performance and a gap existed to establish effect of attitudinal aspect of teachers' morale on pupils' academic achievement. Mwangi (2013) argues that teachers in most cases lack enthusiasm and are unable to teach effectively in order to enhance learners' achievement. Ayele (2014) portends that teachers have negative attitudes towards teaching because of poor achievement of students Apparently a gap existed to determine the effect teachers' morale on pupils' academic achievement which was not focused in the study.

Ayeni and Afolabi (2012) carried out a study on teachers' instructional task performance and quality assurance of students' learning outcomes in Nigerian secondary schools. The findings of the study revealed that teachers' instructional work entailed delivery of lessons, evaluation of learning outcome, classroom management, and feedback on learning outcomes. Apparently, this study was conducted in a secondary school setting and captured performance of teachers' instructional work. Effect of teachers' morale on pupils' academic achievement was not discussed. Perumal (2011) contends that teachers' low morale is caused by pupils' indiscipline and absenteeism, lack of professional development and collaboration at school level, inadequate support from school management and parents, large class sizes, inequity in teaching load between management and staff, poor salaries, nepotism, professional jealousy and lack of unity amongst educators. Mobegi, Ondigi and Oburu (2010) carried out a study on secondary school head teachers' quality assurance strategies and challenges in Gucha district, Kenya. Findings from this research revealed that teachers preferred using discussion and lecture methods as teaching and learning strategies. Other methods such as use of assignments, investigation, experiment, project and dramatization were utilized irregularly. This study focused on strategies used in delivery of lesson rather than teachers' instructional work for example preparation of teaching and learning materials, pupils' evaluation, management of students' records for instance class attendance register, pupils progress reports, issuance of learning materials records and so on which form part of teachers' work and equally influence pupils' academic achievement. The issue of teacher morale was not discussed in the study. Ogamba (2011) found out that inadequate teaching resource materials, poor relationship between teachers and the community, heavy workload, haphazard teacher transfers, and teacher absenteeism were some of the factors contributing to dismal performance in

schools. However, the study did not investigate the effect of teachers' morale on pupils' academic achievement. Nyamosi (2013) contends that adequacy of teaching-learning resources and interpersonal relationships influence pupils' academic performance while Matoke, Okibo and Nyamongo (2015) opine that teachers' capacity building has a significant effect on teacher motivation. The authors missed out on establishing the relationship between teacher morale and pupils' academic achievement hence a gap existed for this study.

Wekesa and Nyaroo (2013) undertook a study to examine the effect of compensation on performance of public secondary school teachers in Eldoret Municipality Uasin Gishu County, Kenya. The findings of the study indicated that fair compensation has an effect on teachers' morale and work performance. The study focused only on compensation as a factor influencing teachers' morale and did not include any information related to pupils' academic achievement hence creating a gap for study. National Center for Education Statistics (1997) observes that, administrative support and leadership, good student behavior, a positive school atmosphere, and teacher autonomy are working conditions associated with higher teacher satisfaction. Further to that, favorable workplace conditions were also positively related to teacher' job satisfaction regardless of teachers' background characteristics or school demographics whether a teacher was employed by a public or private school, an elementary or secondary school, and regardless of teachers' background characteristics or school demographic satisfaction. Kirau (2013) conducted a study on perceptions of secondary school agriculture teachers on selected morale factors in Machakos District. The results indicated that teachers acknowledged pay followed by job security, teaching facilities, student interest, promotions, and administrative support as the most important factors in terms of their working morale. This study focused on specific subject teachers in the secondary schools to find out their perception on selected morale factors thus creating a gap for the study. Mengistu (2012) indicates that teachers are demotivated by inadequate salaries and benefits, slim opportunities for promotion, lack of decision making opportunities and poor relationships among them, with principals and with parents. Lambersky (2014) as well points out that principals' behaviour for instance, showing professional respect, encouraging and acknowledging teachers' efforts and results, providing appropriate protection to teachers and allowing teachers' voices heard enhance teachers' morale. Consequently the current study moved further in an attempt to fill a gap on the effect of teachers' morale on pupils' academic achievement. Koplyay and Matis (1967) examined the relationship between teacher morale and organization climate. The findings of the study showed that open nature of the school climate appeared to be associated more with high teachers' morale whereas the closed nature of the school climate appeared to be associated more with low morale teachers. The study focused on teacher morale and organization climate as study variables. As a result a gap existed to determine the correlation between teachers' morale and pupils' academic achievement.

Oparanya, Kisiangani and Okiya (2015) conducted a study on factors influencing academic performance of standard eight girls in national examinations in public primary schools in Matungu Division, Kenya. Results from the study revealed that teacher factors like training, teacher shortage and inadequate teaching and learning facilities affected girls' performance. A gap therefore existed to investigate whether teachers' morale had an effect on pupils' academic achievement. A study by Olaleye (2011) investigated the perceptions of students on teachers' characteristics in relation to students' academic performance in secondary schools in Osun State – Nigeria. The findings of the study showed that students' perception of teachers' knowledge of subject matter, teachers' attitude to work and teachers' teaching skills correlate positively and significantly with student academic performance. Apparently, a gap existed to find out the effect of teachers' morale on pupils' academic achievement. Mariita (2012) also portends that there exists a positive relationship between parent involvement, socio-economic status and academic performance of pupils in primary schools. Similarly, Farooq, Chaudhry, Shafiq and Berhanu (2011), conducted a study to examine different factors influencing quality academic performance of secondary school students in a metropolitan city of Pakistan and found out that socio-economic status (SES) and parents' education have a significant effect on students' overall academic achievement. Kosgei et al. (2013) investigated the influence of teacher characteristics on students' academic achievement in secondary schools. A study carried out by Mburu (2013) to assess the influence of teachers' job satisfaction on pupils' performance in KCPE examinations in public primary schools in Gilgil District, Nakuru County, Kenya indicated that weak relationship between teachers and their employer led to dismal pupils' academic performance in KCPE examinations. Apparently, the study did not consider the effect of teachers' morale on pupils' academic achievement which the current study endeavored to address.

III. METHODOLOGY

The study used *ex-post facto* design because the researcher had no direct control of teachers' morale and pupils' academic achievement such that by the time the researcher had carried out the study, possible relationships between these variables had occurred. In other words, the researcher did not have the ability to manipulate the two study variables but attempted to establish the relationship and effects that occurred between them (Orodho, 2009). The target population was 320 teachers in 64 public primary schools in the Sub-County. Simple random sampling was used to ensure that all teachers in the defined census had an equal and independent chance of being selected as members of the sample (Mugenda and Mugenda, 1999). This yielded a simple size of 100 teachers out of 320 teachers which represent 30% of target census. Structured closed–ended questionnaire was used as data collection instrument. Content and expert validity was used to ensure that test items covered all objectives and variables of the study while internal consistency technique was used to establish reliability of teachers' questionnaire which yielded a high Cronbach's coefficient alpha value of 0.989 and thus the questionnaire was considered reliable for this study. Quantitative method (descriptive and inferential statistics) was used to analyze data. The descriptive statistics generated were: frequencies, percentages and means. Inferential statistics used was Pearson correlation of coefficient. Data was analyzed using SPSS software. The null hypotheses ($H0_1$, - $H0_3$) were tested at

0.05 alpha level using Pearson correlation of coefficient. The results were presented in form of tables and figures.

IV. RESULTS AND DISCUSSION

To achieve the study objectives, the relationship between attitudinal, professional, and motivational aspects of teachers' morale and standard eight pupils' academic achievement in public primary schools in the Sub-County was determined.

Attitudinal Aspect of Teachers' Morale and Standard Eight Pupils' Academic Achievement

In the first objective of the study the researcher was to establish the relationship between attitudinal aspect of teachers' morale and standard eight pupils' academic achievement. In this case, mean scores of attitudinal aspect of teachers' morale and pupils' academic achievement were computed and compared. Table 1 presents the results.

Table 1
Overall mean score of attitudinal aspect of teachers' morale and pupils' academic achievement by school

School	N	Attitudinal Aspect of Teachers' Morale Mean scores	Pupils Academic Achievement Mean scores
A	5	4.6429	331.00
B	5	2.0667	231.32
C	5	1.7048	200.04
D	5	1.6095	200.86
E	5	1.7238	214.32
F	5	4.6286	336.58
G	5	1.4381	168.47
H	5	1.4000	191.83
I	5	1.5619	204.35
J	5	1.8952	242.89
K	5	4.3714	259.66
L	5	1.5238	232.85
M	5	1.4095	204.35
N	5	1.4952	227.46
O	5	1.8762	223.72
P	5	1.4571	175.35
Q	5	1.4952	200.38
R	5	4.5143	305.12
S	5	4.5333	288.97
T	5	4.5048	268.64
Total	100	2.4933	235.41

Table 1 shows that when the mean of attitudinal aspect of teachers' morale was high, the mean score of pupils' academic achievement was also high, and vice versa. The researcher was further interested to find out the relationship between attitudinal aspect of teachers' morale and pupils' academic achievement and hence the following hypothesis was stated and tested:

$H_0$1: There is no statistically significant relationship between attitudinal aspect of teacher morale and standard eight pupils' academic achievement in public primary schools in Marani Sub-County

To test the relationship, Pearson coefficient of correlation was used. The results are presented in Table 2.

Table 2
Relationship between Attitudinal Aspect of Teachers' Morale and Pupils' Academic Achievement

	Variables	Academic Performance	Attitudinal Aspect of Teachers' Morale
Pearson Correlation	Academic Performance	1.00	.890
	Attitudinal Aspect of Teachers' Morale	.890	1.00
Sig. (1-tailed)	Academic Performance		.000
	Attitudinal Aspect of Teachers' Morale	.000	
N		100	100

As shown in Table 2, the correlation coefficient between attitudinal aspect of teachers' morale and pupils' academic achievement was 0.890 with *p* value of (.000) level of significance. The result implies that the relationship was highly significant at 0.05 level of significance and thus the null hypothesis was rejected.

These results support Wadesango (2012) who measured teachers' morale in a four to one continuum where four represented very high morale and one signified very low morale. The result revealed that majority of teachers (60%) scored 1.0 average mean and thus had very low morale because of the feeling that they are not involved in school activities. Ayele (2014) also found out that there was a link between teachers' negative attitudes towards work and poor achievement of students. Consequently, this denotes that the higher the teachers scored in the Likert scale type the higher was their morale and vice versa. Moreover, low morale scores among the teachers affected total average mean of attitudinal aspect of teachers' morale. Therefore, the results imply that teachers need to feel appreciated in order for them to direct all their energy towards enhancing pupils' academic achievement.

In addition, the findings of this study are congruent with Wanzare (2011) who reported that teachers' negative attitude towards work leads to unsuccessful students' academic performance in schools. Govindarajan (2012) as well agrees with the results of this study by affirming that high mean score of attitudinal aspect of teachers' morale is characterized by interest and enthusiasm towards work and it has a relationship with high students' academic achievement. Therefore it suffices to make an observation that attitudinal aspect of teachers' morale is critical as the teachers need to have a natural push or urge in undertaking

their instructional duties. Results of this study are similar to those of Olaleye (2011) who established that teachers' attitude to work correlated positively and significantly with students' academic performance with Pearson coefficient of correlation (r-0.67, p<.05). DeBruyne (2001) also concurs with these results in his study conducted to identify the factors responsible for job dissatisfaction and low teacher morale when he found out that teachers' attitudes have a significant impact on their job performance and academic performance of students. In the same vein, Luu (2011) study on the relationship between employee attitudes and organizational performance found out that employee attitudes are positively related to productivity. Correspondingly, Achurra and Villardon (2013) utilized analysis of variance to examine the statistical difference between the level of teacher self-efficacy and perceived learning outcomes. The test result showed that teachers with a higher perceived level of overall efficiency had students with greater perceptions of learning (mean = 2.89) than teachers with lower levels of efficacy (mean = 2.74) with a significant level of p <0.01 and F = 6.17.

In regard to pupils' academic achievement from the Sub-County mock examination, the results of this study corroborate those of Ojuodhi (2012) whose study indicated that there was a dismal performance in KCPE for the last eight years in primary schools in Lari Division with an average mean score of below 250 marks. The researcher mentioned inadequate parental support of school activities as the major cause of poor pupils learning outcome. Kaloki (2012) similarly found out that average performance in KCPE of pupils in the division since the year 2002 had been below the average mark of 250 marks. He cited acute shortage of teachers and high pupils-teacher ratio as reasons for dismal performance. Consequently, this denotes that examination results are used as a yard stick to gauge performance level of the pupils. In addition it appears many schools are faced with a myriad of challenges which are inhibiting them from improving on pupils' academic achievement.

Professional Aspect of Teachers' Morale and Standard Eight Pupils' Academic Achievement

The second objective in this study was to find out the relationship between professional aspect of teachers' morale and standard eight pupils' academic achievement in public primary schools in Marani Sub-County. The results have been presented in Table 3.

Table 1
Overall mean score of professional aspect of teachers' morale and pupils' academic achievement by school

School	N	Professional Aspect of Teachers' Morale Mean Score	Pupils Academic Achievement Mean Score
A	5	4.6607	331.00
B	5	2.0857	231.32
C	5	1.5429	200.04
D	5	1.5714	200.86
E	5	1.7000	214.32
F	5	4.7571	336.58
G	5	1.5286	168.47
H	5	1.4857	191.83
I	5	1.4143	204.35
J	5	1.5714	242.89
K	5	4.2857	259.66
L	5	1.5000	232.85
M	5	1.5571	204.35
N	5	1.5429	227.46
O	5	2.2857	223.72
P	5	1.5429	175.35
Q	5	1.8143	200.38
R	5	4.6286	305.12
S	5	4.5286	288.97
T	5	4.6286	268.64
Total	100	2.5350	235.41

Table 3 indicates that when the mean of professional aspect of teachers' morale was high, the mean score of pupils' academic achievement was also high and vice versa. Further analysis was done by the researcher, to determine whether the relationship between professional aspect of teachers' morale and standard eight pupils' academic achievement was significant and consequently the following null hypothesis was formulated and tested:

$H_0$2: There is no statistically significant relationship between professional aspect of teachers' morale and standard eight pupils' academic achievement in public primary schools in Marani Sub-County.

Pearson coefficient of correlation was used to test the relationship and the results have been presented in Table 4.

Table 2
Relationship between Professional aspect of teachers' morale and pupils' academic achievement

	Variables	Academic Performance	Professional Aspect of Teachers' Morale
Pearson Correlation	Academic Performance	1.00	.877
	Professional Aspect of Teachers' Morale	.877	1.00
Sig. (1-tailed)	Academic Performance		.000
	Professional Aspect of Teachers' Morale	.000	
N		100	100

As it can be seen on Table 4 the correlation coefficient between professional aspect of teachers' morale and pupils' academic achievement was 0.877 with p value of (.000) level of significance. The result means that the relationship was highly

significant at 0.05 alpha level thus the null hypothesis was rejected.

Several studies conducted elsewhere such as African Population and Health Research Center (2010) agree with the results of this study by asserting that inadequate initiative by teachers to prepare professional documents and execute teaching-learning process has an influence on low pupils' academic achievement. Regina (2010) too supports the findings of this study by asserting that availability and usage of teaching materials have a positive impact on learners' output and teachers' productivity. Thus, it can be deduced from the results that the higher teachers scored in the Likert scale in regard to professional aspect of morale the higher the pupils' mean score was and vice versa.

Further, the findings of this study are in harmony with Reche, Bundi, Riungu and Mbugua (2012) who found out that teachers' who inadequately prepared teaching-learning resources, had large workload, and irregularly assessed by head teachers, had their pupils post low mean standard scores in primary schools national examination. In the same vein, Nyakundi (2012) in her study on factors affecting teacher motivation in public secondary schools in Thika District, Kenya revealed that 74% of teachers who attended in-service training as part of professional training programmes had improved on their teaching skills and there was improved students' academic performance. Equally, Mphale and Mhlauli (2014) carried out an investigation on students' academic performance for junior secondary schools in Botswana and found out that classroom teaching had a positive impact on students' academic performance in regard to knowledge and skills in problem-solving, final examinations and acquisition of better communication skills.

In addition, authors who used inferential statistics in their studies such as, Ayeni and Afolabi (2012) concur with the results of this study by indicating that there is a significant relationship between teachers professional tasks and students' academic performance ($r = 0.828$ at $p<0.05$). Similarly, Adeyemo, Oladipupo and Omisore (2013) in their study on teachers' motivation on students' performance also found out that there was a significant effect between teachers professional training courses and students' academic performance ($F = 6.437$ with the significance value = 0.013).

Motivational Aspect of Teachers' Morale and Standard Eight Pupils' Academic Achievement

In the third objective sought to establish the relationship between motivational aspect of teachers' morale and standard eight pupils' academic achievement in public primary schools in the Sub-County. Consequently, overall mean scores of motivational aspect of teachers' morale and pupils' academic achievement were calculated. Table 5 presents the results.

Table 5
Overall mean score of motivational aspect of teachers' morale and pupils' academic achievement by school

School	N	Motivational Aspect of Teachers' Morale Mean Score	Pupils Academic Achievement Mean Score
A	5	4.2321	331.00
B	5	2.1571	231.32
C	5	1.9857	200.04
D	5	1.8714	200.86
E	5	1.9143	214.32
F	5	4.2571	336.58
G	5	1.6857	168.47
H	5	1.7000	191.83
I	5	1.7571	204.35
J	5	1.8000	242.89
K	5	3.9857	259.66
L	5	1.7714	232.85
M	5	1.6143	204.35
N	5	1.6429	227.46
O	5	2.0429	223.72
P	5	1.8286	175.35
Q	5	1.7714	200.38
R	5	4.3286	305.12
S	5	4.2143	288.97
T	5	4.1429	268.64
Total	100	2.5429	235.41

Table 5 indicates that when the mean of motivational aspect of teachers' morale was high, the mean standard score of pupils' academic achievement was also high and vice versa.

To determine whether the relationship between motivational aspect of teachers' morale and pupils' academic achievement was significant, the following hypothesis was stated:

$H_0$3: There is no statistically significant relationship between motivational aspect of teachers' morale and standard eight pupils' academic achievement in public primary schools in Marani Sub-County.

To test the relationship between motivational aspect of teachers' morale and pupils' academic achievement, Pearson coefficient of correlation was used and the results are presented in Table 6.

Table 6
Relationship between motivational aspect of teachers' morale and pupils' academic achievement

	Variables	Academic Performance	Motivational Aspect of Teachers' Morale
Pearson Correlation	Academic Performance	1.00	.880
	Motivational Aspect of Teachers' Morale	.880	1.00
Sig. (1-tailed)	Academic Performance		.000
	Motivational Aspect of Teachers' Morale	.000	

N	100	100

As shown in Table 6 the coefficient of correlation between motivational aspect of teachers' morale and pupils' academic achievement was 0.880 with *p* value of (.000) significance. The result implies that the relationship was highly significant at 0.05 alpha level thus the null hypothesis was rejected.

In support of the results, it was imperative for the researcher to review studies related to motivational aspect to teachers' morale. Some authors for instance, Yawson and Wonnia (2014) concur with the results in their study on teacher morale and attitude to work in selected senior secondary schools in the Cape Coast Municipality which found out that teachers' morale was low with a mean of 1.57. They cited lack of motivation from government in form of better remuneration, promotions and capacity building initiatives. Similarly, Gudo, Oanda and Olel (2011) found out that 62.3% of public universities lecturers had a low level aspect of motivational morale. The authors allude to inadequate staff remuneration as the motivational factor negatively affecting the lecturers. As a result, the findings from the Table 5 suggest that the higher teachers scored in the Likert scale type items in regard to motivational aspect of morale the mean was also higher and vice versa.

Furthermore, Lester (1953) established that teachers in secondary schools whose pupils achieved relatively high scholastically appeared to have higher morale than teachers in schools with relatively low pupils' achievement. In the same way, Ajala (2012) examined the influence of workplace environment on workers' welfare, performance and productivity and indicated that recognition for work well done by workers had a highest significance with mean of 3.32. Majority of workers (97.0%) agreed that giving them recognition for a job well done motivated them for greater productivity and increased performance. Consequently it appears that perhaps teachers who had a high morale were more likely to be meticulous in implementing the school curriculum hence high pupils' academic achievement.

Some similar studies which applied inferential statistics were also reviewed to determine their congruency with these results. Consequently, Aacha (2010) found out that there is a positive relationship between motivation of teachers and pupils academic performance with Pearson coefficient of correlation ($r = 0.437$, $p<.05$). Equally, National Centre for Education Statistics (1997) established that favourable work place conditions were positively related to teachers' job satisfaction and in turn influenced students' achievement.

V. CONCLUSION AND RECOMMENDATIONS

It is concluded from the study that there was a strong significant relationship between attitudinal, professional and motivational aspects of teachers' morale and pupils' academic achievement. Based on the results of this study, it is recommended that teachers should prepare, update and maintain teaching and learning instruments such as schemes of work, lesson plans, pupils' assessment and attendance records, records of work covered and lesson notes. These professional activities will promote teachers' morale and spur pupils' academic achievement; School Management Committees should give teachers' incentives when pupils have posted excellent results in their individual subject as a form of appreciation. Such motivation will assist in improving teachers' morale as well as lead to high pupils' academic achievement; and Parents Teachers Associations should ensure schools' environment is conducive for learning. This is because ample teaching and learning facilities have positive impact on teachers' morale and boosts pupils' academic achievement. Further studies can be carried out through replication of a similar study to other Sub-Counties in Kenya in order to have a broader scope in terms of generalization of the study findings.

REFERENCES

[1] Aacha, M. (2010). Study on motivation and the performance of primary school teachers in Uganda: A case of Kimaanya-Kyabakuza, division, Masaka district (Unpublished M.A thesis). Makerere University, Uganda.

[2] Achurra, C. & Villardon, L. (2013). Teacher self-efficacy and student learning. The European Journal of Social and Behavioural Science, 1(1), 366-383.

[3] Adelabu, M. A. (2005). Teacher motivation and incentives in Nigeria. Retrieved on 18th December, 2013, at 2.47 p.m from http://www.r4d.dfid.gov.uk/Output/175181/

[4] Adeyemo A. R., Oladipupo, A., & Omisore, A. O. (2013). Teachers' motivation on students' performance in mathematics in government secondary schools, Makurdi Lg Area. International Journal of Humanities and Social Science Invention, 2 (51), 35-41.

[5] African Population and Health Research Center. (2010, August). Low and High performing schools in Kenya: Do teaching styles make a difference? (Policy Issue Brief No. 17) Nairobi, Kenya: The African Population and Health Research Center.

[6] Ajala, E. M. (2012). The influence of workplace environment on workers' welfare, performance and productivity. The African Symposium: An Online Journal of the African Educational Research Network, 12 (1), 141-149.

[7] Akintayo, D. (2012). Working environment, workers' morale and perceived productivity in industrial organizations in Nigeria. Education Research Journal, 2 (3), 87-93.

[8] Ayele, D. (2014). Teachers' job satisfaction and commitment in general secondary schools of Hadiya zone, in Southern National Nationality and people of Regional State (Unpublished M. A. Thesis in Educational Leadership). Jimma University, Ethiopia.

[9] Ayeni, A. J. & Afolabi, E. R. I. (2012). Teachers' instructional task performance and quality assurance of students' learning outcomes in Nigerian secondary schools. International Journal of Research Studies in Educational Technology, 1 (1), 33-34.

[10] Bambi, B. (2001). Principals must face morale issue. Hyannis, MA 02601, USA: Principal Training Centre (PTC) 110 Breeds Hill Rd. Unit 2.

[11] Beaumont, P. B. (1994). Human resource management: Key concepts and skills (3rd Ed). London: SAGE Publication Ltd.

[12] Bentley, R. R., & Rempel A. M. (1980). Manual for the Purdue teacher opinionaire. West Lafayette, Indiana: The University Book Store.

[13] Canaya, P. S. (2008). Participatory decision making vis-à-vis teachers' morale and students' achievement in public secondary schools in Zamboanga City (Unpublished doctoral thesis). Western Mindanao State University, Zamboanga City, Philippines.

[14] Covington, C. D. (2011). Lagging in the race: The impact of teacher morale on student achievement (Published doctoral dissertation) Capella University.

[15] DeBruyne, W. J. (2001). A Study to identify the factors responsible for job dissatisfaction and low teacher morale (Unpublished M.Sc dissertation). University of Wisconsin-Stout, Menomonie, WI 54751.

[16] Department of Education, Republic of Kenya (2013). National Education Sector Support Programme-Kenya 2013/2014-2017/2018. Nairobi: Government Printers.

[17] Farooq, M. S., Chaudhry, A. H., Shafiq., M., & Berhanu, G. (2011). Factors affecting students' quality of academic performance: A Case of Secondary

School Level. Journal of Quality and Technology Management, 7 (2), 01-14.

[18] French, R. F. (1988). The study of teacher morale in secondary schools. (Published M.A dissertation). University of Durham, North East England.

[19] Govindarajan, K. (2012). Teachers Morale. International Journal of Behavioral Social and Movement Sciences, 1 (2)57-61.

[20] Gudo, C. O., Oanda, I. O., & Olel, M., A. (2011). Role of institutional managers in quality assurance: Reflections on Kenya's university education. Australian Journal of Business and Management Research, 1 (2)113-124.

[21] Houchard, M. A. (2005). Principal leadership, teacher morale, and student achievement in seven schools in Mitchell County, North Carolina (Unpublished Doctoral thesis). East Tennessee State University. Electronic Theses and Dissertations. Paper 1081. Retrieved on 16th December, 2013 from http://www.dc.etsu.edu/etd/1081.

[22] Hoy, W. K. and Miskel C. G. (1987). Educational administration: Theory, Research, and Practice (3rd ed). New York: Random House.

[23] Independent Schools Queensland. (2012, November/ December). Low teacher morale: The reasons, cost and solutions. (Issue Brief No.10). Spring Hill, Australia. The Association of Independent Schools of Queensland Inc.

[24] Kaloki, J. W (2012). Pupils-teacher ratio and its impact on academic performance in public primary schools in Central division, Machakos County (Unpublished M.Ed Project). Kenyatta University, Nairobi.

[25] Kirau A. M. (2013). Perceptions of secondary school agriculture teachers on selected morale factors in Machakos district (Unpublished M.Sc thesis). Egerton University, Nakuru, Kenya.

[26] Koplyay, J. B. & Mathis, B. C. (1967). The relationship between teacher morale and organizational climate. A paper presented at the annual meeting of the American Educational Research Association, New York, February 16, 1967. U.S Department of Health, Education and Welfare Office of Education.

[27] Kosgei, A., Mise, K. J., Odera, O., & Ayugi, E. M. (2013). Influence of Teacher Characteristics on Students' Academic Achievement among Secondary Schools. Journal of Education Practice, 4 (3), 76-82.

[28] Lambersky, J. J. (2014). Understanding the human side of school leadership: Improving teacher morale, efficacy, motivation, and commitment (Unpublished doctoral thesis). University of Toronto.

[29] Leithwood, K. (2006). Teacher Working Conditions That Matter: Evidence for Change. Toronto, Ontario: Elementary Teachers' Federation of Ontario Publishers, Suite 1000, 480 University Avenue, M5G, IV2.

[30] Lester W. A. (1953). Teacher Morale and Student Achievement. The Journal of Educational Research, 46 (9), 693-698.

[31] Lumsden, L. (1998). Teacher Morale. ERIC Digest. No. 120, EDO-EA-98-4. The ERIC Clearinghouse on Educational Management. 5207 University of Oregon. Eugene: Oregon 97403-5207.

[32] Luu, H. (2011). The relationship between employee attitudes and organizational performance: Evidence from cooperative retail stores (Unpublished M.A Project). Colgate University.

[33] Marani Sub-County Education Office Information, 2014.

[34] Mariita, E. O. (2012) Factors affecting pupils' academic performance in Kenya Certificate of Primary Education in public day primary schools in Kenya: A case of Magena division of Kenyenya district (Unpublished M.Ed thesis). University of Nairobi, Nairobi.

[35] Matoke, Y. K., Okibo, W. B., & Nyamongo, D. N. (2015). Determinants of teacher motivation in public secondary schools in Masaba South Sub-County, Kenya. International Journal of Economics, Commerce and Management, 3(6), 139-160.

[36] Mburu, J. N. P. (2013). Influence of teachers' job satisfaction on pupils' performance in Kenya Certificate of Primary Education examination in Gilgil district, Nakuru County-Kenya (Unpublished M.Ed project). University of Nairobi, Nairobi.

[37] Mendel, P. C. (1987). An investigation of factors that influence teacher morale and satisfaction with work conditions (Doctoral dissertation). University of Oregon, Eugene, Oregon.

[38] Mengistu, G. K. (2012). Job satisfaction of secondary school teachers in Ethiopia (Unpublished doctoral thesis), University of South Africa, Republic of South Africa.

[39] Ministry of Education, Republic of Kenya (2012b). A Policy framework for education: aligning education and training to the Constitution of Kenya (2010) and Kenya Vision 2030 and Beyond. Nairobi: Government Printers.

[40] Ministry of Education, Republic of Kenya, (2012a). Task force on the re-alignment of the education sector to the Constitution of Kenya 2010. Nairobi: Government Printers.

[41] Mobegi, O. F., Ondigi, B. A., & Oburu, O. P. (2010). Secondary School Head teachers' Quality Assurance Strategies and Challenges in Gucha District, Kenya. Educational Research and Reviews, 5(7), 408-414.

[42] Mphale, M. L & Mhlauli, M. B. (2014). An investigation on students' academic performance for junior secondary schools in Botswana. European Journal of Education Studies, 3 (3), 111-127.

[43] Mugenda, O. M. & Mugenda, A. G. (1999).Research methods: Quantitative and Qualitative approaches. Nairobi: Acts Press.

[44] Mwangi, J. W. (2013). Effects of leadership styles on teachers' job performance and satisfaction: a case of public secondary schools in Nakuru County, Kenya (Unpublished M.Ed project). Kenyatta University, Nairobi.

[45] National Center for Education Statistics (1997). Job satisfaction among America's teachers: Effects of work place conditions, background characteristics and teacher compensation in the United States of America. Office of Educational Research and Improvement, US Department of Education, Washington DC: USA. 555 New Jersey Avenue. Retrieved from http://www.ed.gov/NCES/ on 24th December, 2013 at 3.43 p.m.

[46] Nyakundi, T. K. (2012). Factors affecting teacher motivation in public secondary schools in Thika West district, Kiambu County (Unpublished M.Ed project). Kenyatta University, Nairobi.

[47] Nyamosi, J. M. (2013). Influence of school climate on pupils' performance at Kenya Certificate of Primary Education in Central division of Machakos District Kenya (Unpublished M.Ed project). University of Nairobi, Nairobi.

[48] Odhiambo, G. (2008). Elusive Search for Quality Education: The case of quality assurance and teacher accountability. International Journal of Educational Management, 22 (5), 417-431.

[49] Ogamba, J. O. (2011). The role of Quality Assurance and Standards Officers in enhancing primary schools teachers' effectiveness in Marani division, Marani Sub-County, Kenya (Unpublished M. Ed project). Kenyatta University, Nairobi.

[50] Ojuodhi, P. A. (2012). Effect of economic activities on pupils' academic performance at Kenya Certificate of Primary Education in Lari division, Kiambu County, Kenya, (Unpublished M.Ed project). University of Nairobi, Nairobi.

[51] Olaleye, O. F. (2011). Teachers characteristics as predictor of academic performance of students in secondary schools in Osun State – Nigeria. European Journal of Education Studies, 3 (3), 505-511.

[52] Oparanya, W. W., Kisiangani, B. W., & Okiiya, A. S. (2015). Factors influencing academic performance of standard eight girls in national examinations in public primary schools: A case of Matungu Division, Kenya. International Journal of Scientific and Technological Research, 4 (6), 46-58.

[53] Orodho, J. A. (2009). Elements of education and social science research methods. Maseno: Kanezja Publisher.

[54] Perumal, M. (2011). Key strategies to raise teacher morale and improve school climate. Distinguished Fulbright Awards in Teaching Program. Fulbright Project. South Africa.

[55] Ravhudzulo, N. A. (2012). Assessing best practice implementation of quality assurance in basic education by establishing standards and measuring programme effectiveness. Journal of Emerging Trends in Educational Research and Policy Studies (JETERAPS), 3(4), 459-464.

[56] Reche, G. N., Bundi, T. K., Riungu, J. N. & Mbugua, Z. K. (2012). Factors contributing to poor performance in Kenya Certificate of Primary Education in public day primary schools in Mwimbi division, Maara district, Kenya. International Journal of Humanities and Social Sciences, 2 (5), 127-133.

[57] Regina, N. O. (2010). The relationship between principals' supervisory strategies and teachers' instructional performance in Delta North Senatorial district, Nigeria. Pakistan Journal of Social Sciences, 7 (6), 437-440.

[58]

[59] Too, C., Kimutai, K. C., & Kosgei, Z. (2012). The impact of head teachers' supervision of teachers on students' academic performance. Journal of Emerging Trends in Educational Research and Policy Studies (JETERAPS), 3(3), 299-306.

[60] Torrington, D., Hall, L., & Taylor, S. (2008). Human resource management (7th Ed). England: Pearson education Ltd.

[61] Wadesango, N. (2012). The influence of teacher participation in decision-making on their occupational morale. Journal of Social Science, 31(3), 361-369.

[62] Wanzare, Z. (2012). Instructional supervision in public secondary schools in Kenya. Journal of Educational Management Administration and Leadership, 40(2), 188-216.

[63] Washington, R., & Watson, H. F. (1976). Positive teacher morale: The principal's responsibility. NASSP Bulletin, 60, 4-6.

[64] Wekesa, J. N. & Nyaroo, S. M. A. (2013). Effect of compensation on performance of public secondary school teachers in Eldoret Municipality, Kenya. International Journal of Scientific and Research Publications, 3 (6), 1-4.

[65] Yawson, M. D. T. A. & Wonnia, L. K. (2014). Teacher morale and attitude to work in selected senior secondary schools in the Cape Coast Municipality, Ghana. European Journal of Educational and Development Psychology, 2 (2), 24-47.

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Study of Internal Fixation of Subtrochantric Fracture of Femur with Dynamic Hip Screw, Dynamic Condylar Screw and Proximal Femoral Nail

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Abstract- Subtrochanteric fracture is commonly seen in young adult and middle age man by high velocity trauma. Present study was taken up to study fracture fixation by PFN, DHS &DCS and compare their result in view of union rate, complication, functional outcome, operative risk and effectiveness of implant. This study helps to decide appropriate implant for subtrochanteric fracture.

Aims and Objectives:
1. To determine the rate of union in subtrochanteric fractures treated with proximal femoral nail, dynamic hip screw & dynamic condylar screw.
2. To determine operative risk in subtrochanteric fracture treated with proximal femoral nail, dynamic hip screw and dynamic condylar screw.
3. To determine functional outcome in subtrochanteric fracture treated with proximal femoral nail, dynamic hip screw and dynamic condylar screw.
4. To determine the effectiveness of proximal femoral nail, dynamic hip screw & dynamic condylar screw in treatment of subtrochanteric fractures.
5. To determine the complications involved in the management of subtrochanteric fractures.

Methods and Materials: Study is done clinically, in a retro to prospective manner by comparing 75(50 cases retro and 25 cases prospectively) cases of either sex above the age of 18years from May 2010 to May 2014.All fracture are classified by Seinsheimer classification system. Fracture is fixed with DHS, PFN or DCS in 25 cases each. Patients with PFN implant were discharged when they started walking independently or with help of walker. Patients with DCS or DHS were discharged when they were able to sit on edge of table or bed with hip and knee in 900flexion. Patients were evaluated clinically and radiologically for recovery of movement, fracture union, stiffness, and presence of infection or other complications.

Results: Males with an average age group 21-40 years were commonly affected with right femur fracture due to high velocity RTA. Fracture pattern was commonly type IIC as per seinsheimer classification .Mean union rate and clinical outcome for PFN is high.

Conclusion: Sub trochanteric fracture is common in high velocity trauma. They have high stress concentration, slow healing time with predominance of cortical bone involvement and difficulties in getting biomechanically sound reduction because of comminution. This has lead to evaluation of various internal fixation devices.PFN attempts to combine advantage of a sliding hip screw with those of intramedullary fixation devices. Cases treated with PFN nail have shown easier rehabilitation, less blood loos, less surgical trauma, early mobilization, early rate of fracture union when compared to those cases treated with DHS & DCS barrel plate as per observation of our study.
With our study PFN has given us encouraging results over conventional DHS& DCS. Hence we recommend PFN as better implant for fixation of subtrochanteric fracture.

Index Terms- Sub trochanteric fracture, DHS, PFN, and DCS.

I. INTRODUCTION

Subtrochanteric fractures are femoral fractures where the fracture occurs below the lesser trochanter upto 5 cm distally in the shaft of femur.[1]

These fractures occur typically in two age groups. In young and healthy individuals, the injury results from high-energy trauma, whereas in the elderly population, most of the fractures are osteoporotic, resulting from a fall. With the increase in the aging population, there is also considerable growth in the number of pathological fractures and fractures around hip prosthesis (periprosthetic fractures).

These fractures occur typically at the junction between trabecular bone and cortical bone where the mechanical stress across the junction is highest in femur, which is responsible for heir frequent comminution. These fractures account for 10% to 34% of all hip fractures.

Subtrochanteric region is usually exposed to high stresses during activities of daily living. Axial loading forces through the hip joint create a large moment arm, with significant lateral tensile stress and medial compressive load. In addition to the bending forces, muscle forces at the hip also create torsional effects that lead to significant rotational shear force. During normal activities of daily living, up to 6 times the body weight is transmitted across the subtrochanteric region of the femur.

As a result of these high forces, the bone in this region is a thick cortical bone with less vascularity and results in increased potential for healing disturbances. Hence subtrochanteric fracture is difficult to manage and associated with many complications.

The obvious advantages of operative treatment are
Accurate reduction and anatomical alignment.
Early mobilization and weight bearing, is possible with this (PFN) implants and fixation technology.

The two primary options for treatment of subtrochanteric fractures are intramedullary fixation and extra medullary fixation. Many internal fixation devices have been recommended, but because of high incidence of complications like non- union and implant failure, a series of evolution in designing a perfect implant has begun. Only recently because of better understanding of biology, reduction techniques and biomechanically improved implants like Gamma nail, Russell Taylor nail, Proximal femoral nail these fractures have been addressed with consistent success.
Closed management of these subtrochanteric fractures thus poses difficulties in obtaining and maintaining a reduction, making operative management the preferred treatment. The goal of operative treatment is restoration of normal length and angulation to restore adequate tension to the abductors.

Subtrochanteric fracture treated in a long quadrilateral cast-brace with a pelvic belt. patients with severely comminuted fractures in which stability can not be obtain by internal fixation ,as well as those with open fractures ,are considered candidates for such treatment by traction followed by a ambulatory cast-brace with pelvic band resulted in a shorter period of treatment, an excellent range of motion of the hip and knee**.**

BIOMECHANICS

The plane of the femoral head and neck is anteverted 13°±7°to the plane of the femoral shaft in most adults. In Asian populations, anteversion may approach 30°. The average neck-shaft angle in women is 133°±6.6^0 and it is 129°±7.3°in men. The plane of the femoral neck and head is also anteriorly positioned 1 to 1.5 cm in relation to the central axis of the femoral shaft. If the centerline of the femoral shaft is continued through the intertrochanteric region ,it emerges from the femur in the piriformis fossa.

The lesser trochanter is a posteromedial prominence at the termination of the intertrochanteric ridge and serves as the prominent insertion point of the iliacus and psoas tendons. The femoral shaft is bowed primarily anteriorly, but also slightly laterally.

The trabeculae of the compressive system carry heavier stresses than those of the tensile system in corresponding positions. The maximum tensile stress at section 8 in the outermost fiber is 771 pounds per square inch, and at the corresponding point on the compressive side the compressive stress is 954 pounds per square inch. The thickness and closeness of spacing of the trabeculae varies in proportion to the intensity of the stresses carried by them. The trabeculae lie exactly in the paths of the maximum tensile and compressive stresses. The tensile system of trabeculae correspond exactly with the position of the lines of maximum and minimum tensile stresses which were determined by mathematical analysis. The amount of vertical shear forces varies almost uniformly from a maximum of 90 pounds to a minimum of 5.7 pounds.

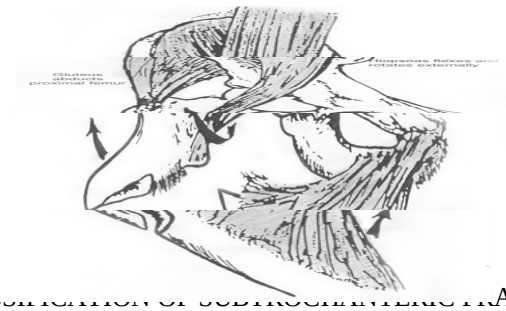
Mechanism of injury:

The unique anatomy of the proximal femur due to the femoral neck-shaft anatomy is one of the key factors in determining the specific configuration of subtrochanteric fractures. The transition from the cortical compact bone in the diaphysis to the cancellous trabecular bone in the proximal femur also explains the characteristic comminution with proximal and distal extensions.

The majority of subtrochanteric fractures result from complex loading patterns.

Nevertheless, there are specific loading patterns that produce characteristic fractures:

Fig (



CLASSIFICATION OF SUBTROCHANTERIC FRACTURES

1) FIELDING AND MAGLIATO'S CLASSIFICATION (1966)

Fielding and Magliato's classification

Type I: Fracture occurring at the level of lesser trochanter.

Type II: Fractures occurring in an area one to two inches (2.5-5.0) below the upper border of the lesser trochanter.

Type III: Fractures occurring in an area two to three inches (5.0-7.5 cm) below the upper border of the lesser trochanter.

2) SEINSHEIMER CLASSIFICATIONS:

Seinsheimer described the classification of the types I till V based on fracture pattern, with sub groups A, B and C based on the stability and comminution.

Type 1: non displaced fracture; any fracture with less than 2 millimeters of displacement of the fracture fragments.

Type 2: two part fracture

(A) Transverse fracture;

(B) Spiral fracture with lesser trochanter attached to proximal fragment;

(C) Spiral fracture with the lesser trochanter attached to distal fragments.

Type 3: three part fracture

(A) Spiral fracture in which the lesser trochanter is a part of the third fragment, which has
inferior spike of cortex of varying length;

(B) Fracture of the proximal one third of femur with third part a butterfly fragment.

Type 4: comminuted fracture: 4 or more fragments

Ty**pe 5: Subtrochanteric-Intertrochanteric fracture: any subtrochanteric fracture with extension through the greater trochanter**

3) AO classification:

AO/ASIF group in their manual of internal fixation recommended a three part classification A,B and C (simple, transverse and oblique fracture, fracture with three major

fragments). Each of the three types is subdivided into three subgroups 1, 2 and 3 for allowing further fracture description. This classification did not consider about the trochanteric extension.

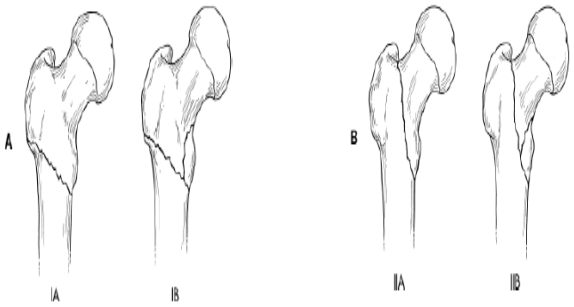
4) RUSSELL AND TAYLOR CLASSIFICATION

Russel and Taylor devised a classification scheme based on lesser trochanteric continuity and fracture extension posteriorly on the greater trochanter involving the piriformis fossa, the major two variables influencing treatment.

Type I - Fractures does not extend into the piriformis fossa.
Type IA- Comminution and fracture lines extend from below the lesser trochanter to the femoral isthmus. Any degree of comminution may be present in this area, including bicortical comminution.

Type IB -Fracture line and comminution involving the area of the lesser trochanter up to the isthmus.

Rusell Taylor Classification-Type I
Figure no .9



Type II

Fracture extends proximally into the greater trochanter and involves the piriformis fossa, as detected on the lateral roentgenogram of the hip, which complicates closed nailing techniques.

Type IIA

Fracture extends from the lesser trochanter to the isthmus with extension into the piriformis fossa, as detected on lateral roentgenograms, but significant comminution or major fracture of the lesser trochanter is not present.

Type II B

The fracture extends into the piriformis fossa with significant comminution of the medial femoral cortex and loss of continuity of the lesser trochanter.

MANAGEMENT OF SUBTROCHANTERIC FRACTURES:

1. **Non-operative Treatment: 2.Operative treatment: Open Method: Closed Method:**

1) **Bone quality 2) Fragment Geometry 3) Reduction 4)Fixation Device 5) Device Placement**

I)EXTRAMEDULLARY DEVICES:

1. Fixed angle nail-plates 2. AO. 95 degree blade-plate 3. DCS 4. DHS 5. Medoffs axial compression Screw

Fixed angle nail plates:
Ex. JEWETT nail. Jewett nail
Figure no. 12

Dynamic condylar screws:

The 95°dynamic condylar screw is a two-piece device with the same basic design as the 95°condylar blade plate but with the blade replaced by a large-diameter cannulated lag screw that is inserted over a guide pin after its channel is reamed and tapped. The device is technically easier to insert than the blade plate. Varus/valgus malalignment of the guide pin is easily corrected, and flexion/extension can be adjusted by rotation of the lag screw. Moreover, the 95°dynamic condylar screw may provide better purchase in osteopenic bone than the condylar blade plate. It does not, however, provide as much control of the proximal fragment as does the 95°blade plate, and it requires insertion of an additional screw through the plate into the proximal fragment for rotational stability.

Sanders and Regazzoni reported on a consecutive series of subtrochanteric fractures in which 22 patients were available for follow-up at an average of 238 months. The union rate was 77% (17 of 22), with functional results rated as good or excellent in 68% (15 of22). All five technical failures were associated with extensive bone comminution; of these, four were not bone grafted.

Dynamic hip screws:

The popularity of the sliding hip screw in the early 1970s led to use of this device for stabilization of subtrochanteric fractures. The sliding mechanism allows impaction of fracture surfaces as well as medial displacement of the femoral shaft relative to the proximal fragment, which serves to reduce the bending movement on the implant and thus decrease the possibility of varus displacement or device failure.

Intra-medullary fixation:

During the past century a better understanding of the biomechanics of pertrochanteric and subtrochanteric fracture has led to the development of better implants and radical changes in treatment modalities. Koch analyzed mechanical stresses on the femur during weight bearing and found that compression stresses exceeded 1200 Lb per sq inch in the medial subtrochanteric area 1 to 3cms distal to lesser trochanter.

This explains why the typical comminution on the medial side after a fracture and underlines the importance of restoring medial cortical support after fracture fixation in order to achieve stable fixation.

For most subtrochanteric femur fractures, the implant of choice is an intramedullary nail. Biomechanically, these devices offer several advantages over plate and screw fixation:

II) INTRAMEDULLARY DEVICES:
1] Condylocephalic-Enders pins 2] Cephalomedullary;
i) AP Gamma Nail ii) Russel and Taylor reconstruction Nail, iii) Zickels Nail, iv) Uniflex Nail, v) Proximal Femoral Nail
Proximal Femoral Nail:

In 1997, the proximal femoral nail was introduced for treatment of peritrochanteric femoral fractures. It was designed to overcome implant-related complications & facilitate the operative treatment of unstable peritrochanteric fractures. The proximal femoral nail uses two implant screws for fixation into the femoral head & neck. The larger screw, the femoral neck screw, is intended to carry the majority of the load. The smaller screw, the hip pin, is inserted to provide rotational stability. Biomechanical analyses of the proximal femoral nail show a significant reduction of distal stress and an increase of overall stability compared with the Gamma nail. Evaluation of treatment results of the proximal femoral nail show a relatively low percent of complications and a low incidence of implant failure.

METHODOLOGY

The present clinical retrospective to prospective comparative study consists of 75 patients, from may 2010 to may 2014, of traumatic subtrochanteric fractures of femur, out of which 25 patients are treated with Dynamic Hip Screw and barrel plate and 25 patients are treated with Proximal femoral nail and the rest 25 with dynamic condylar screw in the Department of Orthopedic surgery, M.V.J .medical college and hospital and research center Bangalore.

Patients operated after may 2010, were collected from operation theater record book, patients operated in our hospital after may 2013 to may 2014, with subtrochanteric fracture by either method were recorded at the time of discharge. patients were called by telliphonic/email/postel address for follow up and record mentain and proforma prepaired.

Total 50 patients are collected from retrospectively from operation theater record book from may 2010 to may 2013.25 patients were collected prospectively from may 2013 to may 2014.last follow up were made up to may 2015.

This study was carried to find out age, sex and side incidence of subtochanteric fractures and to testify rate of union, functional outcome and functional outcomes of treatment with DHS & Barrel plate, DCS & Barrel plate and proximal femoral nail.

All these 75 patients, who were available for study, were followed at regular intervals up to fracture union.

Once the patient was admitted to the hospital, all the essential information was recorded in the proforma prepared for this study. They were regularly observed during their hospital stay and were discharged with the advice to come to the outpatient department regularly. Those who did not come were reminded by post. One patient, who could not come for subsequent follow up answered the necessary questions. The patients were followed up for one year after surgery at regular intervals and if necessary subsequent follow ups were done.

STATISTICAL METHODS APPLIED

1. Descriptive statistics: 2.**Chi-square test 3.Contingency table analysis 4.Independent samples‘t’ test:**

INCLUSION CRITERIA:

1) Subtrochanteric fractures in adults more than 18yrs

EXCLUSION CRITERIA: 1) Pathological fractures. 2) Fractures in children. 3) Old neglected fractures. 4) Open fractures

DATA COLLECTION:

When the patient with subtrochanteric fracture were admitted to hospital, from may 2013 to may 2014,all the necessary clinical details were recorded in proforma prepared for this study. After the completion of the hospital treatment patients were discharged and called for follow up at outpatient level at regular intervals for serial clinical and radiological evaluation. The patients were followed up till fracture union and functional recovery. At regular intervals if necessary subsequent follow up was done.

MATERIALS:

A. Dynamic Hip Screw with Barrel Plate:

1. It consists of a cannulated lag screw with a threaded distal portion. It comes in various lengths from 2 1/4 inch to 4 1/2 inch. It is cannulated to accept a 3.2 mm guide wire.

2. This screw is inserted into a barrel side plate, into which it can slide.

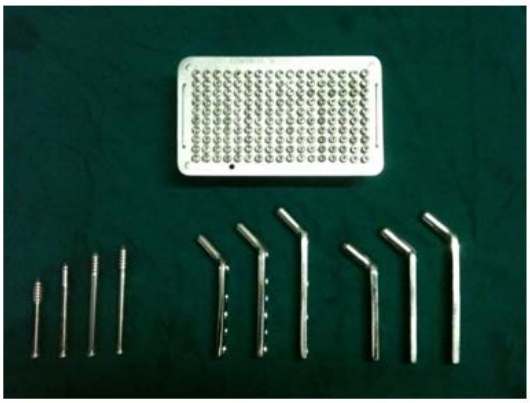
3. There is a groove in the shaft of the lag screw which corresponds to a 'key' in the barrel which prevents rotation.

4. The side plate accommodates 4.5 mm cortical bone screw, and comes in different hole lengths.

Static and Dynamic Compression: The ability to allow impaction at the fracture site is a central feature of this device. The compression obtained on the O.T. table with the compression apparatus is called static compression. The sliding feature which is achieved by body weight and muscle contraction keeps the fragments compressed later and this phenomenon is known as dynamic traction.

Figure no.16

INSTRUMENTS OF DHS & PLATE FIXATION



DHS & BARREL PLATE-IMPLANT

B. Dynamic Condylar Screw with barrel plate

- The DCS Plate has a 95°barrel angle, allowing it to enter the femur more proximally than the DHS Plate and allowing insertion of two or more screws into the calcar.
- Its two round proximal plate holes permit insertion of 6.5 mm Cancellous Bone Screws, for stable proximal fixation
- There is a groove in the shaft of the lag screw which corresponds to a 'key' in the barrel which prevents rotation.
- The side plate accommodates 4.5 mm cortical bone screw, and comes in different hole lengths.
- Static and Dynamic Compression is also obtained as in the case with Dynamic hip Screw and plate

Figure no. 17

INSTRUMENTS OF DCS & PLATE FIXATION

DCS & BARREL PLATE-IMPLANT

PROXIMAL FEMORAL NAIL

The implant consists of proximal femoral nail, self tapping 6.5mm pin, self tapping 8mm femoral neck screw, 4.9mm distal locking screw and an end cap .PFN is made up of either 316L stainless steel or titanium alloy which comes in following sizes,

1. Length; Standard PFN-250 mm.
   Long PFN; 340, 380, 420 mm.
2. Diameter 9, 10, 11, 12 mm.
3. Neck shaft angle range 125 ,130, 135 degrees.

The nail is having 14mm proximal diameter. This increases the stability of the implant There is 6 degrees mediolateral valgus angle which prevents varus collapse of the fracture even when there is medial communition.

The distal diameter is tapered to 9-12 mm which also has groove to prevent stress concentration at the end of the nail and avoids fracture of the shaft distal to the nail

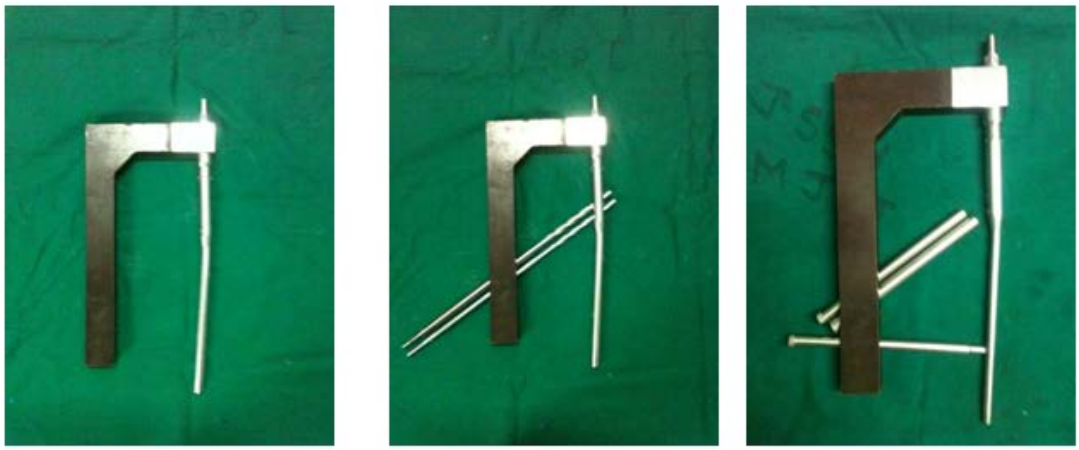
Proximally it has two holes, the distal one for insertion of 8mm neck screw which acts as a sliding screw and the proximal one is for 6.5mm hip pin which helps to prevent the rotation.

Distally pin has two holes for insertion of 4.9mm locking screws of which one is static and the other one is dynamic which allows dynamization of 5mm.

Figure no .18

INSTRUMENTS OF PFN FIXATION

PFN -IMPLANT



PFN ASSEMBLY

A) INTERNAL FIXATION OF SUBTROCHANTERIC FRACTURES WITH DYNAMIC HIP SCREW/DYNAMIC CONDYLAR AND BARREL PLATE AND PLATE

a) Method of reduction:

Following spinal/epidural anaesthesia place the patient supine on the fracture table. Fasten both the extremities to foot plate. Apply enough traction in abduction and neutral / internal rotation to restore length and the normal neck shaft angle. Position the extremity to allow for two plane imaging with the C-arm image intensifier.

Check the reduction by anteroposterior and lateral views with the image intensifier with special attention to cortical contact medially and posteriorly. Taking strict aseptic precautions, the operative site, from umblicus above to knee below is painted with savlon, betadine and spirit followed by meticulous draping.

B)Exposure:

The standard lateral, vastus lateralis splitting approach is used.

c) Insertion of guide pin:

Opposite the lesser trochanter, parallel to the floor, at the desired angle insert the guide pin midway between the anterior and posterior cortices. The second guide wire if required is passed 1 cm posterior and inferior to the first wire. All this is done with the help of intra operative image intensifier. Insert the guide pin through the fixed angle guide or insert it with a freehand technique.

In case of Dynamic condylar screw entry point is anterior part of bulge of greater trochanter.

Ideal position of the guide pin should be in the lower half of the femoral head. The screw should be below and tangential to the superior cortex.

A large drill bit can be used to make an opening in the lateral cortex to allow easy insertion of the guide pin.

The guide pin should be either centralized or postero inferior in the femoral head. Placement should not be too far superior or anterior. The guide pin should enter within a distance of 1cm from the articular surface of the femoral head.

Carefully confirm this length with the direct measuring gauge.

d) Reaming of the neck of femur:

Set the triple reamer to the length of the guide pin indicated by the direct measuring gauge. In very osteoporotic bone, set the reamer 5 mm less than the length of the guide pin to reduce the chance of pin withdrawal and to allow better purchase of the lag screw in un reamed bone.

Continue reaming until the lateral cortex. Remove the reamer by gently pulling it, while turning it clockwise.

The guide pin has a threaded portion near its tip and turning the reamer in a clockwise direction lessens the chance of pin withdrawal. If the guide pin is inadvertently withdrawn, reinsert it using the guide pin replacement instrument.

e) Tapping of the femur:

In firm cancellous bone and in younger patients, it is essential to cut the threads of the lag screw. If not tapped properly, it may be difficult to fully seat the lag screw, placing excessive torque demands on the insertion wrench. Also the proximal fragment may rotate during fracture screw insertion.

f) Insertion of the lag screw and plate:

Determine the correct length of the lag screw with the direct measuring gauge; this measurement should allow for 5 mm of compression. If more compression is desired use a shorter screw. A screw 5 mm shorter permit 10 mm of compression and a screw of 10 mm shorter allows 18 mm of compression. In most of our patients we used a 10mm shorter screw. When using a screw shorter than the length indicated by the direct measuring gauge, advance the appropriate mark on the centering sleeve by the amount of shortening. Insert the lag screw with the help of screw inserter over the guide wire.

Confirm the position under the image intensifier.

g) Attachment of the plate:

When proper screw position has been verified under image intensifier, seat the barrel plate in the final position on to the lag screw shaft using the plate tamper. Secure the plate to the shaft by plate holding forceps. Release some traction and manually impact the fracture fragments and readjust the plate holding forceps if necessary.

Use a drill guide and 3.5 mm drill bit to drill screw holes. Determine the length of the cortical screws with the depth gauge and insert the 4.5 mm screws.

Tapping is usually required. Insert the screws with either a power or hand screwdriver.

When all screws are inserted and tightened, release the traction and apply compression with the compression screw. The compression screw exerts a powerful force that must be correlated with the quality of the bone. If fixation of the lag screw in the femoral head seems insecure, as in osteoporotic bone, use only finger pressure to prevent stripping the screw out of the bone. We leave the compression screw in place. Later incision is closed in layers leaving drain in situ.

INTERNAL FIXATION OF SUBTROCHANTERIC FRACTURES WITH PROXIMAL FEMORAL NAIL PATIENT POSITIONING AND FRACTURE REDUCTION

The patient is placed in supine position on fracture table with adduction of the affected limb by 10-15 degrees and closed reduction of the fracture was done by the traction and internal rotation. The unaffected leg is flexed and abducted as far as possible or kept in wide abduction. The image intensifier was positioned so that anterior-posterior and lateral views of hip and femur could be taken. Open reduction is performed if closed reduction failed.

The patient is then prepared and draped as for any standard hip fracture fixation. Prophylactic antibiotic is given in all patients 30 mins before surgery.

APPROACH

The tip of greater trochanter was located by palpation in thin patients and in obese patients, we used image intensifier. 5cms longitudinal incision was taken proximal from the tip of the greater trochanter. A parallel incision was made in fascia lata and gluteus medius was split in line with the fibers. Tip of greater trochanter is exposed.

DETERMINATION OF ENTRY POINT AND INSERTION OF GUIDE WIRE

In AP view on c-arm, the entry point is on tip or slightly lateral to the tip of greater trochanter. In lateral view, guide wire position is confirmed in the center of the medullary cavity. Medullary canal entered with a curved bone awl, the guide wire is inserted into the medullary canal.

REAMING

Using a cannulated conical reamer proximal femur is reamed for a distance of about 7cms.

INSERTION OF PFN

After confirming satisfactory fracture reduction, an appropriate size nail as determined preoperatively is assembled to insertion handle and inserted manually.

This step is done carefully without hammering by slight twisting movements of the hand until the hole for 8mm screw is at the level of inferior margin of the neck. Open reduction is

performed in case satisfactory reduction is not possible by closed means.

INSERTION OF THE GUIDE WIRE FOR NECK SCREW AND HIP PIN

These are inserted with the help of aiming device lightly screwed to the insertion handle. A 2.8 mm guide wire is inserted through the drill sleeve after a stab incision. This guide wire is inserted 5mm deeper than the planned screw size. The final position of the guide wire should be in the lower half of the neck in AP view andin the center of the neck in lateral view.

A second 2.8 mm guide wire is inserted through the drill sleeve above the first one for hip pin. The tip of this guide wire should be approximately 25-20mm less deep than planned neck screw.

INSERTION OF THE NECK SCREW AND HIP PIN

Drilling is done over 2.8mm guide wire until the drill is 8mm short of tip of the guide wire. Tapping is not done as neck screw is self tapping. Neck screw is inserted using cannulated screw driver. Similarly appropriate length hip pin is inserted. Length and position of the screw is confirmed with c-arm image

DISTAL LOCKING

Distal locking is usually performed with two cortical screws. A drill sleeve system is inserted through a stab incision. A drill hole is made with 4mm drill bit through both cortices. Locking screw is inserted and position confirmed with image intensifier.

CLOSURE

After fixation is over, lavage is given using normal saline and incision is closed in layers. Suction drain is used in case open reduction is performed. Sterile dressing applied over wound and compression bandage applied.

STATISTICAL METHODS APPLIED:

Clinical out come was assessed by Kyle's criteria:

Table no .1

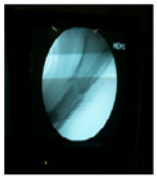
	Excellent	Good	Fair	Poor
Pain	No	Mild	Moderate	Pain in any position
Limp	No	Mild	Moderate	Wheel chair bound

Knee range of motion

Flexion	Above 120^0	100^0 to 120^0	71^0 to 100^0	70^0 and below
Extension	Full extension	<20 ^{0}short of full extension	21^0 to 40^0 short of full extension	$>40^0$ short of full extension

Hip range of motion

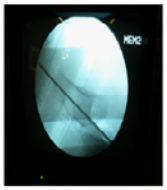
Flexion	Above 120^0	101^0 to 120^0	81^0 to 100^0	80 ^{0}and below
Extension	Above 10^0	5^0 to 10^0	Below 5^0	No extension
Adduction	Above 25^0	16 ^{0}to 25^0	15^0 and below	No adduction
Abduction	Above 30 ^{0}	21^0 to 30^0	11^0 to 20^0	10^0 and below
Internal rotation	Above 25^0	16^0 to 25^0	15^0 and below	No internal rotation
External rotation	Above 30^0	21^0 to 30^0	11^0 to 20^0	10^0 and below



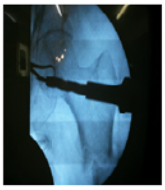
PRE-OPERATIVE

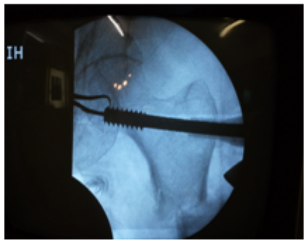
GUIDE WIRE PLACEMENT-AP VIEW

GUIDE WIRE PLACEMENT-LATERAL VIEW



REAMING PROXIMAL FEMUR





RICHARD'S SCREW PLACEMENT

BARREL PLATE WITH COMPRESSION SCREW & CORTICAL SCREW APPLIED

Intraoperative Photographs for fixation with Dynamic Condylar Screw & Barrel Plate

II. RESULTS

The following observations were made from the data collected from, retro to prospectively, during this study of Surgical management of subtrochanteric fractures of femur in the Department of Orthopaedic Surgery, M.V.J medical college and hospital and research centre ,Babgalore.

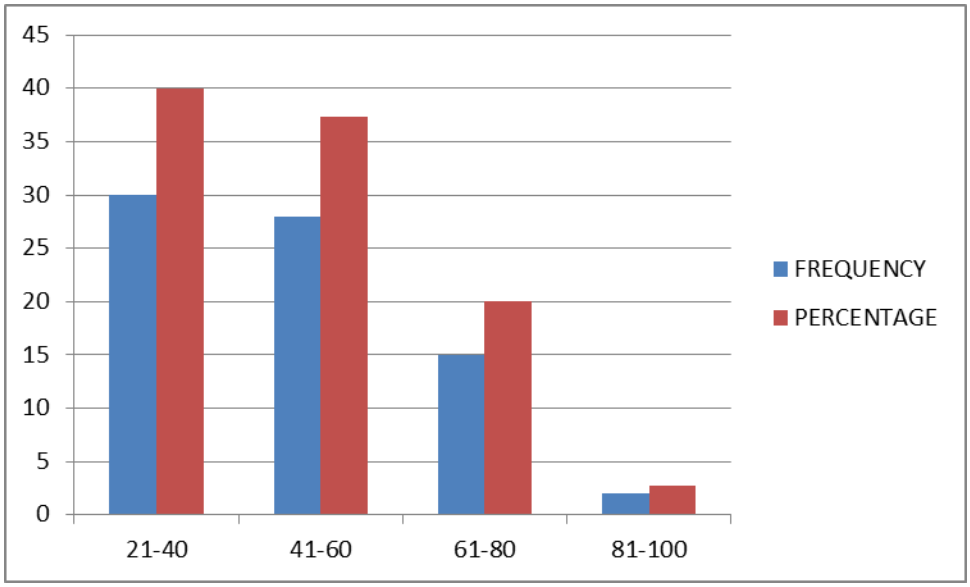
AGE DISTRIBUTION

In our series maximum aged patient was 84 years. Most of the patients were in the age group of 21 to 40 years. The distribution of cases in various age groups is shown below.

TABLE NO: 2

AGE GROUP	FREQUENCY	PERCENTAGE
21-40	30	40
41-60	28	37.3
61-80	15	20
81-100	2	2.7
TOTAL	75	100

GRAPH NO.1 AGE DISTRIBUTION



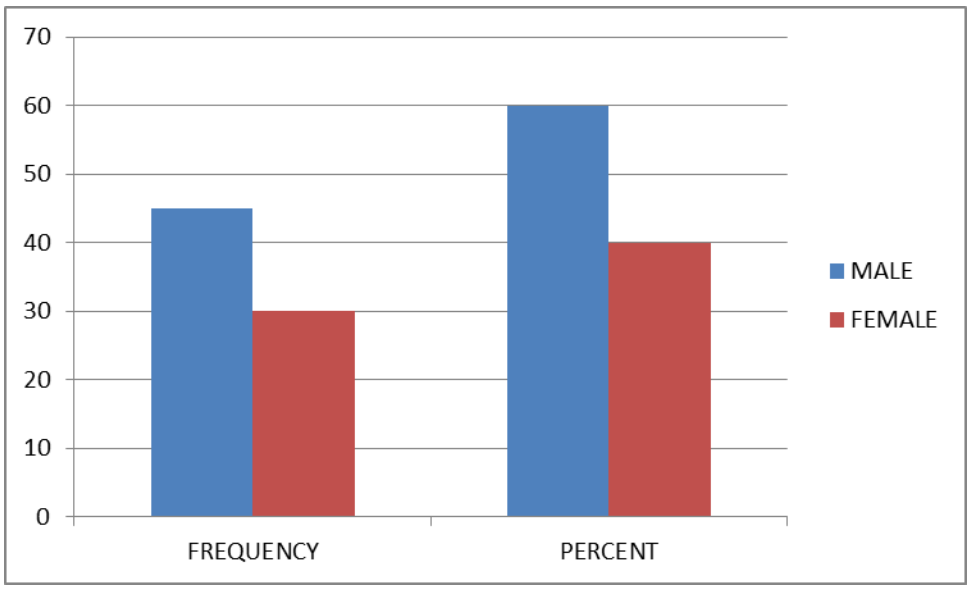
SEX DISTRIBUTION:

In this series 45 patients were male and 35 were female. This shows preponderance of males over females.

TABLE NO.3

SEX	**FREQUENCY**	**PERCENTAGE**
MALE	**45**	**60**
FEMALE	**30**	**40**
TOTAL	**75**	**100**

GRAPH NO .2



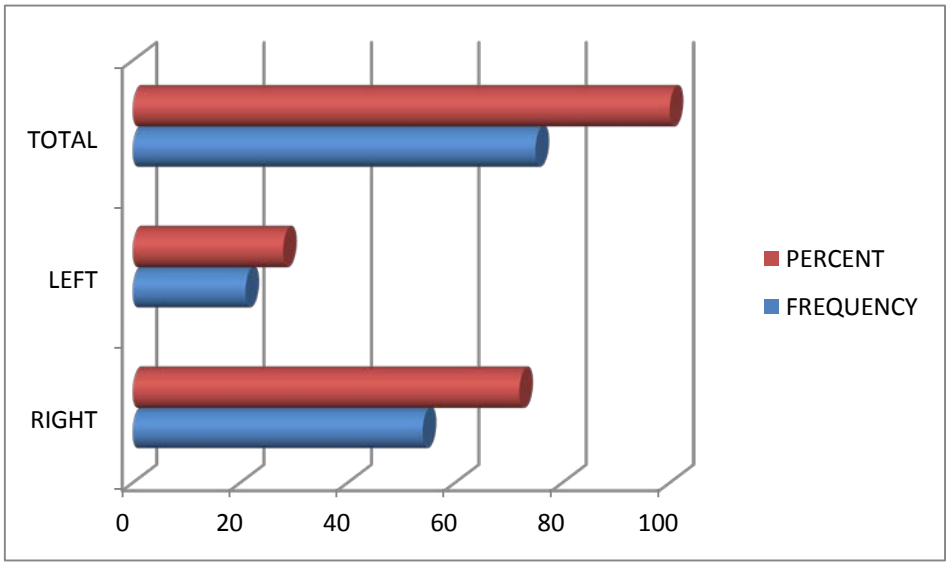
SIDE AFFECTED

In 54 cases Right side was affected and in remaining 21 cases left side was affected

TABLE NO.4

	FREQUENCY	PERCENT
RIGHT	54	72
LEFT	21	28
TOTAL	75	100.0

GRAPH NO.3



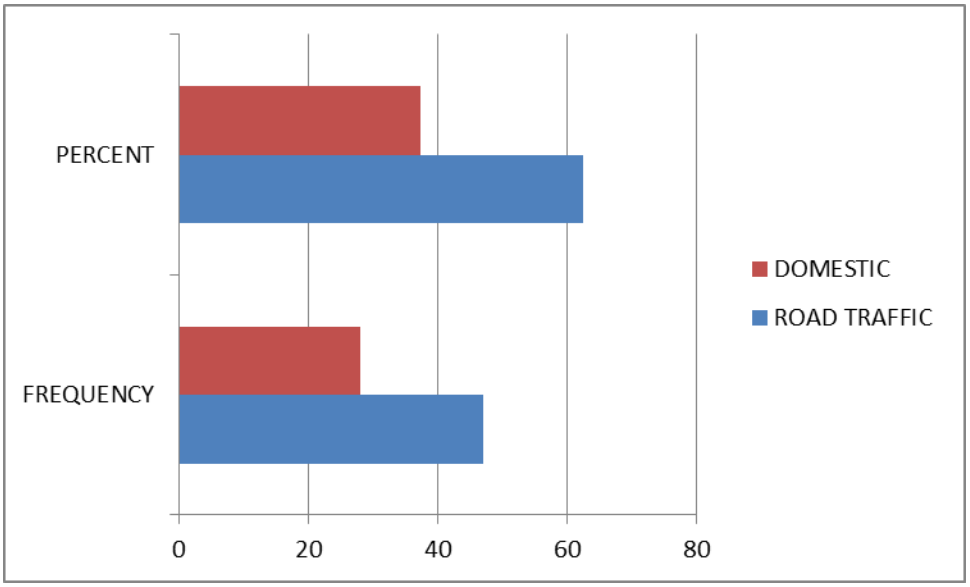
MODE OF INJURY:

Out of 75 cases 47 cases gave history of road traffic accidents, 28 cases gave history of slip and fall. In our series road traffic accidents contributed to 62.6% of the injuries.

TABLE NO.5

	FREQUENCY	PERCENT
ROAD TRAFFIC	47	62.6
DOMESTIC	28	37.4
TOTAL	75	100.0

GRAPH NO.4



FRACTURE PATTERN

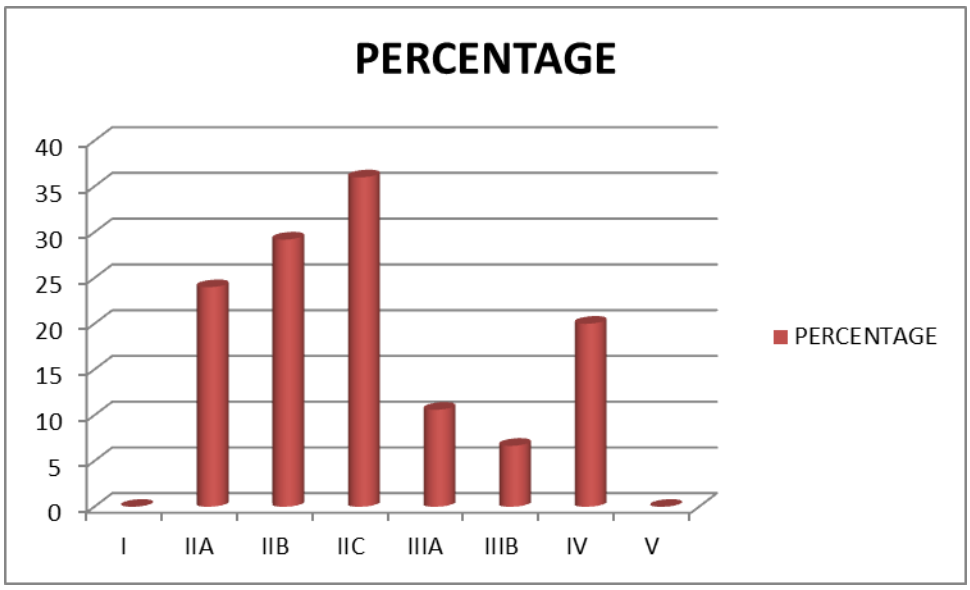
- Subtrochanteric fractures are classified according to Seinsheimer classification.

In our study majority of fractures are type 2C and least number of cases are from type 3B and no cases from type 1 & type 5 are reported.

TABLE NO.6

TYPE OF FRACTURE	NUMBER OF CASES	PERCENTAGE
I	0	0
IIA	10	24
IIB	17	29.3
IIC	28	37
IIIA	8	10.6
IIIB	5	6.6
IV	7	20
V	0	0

GRAPH NO .5



COMPLICATIONS

Infection: there were 4 cases of infection seen in the study. All were superficial infection and were treated with antibiotics; none required implant removal and healed.

Shortening & varus angulations: in one case fixation of fracture in varus angulation took place

- One case of non union due to PFN was encountered and was presumed to be due to over distraction at fracture site.

FUNCTIONAL OUTCOME:

In our study, clinical outcome was assessed based on Kyle's criteria.

36% of patients treated with dynamic hip screw, 40% of patients treated by dynamic condylar screw and 76% of patients treated with PFN nail showed excellent results.

Good results were 32% in dynamic hip screw group and 28% in dynamic condylar screw nail group& 16% in PFN

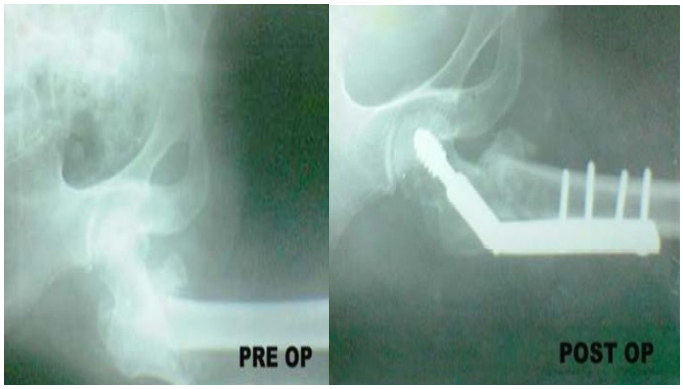
Fair results were 32% in dynamic hip screw group, 32% in dynamic condylar screw group & 8% in PFN group. None of our patients showed poor results.

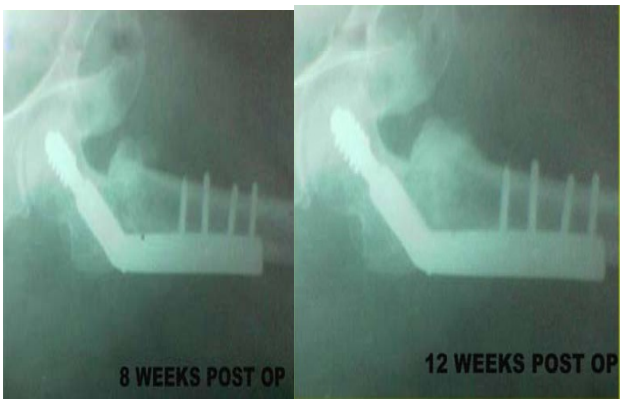
On the whole 50% showed excellent and 25% showed good results. 24% showed fair results.

TABLE NO. 12

	EXCELLENT	GOOD	FAIR
PFN	19	4	2
DHS	9	8	8
DCS	10	7	8
TOTAL	38	19	18

CASE 1





FULL FLEXION

FLEXION & EXTERNAL ROTATION

FULL WEIGHT BEARING

30 DEGREE'S ADDUCTION

40 DEGREE'S ABDUCTION

CASE 2

FULL FLEXION

FULL WEIGHT BEARING

30 DEGREE'S ADDUCTION

30 DEGREE'S ABDUCTION

CASE 3

110 DEGREE'S FLEXION

FULL WEIGHT BEARING

30 DEGREE'S ADDUCTION

40 DEGREE'S ABDUCTION

III. DISCUSSION

The characteristic anatomy, the biomechanical stress and forces acting at the subtrochanteric region makes it difficult to manage these fractures (Cech O, 1974; Fielding JW, 1973; Seinshemier, 1978). Young patients usually sustain high energy trauma, which results in communited fractures whereas in older patients usually communited fractures are seen after minor fall.

At present it is generally believed that all subtrochanteric fractures should be internally fixed to reduce the morbidity and mortality by early ambulation.

Because of communition and high incidence of complications reported after surgical treatment (Fieldeing JW, 1973; Delec JC, Claton TO and Rockwood CA, (1981), surgeons are compelled to give a second thought regarding the selection of proper fixation device. The most common current methods of fixation are blade plate systems, sliding nail plate systems and intramedullary devices.

In our study, the common age group for subtrochanteric fractures is 21 to 40 year which is comparable to those of other Indian authors but was less than most of the studies of western authors.

Males contributed major share in our series which was comparable with other studies.

Right side was more common than left side as seen in other series.

High velocity injuries due to road traffic accidents was the main cause of these fractures seen in our studies similar to other studies Associated injuries such as fracture ribs, Colle's fracture, compression fracture of D8, fracture shaft tibia were seen in our study similar to other studies (Bermon et al 1987) also other injuries like fracture pelvis, fracture calcaneum and visceral injuries as noted in other studies.

In the study group, majority of fractures belonged to class IIC of Seinsheimer's classification i.e., 37% and majority of the fractures were unstable, similar to other studies..

Mean blood loss was significantly more in those fixed with dynamic hip screw and dynamic condylar screw with barrel plate compared to those fixed with proximal femoral nail i.e., 425 ml in DCS, 400 ml in DHS and 300 ml in PFN .Our results matched with other studies.

The period of hospital stay was almost the same in either group and was statistically insignificant.

Shortening was seen in 1 patient treated with dynamic hip screw and barrel plate.. Postoperative quadriceps exercises were started on second day in all cases. Full weight bearing is allowed early amongst the patients fixed with proximal femoral nail group compared to those fixed with dynamic hip screw and barrel plate, dynamic condylar screw and barrel plate i.e. 4 weeks in proximal femoral nail group to 17 weeks in dynamic hip screw and barrel plate & dynamic condylar screw and barrel plate. Our results matched other results.

Mean union rate was faster in those treated with proximal femoral nail 17 weeks than those treated with dynamic hip screw19 week and barrel plate & dynamic condylar screw and barrel plate 20 weeks.

None of the patients in our series showed implant failure, only 5 patients of those fixed with dynamic hip screw and barrel plate & 3 patients fixed with dynamic condylar screw showed superficial infection.

One mortality was seen in our series, treated with PFN, the patient succumbed to cardio respiratory complication.

Overall we had 76% good to excellent results in those treated with proximal femoral nail, 36% good to excellent results in those treated with dynamic hip screw and barrel plate. 40% good to excellent results in those treated with dynamic condylar screw & barrel plate. Our results were comparable to results of other studies.

IV. CONCLUSION

Subtrochanteric fractures are common in high velocity trauma. High stress concentration, slow healing time, predominance of cortical bone and difficulties in getting biomechanically sound reduction because of communition has lead to evolution of various internal fixation devices.

Inspite of evolution of various implants the incidence of complications is high after surgical treatment. Hence, implant of choice in this area is still an unsolved problem.

Proximal femoral nail attempts to combine the advantages of a sliding hip screw with those of intramedullary fixation devices. Cases treated with PFN nail have shown easier rehabilitation, less blood loss, less surgical trauma, early mobilization and early rate of fracture union when compared to those cases treated with dynamic hip screw and barrel plate& dynamic condylar screw and barrel plate as per observations in our study.

With our sample study Proximal femoral nail has given us encouraging results over conventional dynamic hip screw and barrel plate & dynamic condylar screw and barrel plate. Hence we recommend proximal femoral nail as a better implant for the fixation of subtrochanteric fractures.

V. SUMMARY

In our study, of 75 cases of subtrochanteric fractures, 25 were treated with dynamic hip screw and barrel plate and 25 were treated dynamic condylar screw and barrel plate & 25 with proximal femoral nail. All cases were collected from patients attending orthopedic out-patient department at MVJ Hospital, Sion, and Bangalore

According to our study subtrochanteric fractures were common among the middle age and elderly male as a result of high velocity trauma with right side predominance.

Unstable fractures belonging to IIC of Seinsheimen's classification is the most common pattern seen in subtrochanteric fractures of our series. Associated injuries such as Colle's fracture, tibia, vertebral fracture and fracture ribs were seen only in a few i.e., 16.7% of total cases.

Surgery was never done as an emergency and was delayed till patient was stabilized. Mean blood loss intraoperatively being slightly higher for those treated with dynamic hip screw and barrel plate and dynamic condylar screw and barrel plate when compared to patients treated with proximal femoral nail. The mean duration of hospital stay was almost the same in either case irrespective of the implant used.

Postoperative mobility was allowed after a frank period of non weight bearing. Independent and full weight bearing was allowed early i.e., about 4 weeks in those treated with proximal femoral nail group when compared to dynamic hip screw and barrel plate and dynamic condylar screw and barrel plate i.e., 17 weeks.

Superficial wound infection was seen only in 4 patients of those treated with dynamic hip Screw and barrel plate,3 in patients treated with dynamic condylar screw and barrel plate and none amongst those treated with proximal femoral nail.

In one case, fixation of fracture in varus angulation took place. One case of non union due to PFN was encountered and was presumed to be due to overdistraction at fracture site. Mean union rate was faster in those treated with proximal femoral nail 17 weeks than those treated with dynamic hip screw19 week and barrel plate & dynamic condylar screw and barrel plate 20 weeks.

Hence, we conclude by saying proximal femoral nail is a superior implant to dynamic condylar screw & barrel plate and

dynamic hip screw & barrel plate for the management of subtrochanteric fractures.

REFERENCES

[1] Robert W Bucholz, James D Heckman, Charles M Court-Brown, Rockwood and Green's "Fractures in Adults"; volume 2, 6 th edition; pages1827-1844.

[2] David G. Lavelle. Fractures and dislocations of the hip chapter-52 in Campbell's Operative Orthopaedics, eleventh edition.VOL-3 pages; 3237-3308.

[3] Toni M. Mclaunn. Ericka A. Lawler: Treatment Modalities for Subtrochanteric Fractures in Elderly. Lippincott Williams and Wilkins Inc. Philadelphia. Techniques in OrthopaedicsVol 19: No.3 2004: PP 197 –213.

[4] DeLee JC, Clanton TO, Rockwood CA Jr. Closed treatment of subtrochanteric fractures of the femur in a modified cast-brace. J Bone Joint Surg Am 1981;63:773.

[5] Sir Astley Cooper 2,in 1822 intracapsular and extracapular fracture of femur.

[6] Boyd HB, Griffin "classification and treatment of trochanteric fractures"Arch surgery, 1949; 58; 853-866.

[7] Fielding JW, Magliato HJ. Subtrochantericfractures. SurgGynecolObstet 1966: 122:555-560.

[8] ZickelRE.Subtrochanteric femoral fractures.Orthopclin North Am 1980;11:555-568.

[9] Habernek H ,Wallnce T, Aschaner E, Schmid L, "comparision of Ender's nails,dynamic hip screw and gamma nails in treatment of peritrochanteric femoral fractures"Orthopaedic 2000;23(2);127(7).

[10] Velasco RU, Comfort T. Analysis of treatment problems in subtrochanteric fractures of the femur. J Trauma 1978; 18:513-522.

[11] Seinsheimer"subtrochanteric fractures of the femur". JBJS, 1978, 60(A), 300-306.

[12] Kinast C. Bolhofner BR, Mast JW. Ganz R. Subtrochanteric fractures of the femur: results of treatment with the 95-degree condylar blade plate. ClinOrthop 1989: 238:122-130.

[13] Wiss DA. Brien WW. Subtrochanteric fractures of the femur. Results of treatment by interlocking nailing.ClinOrthop 1992; 283:231-236.

[14] Halder SC .The Gamma nail for peritrochanteric fractures J Bone Joint Surg(Br) 1992;74;340-344.

[15] Shepherd F. Rosenblum, Joseph Zuckerman"A Biomechanical evaluation of the gamma nail"JBJS (Br) 1992; 74(B):352-7.

[16] Lindsey RW et al. 29 patients, Bunstable fractures, mean age 64 years, 6 months follow-up. J. Trauma, 1991; 31(12): 1649-1658.

[17] Waddell JP, Czitrom A, Simmons EH. Enders nailing in fractures of proximal femur.J .Trauma , 1987; 27(8): 911-916.

[18] Vanderschof P. et al. 1995. "A review of 161 subtrochanteric fractures- risk factors influencing outcome: age, fracture level and fracture pattern". Unfallchirug, 98(5):265-71.

[19] BoldinC,Seibert FJ ,Fankhauser, a/c orthosc and .2003,feb,74(1);53-8.the proximal femoral nail –a minimal invasive treatment of unstable proximal fracture;prospective study of 55 patients with a follow up of 15 month.in

[20] Pugh,KevinJ;Morgan,Roberta;Gorczyca,John T;A mechanical comparison of subtrochanteric femur fracture fixation. Lipincott,Williams and wilkinsInc,volume 12(5) 1998 pp 324-329.

[21] Kish,B,SapirO;Carmel,A;Regev,A;Masrawa,S: Full weight bearing after unstable per and subtrochanteric fracture using proximal femur nail. J Bone Joint Surg(Br)volume 83-B, supplement III, 2001,pp289.

[22] Schipper IB,BresinaS,Wahl D, Biomechanical evaluation of the proximal femoral nail.Clinorthorelat res:2002 Dec;(405):277-86.

[23] Craig S Roberts,AkbarNawab,MeiWang,Michael J Voor and David Seligson; "Second Generation Intramedullary Nailing of Subtrochanteric Femur Fractures:A Biomechanical Study of Fracture site Motion". Journal of orthopaedicTrauma;Vol 16 No 4,pp231-238.

[24] Christian Boldin"The proximal femoral nail-a minimal invasive treatment of unstable proximal femoral fractures"ActaOrthop Scand2003:74(1); 53-58.

[25] S.Nuber, T.Schoweiss and A.Ruter. "Stabilization of unstable trochanteric femoral fractures:dynamic hip screw with trochanteric stabilization plate Vs Proximal femoral nail"Journal of orthopaedic trauma vol 17(4) 2003,pp 316-317.

IMPACT OF FIRE ON STEEL REINFORCEMENT IN REINFORCED CONCRETE STRUCTURES

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Abstract: The behaviour of RC beam and column members at elevated temperatures are being studied experimentally and analytically widely. However, hardly any attention is given towards analyzing the behaviour of structures with SFRC, e.g. SFRC beams, columns, portal frame etc. exposed to fire. Herein, is a paper research to study the impact of fire on steel reinforcement in reinforce concrete structures at elevated temperature that analyzed by means of a three dimensional (3D) nonlinear transient thermo-mechanical finite element (FE) analysis and validated with commercially software ANSYS and SAFIR.

Key Words: SFRC, Fire, Steel, Concrete, ANSYS, SAFIR.

1.0 INTRODUCTION

Fire remains one of the serious potential risks to most buildings and structures. The extensive use of concrete as a structural material has led to the need to fully understand the effect of fire on reinforces concrete structures. Fire has been a source of comfort and catastrophe to the human race since ancient history. Fire is a destructive force causing thousands of deaths and loss of property worth billions of dollars. Fire disasters can occur below the ground, on the ground or above the ground. Sometimes, they occur in the most unexpected or unpredictable circumstances. Considerable progress has been made in the understanding of structural fire protection since the earliest attempts to implement fire safety. Fire protection activity was initiated after a great fire in London in 1666; however investigation of structural fire protection began in second half of 18th century. Further the advances in material technology led to the concept of fire proof structures using gypsum. Later, Metropolitan Borough Act (1844) and London Building Act (1894) brought refinement in building control regulations. A scientific approach to research into structural fire resistance began towards the end of 19th century after the establishment of British Fire Protection Committee (BFPC). In 1932 first British Standard (BS 476:1932) related to fire was published which defined the test for fire resistance. The recent collapse of the twin-towers, World Trade Centre building in New York, USA, due to the terrorist attack and subsequent fire has renewed the interest in fire-resistant design of structures. Traditionally, the provision of fire resistance for reinforced concrete (RC) structures and components is usually treated indirectly in structural design. Most design procedures assume sufficient fire resistance, if certain criteria, mainly the distance of the reinforcing bars from the concrete surface, are kept. Building codes specify regulations for buildings designed in such a way that they exhibit an acceptable level of performance in the event of fire. These regulations are concerned with the prevention of premature collapse, the provision to evacuate the occupants from the structure on fire, avoiding spread of the fire to adjacent properties etc. However, when the means for containing a fire fail, such as a Fire Suppression System, Structural Integrity is the last line of defense. Hence, it is necessary to consider the risk of fire in designing of structures. Generally concrete is thought to have good fire resistance but the behavior of reinforced concrete columns under high temperature is mainly affected by the strength of the concrete, the changes of material property and explosive spalling. However, high temperatures affect the strength of the concrete by explosive spalling and so affect the integrity of the concrete structure. In recent years, many researchers studied the fire behavior of concrete columns; their studies included experimental and an analytical evaluation for reinforced concrete. Concrete is a material that has an excellent intrinsic behavior when exposed to fire, it does not burn, (non-combustible), and it has a high thermal massively, which significantly slows down the spread of heat through concrete elements. As a matter of fact, in most common fires only the outer layer of the concrete with a thickness of approximately 3 to 5 cm is damaged (Denoël, 2007). Therefore, many concrete buildings that experienced fire can be fairly simply restored and reused. An excellent example of the good behavior towards fire of concrete structures is the Windsor Tower in Madrid (Denoël, 2007). The fire occurred on 14 February 2005, during which the building was fortunately unoccupied. Despite that the fire spread over numerous floors and lasted for 26 hours, the building remained standing, as can be seen in Figure 1.1, only the part that collapsed were the steel perimeter columns above the 20th floor, which supported the floors.

Figure 1.1: The Windsor Tower in Madrid after a 26 hour fire in 2005.

2.0 FE ANALYSIS PROCEDURE FOR THERMAL AND MECHANICAL LOADS

The need for incorporating the fire loading into structural design has long been recognized, and is becoming a greater concern because of security-related issues. Reinforced concrete structures are also commonly exposed to thermal loads as the result of the design function of the structure, ambient conditions, heat of hydration, or exposure to fire. Therefore, there has been a growing interest in research on the advanced analysis and design of reinforced concrete structures subjected to thermal loads. Currently, transient thermal analyses are typically not employed in the design of reinforced concrete structures for thermal (fire) conditions. Rather, code provisions are typically based on detailing and cover requirements, which is based on the empirical data and provide an acceptable fire-rating in terms of the length of time that the structure must sustain its mechanical loads in the presence of fire without collapsing (e.g. three hours).

2.1 ANALYSIS PROCEDURE

To understand the response of structures to thermal loads, various stages of analyses must be considered separately. The general procedure for transient thermal-stress analysis of a RC structure in ANSYS R15.0 consists of:

i. Building a two-dimensional or three-dimensional model of the structure. The model incorporates the geometry (concrete and steel bars as reinforcement), appropriate material properties, and boundary conditions.
ii. Applying the thermal loads to the desired surface of the structure resulting from the furnace transient fire (in the form of transient temperatures versus time curves) using 24
iii. "Standard Time-Temperature" curve applied according to the ISO 834 or ASTM-E119 (shown in Figure 4.8). The remaining surfaces of the structure are considered exposed to ambient temperature.

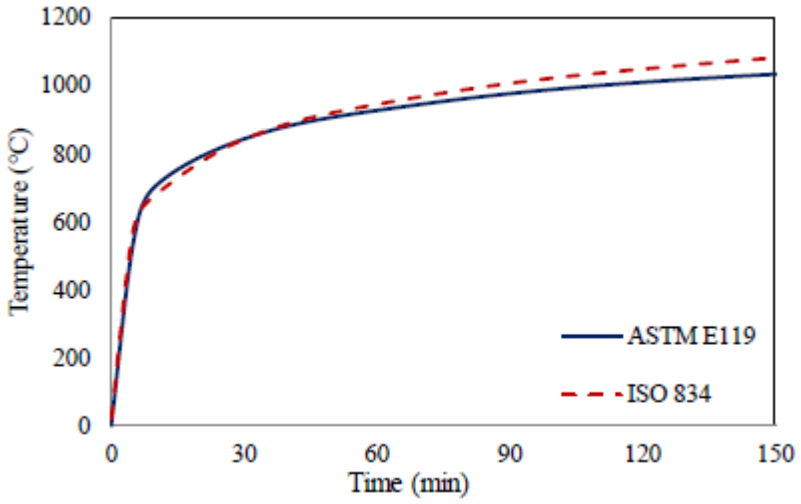

Figure 2.1: Standard Fire Curve as per ISO 834 and ASTM E119.

iv. Applying a mechanical load on suitable surface (uniformly distributed load on top face for beam and axial load for column) to simulate the dead and live gravity service loads during fire exposure. Also, apply the thermal loads in the form of nodal temperature at several time points obtained in step 2, on the structural finite element model and compute the deflection and strains in the structure.

v. Evaluate the total deflection as well as the thermal, mechanical, and total strain for different points within the mid-span beam cross section and at the beam column joint during the time of exposure to the fire from the structural finite element model. The deformation field in the model at the first load step (due to the applied gravity load) is used to verify the correct behaviour of the model and correct modeling of boundary and loading conditions.

3.0 VALIDATION PROBLEMS

3.1 AIM AND OBJECTIVES

The main aim of the present study is to provide a better understanding of the impact of fire on steel reinforcement in reinforced concrete structures this was achieved by carrying out the investigations with following objectives:

- Modelling a cross section and analysing the effect of fire on the cross section.
- Using SAFIR & ANSYS software to analyses the impact of fire on the steel reinforcement.
- Validating it with the experimental data available in the literature.

A number of FE models are available in literature studying the behaviour of RC structural elements such as beams and columns under mechanical loading with or without fire. Therefore, as a part of validation process a problem was carried out by:

3.2 TRANSIENT HEAT TRANSFER ANALYSIS

A two dimension transient analysis was carried out of unprotected steel under elevated temperature.

3.2.1 PROBLEM SPECIFICATION

The experimental results used for validating the model in SAFIR are based on the investigation carried out by Newman (1990). Using this numerical example given below as done in the design of steel structures book that to calculate the temperature rise for an ISMB 400 heated on four sides after 15min to ISO 834 fire.

4.0 MODELLING AND RESULTS DISCUSSION USING SAFIR SOFTWARE

From IS808 for ISMB400 the dimensions are as given below, Area=78.46cm^2, where D=400mm, B=140mm, t=8.9mm.

STEP 1:

The first step is to calculate the heating parameter as given by the formula for unprotected steel member heated in for sides as H_P= 2D+4B-2t,

Therefore H_P= 2D+4B-2t=2 x 400+4 x 140 - 2x8.9=1342.2mm, H_p =1.342m

STEP 2:

After obtaining the heating parameter, we can get the section factor as the ratio between the heating parameter to the cross section area,

$$Hp/A = 1.342x100^2/78.46 = 171m^{-1}$$

STEP 3:

$$To\ obtained\ \Delta t = \frac{25{,}000}{Hp/A} = \frac{25000}{171} = 146mm$$

Δt=120s.

The governing equations are

$\Delta T_s = (1/C_sP_s)(H_p/A)h_{net}\Delta t$

$With\ h_{net} = \alpha_c(T_t - T_S)+\sigma\varphi\varepsilon[(T_t + 234)^4 - (T_t + 234)^4]$

$=25(T_t - T_S)+1\times0.8x5.67x10^{-8}[((T_t + 234)^4-(T_t + 234)^4]$

$And\ T_s=1/(600x7850) \times171 \times h_{net}\times120^oC=4.36x10^{-3}h_{net}$

At t=0, both T_o and T_s are 20. T_t is given by

$T_t = T_o +345log\ (8t+1)$

The values of T_s are calculated at t=0,2,4,6,8,…minutes and the values of T_o h_{net} $(T_t - T_S)$ and ΔT_s at t=1,3,5,7,…min. the calculations are carried out in the spread sheet form as shown in table 3.1 below.

Table 4.1: Temperature Rise in an Unprotected Steel Section

t(min)	T_s(°C)	h	ΔT_s(°C)	T_s(°C)
0				20
	349.2	14693	64	
2				
	502.3	26110	113.8	84
4				
	576.4	30847	113.5	332.3
6				
	625.8	30850	134.5	466.8
8				
	662.8	26099	113.8	466.8
10				
	692.5	18132	79.1	580.6
12				
	717.3	10843	47.3	659.6
14				
	738.6	6473	28.2	671
16				672

Taking the mean of values 14 and 16min, the steel has reached a temperature of 671.5°c after 15 min.

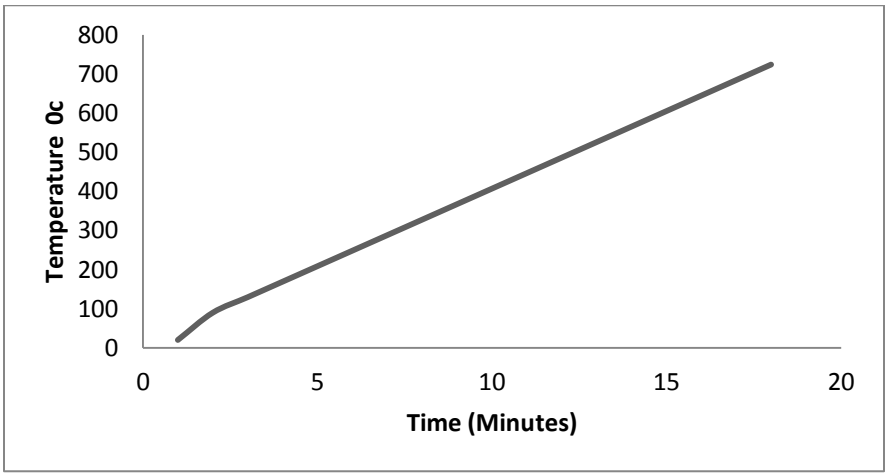

Figure 4.1: Newman (1990) Temperature-time curve for steel reinforcement (ISMB400).

4.1 MODELING USING SAFIR

Similarly this calculation was done using SAFIR software in other to calculate the amount of temperature exacted on the steel reinforcement as done by Newman (1990) structures. The steps are as follows:

STEPS OF CALCULATING TEMPERATURE USING SAFIR SOFTWARE

First Step: Using WIZARD2007 to obtain the input file for SAFIR.

i. Click on from desktop wizard2007
ii. A dialogue box opened select user, input the height of section as (D) 400, input , input thickness of the web as 8.9mm also input the Root fillet if any and click on concrete slab if you want to add concrete slab to your problem. And click on next -

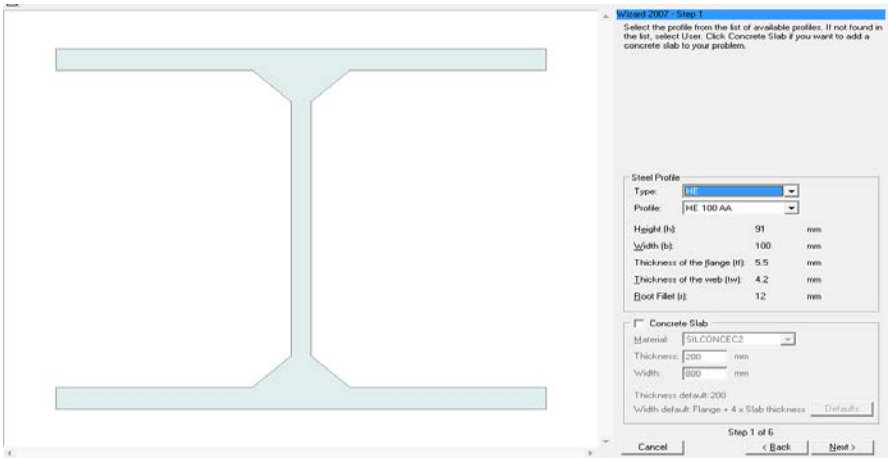

Figure 4.2: Wizard 2007 input data dialog box.

iii. Select the protection material and the protection thickness. If any, but in this case protection layer select (None) and click on next -

iv. Select the number of elements to describe the steel profile, that is the meshing and click on next -

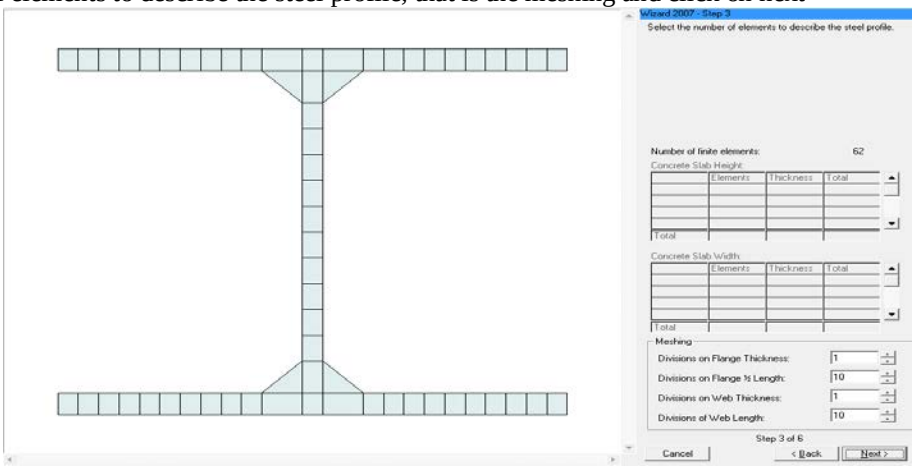

Figure 4.3 mesh configuration.

v. Select the fire curve as FISO and the rotation angle if any, and so also the exposed faces of the steel profile, Face1,face2,face3,fac4 and press on next -

vi. Select the number of integration points on elements and global coordinates of the node line and the centre of torsion. Precision as -4,number of integration points as 3 , time step as 12sec, end time 2400, time print 60sec, and press on next -

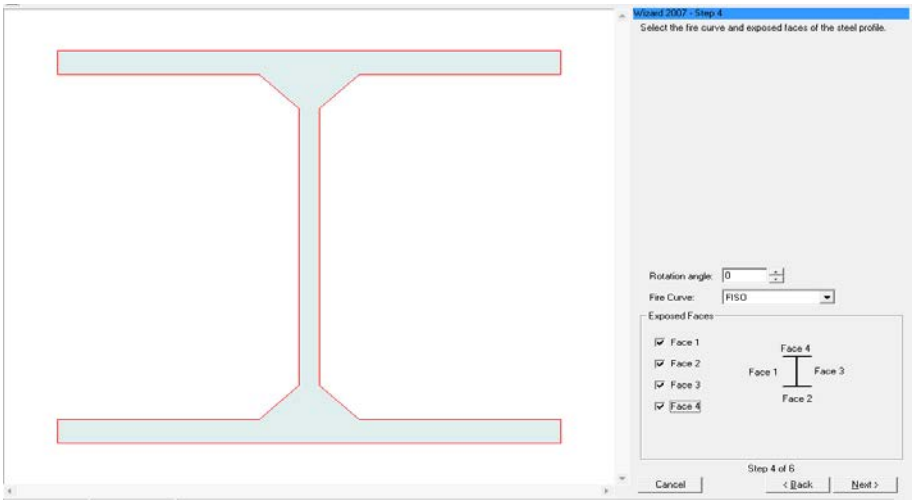

Figure 4.4: Wizard 2007 faces in contact with fire dialog box

vii. The wizard has finished collecting the information needed for the SAFIR input file, and press Finish to save values in the data file as **abba.**

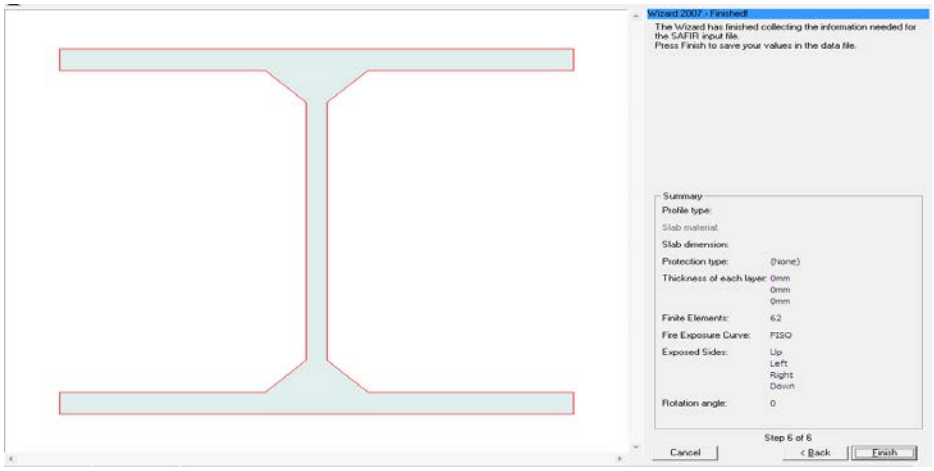

Figure 4.5: Wizard 2007 input data final dialog box.

Second Step: Using SAFIR software to run the inputed data from WIZARD2007 software

i. Go to C: / click on SAFIR.
ii. A dialogue box opened input the file name as **abba** and click enter to run the data for the out file to be used in DIAMOND software.

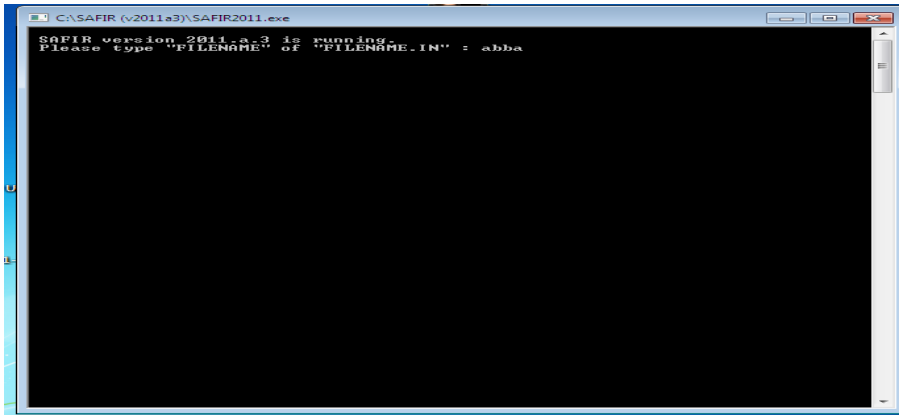

Figure 4.6: SAFIR processing data dialog box.

Third Step: Using DIAMOND software obtain the temperatures as well as the charts

1. Click on DIAMOND 2011 from the desktop
2. Click on file menu and select open from there select the output file created from SAFIR as abba.
3.The file will opened from there click on result and select temperature, the result for temperature will be displayed, also by clicking on result by selecting chart the chart is going to be plotted.

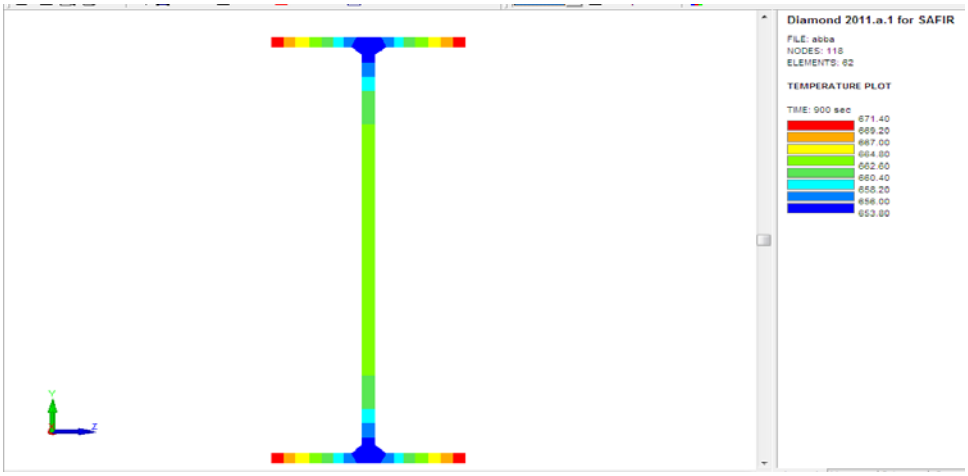

Figure 4.7 Diamond output chat file.

The image above shows the screen snap from the DIAMOND environment, representing the temperatures at the time of 900sec (15minutes). Similarly the chart for that is as shown below.

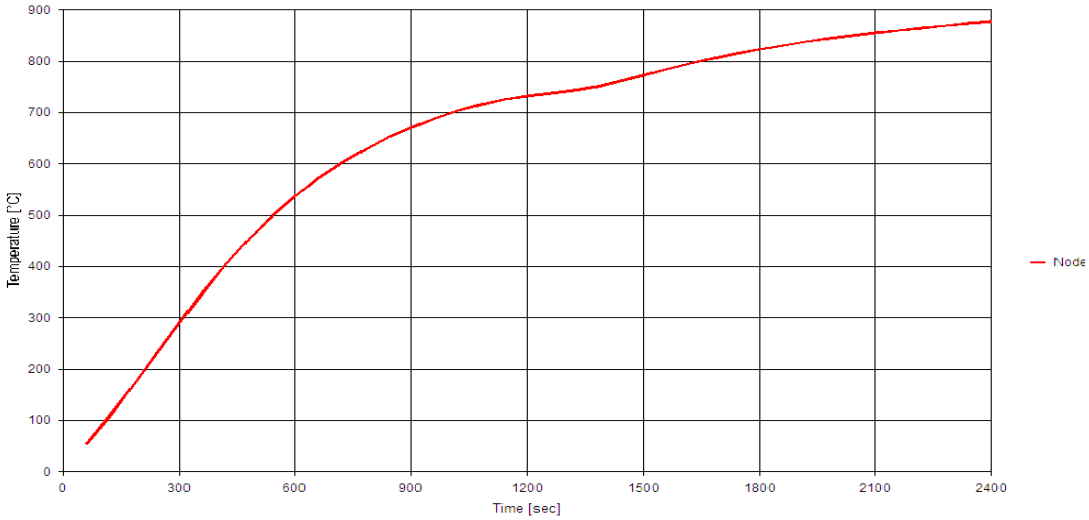

Figure 4.8: Temperature-time curve for steel reinforcement Model (SAFIR v2011a3)

It can be seen that the value of temperature obtained as the time of 15min (900sec) from Fig.4.1 the manual calculation (Newman 1990) the steel has reached a temperature of 671.5^{o}C after 15 min. while from Fig. 4.8 the DIAMOND Output file the steel reached 671.4^{o}C at 900sec (15min). Almost about 0.5^{o}c is the difference between the two. Thus, it is clear to say that the predicted and experimental values are in good agreement with each other.

4.2 HEAT TRANSFER ANALYSIS

Three Dimensional (3D) Transient heat transfer analysis of a concrete beam reinforced with glass fiber reinforced polymer (GFRP) rebar is carried out.

4.2.1 PROBLEM SPECIFICATION

Here, a 3D heat transfer analysis on RC beam reinforced with GFRP rebars is carried out using ANSYS 15.0. The experimental results used for validating the model in ANSYS are based on the investigation carried out by Pratik (2013). A FE model for the same was also developed by Abbasi and Hogg, (2006). The beam is subjected to fire, at its bottom and on the sides, simulated by using standard fire curve as per ISO 834. The beam is 4400 mm long with cross section dimensions of 350 by 400 mm reinforced with 12.7 mm diameter 7 GFRP rebars in two layers at the bottom and 2 at the top; surrounded by 9 mm stirrups at 160 mm center to center arranged as shown in Figure 4.9. The cover to the reinforcement is 75 mm at the bottom and 50 mm on the sides and at the top. The thermal properties of the material useful for the analysis are provided in Table 4.2 below. The strength of concrete used is 42 MPa i.e. a normal strength concrete.

Table 4.2: Thermal Properties of the Materials for Validation Problem

Material	Thermal conductivity (k) Wm/K	Density (ρ) kg/m^3	Specific heat (C) J/kgK
Concrete	2.7 *X* 10^{-3}	2.32 X 10^{-6}	722.8
Rebars	4.0 X 10^{-3}	1.60 x 10^{-6}	1310

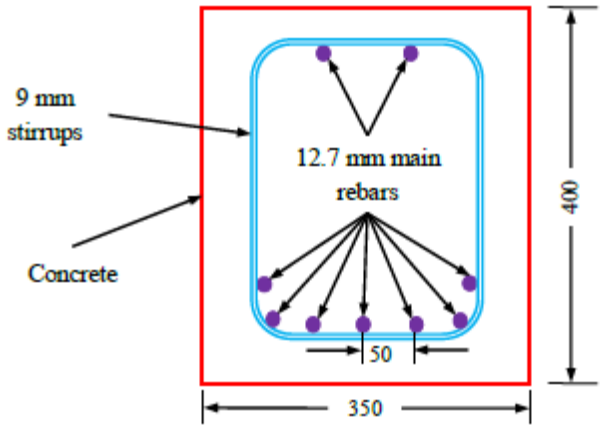

Figure 4.9: Arrangement of GFRP Rebars in Concrete Beam (All Dimensions are in mm)

5.0 MODELLING, RESULTS AND DISCUSSION

The 3D beam Reinforced concrete was modelled using ANSYS 15.0 software. The concrete beam was modelled using SOLID 65 element, for heat transfer analyses. It has single degree of freedom at nodes i.e. temperature. The GFRP bars are modelled using LINK180 element. This element also has single degree of freedom, temperature, at each node. As no mechanical load is applied, no mechanical boundary conditions are applied to the model. Full bonding is assumed between the rebars and the concrete and this was achieved in the software. The entire beam model was subjected to an ambient room temperature of 20^0C in the form of predefined initial condition. Then, the beam is subjected to fire in the form of standard time temperature curve as per ISO 834 at the vertical faces and the soffit of the beam. For this, temperature boundary condition is specified at the sides and soffit of the beam and varying with amplitude of standard time temperature curve during the transient heat transfer. The temperature variations at different time intervals obtained in this analysis using ANSYS at the centre and side of the beam are shown in Figures below 5.8 and 5.9**.**

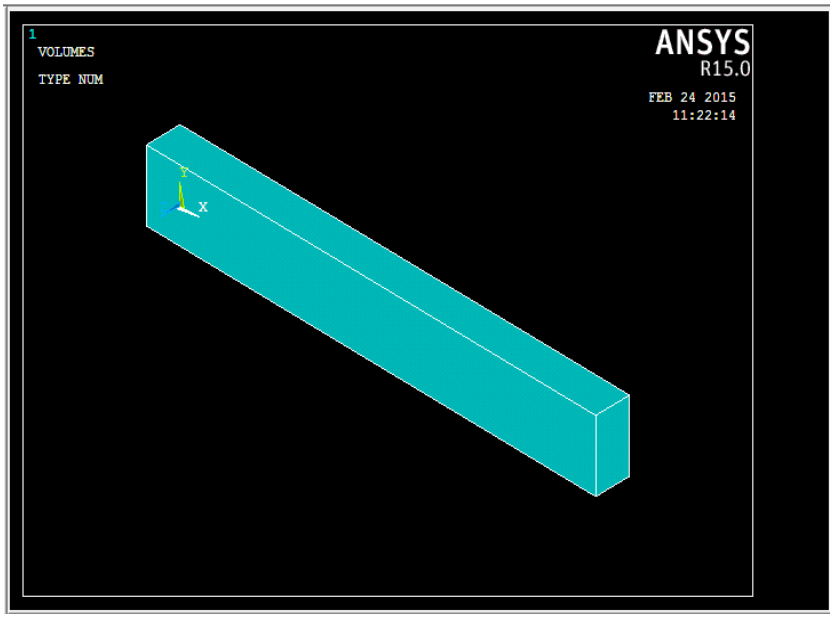

Figure 5.1: Concrete beam layer FEM model.

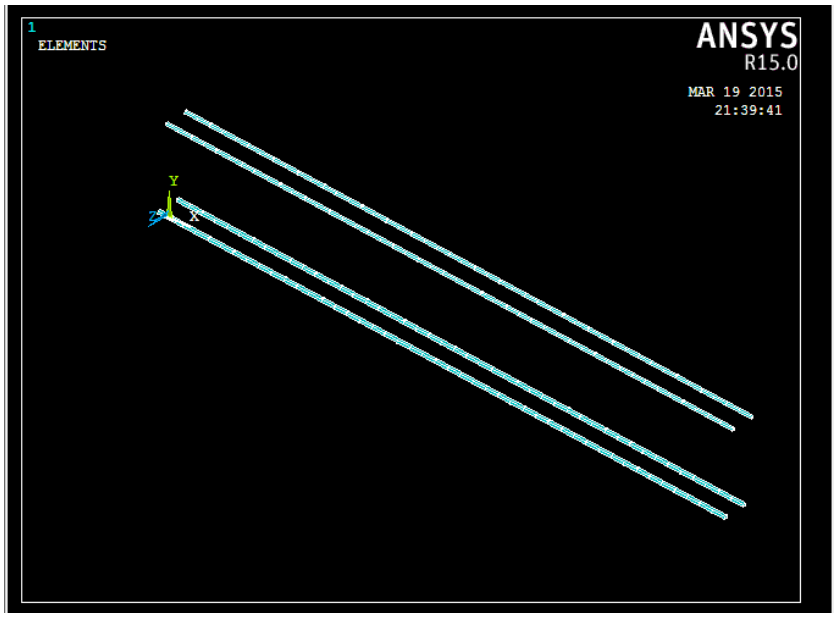

Figure 5.2: GFRP layer FEM model.

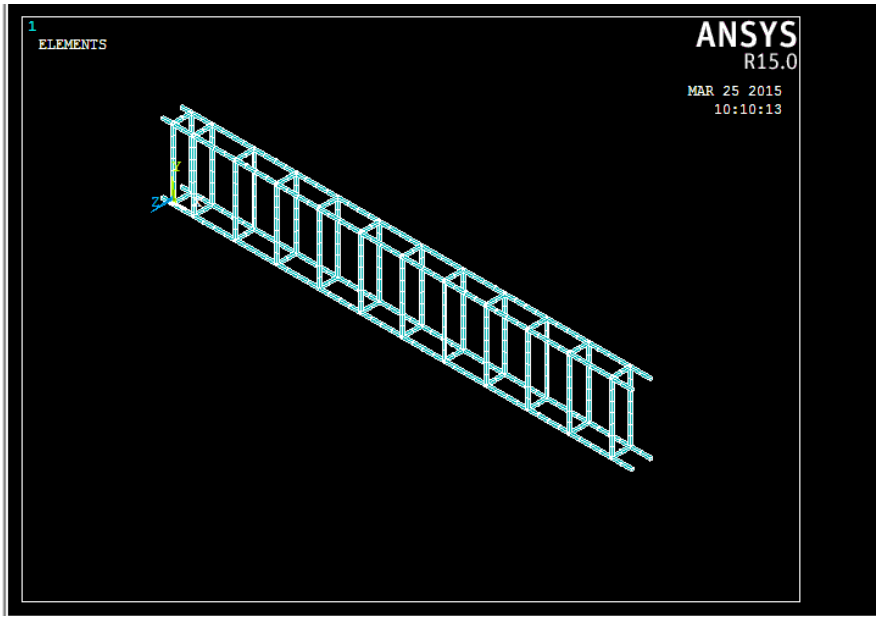

Figure 5.3: GFRP and stirrups layer FEM model.

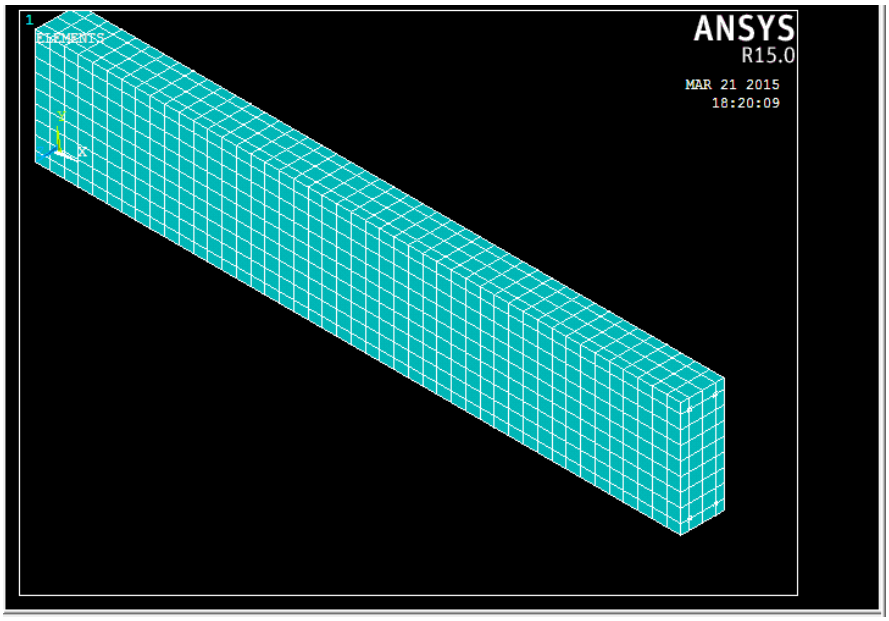

Figure 5.4: Mesh configuration of Beam with Rebars for problem.

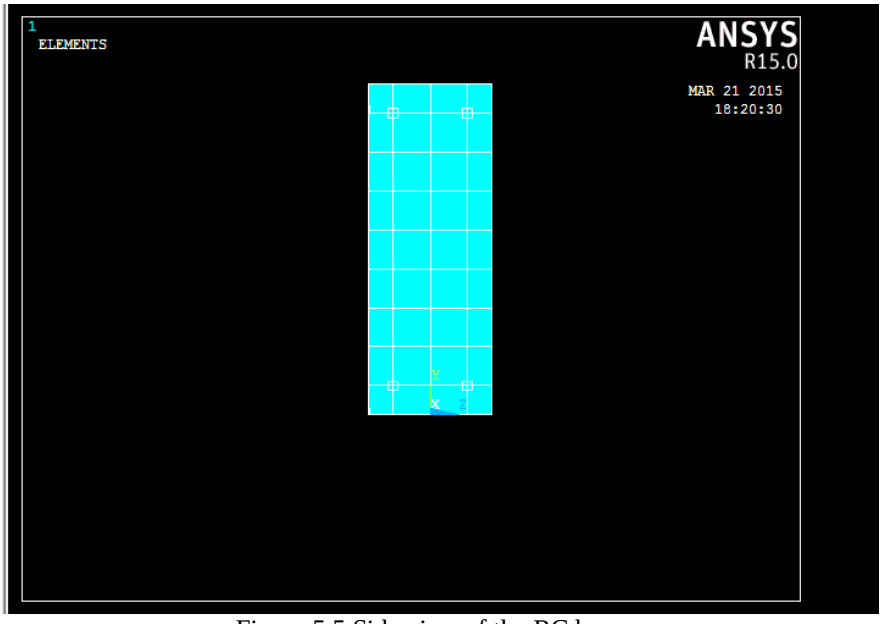

Figure 5.5 Side view of the RC beam.

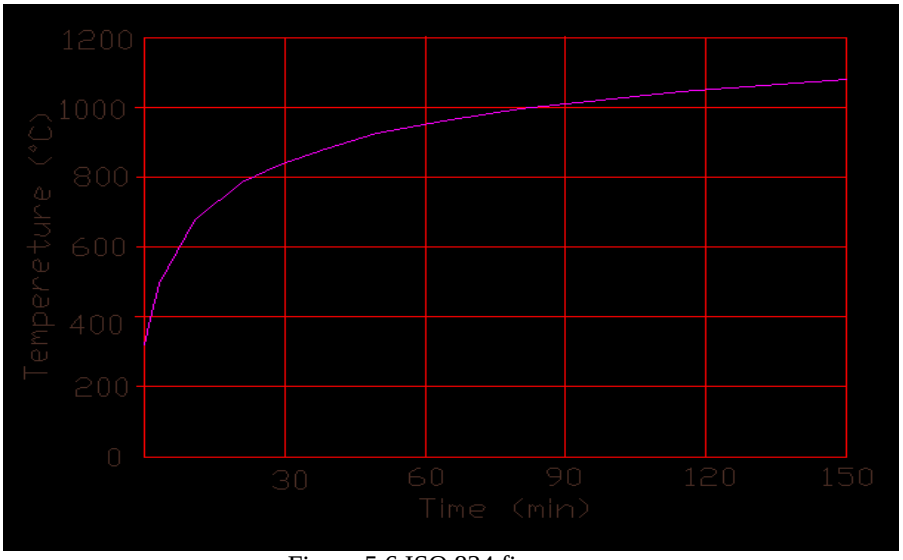

Figure 5.6 ISO 834 fire curve.

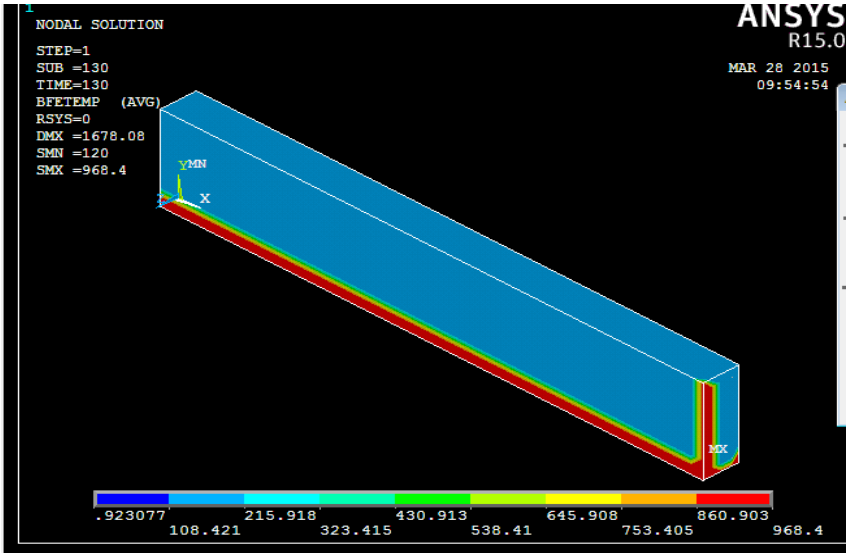

Figure 5.7: Nodal Solution for the FEM model at 130min.

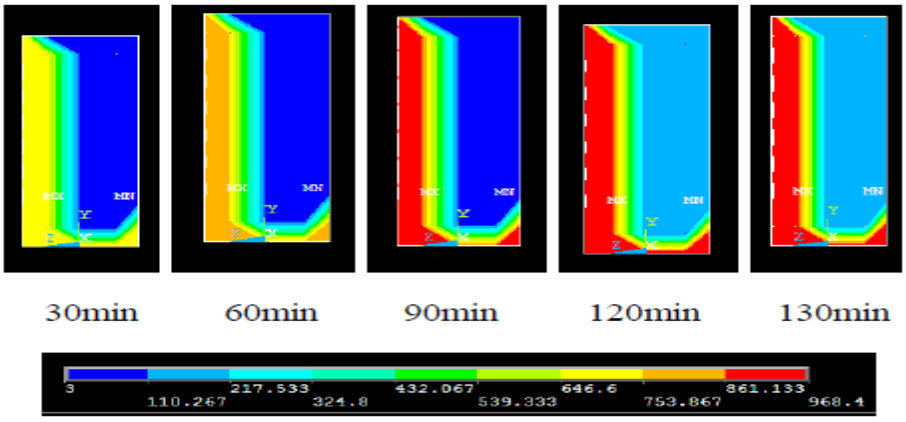

Figure 5.8: Side view Temperature Variation in Beam Obtained in Present Study.

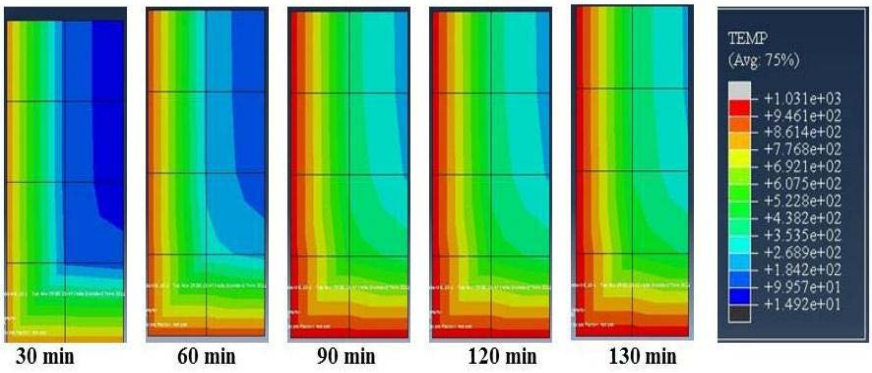

Figure 5.9: Temperature Variation in Beam (Pratik, 2013).

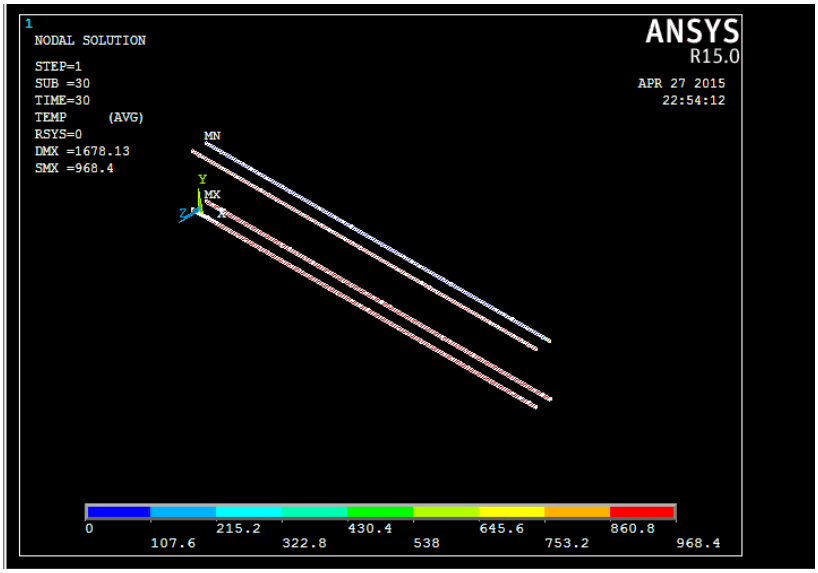

Figure 5.10: Temperature Variation in GFRP Obtained in this study

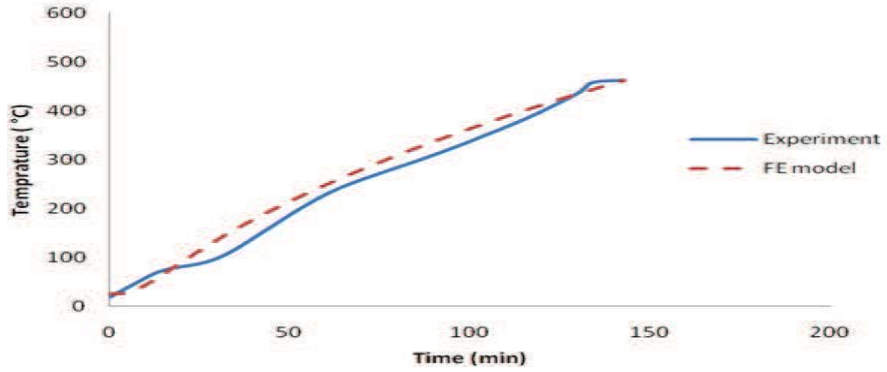

Figure 5.11: Temperature Variation in GFRP Obtained at the end of this simulation.

The time at which the temperature in GFRP bars reached 430^0C which was considered as the beginning of failure of GFRP bars was around 90 minutes for the ANSYS model as shown in Figure 5.11 above, which is 3 minutes less than that of experimental value. It is clear that the predicted and experimental values are in good agreement with each other. Although the FE model overestimates the result as compared to the experimental data, this may be attributed to the lack of temperature dependent material properties of GFRP rebars. Thus the developed FE model can be used as a valid numerical tool to predict the temperature distribution in concrete beams.

6.0 CONCLUSION AND RECOMMENDAATION

6.1 CONCLUSION

A nonlinear 3D FE model was developed in this study and validated against the experimental program conducted by Abbasi and Hogg (Abbasi & Hogg, 2006) as can be seen in the previous sections. Good agreement between the measured experimental and predicted FE simulation was obtained for the average temperature in the GFRP bars at all stages of fire exposure. Although the UK Building Regulations (Building Regulations, 2000) for fire safety recommends the minimum periods of the fire resistance for the most structural elements to be of 90 min, the fire tests and FE simulation results showed that concrete beams reinforced with GFRP bars can achieve a fire endurance of about 130 minutes. Thus, using GFRP bars as concrete reinforcement seems to meet the fire design requirements. Upon the validation of the measured data, the FE modeling could provide full field of results, in terms of 3D temperature distribution.

It could be concluded that the developed FE model is a great tool to aid designers and researchers to predict numerically the temperature distribution of RC beams reinforced with GFRP bars. Thus, the validated model could be used as a valid tool in lieu of experimental testing especially in design oriented parametric studies.

6.2 RECOMMENDATION

Furthermore, the developed and verified FE model in this study could be used as a tool for further investigation of the fire performance of RC beams reinforced with GFRP bars under different applied fire curves and boundary conditions. The FE modeling can also be used to predict the deflection, ultimate load capacity and fire resistance time of the structural member with sufficient accuracy. Modeling of shear stirrups in the structural member can be neglected for thermo-mechanical analysis.
In conclusion many cases, the design methods used in practice do not completely capture the true behaviour of steel reinforcement in reinforced concrete structures on fire. A proper design should incorporate a design fire that is realistic and based upon physical parameters and the structure must be studied as a whole, taking in account all the interactions between the elements. However, a lot of work is still needed in order to incorporate these elements in a practical design tool.

7.0 ACKNOWLEDGMENT

The authors wish to acknowledge the staffs and management of Sharda University, India for their input and suggestions toward the completion.

8.0 REFERENCES

[1]. Ali, F., Najdai, A., and Choi, S. (2010). “Numerical and Experimental Investigation of the Behavior of High Strength Concrete Columns in Fire.” *Engineering Structures*, 32(5), 1236-1243.
[2]. Altun, F., Haktanir, T., and Ari, K. (2007). “Effects of Steel Fiber Addition on Mechanical Properties of Concrete and RC Beams.” *Construction and Building Materials*, 21(3), 654-661.
[3]. Arioz, O. (2007). “Effects of Elevated Temperatures on Properties of Concrete.” *Fire Safety Journal*, 42(8), 516-522.
[4]. Balaguru, N., and Shah, S. P. (1992). “*Fiber Reinforced Cement Composites*.” McGraw-Hill, New York
[5]. Behbahani, H. P., Nematollahi, B., Sam, A. R. M., and Lai, F. C. (2012). “Flexural Behavior of Steel-Fiber-Added-RC (SFARC) Beams With C30 and C50 Classes of Concrete.” *International Journal of Sustainable Construction Engineering & Technology*, 3(1), 54-64.
[6]. Brea W., Venkatesh K., Mark F. Green, and Luke B.(2008)”*fire endurance of fiber-reinforced polymer strengthenedconcrete t-beams*”,ACI Structural Journal.
[7]. Lie, T. T., and Kodur, V. (1995). “Mechanical Properties of Fiber Reinforced Concrete at Elevated Temperatures.” *Internal Report, Institute for Research in Construction, National Research Council, Canada*.
[8]. Colombo, M., Prisco, M. Di., and Felicetti, R. (2010). “Mechanical Properties of Steel Fiber Reinforced Concrete Exposed at High Temperatures.” *Materials and Structures*, 43(4), 475-491.
[9]. Chen, S. C., Lu, X. Z., Ren, A. Z., and Jiang, J. J. (2007). “Fiber Beam Element Model for the Collapse Simulation of Concrete Structures Under Fire.” *Proceedings of the International Symposium on Computational Mechanics, July* 30th-*August* 1st, *Beijing China* .
[10]. Chen Y.H ,ChangY.F , Yao G.C , Sheu M.S , Experimental research on postfirebehaviour of reinforced concrete columns, "*Fire Safety Journal*” 44 (2009) 741.748.

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Structural Analysis of an ATV Frame

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Abstract- All-terrain vehicles (ATVs) are motorized vehicles with large, low pressure tyres. ATVs are designed to carry one rider on uneven surfaces. ATVs weigh up to 600 pounds and can reach speeds of 75 mph.

The uses of ATVs are increasing day-by-day and it is spreading across worldwide. As the use of ATV is increasing day-by-day, there is a black side also which increases number of accidents and injuries happened during riding.

The main objective of this research work is to perform a structural analysis on an ATV frame considering mainly the safety features including total safety of driver during any crash or any accident, to have a compact structure with less weight and with good aesthetics as well.

To achieve this objective the material selection for roll cage structure is based on good strength to weight ratio as compared between various tubing international grades. The numerical analysis of the frame is accomplished in ANSYS software using structural model prepared in CREO software. The frame is analysed under various type of crash tests like front impact, side impact etc. to check its strength and required safety features of the frame. The Impulse-momentum equation is considered for the forces which act on the body during any collision.

Index Terms- ATV, ANSYS, FRAME, DESIGN.

I. INTRODUCTION

All-terrain vehicles (ATVs) have been popular recreational vehicles since their introduction in the United States in the 1970s. They have experienced increased use worldwide since the early 1990s and newer models weighs up to 600 pounds and can reach speeds of 75 mph [1]. They have widely used for agricultural purposes on farms. Since 1983, there have been about 190 scientific papers and technical reports written about ATV-related injuries and deaths, associated costs, effectiveness of laws, various prevention strategies, and identification of high-risk groups. As the no. of accidents is increasing day-by-day on ATV hence safety of the particular ATV is the most important concern and there may be some extra safety precautions from manufacturer side to buyer and rider.

To check the strength and safety features of an ATV frame, structural analysis is performed. Structural analysis is the determination of the effect of loads on physical structures and their components. Structural analysis incorporates the fields of applied mechanics, material science and applied mathematics to compute a structure's deformation, internal forces and stresses etc. There are three approaches to the analysis: the mechanics of materials approach, the elasticity theory approach and the finite element approach. The finite element approach is a numerical method for solving differential equations generated by theories of mechanics.

II. LITERATURE REVIEW

A great amount of published literature and various project & design reports are reviewed for this research. Few of them highlight the importance of topic. The literature review indicates that much of the published research about ATVs and ORVs (Off-road vehicle) has focused on their use and impacts. Most of them mainly concerns about the safety of children (younger than 16 years), because 40-50 % accidents or injuries happened with children under 16 years age not with adults elder than 18 years or more. Jo Annette David (CPSC 1998) collects reports of ATV-related incidents resulting in death from a variety of sources [2]. A report prepared by MIRA Ltd. emphasized on the seating position of rider on the ATV and also check performance of the ATV during different Rollover scenarios [3]. RIRDC (Australian Govt.) Emphasized on to setup a national framework for development and to reduce the no. of deaths and serious injuries happened during operation with ATV [4].

Delta-V Experts team concerned on Simulation of a quad bike in rollover condition for reducing no. of injuries happened during accident [5]. Various ATV safety summits have been held in U.S. also emphasized on safety of rider under the age of 16 years.

III. ATV FRAME MODELLING

a) Modelling introduction

With the advent of powerful computers and robust software, computational modelling has emerged as a very informative and cost effective tool for material design and analysis. Modelling often can both eliminate costly experiments and provide more information than can be obtained experimentally. A wide variety of software, for e.g. CREO, CATIA, SOLIDWORKS, FEMPRO, ANSYS etc. are commercially available and can be used to model and analyse the ATV frame. In this research Creo2.0 is used for modelling and ANSYS 14.5 is used as a tool for analysis.

This ATV frame is made according to BAJA SAEINDIA 2015 rules and regulations [6].

b) Material properties

The material selection will be based on various researchers in literature and by considering some important points like carbon content, density, weight to strength ratio, tensile strength etc. The material was chosen AISI 4130 and AISI 1018 for fabrication of roll cage frame as per our requirements.

Material properties [7, 8]

S.NO.	Parameters	AISI 4130	AISI 1018
1.	Carbon content	0.3%	0.18%
2.	Young's modulus	205 GPa	205GPa
3.	Poisson ratio	0.29	0.3
4.	Tensile strength	435 MPa	365 MPa

Analysis of the frame is done under static conditions.

c) Analysis

The structural analysis was performed on the roll cage frame. The roll cage frame is tested under various impact (crash) tests such as frontal impact test, rear impact test, side impact test, torsion test, drop test etc. The frame is a distributed mass system. The analysis was conducted by providing proper boundary conditions and applied forces at on specified locations.

All the forces are calculated by using impulse-momentum equation which is as-

$$M_1 V_1 = M2V2$$

S.No.	Crash test type	Magnitude(N)
1.	Frontal impact	16700
2.	Rear impact	8600
3.	Side impact	8600
4.	Rollover	7400
5.	Torsion test	4905
6.	Drop test	7100
7.	Front bump	4905
8.	Rear bump	4905
8.	Lozenging	1406

c) Meshing

Any continuous object has infinite degrees of freedom. Finite element method reduces this from infinite to finite by means of Meshing. Meshing is a process of creating nodes and elements on a particular object.

ANSYS Meshing is a component of ANSYS Workbench. It's a next generation meshing platform. Meshing provides a wide range of highly robust automated meshing tools-from tetrahedral meshes to pure hexahedral meshes, inflation layers and high quality shell meshes .The roll cage frame is meshed using the mesh tool. The mesh tool provides a convenient path to many of the most common mesh controls, as well as to the most frequently performed meshing operations. The frame throughout this project is subjected to simply supported boundary conditions.

IV. RESULT

In this section we present several numerical simulations, in order to assess the behaviour of the roll cage frame subjected to various impact conditions.

Deflection, von-mises stress, von-mises strain, safety factor etc. are some tools which are used as a resulting tool to show the behaviour of the roll cage frame as per the applied load conditions. Following table shows the results of various tests-

S.No.	Impact test	Max. Stresses (MPa)	FOS
1.	Front impact	273.35	1.5914
2.	Rear impact	**322.87**	**1.3473**
3.	Side impact	165.91	2.6219
4.	Rollover	215.79	2.0159
5.	Torsion test	244.79	1.7771
6.	Drop test	126.8	3.4306
7.	Front bump	191.38	2.2729
8.	Rear bump	235.72	1.8454
9.	Lozenging	32.523	13.375

ANSYS DIAGRAMS

In this section we present several numerical simulations diagram of von-mises stresses in following figures for different type of impact condition to assess the behaviour of the roll cage frame.

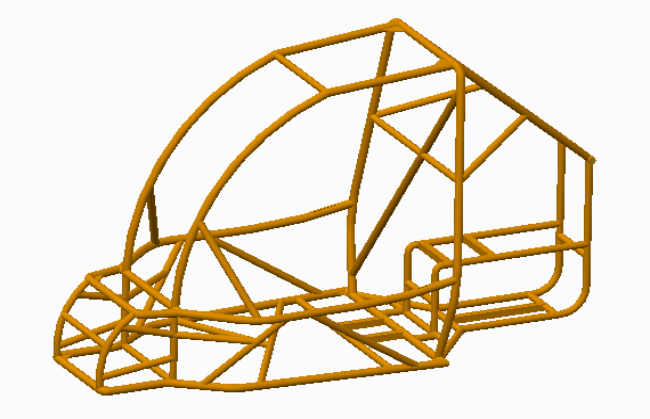

Fig 1- Isometric view of frame

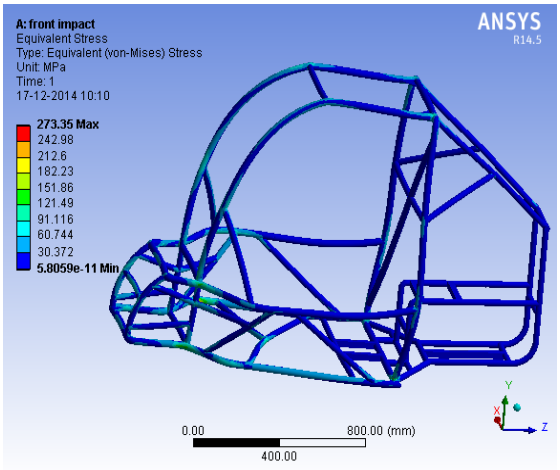

Fig 2- Frontal Impact

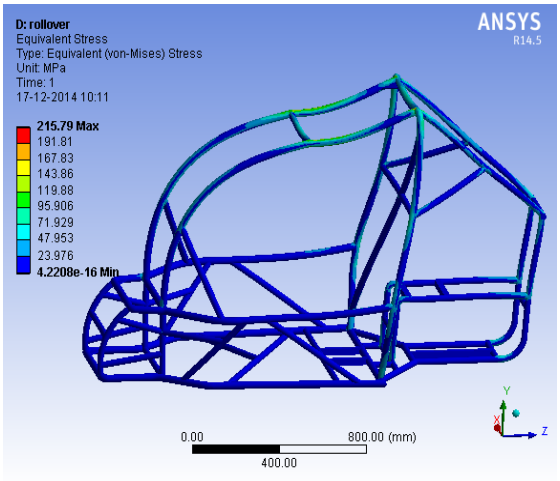

Fig 3- Rollover test

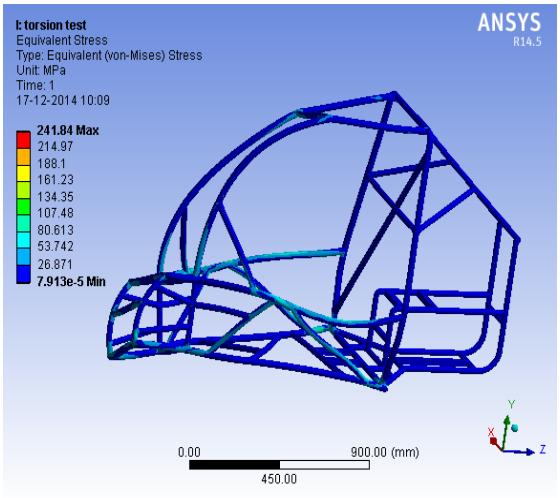

Fig 4- Torsion test

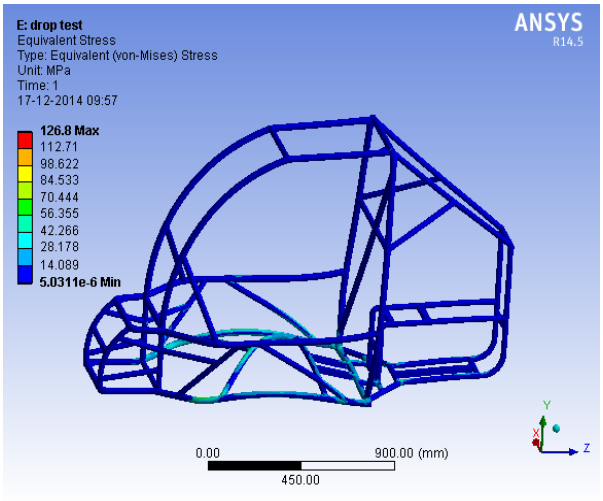

Fig 5- Drop test

V. CONCLUSION

In this research analysis is carried out on a roll cage frame made of AISI 4130 and AISI 1018 tubular sections. The structural response of this roll cage frame is studied with respect to load in various conditions.

A frame is designed that corrects weaknesses of previously designed frames. Upmost attention has kept on compactness of the frame as well as increased strength in critical areas to have the proper safety of driver during any impact. A complete analysis has done by ANSYS simulation software which will elevate the validity of the design.

It is observed that during all tests and calculations the minimum factor of safety achieved is 1.3473 (for rear impact), which is regards as safe as the result of maximum von mises stress is 322.87 MPa.

ACKNOWLEDMENT

This project is resulted in design and fabrication of a frame that will allow us to compete in BAJA SAEINDIA-2015.

REFERENCES

[1] National Farm Medicine Center "All-Terrain Vehicle Safety" © 2003 Marshfield Clinic (910-053-01)

[2] Jo- Annette David (U.S. Consumer Safety Commission), “Report on AU-Terrain Vehicle-Related Deaths” April 1998.

[3] Jonathan Webb, Meng Ceng Mimeche (MIRA LTD.) “Mathematical modelling of the stability of passenger carrying tandem seat all-terrain vehicle (ATV)” Research report 223 for Health and Safety Executive 2004.

[4] Lyn Frager, Kirrily Pollock, John Temperley, “A National Strategy for Improving ATV Safety on Australian Farms”, RIRDC Publication No 05/082, RIRDC Project No. US-122A, June 2005.

[5] Shane Richardson, Tia Orton, Andreas Sandvik, Chris Jones, Nikola Josevski and Wei Pei (Tandy) Pok (Delta-V Experts), “Simulation Of Quad Bike (ATV) Rollovers Using Pc-Crash To Evaluate Alternative Safety Systems”, Paper No. 13-0286, 2012.

[6] Rulebook BAJA SAE INDIA 2015

[7] http://asm.matweb.com/search/SpecificMaterial.asp?bassnum=m4130r

[8] http://www.azom.com/article.aspx?ArticleID=6115

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Climate Change and its Implications to Africa

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Abstract- Climate change is a reality and its impact are felt daily by communities around the world, The United Nations Framework Convention on Climate Change (UNFCC) defines climate change as a change which is attributable directly or indirectly to human activity that alters the composition of global atmosphere and which is in addition to natural climate variability observed over a comparable time periods. This paper therefore examines the phenomenon called climate change, its meaning, history as well as manifestations and its implications to Africa. The paper recommended that adoption measures are emphasize in African urban centres and concluded that there is an urgent need to translate awareness of climate change impacts into those tangible adaptation measures at all levels of governance in the African countries.

Index Terms- Africa, Change, Climate, Global-Warming, Implications.

I. INTRODUCTION

Environmental management resulting in desertification, degradation, decay and demise of lower level living things in the eco-system is a great challenge of the global community in recent times (Oyedele, 2010). This degradation has brought about the imminent global warming due to ozone layer depletion, loss of fauna and biodiversity due to deforestation and pollution. Of greater concern than other issues is climate change and global warming because of their effects on the environment.

The climate is a complex, interactive system consisting of the atmosphere, land surface, snow and ice, oceans and other bodies of water and living things, the atmospheric component of the climate system most obviously characterises climate (Le Treut, Somerville, Cubasch, Ding, Mauritzen, Mokkssit et al 2007, p96). Climate is often expressed as the average weather and is usually described in terms of the mean and variability of temperature, precipitation and wind over a period of time.

Change, the only permanent phenomenon has finally hit our environment. The climate has changed; it will continue to change for the good of man or for his woes. This paper therefore is to examine the phenomenon called climate change, its meaning, history as well as manifestations and its implications to Africa.

Climate is central to most of human endeavour and therefore cannot be ignored just as architectural and engineering professionals need a deep knowledge of climate to proffer good designs for human environment so also do farmers need climate information for a successful cropping. Aviation experts' reference climate and its daily occurrence –weather, as they reference some deities. One can safely say that the noises being made about climate change is therefore justified. Crop failure, a bye-product of climate change is too threatening to be contemplated. The current report of food shortage in the world is not unconnected with climate change.

II. MEANING AND HISTORY OF CLIMATE CHANGE

Climate change or global warming refers to a measureable increase in the average temperature of the earth's atmosphere, oceans, and landmasses. Scientists believes earth is currently facing a period of rapid warming brought on by rising levels of heat-trapping gases, known as greenhouse gases, in the atmosphere(Encarta, 2005). According to UN Convention 2007, Climate change means a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time period. The term Climate Change implies a significant change from one climatic condition to another including changes in temperature, precipitations, wind and humidity. Because it affects other climate patterns, the aspect of climate that receives the most attention from scientists and policy makers is that of global temperature change (Global Climate Change: Resources for Environmental Literacy, 2007)

The global climate is warming, climatic zones are shifting; glaciers are stirring-up while the sea level is rising. These are not hypothetical issues or scientific fictions, these changes and other episodes are factual. Climate is defined as the average weather or regular variation in weather of particular region over a given period of time that is not less than 10 years. Long term alteration in global weather patterns, especially increase in temperature and stormy activity, regarded as a potential consequence of greenhouse effect is referred to as climate change. The atmosphere serve as a shield of life and the built environment, protecting us from ultraviolet rays and other harmful objects in orbit that infiltrate into the atmosphere from space. Global warming or climate change is measurable increase in the average temperature of earth's atmosphere, oceans and landmasses. It is a scientific consensus that the earth is currently facing a period of rapid warming brought on by rising levels of heat-trapping gases, in the atmosphere (Mastrandrea and Schneider, 2009). The fact that heat-trapping gases have been accumulating in the atmosphere is well established. Since the mid-19th century, the quantum of atmospheric carbon dioxide increased by about 25%. Recent investigations unveil that the atmospheric burden of greenhouse gases other than carbon dioxide, such as methane,

Nitrous oxide (N2O) and Chlorofluorocarbons (CFC's) is also growing at an alarming rate (Onuigbo, 2004).

Historically, an interglacial period began about 10,000 years ago, when the last ice age came to an end. Prior to that ice age, an interglacial periods, greenhouse gases such as carbon dioxide and methane naturally increase in the atmosphere from increased plant and animal life. But since the year 1750 greenhouse gases have increased dramatically to levels not seen in hundreds of thousands of years, due to the rapid growth of human population combined with developments in technology and agriculture. Human activities now are a powerful factor influencing earth's dynamic climate.

However, there is undeniable evidence that global temperature are increasing, based on direct temperature measurements and observations of other impacts such as melting glaciers and polar ice, rising sea level, and changes in the lifecycles of plants and animals. In fact, there is overwhelming evidence that greenhouse gas emissions from human activities are the main cause of the warming. Greenhouse gases retain the radiant energy (heat) provided to earth by the sun in a process known as greenhouse effect. Greenhouse gases occur naturally, and without them the planet would be too cold to sustain life as we know it. Since the beginning of the Industrial Revolution in the mid-1700s, human activities have added more of these gases into the atmosphere. For example, levels of carbon dioxide, a powerful greenhouse gas, have risen by 35% since 1750, largely from the burning of fossil fuel such as coal, oil, and natural gas. With more greenhouse gases in the mix, the atmosphere acts like a thickening blanket traps more heat (Mastrandrea and Schneider, 2009).

2.1 CLIMATE CHANGE MANIFESTATIONS

2.1.1 Rise in Temperature: The first noticed change which gave rise to Global warning which is now seen as the Siamese twin of climate change is rise in temperature. In some literature climate is rise in temperature. Also climate change and Global warning are treated as one and the same thing. "we are facing a convergence of the most serious crisis in the history of the planet-Global warming and climate change threatens the survival of the planet".

2.1.2 Extreme Weather: Floods and drought South Western Nigeria of 1980s and hurricane Katrina in New Orleans, Louisiana of 2005 are two quick examples to help us understand the concept of extreme weather that generates floods. Tsunami is flood on a very high scale that destroys life and property the tsunami of Dec 26, 2004 in Sumatra is a case in point.

Myanmar (Burma) recently experienced extreme weather that brought a devastating flood. More than 100,000 people were reported dead. Drought as a manifestation of climate change is being experienced here at home (Africa) where the desert is said to be advancing at 20m per year.

The definite outcome of this is destruction of arable farming, just as we experience flooding and advancing desert here do also other parts of the word are experience one form of extreme weather or the other the Arctic and Antarctic regions are experiencing thawing of ice which is causing flooding in some parts

2.1.3 Rise in Sea Level: the thawing of is ice as noted above causes coastal flooding as is being witnessed in Lagos-Nigeria yearly at the local level yearly flooding puts a strain on the budget of Lagos state and Federal government. Massive protective works require massive injection of funds this means other badly needed services such as education, health, housing and transportation may suffer.

2.2 CAUSES OF CLIMATE CHANGE

Climate change is made possible by the increase in the atmosphere concentration of Green House Gases (GHG) such as Carbon (IV) Oxide (Co2), Nitrous Oxide (No2), Methane (CH4), Hydrofluorocarbon (HFC), Perfluorocarbon (PFC) and Sulfurhexaflouride (SF6). All these gases absorb terrestrial infrared radiations (Oyebanjo, 2010). Infrared radiation from the high temperature sun is absorbed by the earth and some emitted in form of heat to warm up the earth to the suitable temperature required by the earth. With increasing concentration of GHG in the atmosphere the heat emitted into the atmosphere is re-absorbed and re-emitted to the earth. This tends to increase the average temperature on the earth's surface above tolerance levels. Further temperature increase is caused by some of the Green House Gas especially Chlorofluorocarbons (CFC) combining with ozone (O3) to delete the ozone layer in the atmosphere. Ozone presence in the atmosphere keeps about 99% of the solar harmful ultraviolet radiation giving off by the sun from the earth's surface (Ahmed, 2006).

Intergovernmental panel on climate change 1992 asserted that most of the increase levels of greenhouse gases have been caused by human activities such as burning fossil fuels, use of Chlorofluorocarbons (CFC), agriculture and deforestation.

2.3 CONCEPTS EXPLAINED

2.3.1 Green House Effects

Variations in Orbital Characteristics that is based on Milankovitch theory states that "normal cyclical variations in three of the Earth's orbital characteristics are probably responsible for some past climate change". The basic assumption here is that the cyclic events over a long period vary the amount of solar radiation .There are three phase of the variation namely eccentricity, the precession of the equinox and obliquity of the Earth's axis.

Eccentricity has to do with the control of "the shape of the Earth's orbit around the sun." The earth orbit exhibits two shape-elliptical and circular. A cyclic period of 100,000 years shows the earth's orbit changing from elliptical to being near perfect, circular orbit. What has been observed is that the top of the atmosphere receives more energy during the elliptical period and so "the greater the eccentricity of the orbit, i.e. the more elliptical it is, the greater the variation is solar energy received at the top of the atmosphere between the earth closest (perihelion) and farthest (aphelion) approach to the sun."

The precession of Equinox occurs when the Earth rotates on its axis. It manifests in form of wobbles akin to Grandma's spinning instrument to make thread out of raw cotton. The cobbling effect changes the orbital timing of the equinoxes and solstices. The cycle for this effect i.e. precession of equinox is about 26,000 years. According to Physical Geography.net, the earth is closer now (2015) Jan. perihelion and further away in July (2015) aphelion, but because of the precession, the reverse will be in 13,000 years and the Earth will then be closer to the sun in July. This means, of course that if everything else remains constant, 13,000 years from now seasonal variations in the

Northern Hemisphere should be greater than at present (colder writers and warmer summer) because of the Earth's position to the sun.

The tilt phenomenon exhibits thus - the larger tilt result, the greater variation in seasonal climatic variations. Warmer periods, i.e. summer months are as a result of greater tilts. Additional energy is produced at this period to melt the polar ice.

Colder winters have been known to produce less snow because of lower atmospheric temperatures. The net effect of this that if the warmer summers persist, there is the tendency for the polar glaciers to recede.

While the cause of climatic change discussed so far may appears less known to the lay persons, the issue of carbon dioxide emission is not. Nonetheless, it is this widely known issue that has been trivialized, denied, and ignore to man's peril. And alas, it is an issue within human control for man's benefits.

2.3.2 Atmospheric Carbon-dioxides Variations

The means global temperatures are closely linked to variation in the concentrations of carbon dioxides in the atmosphere. The much talked about greenhouse effect is largely occasioned by the concentration of carbon dioxide in the immediate environment. Perhaps we should discuss the greenhouse concept before proceeding.

The greenhouse is an enclosure i.e. a house is roofed with translucent material that allow light energy to go in thereby generating heat that is trapped to stimulate a tropical climate. The greenhouse came into being as a result of botanists trying to cultivate tropical plant in the temperate regions. If we regard the earth as a house, and the atmosphere as the translucent roof, the phenomenon of trap as occurs in a greenhouse will be easily grasped.

Carbon dioxide is largely responsible for the earth green-house effect. The earth's energy balance is altered when certain gases like methane, water vapour and carbon dioxide absorb long wave radiation emitted from the earth's surface. The long wave re-emitted back to the earth in a see saw manner. When this occurs, the heat energy of the earth's surface is increased. It is said that without this greenhouse effect the temperature of the earth's surface would have been "a cold 180cel-cious rather than the present 150 Celsius." Why then are the hues and cries over the carbon dioxide included greenhouse effect?

2.3.3 Research Revelations

i. Temperature variations are closely correlated to the concentration of carbon dioxide in the atmosphere.

ii. Temperature variations also are related to variations in the solar radiation received by the earth's surface as controlled by Milankovitch cycle.

iii. The past three decades have witnessed concentration of carbon dioxide on the earth's atmosphere.

iv. Human activities like the combustion of fossil fuels, conversion of natural prairie to farmland and deforestation in Africa and South America have caused the release of carbon dioxide into the atmosphere"

2.3.4 Volcanic Eruption and Sulphur-Dioxide

Volcanic eruptions have been observed to have been followed by a short term climate change. The impression was that the volcanic dust was responsible for the cooling by partially blocking the transmission of solar radiation to the earth's surface. This has been found to be false as evidence has shown that most of the dust returns to earth in about six months. Rather it was found out that the volcanic eruptions emit large qualities of sulphur dioxide gas which remain in the atmosphere for as long as three years.

The sulphur dioxide reacts with water vapour in the stratosphere to form "a densely optically brightly haze layer that reduces the atmospheric transmission of some of the sun's in coming radiation. A connection has been observed between the mouth Pinatubo eruption and the global decrease in temperature of 1992 and 1993. Reflection of the sunlight back into space caused the cooling of the earth's surface

2.3.5 Ocean Circulation

Changes in deep ocean circulation have been known to produce certain varieties of weather like El Nino that seems to re-occur every two to six years.

The cold water that sinks at the poles travel through-out the words oceans. It gathers heat, becomes warm and less dense to allow its mix with surface water. The circulation returns to the poles with the warmth. This act warms up the poles making it a little habitable; out a continuous heating up of the poles has its negative effect after all.

III. GENERAL IMPLICATIONS OF GLOBAL WARMING

It is known fact that the global climate has changed significantly in the last one century, the Intergovernmental Panel on Climate Change (IPCC) is an international group of scientists that evaluates scientific and technical information related to climate change and global warming (an increase in earth's temperature). The IPCC identified human activity as the primary cause for global warming. Human activities have produced inadvertent effects on weather and climate. Accordingly, addition of gases such as carbon dioxide and methane to the atmosphere has increased the greenhouse effect and contributed to global warming by raising the mean temperature of the earth by about 0.5^0C (about 0.9^0F) since the beginning of the 20th century. More recently, CFCs which are used as refrigerants and in aerosol propellants have been released into the atmosphere, reducing the amount of ozone worldwide and causing a thinning of the ozone layer. The impending consequences of these changes are vast. Global warming may cause sea-level to rise, and the incidence of skin cancer may increase as a result of the reduction of ozone (IPCC).

Besides, man's aspirations of living close to coastal and beach areas are potentially threatened by climate change. Impacts of climate change are likely to cause conflicts for society, such as where people want to live and where they can live safely. This could negatively impact our ability to continue to develop built environments to support some of our lifestyle aspirations. There is a need to start responding to the impacts of climate change within our built environment. This is required at both the individual building level and also for our neighbourhoods and communities – in the way that they are structured and serviced, allowing for greater resilience to sudden shocks. For example, in an effort to prevent such consequences, production of chlorofluorocarbons has been curtailed and many measures have been suggested to control emissions of greenhouse gases, including the development of more efficient engines and the use

of alternative energy sources such as solar energy and wind energy.

These implications are mentioned below:

i. Rising sea level, leading to more coastal flooding during storms, erosion and permanent inundation.

ii. Increased drought and an increased incidence of wildfires.

iii. Severe stress on many forests, wetlands, alpine regions, and other natural eco-systems. Health as mosquito and other disease carrying spread disease over larger geographic regions.

iv. Disruption of agriculture in some parts of the world due to increase in temperature, water stress, and sea level rise in low lying areas such Mississippi Delta, Lagos and Niger Delta areas of Nigeria.

v. Intensity of hurricanes such as Katrina in New Orleans, the Tsunami and recent flood in Burma.

vi. Destabilization of the Greenland and west Antarctic ice sheets, leading to much greater sea level rise.

vii. Acidification of the world oceans and vastly increase rate of species extinction.

viii. Eviction of people from their homelands.

IV. IMPLICATIONS OF GLOBAL WARMING FOR AFRICA

The topical issue now is the alarm raised on food shortage, Africa indeed is in trouble. Africa has been a continent of drought in parts for decades. Climate change may in fact be the last straw that will break the camel's back. This is so because food supplement from other lands may not be readily available any more due to global shortage. Can Africa indeed survive the onslaught of global food shortage and global warming?

The answer to the above question is that because of its poverty, it is dependent on locally grown food, recurrent droughts and floods, the civil unrest and political instability of failed states and diseases like malaria and AIDS pandemic, parts of Africa are in crisis. Global warning will make coping with these problems worse in some causes much worse.

Since Africa largely depends on rain fed agriculture for her existence, any disruption in the amount of rainfall available to Africa will definitely spell doom. The reality though scary, is that global warning (climate change) has been projected to reduce rainfall in even areas now known as water-scare environment by between 5% - 20%.

Countries like Niger, Chad, Sudan, and Burkina Faso are definitely endangered already. The situation will be exacerbated if further reductions in these countries are experienced.

Countries like Nigeria, Cameroon, and Ghana are already bearing a lot of burden on behalf of the sub-Sahara countries. This writer believes that until a country like Nigeria includes Chad, Niger, and Burkina Faso in her food budge and production, it will continue to experience the hunger-induced influx of citizen of the named countries into Nigeria. Now that food scarcity is predicate for the next decade, how many of these 'aliens' will Nigeria support. The xenophobia going on in South Africa has to do with the matter of the stomach. South Africa believes that foreigners especially Zimbabweans who flee their country to avoid hunger are dislocating them from their own livelihood. Africa has been described as a top notcher among the failed state of the world.

While parts of Africa are thriving, Africa is the world poorest continent, with 19 out of the world 25 poorest countries located in the continent. Using social, economic political and military indicators, a recent study on "Failed States" has 11 African countries in the top 20. Nearly 200 million Africans are undernourished and one third of Africa children are stunted or underweight. Sub-Sahara Africa has 10% of the world's population, but 24% of the world diseases burden.

Naturalists may attribute this to the God's anger. Even if this is so, the Gods should spare a thought for the hundreds of millions that will be affected if their anger persists. However the scientists using empirical evidence are concerned over the destruction to humans that will occur in Africa if climate change is not mitigated around the world and its effect is let loose on Africa.

Climate change (Global Warming) will affect Africa in the following observed ways: hunger, disease burden, political instability, brain-drain and decimation of populations.

4.1 Hunger: It has already been said that over 90% of agriculture is rain fed with "about 300 million Africa currently living in a water-scare environment" which increase in population could jack-up to 600 million peoples. If global warning persists, crop failure will occur in areas where rainfall diminished. Hunger is the attend-ant result. Many of the country concerned are not economically viable to import food. Foods donors will, reduce in number govern the current schism on food scarcity. The economic melt –down has further compounded the problems of food shortage in the world even in America. African American in Chicago will tell the story better.

4.2 Brain- Drain: Africa is experiencing flight of her well trained citizens to countries of Europe and America where life is more comfortable. For now it's because of jobs that are not available locally, every day, necessities of life like electricity, water good hospital, socio-physical security and adventure. When food security is added to already tense situations in some African countries, the rate of emigration of well-trained manpower can be imagined.

"A prime example of how climate change will impact human health is malaria. Currently, 360-400 million people live in area with malaria worldwide resulting in over one million deaths each year-with 90% of fatalities occurring in Africa. Ninety percent of malaria victims are children under five. Because climate change will help disease-carrying agent such as mosquitoes move in to area, millions of Africans could be exposed to malaria for the first time. Other vector borne diseases such as dengue fever will also increase. Beside t5hese disease, additional flooding from climate change will also exacerbate health resulting from poor sanitation such as cholera and diarrhoeas' (one of the leading killers of children). Finally climate – exacerbated malnutrition will weaken bodily defence and leave many Africans more susceptible to all types of disease including AIDS".

4.3 Political Instability: Population displacement is a sure recipe for internal and external attrition among people of the world. African cannot be an exception of this rule. It is population saying that a hunger man is an angry man. Food scarcity caused by crop failure which re due to global warning will heart up the polity. Some government have been toppled or voted out because of rise in price of bread and corn.

4.4 Decimation of Populations: The current examples are Burma volcano, hurricane Katrina in New Orleans, and the Tsunami of 2004, Rwanda presents an example for Africa. The 1994 genocide in Rwanda was preceded by an unusual drought that decreases crop production, as well as an influx of refugees escaping Burundi after a coup; food prices soared and famine ensured. Several months later the genocide began.

There are towns and villages in some coastal areas of Africa that are prone to flood. If global warning persists, such cities as Lagos, Port Harcourt in Nigeria and other such low lying cities in Africa may be in danger.

Inland flash flooding due to heavy rains is also projected an increase in intensity and occurrences. The 1997-98 floods in Kenya resulted in $1billion in damage, and the floods in Mozambique in 2000 resulted in 2million people being displaced with 350,000 jobs lost impacting the livelihood of up to 1.5 million people.

V. RECOMMENDATIONS

The following strategies and recommendations are made to lessen the impact of climate change in the African continent:

i. Have bilateral relations with developed countries in terms of capacity building programmes, development of awareness programmes, information techniques and technology, offer solutions that will minimize climate change as well as monitoring mechanisms.
ii. Legislation, Policy guidelines need to be enacted by the various countries legislative bodies. Strategy and policy on sustainable development, planning, energy, waste water, food, landscape character, biodiversity and transportation including aviation need to be made and conflicts avoided.
iii. All tiers of government in African countries should develop, regulate and enforce climate change strategies and action plans implementation strategies.
iv. There is need for close collaboration between public and private sector on barriers of sustainable development as well as research and development to simulate the development of broad portfolio of appropriate response to the challenges posed by climate change and sustainable technologies and practices.
v. There is need to conduct a stock-taking of existing and proposed climate change data, studies and resources relevant to African environment.
vi. The countries need to undertake a more detailed analysis of key environmental sectors and geographical locations at risk from climate change, link it to a feasibility study of adaptation options.
vii. Support initiatives to build capacity in climate change skills within public and private institutions in the continent.

VI. CONCLUSION

Africa is involved in stimulating climate change through bush burning, over grazing, logging for fire wood and furniture, Co2 emission from company and private electronic generators, CFC emitting equipment like refrigerators, air conditioners and perfumeries. It is unacceptable to ignore problems caused by climate change as being felt in all areas of endeavour. A holistic approach is required to appropriately respond to challenges posed by climate change and the creation of sustainable environment for development. Right policies, processes and decisions should be put in place in Africa now to create opportunities for sustainable development.

Fighting climate change by reducing greenhouse gas emissions (GHG) will not suffice alone. To ensure that the environmental and social challenges of global warming are overcome, it is also crucial for communities to adapt to climate change. Adaptation measures for urban areas are being emphasised for Africa, since compared to mitigation it is shorter term and less expensive and cost effective to implement, does not require intensive data which Africa lacks and can be incorporated into policies and plans that will ensure timely adaptation.

There is need to develop a robust set of principles, tools and data to underpin the evolution of Africa's environment to one that is well designed, high quality, inclusive, low carbon and sustainable. Above all, there is an urgent need to translate awareness of climate change impacts into tangible adaptation measures at all levels of governance in the African countries.

REFERENCES

[1] Ahmed, I. (2010). An Appraisal of Ozone Depletion and its Impact on Health and Environment. A Paper Presented at the First National Conference of Institute of Environmental Studies, Kwara State Polytechnic Ilorin, 15th – 16th November, 2006.

[2] IPCC (2007). Climate Change 2007: the IPPC Fourth Assessment Report. Accessed from http://www.ipcc.ch/publications_and_data/publications_and_data_reports.shtml£I.

[3] Le Treut, H. Somerville, R., Cubasch, U., Ding, Y., Mauritzen, C., Mokkssit, A., Peterson, T., and Prather, M. (2007). Historical Overview of Climate Change; in Climate Change 2007: The Physical Science Basis, Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change {Solomon, S.D, Qin, M, Manning, Z., Chen, M., Marquis, K.B, Averyt, M., Tignor, and Miller, H.L. (eds.)}. Cambridge University Press, United Kingdom.

[4] Mastrandrea, M, and Schneider, P. (2009). Global Warming: Microsoft Encarta (DVD). Microsoft Corporation, Redmond, WA, United States of America.

[5] Mills, G, (2006). Progress Towards Sustainable Settlements: A Role for Urban Climatology. Theoretical and Applied Climatology, 84, p69=76.

[6] Oak, M. (2010). Global Warming and Deforestation. Accessed on 20th July, 2015 from www.facethefuture.com

[7] Obot, E. A. (2010). Climate Change: What Nigeria Must Do. Accessed on 20th July, 2015 from http://www.nigerianbestforum.com/blog/? p33

[8] Onuigbo, I.C (2004). Population Pressure and Climate Change: Realities and Dangers. In A.O Ibitoye (eds.), Scientific and Environmental Issues in Population, Environment and Sustainable Development, 118-121.

[9] Onyenechere, P. O. (2010). Climate Change and Spatial Planning Concerns in Nigeria: Remedial Measures for More Effective Response. Journal of Human Ecology, 32 (3), 137-148.

[10] Oyedele, O. (2010). Global Warming: Is It Bad as It's Made to Be? Accessed on 3rd August, 2015 from www.helium.com/items-global-warming-i-it-as-bad-as-it-is-made-out-to-be.

[11] Porbeni, C.V (2004). The Impact of Global Warming on High Latitude and Attitudes. Journal of Arid Environment, 3(2): 75-88.

[12] Putatunda, R. (2010). Causes and Effects of Deforestation. Accessed on 20th July, 2015 from www.facethefuture.com

[13] Souch, C. and Grimmond, S. (2006). Applied Climatology: Urban Climate. Progress in Physical Geography, 30, p270-279.

[14] USDA. (2007). Commodity Intelligence Report: Brazil Soyabean Update, March 30, 2007. United States Development Agency, Washington DC, USA.

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Creating a unified online identity to provide a single seamless presence on the internet

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Abstract- Online presence has become an important part of everyone's life. This paper provides an overview of the technologies used in creating a portal to achieve a unified online identity via integrating user identities across different networks. It mainly focuses on the MVC architecture of the portal, the bcrypt algorithm for a secure log in, OpenID and OAuth implementations for authentication and Oliver's text similarity algorithm for an efficient search. It also describes the scope for further improvements and possible future developments in achieving a seamless unique online presence across the internet.

Index Terms- unique identity, online presense, MVC, bcrypt, OpenID, OAuth, text similarity, UID, UOI

I. Introduction

Internet identity (sometimes also referred as "internet persona") is a social identity that an Internet user establishes in web portals and online communities. It can also be considered as an actively constructed presentation of oneself. Although some people prefer to use their real names online, some Internet users prefer to be anonymous, identifying themselves by means of pseudonyms, which reveal varying amounts of personally identifiable information. An online identity may even be determined by a user's relationship to a certain online social group they are a part of. Some may even prefer to be deceptive about their identity.

In some online contexts, including internet forums, chat rooms, and massively multiplayer online role-playing games (MMORPGs), users can represent themselves visually, by choosing an avatar, an icon-sized graphic image. These avatars are one of ways the users express their online identity. As other users interact with an established online identity, it acquires a reputation, which enables them to decide whether the identity is worthy of trust. [1] Some websites also use the user's IP address to track their online identities using methods such as tracking cookies.

So this project aims at providing a central web portal for maintaining every users list on online identities hence aiding searching of known people on new networks. This helps in a multitude of tasks. It assists users by providing a facility to search for people with similar interests. It also caters to emerging or lesser known websites, not just the famous ones.

II. Need of a Unified Online Identity

Almost everyone has access to the internet in today's rapidly advancing age. And most people who use the internet are sure to have an account on more than one social/professional networking sites or other networks. Even though the person accessing these accounts many be one, he is essentially a different entity on every site. This gives way to many problems.

Primarily, from a layman's point of view, it is increasingly difficult to find the person you want on a website primarily due to numerous repeated names. For instance, from a list of John Doe's it becomes impossible to figure out who is the one being searched for.

Also, if a person is not present on a specific network, it opens an opportunity for a malicious person to impersonate him on the same. So it becomes imperative to know which accounts are the real accounts of one's friends on different networks. In this way one can protect oneself from falling prey to identity thefts.

Furthermore, in the current scenario, a few sites like Google and Microsoft provide integration with other networks. For example, Google integrates the accounts for YouTube, Gmail, Google+, Google Drive etc. into one. But the scope of this is very limited. Like in the case of Google, the integration is limited to Google-owned networks. In the case of Microsoft, a little wider range is allowed as it allows integration with a few other networks as well. But it caters only to big, well known networks.

So the need arises for a web portal to do the work of a central repository where one can just list all his/her online identities. This facilitates one's searches for one's friends. It also lets him/her get searched and found by people with common interests or even organizations with specific needs.

III. System Architecture

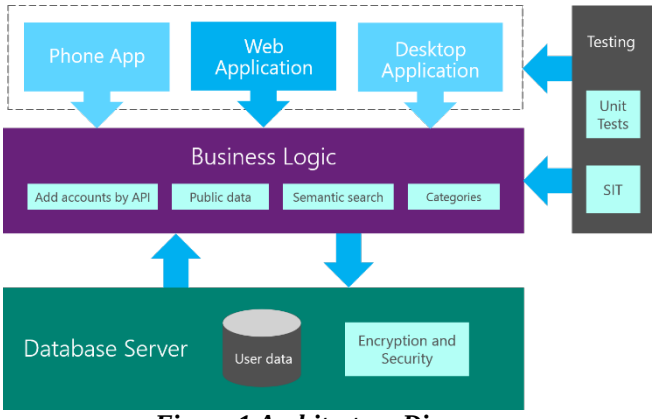

Figure 1.Architecture Diagram

MVC

The basic structure of MVC is as follows:

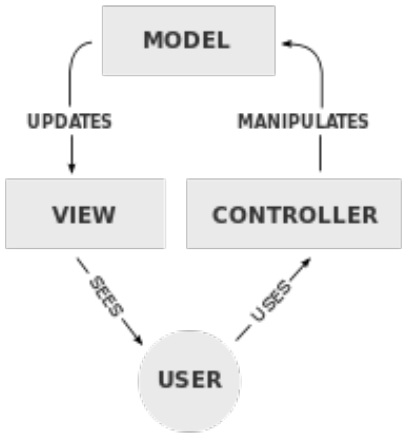

Figure 2.Model-View-Controller

The framework divides the application into three components. It also defines the interactions that take place between them.

- A controller can send commands to the model to update the model's state (e.g., changing contents of a document). It can also send commands to its associated view(s) to change the view's presentation of the model (e.g., by scrolling the document).
- A model can notify its associated view(s) and controller(s) its state changes. This notification allows the views to update the output, and the controllers to change the set of commands. A passive implementation of MVC may omit these notifications, because the application may not require them and/or the software platform may not support them.
- A view requests information from the model that it needs for representing the output data to the user.

Codeigniter framework

The framework being used for the implementation of the MVC architecture is the PHP-based framework, CodeIgniter.

CodeIgniter, an open source rapid development web application framework, is a comprehensive toolkit for building dynamic websites with PHP.

It is an extremely light weight MVC-based system which features Active Record Database Support, Form and Data Validation, Security and XSS Filtering, Session Management, Email Sending Helper Class, Image Manipulation Libraries, FTP Helper Class, Localization, Pagination, Data Encryption, Benchmarking, Full Page Caching, Error Logging, Application Profiling, XML-RPC Library, Unit Testing, Flexible URI Routing and support for Hooks and Class Extensions.
The portal is built on CodeIgniter version 2.1.4.

IV. SECURITY

Bcrypt

"Bcrypt", in simple terms, is a key derivation function for passwords. Based on the Blowfish cipher, it was designed by Niels Provos and David Mazières, and presented at USENIX in 1999. [2] Besides incorporating a salt to protect against rainbow table attacks, bcrypt is also an adaptive function: the iteration count can be increased to make it slower, so it remains resistant to brute-force search attacks even with the increasing computation power over time.

Blowfish is notable among block ciphers for its expensive key setup phase. It starts off with subkeys in a standard state, then uses this state to perform a block encryption using part of the key, and uses the result of that encryption (which is a hashing) to replace some of the subkeys. Then it uses this modified state to encrypt another part of the key, and uses the result to replace more of the subkeys. It proceeds in this manner, using a progressively modified state to hash the key and replace bits of state, until all subkeys have been set.

Provos and Mazières took advantage of this approach, and took it further. They developed a new key setup algorithm for Blowfish, and dubbed the resulting cipher "Eksblowfish" ("Expensive Key Schedule Blowfish"). The key setup begins with a modified form of the standard Blowfish key setup, in which both the salt and password are used to set all subkeys. There are then a number of rounds. In each round, the standard Blowfish keying algorithm is applied, using alternately the salt and the password as the key. Each round starts with the subkey state from the previous round. Cryptotheoretically, this is no stronger than the standard Blowfish key schedule. But, as the number of rekeying rounds is configurable; this process can therefore be made arbitrarily slow, which helps deter brute-force attacks upon the hash or the salt.

The iteration count is a 2^n, where 'n' is the power of two, which is an input to the algorithm. The number is encoded in the textual result.

The bcrypt algorithm depends heavily on its "Eksblowfish" key setup algorithm, which runs as follows:

EksBlowfishSetup(*cost*, *salt*, *key*)
state ← InitState()
state ← ExpandKey(*state*, *salt*, *key*)
repeat (2^{cost})
state ← ExpandKey(state, 0, key)
state ← ExpandKey(state, 0, salt)
return *state*

The full bcrypt algorithm utilizes these functions to compute a hash as follows:
bcrypt(*cost*, *salt*, *input*)
state⟵ EksBlowfishSetup(*cost*, *salt*, *input*)
ctext⟵ "OrpheanBeholderScryDoubt" //three 64-bit blocks
repeat (64)
ctext⟵ EncryptECB(*state*, *ctext*) //encrypt using standard Blowfish in ECB mode
return Concatenate(*cost*, *salt*, *ctext*)

Authentication and Authorization

Majority of the API's provided by different networks to authenticate the user and authorize third-parties to access user details use two mechanisms: OpenID and OAuth. These standards are explained in detail below:

OpenID

OpenID is an open standard that allows users to be authenticated by certain co-operating sites (known as Relying Parties) using a third party service. This eliminates the need for webmasters to provide their own ad hoc systems and allows users to consolidate their digital identities together. [3]

OAuth

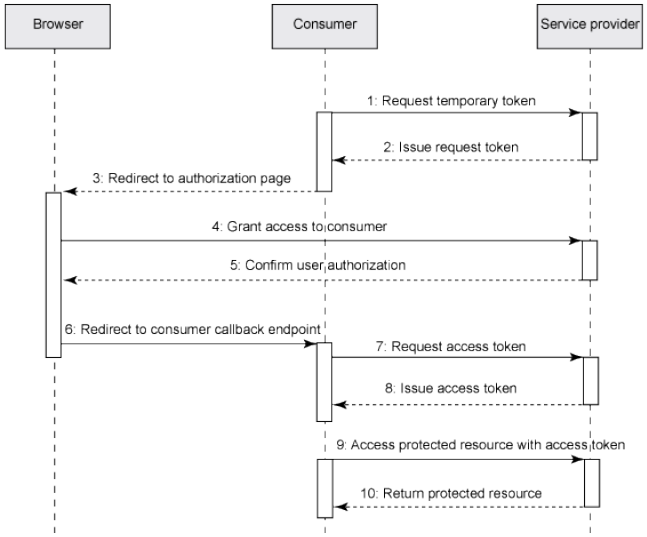

Figure 3.Three-Legged OAuth Dance

OAuth is an open standard for authorization. OAuth provides a method for clients to access server resources on behalf of a resource owner (such as a different client or an end-user). Also, it provides a process for end-users to authorize third-party access to their server resources without sharing their credentials, typically a username and password pair, using user-agent redirections.

OAuth is a service that is complementary to, and therefore distinct from, OpenID.

OpenID vs. pseudo-authentication using OAuth

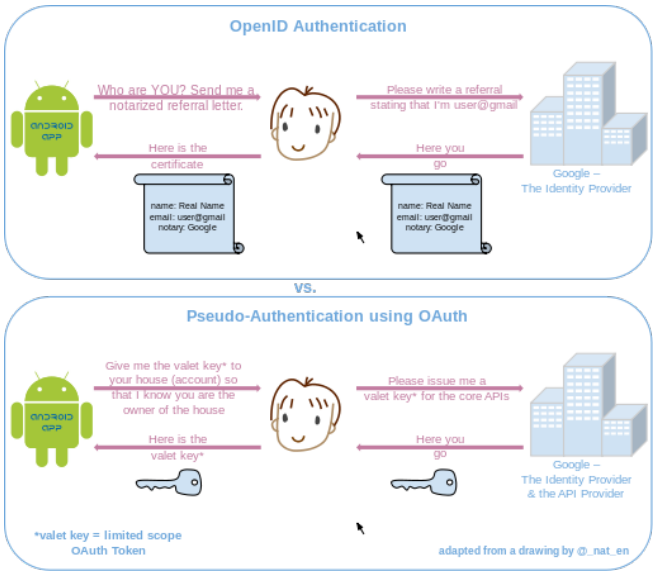

Figure 4.OpenID vs. Pseudo-Authentication using OAuth

The following figure highlights the differences between using OpenID vs. OAuth for authentication. Note that with OpenID, the process starts with the application asking the user for their identity (usually an OpenID URI), whereas in the case of OAuth, the application directly requests a limited access OAuth Token (a valet key) to access the APIs on the user's behalf. If the user can grant that access, the application can retrieve the unique identifier for establishing the identity using the APIs.

V. SEARCH

Introduction

Search is an important functionality provided to the user, which facilitates him to search his friends on the web.

Text Similarity
Introduction

Text similarity has two basic stages. Firstly, feature strings (called "fingerprints") are extracted from each text in different ways. Secondly, the similarity of a text pair is measured by comparing the fingerprints of the texts, using different models.

The five similarity models[5] are:

1. Ferret model [5, 6, 7], which looks for lexical matches. Each text is converted to a set of 3 word trigrams. Then, the matching trigrams are found. Though there are usually some matches, above a certain threshold the texts are similar. The comparison is based on the Jaccard coefficient value.
2. String matching model, which counts those words/word sequences that occur in both texts (omitting stop words) and calculates the Jaccard coefficient value to determine the similarity between two texts.
3. Meaning matching model, which is developed from the string matching model. The difference is that meanings rather than lexical strings are matched between texts.

The meanings of a string include the synonyms/hypernyms of the whole string as well as that of each word in the string. WordNet is used to look up word meanings.

4. Semantic sequence kin model (SSK), which extracts semantic sequences from a text as its feature strings, and then takes into account both word and word position when 2 semantic sequences are compared.
5. Common semantic sequence model (CSSM), which is similar to semantic sequence kin model, but uses another formula to calculate similarity of semantic sequences. In this model, the word position is not considered.

Out of these five similarity models, we have used the "string-matching model". This model has been implemnted by an in-built PHP function similar_text(). This function for text similarity implements Oliver[1993] algorithm[4]. It compares the two strings, one of them is entered by user and the other is database entry. This function returns a value known as the "similarity ratio" based on number of characters common in both the strings. If the similarity ratio is above the set threshold, then the link to the profile is stored in an array and after completition of search is shown as an output to the user. This implementation does not use a stack as in Oliver's pseudo code, but recursive calls which may speed up the whole process. Also, note that the complexity of this algorithm is O(N**3) where N is the length of the longest string. The user can view the public profile of searched individual and can find his links on other website. Hence the objective is met.

Calculation of similarity_ratio:

Similarity ratio = sim * 200.0 / (len_t1 + len_t2)

where, sim-Number of similar characters, len_t1 and len_t2 are the lengths of the strings to be compared.

Future Development

There is a scope of improvement in the search functionality. The queries can first check the cache and if a hit is found there then return the link to the profile from there itself. It saves time as the need to scan the entire database is not required. The caching functionality is available in PHP and the decision can be made to cache the type of queries. This reduces the burden on system and reduces the search time.

VI. Future Development

Semantic search and Natural Language Processing

There are three methods to implement semantic search as follows:

- String matching method

The first step identifies locally frequent words; the second step extracts phrases consisting of adjacent frequent words and the third step looks for matches. A semantic sequence can be a phrase or a single word. The method is implemented by the Java class StringMatchBasedSimilar with the class SemSeqBasedTopicStrings and the class SameWord SS.

- Semantic Sequence Kin method (SSK)

Like string matching method for semantic sequences, the first step is to identify locally frequent words. These frequent words are compared for the two texts. The metric used also takes into account the distance between frequent words. The method is implemented by the class SSK along with the same class SameWord SS.

- Common Semantic Sequence Model (CSSM)

Similar to the Semantic Sequence Kin method (SSK), but employing a different formula to measure the similarity score. The method is implemented by the class CSSM with the class SameWord SS.

Web service

The project develops a centralized repository of all the online identities of a specific user. This data is very useful for many purposes. It can be used by search engines to improve the validity of the results. It can also be used by existing networks to identify if an account is genuine or not. So we can write a web service that makes this data available to any consumer. This API could return the online identities of a user to authorized applications.

Use Crawlers

Crawlers can be used to authenticate a users profile on networks that do not use OpenID or OAuth. The crawler can go to the network and verify from the web page whether it belongs to the same user by matching details.

They can be also be used to suggest a user his identities on other networks. This can be done by searching other networks with the known usernames.

VII. Conclusion

The portal helps unify all the internet identities into a single online presence. The web portal does the work of a central repository where one can just list all his online identities. It makes it easier for his/her friends and acquaintances to find him/her on any website. It also lets him/her get searched and found by people with common interests or even organizations with specific needs. It also prevents malicious people to impersonate users who are not present on a particular network. In this way, the portal helps protect users from falling prey to identity thefts.

Furthermore, it provides a complete solution to integrate a multitude of networks unlike the current integration options provided by tech giants like Google and Microsoft, which mostly focus on integration of their own services.

References

[1] Nabeth, Thierry (26 May 2006). Understanding the Identity Concept in the Context of Digital Social Environments (PDF). "D2.2: Set of use cases and scenarios". FIDIS Deliverables(FIDIS) 2 (2): 74–91.

[2] Provos, Niels; Talan Jason Sutton 2012 (1999). "A Future-Adaptable Password Scheme". Proceedings of 1999 USENIX Annual Technical Conference: 81–92.

[3] Eldon, Eric (2009-04-14). "Single sign-on service OpenID getting more usage". venturebeat.com. Retrieved 2009-04-25.

[4] Ian Oliver; "Programming Classics: Implementing the World's Best Algorithms" (01 April 1994) (Pearson Education – ISBN 13: 9780131004139)

[5] JunPeng Bao; "Comparing Different Text Similarity Methods" http://homepages.stca.herts.ac.uk/~comqcml//TR2-v6.pdf

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Utilization Methods of Polymer Waste in Geotechnical Applications

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Abstract- In this study, the enhancement procedures over the pre-existing problem is studied that is solid waste (MSW) which is increases increasing. In Future, when we don't even have land to dispose or landfill till we find a way. Therefore this study can be necessitate to study the properties, major issues, harmful effect on environment ecology and utilization. Therefore, the present study will focus based on literature work related to the field of soil improvement and solid waste related problems. Also Plastic waste (polymer) is more suitable for geotechnical purposes. The various plastic waste with different properties may also be used for different suggested methods. The present study also discusses the methods to be adopted for soil enhancement with the various plastic waste.

Index Terms- Municipal Solid waste, Permeability, HDPE, LDPE, PET, PP, Polymer waste, Utilization, Hazardous, Environment.

I. INTRODUCTION

The importance of the soil comes in engineer's mind, whenever we got to find the requirement of the material that could do sustain or hold every structure into its own place. The object of this paper is to reinforce the soil at various places like roads, foundation, embankments, hilly areas etc. wherever the soil reinforcement is needed. The basic approach in this paper is to figure out the problems of soil and the failure. How the use of additive in soil will be stabilize effectively. For stabilization we have various methods and materials but they seems to be uneconomical for the constructors. Which leads us to go with the alternative methods and materials.

Solid waste is another major problem of whole world to consider it seriously. According to the data published by Environmental Protection Agency US 1992[26]. The total solid waste produced is 14.4 million tons and covers 20% of the area by the volume of available area .Approx. 2.2million tons HDPE is produced every year and only 7% is recycled .The Production municipal solid waste data estimated in India up to 2000 is 39 million tons per year and it will be reached 56 million tons at end of the year 2010.The typical percentage of plastics waste in Municipal solid waste is 1%. The main reason cited behind the Mumbai flood in (2005) was choking of drains by plastic waste thrown everywhere carelessly.

After implication of Solid waste management system there's still solid effecting the environment and covers large land area to dump. The solution of this indiscriminately thrown solid waste is to utilize it intelligently use for engineering purposes.

The other problems discussed are as follows:

a) To analyze the different types of solid wastes, which will be the major problems for the future generation to save environment, land areas and to save ground water from open dumping waste land.
b) We transport soil from one place to other by extract soil and fill it in elsewhere. This will harm the surface layer soil which is best suited for farming having nurturing minerals waste which avoided by replacing the material.
c) To analysis the problem of solid waste management that may be really utilized for recycling and re-utilization processes.

II. PROBLEMS IN USE OF REGULAR SOIL

The regular soil have various weaknesses for different kinds of geotechnical uses in civil engineering .So here we discuss about some of the problems with the soil.

a) Firstly, soil is basically strong in compression than in tension or in horizontal phase. It has no tension so this emerges its negative point.
b) Soil is eroded by environmental effect on it such as wind, heat, water, and rain or runoff water by living animals etc. and weaken the soil mass till failure.
c) Poorly graded soil in environment is easily failed by the conditions of its physical and chemical properties like grain size, chemical composition, shear strength etc.
d) The natural soil directly cannot be used in civil engineering purposes unless improvement is to be made.
e) It may be behave like liquid in vibration or in seismic condition.

III. LITERATURE REVIEW

Jegede (2000) has shown that more and more building and highway are failed or collapsed due to un-appropriate property of soil to sustain. It's dangerous for any structure to have that concludes that we have to make soil somehow reliable to use in construction. And this actually concerns with mixing of some kind of external material (additives) in soil to increase in these following properties and we called stabilization of soil. Moisture content, bearing capacity, particle size, consistency limits, compressibility, swelling potential and volume change etc.

To alter and enhance the soil properties by *Amadi(2010)* studies with chemically active additive to use in soil to enhance

property like Portland cement , lime , sawdust ash , rise husk ash etc. or sometime the collection of these material . As these material got in use, the prices escalated higher with time. It's uneconomically to use i.e lime and cement in improvement of soil according to *Neville (2000).*

Therefore it's needed to redirect our view to change the additives to improve the soil by different kinds of solid waste (MSW). Due to worthlessness of these materials, these may be used for construction as a cheap material.

IV. PREVIOUS STUDIES AND INVESTIGATION

Bauer and Oancea (1996) – By his tri-axial test result show that to measure stiffness called secant modulus of reinforced soil the initial vertical strain is 2 % decreased with increasing polypropylene fiber 0.5% but there's not enough decrement to notice fairly beyond the vertical strain .

Feitag (1986)-Notices that randomly distributed fiber could result better increment in stiffness when mixing with compacted fine grained soil.

Consoli et al. (1998) - Experiment on tri-axial comparison test fiber reinforced dressed the stiffness at a level.

Gray and Al-Refeai (1986) - Conduct tri-axial compression test and found that randomly discrete fiber in Sand resulted in a loss of compressive stiffness at low strains (lower than 1 percent).

Gray and Ohashi (1983) - According to his result that it comes out there is an increased in shear strength and leveled the post peak shear resistance and no increase in stiffness in fiber sand composite.

Benson and Khire (1994)- In his study they uses cut pieces of waste milk jugs and showed that there is an increment in CBR value by 5 and secant modulus also improved .

Bueno (1997) - In his laboratory test study on mechanically stabilized soil with thin plastic strips of different length (Aspect Ratio) and content (by weight) will enhanced the bearing capacity.

Michalowski and Zhao (1996) - By his tri-axial test result steel fiber led increased the stiffness of soil prior to the failure.

Yetmoglu and salbas (2003) - this study said that there's no increase in stiffness with consideration of the randomly distributed fiber.

Kumar (1999) - In his Investigation of laboratory on silty soil and pond ash specimen with randomly distributed polyester fiber found that it'll increased the CBR value and ductility.

Venkatappa Rao and Dutta (2004)- Papered in his theoretical analysis of tri-axial test result to found the improvement in bearing capacity of footing in reinforced sand bed resting on clay soil by waste plastic strips and get , it was improved.

Yetimoglu et al. (2005)- Conducted CBR test on sand fill reinforced with randomly distributed discrete fiber overlying soft clay and test result that's its increased the piston load penetration curve no satisfactory effect by fiber reinforcement .

Datir et al. (1997)- Investigate that the effect of polypropylene fiber on tensile strength of cohesive soil stabilized with lime and fly ash with the ratio of 1:2 and found that there is 25% reduction in stabilize soil when it did with fly ash and lime .But 251% of increase in tensile strength when stabilize with 2% of polypropylene fiber .

Kumar et al. (2007) - Made an experimental study programmed and find the effect of polyester fiber inclusion and lime stabilization as the geotechnical properties of expensive soil by mixing and 28 days of curing of it and got it increased.

Huntohar (2004)- He made program to study and investigate the strength of stabilized clay soil reinforced with randomly distributed discrete plastic waste fiber by curing out (UCT) unconfined compression test for strength and tensile split strength test .

V. SOLID WASTE

Solid waste is a big task to handle by engineers planners groups of society. A huge amount of waste need to be utilize by different methods and ways cause its generated in large amount as it seems by collected data around world . As we seen in the Figure-1

Fig-1 Open Dumped Solid waste [Behind KNIT campus]

A. TYPES OF WASTE

Sources of Solid Waste

Sources of solid waste are generated from various places such as Municipal services, treatment plants and special category.

a) Municipal solid waste concluded residential, commercial and institutional areas, construction and demolition waste. And the term is mainly used as a solid waste.
b) Solid waste generation in continuous action which increasing day per day and proportional to the population and lifestyle of the people.
c) In India, 150 times of body weight of per person solid waste is generate in his life time. In Delhi about 6000 tons of MSW are generated every day.

The detail version of sources and types of soil combined is giving as below. This configures the sources, places of generation and type of solid waste.

B. IMPACT ON ENVIRONMENT BY SOLID WASTE

As we suspect that there are various solid waste dumped on environment which raises harming effect. The answer may be yes, it will harm our life and environment in different ways. Table [1] shows the effect of these waste in different areas of our life.

Table -1 Impact Table in ways

Environme-ntal pollution	Land quality , air and water , poor aesthetics , deterioration high level of noise
Disease	Diarrhea , gastrointestinal disorder , jaundice , dermal disease , cancer
Injury	Pieces of glass, chemically active substance in water.

C. PHYSICAL AND GEOTECHNICAL PROPERTIES OF SOLID WASTE

Solid waste analysis is the priority to figure out how and which kind of waste do we use and will be used in soil enhancement only by the use of various solid waste.[Table-2] So these are the some physical and geotechnical properties of solid waste.

i. Specific weight
ii. Moisture content
iii. Particle size and size distribution
iv. Field capacity
v. Permeability

Chemical Properties of Solid Waste

i. Moisture content –chemically change
ii. Volatile matter
iii. Ash
iv. Fixed carbon
v. Fusing point of it
vi. Calorific value
vii. Percentage of carbon, oxygen, sulphur and ash

Table -2 Composition Municipal Solid Waste in Delhi

Component	Percent fraction
Food	20-30
Paper	3-5
Cardboard	3-4
Plastics	4-6
Textile	0.2-0.5
Rubber	1-2
Leather	0.2-0.5
Yard-waste	20-30
Wood	1-2
Glass	0.2-0.7
Metals	0.2-0.5
Silt/ ash/ dirt	30-40

VI. LITERATURE REVIEW OF SOLID WASTE

In our country the amount of municipal solid waste that was generated every day is about 160,000 Metric tons (MT) .Accordance with the population of cities per capita waste generation varies from 0.2kg to 0.6kg and the analytically probable it will increase 1.33% annually. Solid waste management of India it is estimated that by the end of the year of 2047 the total amount of Municipal solid waste generation will be 260,000 Metric tons , which actually cover the 1400 km2 area equivalent to the city of Delhi. Papered about 4.8 million tons/year waste is recycled and rest 3.2 million tons/year waste remains non-recyclable. This concern with the waste of plastics of different variety and synthetic material. According to a survey 1500 bottles are dumped into garbage every second. PET investigate and said that its one of the most abundant urban solid waste *(de Mello et al .2009).* As we sees and know that all waste is just large loss of raw material land resources. So it could be recycled, recover or re-use in any way. World's annual consumption papered that PET bottles 10 million tons and its increasing 15% BY per year. Its analysis shows that 4-5% post-consumer plastic comes by Municipal solid waste in India and in USA its 6-9%. As per the MSW data shows 4000-5000 tons per day by post-consumer plastic waste generated.

VII. LITERATURE REVIEW OF SOIL STABILIZATION

The artificial traditional admixes in order of high usage

i. Portland cement (cement fly ash)
ii. Lime (lime fly ash)
iii. Fly ash
iv. Fly ash with cement and lime
v. Bitumen and tar
vi. Cement and kiln dust

Here are some previous works done on some of these methods to stabilize soil. But as we aware most of less economic or costly material to employ as a stabilization material is not worth it to use.

a) *Hussain M. and Dash S.K. (IGC 2009)-* [27]Analyze that the soil stabilization done by lime sure increase its properties and performance like increase of lime in soil up to 3% decrease the MDD afterword its star increasing , an increase of lime content up to 3% increase the OMC and afterwards in star decreasing .
b) *Pal, Sujit Kumar and Ghosh, Ambarish (IGC 2009)* - In this study of various fly ash with the soil under different confining pressure like 100, 200 and 300Kpa and the effect of this confining pressure, MDD and OMC on fly ash sample was analyzed and found that the increase in confining pressure also increases the shear strength irrespective of type of ash. [28]
c) *T.K. Roy, B.C. Chattopadhyay and S.K. Roy (IGC 2009)* - Soil improvement by the use of ash and lime were conducted and found that the mixing of fly ash in increasing order with the soil lime mixed soil decreases the MDD but increasing the both lime and ash increases the OMC. [30] And CBR value increases up to the 20% RHA with lime after that it start decreasing.

In recent years increment of non-traditional additives developed enough to stabilize soil and fulfill their purpose. And these stabilizers became popular because of there, relatively low cost, ease of application and short curing time. So non-traditional stabilizers are –

i. Polymers based products

ii. Copolymer based products
iii. Fiber Reinforcement
iv. Calcium carbide
v. Sodium chloride

These are some work and studies on recent day's stabilization materials which is basically related to polymer based products. Which is having a lots feature to use.

a) *R.M. Subramanian and S.P. Jeyapriya (IGC 2009)* - In this investigation waste tyre used as a stabilization material to soil performance, when crumb tyre mixed with soil at different percentage in CBR test only marginal increase was found. [29] But when it performs on the 30*30*30 cm tank of soil mixed with and without of crumb tyre, decrease in deflection in mm found under increase in pressure.

b) *M.S. Dixit and S.H. Pawar (IGC 2009)*- This study concerns with soil stabilization with the use polypropylene fiber and found that the increasing of polypropylene fiber ranges 0.75% to 3% decreases the MDD and increases the OMC by 3% to 14% and 1% to 9% respectively .[31] Cohesion increases

Table-3 Waste Types By composibility

Decomposable	Non decomposable
a) Food waste b) Garden waste c) Animal waste d) Human waste	a) Tin can/metal b) Glass c) Plastic/ rubber d) Dry cloth e) Feather / leather f) Hard shell / bone

c) 2% to 21% at the 2.25% of fiber mix and after that it starts decreasing. CBR value increases from 11% to 47% at 2.25% fiber and then decreasing.

VIII. SOLID WASTE MANAGEMENT ISSUES

A. WASTE REDUCTION

Due to limited availability of land space it is not suitable solution to dispose waste in landfill for a long time. In India many urban centres already face problems to dispose waste that will accumulate in next 25 to 30 years.

There's only two or three ways to reduce the solid waste to make in it a 'zero waste' society like. there limited pollution will be which can utilize as whole by society or other than this we can recycling the waste product left and use and reuse of municipal and industrial waste .These are the ways to do that –

a) Recycling of paper, metal, glass of the household level organized through the local kabahdi wallah or rag picker.
b) Conversion of kitchen organic waste to compost and using it as manure.
c) Use of fly ash, fine component of coal ash, as pozzolonic material for production of cement.
d) Use of slag from steel plants in construction of sub-base course of roads.

B. SOLID WASTE MATERIAL AS CONSTRUCTION MATERIAL

In construction, soil was use as a material in various applications for earth dams, for road and rail embankments, for filling of low lying area, for embankments of canal and lakes, for backfilling behind retaining wall structure. [6] Several million cubic meter of earth works are excavated each year alone in India. If soil could be replaced by solid waste material in some of these application, not only would soils waste material disposed of but would result in the following added benefits.

i. Reduction in the quantity of valuable top soil, that is suitable for agriculture, for being used in non-agriculture application.
ii. Reduction in the number of depression created in flat or undulating ground due to excavation of soil for earthwork projects leading to land degradation.

C. SOLID WASTE USED AS SOIL REPLACEMENT

a) Should not be classified as hazardous material
b) Should not have any biodegradability in its components.
c) Particle should remain physically and chemically stable in long term ,i.e. ,
d) They should not be soluble, not volatile not be susceptible for disintegration.
e) Should not have potential of harming the ground water quality.
f) Should not contain deleterious material chlorides and sulpher which can harm there building material.
g) Particle should in clay to gravel size ranges to enable ease in handling by standard earth moving equipment s.
h) Should not exhibit a high degree of heterogeneity or variability.

In most of the above wastes, the basic mineral is silica and that is suitable for geotechnical construction works.

D. NON BIODEGRADABLE SOLID WASTE

In vast variety of solid waste existence there are some non-biodegradable solid wastes present with it. Some of non-biodegradable solid wastes are as follow according to the feature of utilization in our analysis. [Table-4] These solid wastes will also be recycled but somehow only some fraction of it is recycled. That's the reason we can utilize it in Geotechnical purposes.

Table -4 Non degradable wastes

Plastic	1. Carry bags 2. Milk oil bags 3. Plastic bottles 4. Thermo-Cal
Rubber	1. Automobile tires 2. Tubes of it 3. Bottles
Glass	1. Electric bulbs 2. Tube light 3. Glass bottles

IX. PLASTIC WASTE

Plastic waste buy at the local shop in the market as required or Buy from the rag picker. Cut it in a specified aspect ratio. As we know importance of aspect ratio like why we not using plastic

waste in same size? Why in a different size by aspect ratio? That's because of the un-identification of a perfect size required to improve soil performance and characteristics. [Figure-2] That is the main reason of using different aspect ratio to overcome the identification problem of perfect size of plastic waste

Fig -2 some collected Plastic waste

But next problem is that how we find out, what is aspect ratio and minimum aspect ratio we choose or assume. One way to follow that is too aware with the past research literature of this field of stabilization. [Table-5, 6, 7] Or we assume some fundamental points what is best suitable options to choose.

i. Maximum aspect ratio should approx. equal to ¼ of the diameter of the mould
ii. Minimum aspect ratio depends upon the other part of the size factor so this should be 1.

Table -5Waste plastic and its sources

Waste Plastic	Origin
Low Density Polyethylene (LDPE)	Carry bags, sacks, milk pouches, bin lining, cosmetic and Detergent bottles.
High Density Polyethylene (HDPE)	Carry bags, bottle caps, house hold articles etc.
Polyethylene Terephthalate (PET)	Drinking water bottles etc.,
Polypropylene (PP)	Bottle caps and closures, wrappers of detergent, biscuit, vapors packets, microwave trays for readymade meal etc.,
Polystyrene (PS)	Yoghurt pots, clear egg packs, bottle caps. Foamed Polystyrene: food trays, egg boxes, disposable cups, protective packaging etc.
Polyvinyl Chloride (PVC)	Mineral water bottles, credit cards, toys, pipes and gutters; electrical fittings, furniture, folders and pens, medical disposables; etc.

Table -6 Thermal behaviour of plastic

Polymer	Softening Temp in (oC)	Decom position Temp. (oC)	Products papered	Ignition Temp. range (oC)
PE	100-120	270-350	CH4, C2H6	>700
PP	140– 160	270-300	C2H6	>700
PS	110-140	300-350	C2H6	>700

Table -7 Physical and Mechanical properties

Plastic	Absorption of water (%)	Melting point (°C)	Density	Tensile strength
PE	0.013	130	0.93	24
PET	0.016	250	1.32	42
PP	0.010	160	0.90	33

X. PROCESS PLAN FOR PLASTIC WASTE PREPARATION

In these tests, we test out the best proportion of waste material and check out to mix with soil in different percentage of with respect to soil like 0%, 1.0%, 1.5%, 2.0% etc. if required that enough. And we will do the applicable test on that as we noted out before to get the better idea about the increment in strength of soil with graph of this combined test.

Now we test these waste one by one with soil in compaction test in different aspect ratio .Then we have the best proportion of AR with these waste.

After this we know the best aspect ratio and the proportion of to mix with soil .Then at the very last these three solid waste will be teat with soil in different % of mixing with soil by weight.

This is how we prepare the solid waste thoroughly in big quantity to start making soil samples with this mixer of waste to perform various tests.

XI. COMPARISON OF SOIL ENHANCEMENT

Prepare solid waste like (plastics waste, cardboard ,other fibre) and mix with both soil sample with different proportion and percentage which is as follows 0%,1.0%,1.5%,2.0% or may be 0.25%, 0.50%,0.75%, 1.0% or 0.1%.0.2%,0.3%,0.4% for various types of soils. And then we perform these tests. After conducting the influential test which required also we put this data in manner we can visit comparatively. [Table-8] This simplifies the main influential part of soil enhancement with various solid wastes. This comparison come in between percentage of particular solid waste with the specific performed test like what's the variation happen when we mix different ad-mixers.

Table -8 Comparison Table

Tests /	Soil Sample X			
% Solid waste	0.50%	1.00%	1.50%	2.00%
Specific Gravity	A1	A2	A3	A4
CBR Test	B1	B2	B3	B4
Proctor Test	C1	C2	C3	C4
Triaxial Test	D1	D2	D3	D4
Permeability	E1	E2	E3	E4

XII. CONCLUSION

a) The solid waste in future will be major problem and needed the solution. Otherwise a large land area will not be utilized due to solid waste layer overtopping ti. The solid waste may be utilized as a stabilizing material with the soil instead of high costs materials like lime, cement etc.

b) Out of various waste material present, the suitable once are non-degradable waste that is plastic waste. This plastic waste have a vast variety to use the types of plastic that can be used effectively are PET, HDPE, LDPE, PP etc.

c) The suggested proportion of these plastic waste to be mixed with soil is 0.1% to 2.0% or 0.1% to 1.0% generally. The need uses to carry out the tests have the influential properties like Specific gravity, MDD, OMC, CBR, Permeability, Tri-axial test has to compared for the suggested proportions to see the effect for various plastic waste. This will pave the way to use these plastic waste in a more technical manner for various civil engineering construction purposes.

REFERENCES

[1] Dutta, R. K and Surda, D.K;"CBR behavior of waste plastic strip reinforced stone dust, fly ash overlying saturated clay". Turkish T.Eng.Env. Sci. 31 (2007) , 171 -182

[2] Chamberlin, shyam k with Neoponey, Megnath and Kezong wangchuk, Ugyen, Tenzin sherub."Stabilization of soil by plastic waste ". International Journal of Emerging trends in Engineering and development ,ISSN2249-6149 issue 2 ,vol-2 (March 2012)

[3] A.K. Choudhary, J.N. Jha and K.S. Gill," A study on cbr behavior of waste plastic strip reinforced soil". Emirates Journal fo Engineering Research, 15 (1), 51-57 (2010)

[4] Chebet, F C and Kulumba, D,"Laboratory investigation on reusing polyethylene (plastic) by waste material for soil reinforcement in geotechnical engineering ". Civil Engineering and Urban Planning an International Journal (CiVEJ) vol-1 ,No-1 June 2014

[5] Muntohar, A S," Influence of plastic waste fiber on the strength of lime-rise husk ash stabilization clay soil ". Civil Engineering, Dimension, Vol-11, No-1 March.2009, 32-40. ISSN .1410-9530 print

[6] Bolden .Johny, Lebdeh, TaherAbu and Fini, Ellie,-"Utilization of recycled and waste material in various construction application ". American Journal of Environment Science, 9(1):14-24, 2013, ISSN: 1553-345X.

[7] C. Gümüşer1, A. Şenol." Effect of fly ash and different lengths of polypropylene fibers content on the soft soils". International Journal of civil engineering

[8] G L Sivakumar Babu. "Laboratory shear strength studies of soil admixed with plastic waste". CiSTUP Indian Institute of Science Bangalore 560 012 , Project Paper

[9] Agus Setyo Muntohar1; Anita Widianti2; Edi Hartono3; and Wilis Diana4." Engineering properties of silty soil stabilized with lime and rice husk ash and reinforced with waste plastic fiber" American Society of Civil Engineers.

[10] Ario Muhammad and Agus Setyo Muntohar. "Uses of lime -rice husk ash and plastic fibers as mixtures-material in high-plasticity clayey subgrade: a preliminary study".

[11] Salvacion S. tidon."Management and utilization of urban solid waste " .Research information series on Ecosystem .Vol-12 , No-3 Sep-Dec 2000

[12] Delfin G. Carreon." Stabilization of marginal soils using recycled materials". University of South Florida Scholar Commons. 2006

[13] Babu, G.L. Sivakumar, Chouksey, S., Anoosha, G. Manjari, K. Geetha," Strength and compressibility response of plastic waste mixed soil". Indian Geotechnical Conference – 2010, GEOtrendz December 16–18, 2010 IGS Mumbai Chapter & IIT Bombay

[14] Maheshwari, K.V. Desai, A.K. Solanki, C.H. "Model footing tests on fiber reinforced soil ". Indian Geotechnical Conference – 2010, GEOtrendz December 16–18, 2010 IGS Mumbai Chapter & IIT Bombay

[15] S. Twinkle, M.K.sayida," Effect of polypropylene fibre and lime admixture on engineering properties of expansive soil". Proceedings of Indian Geotechnical Conference December 15-17, 2011, Kochi (Paper No.H-085)

[16] Ashraf Anas, Arya Sunil, J. Dhanya, Mariamma Joseph, Meera Varghese, M. Veena," Soil stabiliisation using raw plastic bottles". Proceedings of Indian Geotechnical Conference December 15-17, 2011, Kochi (Paper No. H-304)

[17] Sen Arpan (108CE019) and Rishabh Kashyap (108CE018) under the supervision of Prof. N. Roy." Soil stabilization using waste fiber materials". Thesis Department of Civil Engineering National Institute of Technology, Rourkela Rourkela- 769008, India.

[18] Meera Manuel, Shyla Joseph A." Stability analysis of kuttanad clay reinforced with pet bottle strips". International Journal of Engineering Research & Technology (IJERT) IJERTIJERT ISSN: 2278-0181

[19] Dhanya J.S., Ilamparuthi K.," Stress-strain response of fibre reinforced admixed soil" Proceedings of Indian Geotechnical Conference December Delhi (Paper No. A103)

[20] Dixit M.S., Pawar S.H.," Study of improvement in properties of soil by addition of polypropylene fibers" Indian geotechnical sosciety, IGS 2009,GUNTUR ,INDIA

[21] Sreedhar M.V.S., STU. T. Sathish, K. Kranthi Kumar and P. Krishna Pravallika." Investigations on effect of reinforcement in planar and fiber forms on cbr value of sand". Indian geotechnical sosciety, IGS 2009,GUNTUR ,INDIA

[22] Ghosh Mahuya, Choudhury P.K., Sanyal Tapobrata," Suitability of natural fibres in geotextile applications". Indian geotechnical sosciety, IGS 2009,GUNTUR ,INDIA

[23] K. Suresh, Padmavathi V., Sultana Apsar," Experimental study on stabilization of black cotton soil with stone dust and fibers". Indian geotechnical sosciety, IGS 2009,GUNTUR ,INDIA

[24] Gawande Amit , Zamre G. S., Renge V. C., Bharsakale G. R. and Tayde Saurabh ." utilization of waste plastic in asphalting of roads". – A REVIEW Sci. Revs. Chem. Commun.: 2(2), 2012, 147-157 ISSN 2277-2669

[25] Konin A." effect of plastic waste content on physico-mechanical properties of flexible pavements". International Journal of Civil and Structural Engineering Volume 2, No 1, 2011 ISSN 0976 – 4399

[26] Snapshot "solid waste management of india". EUROPEAN BUSINESS AND TECHNOLOGY CENTRE , www.ebtc.eu

[27] Hussain, M. and Dash, S.K." influence of lime on compaction behaviour of soils". IGC 2009, Guntur India GEOTIDE.

[28] Pal, Sujit Kumar and Ghosh, Ambarish." shear strength behaviour of indian fly ashes". IGC 2009, Guntur India GEOTIDE.

[29] Subramanian R.M. and Jeyapriya S.P. (IGC 2009)." study on effect of waste tyres in flexible pavement system". IGC 2009, Guntur India GEOTIDE.

[30] Roy T.K., Chattopadhyay B.C. and Roy S.K. "effect of lime on the properties of subgrade of roads with addition of rice husk ash". IGC 2009 , Guntur India GEOTIDE

[31] M.S. Dixit and S.H. Pawar." study of improvement in properties of soil by addition of polypropylene fibers". IGC 2009, Guntur India GEOTIDE.

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Evaluation of the Thermal Performance of Thermosyphon Heat Pipe Solar Collector with Copper oxide as Nanofluid

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Abstract- In this research the effect of copper oxide nanofluid (pure water mixed with copper nanoparticle with 30-50nm diameter) on the thermal efficiency enhancement of a heat pipe at different operating state was investigated . The heat pipe made of straight copper tube of outer diameter 12 mm and inner diameter 10 mm. The tested concentration level of nanofluid are 0.3, 0.6, 0.9wt%. This study presents the discussion on the effect of coolant rate, inclination angle of solar collector and effect of nanomaterial concentration on the performance of solar collector. Result shows that by charging the nanofluid to the heat pipe the thermal performance is enhanced. Performance of solar collector was increases with increase in inclination of solar collector and concentration of nanofluid up to certain level and then again decreases. Increase in coolant rate also increases the thermal performance up to certain level.

Index Terms- Solar collector, Heat pipe, nanofluid,

I. INTRODUCTION

Solar water heaters are the most developed renewable energy technologies used in the world. For the past several years, conventional flat plate collectors have been well studied and developed. Their relatively low cost, lower maintenance and easy of construction have made these systems very competitive and are widely used all over the world especially for low temperature thermal systems. Conventional flat plate solar collectors use water pipes attached to the collecting where water circulates either naturally or forced inside the pipes and so transfers the heat collected by the plate to the storage tank. The following are some of the limitations of conventional flat plate solar collectors for water heating

- Low heat transported by the fluid which leads to low thermal efficiency
- Pipe corrosion due to the use of water
- Freezing of water used in cold nights
- The night-cooling effect due to the transverse flow of cooled water
- The extra space required for natural circulation due to the position limitation required
- And the heavy total system weight

A design improvement of conventional flat plate collectors increases the solar energy share for hot water production. Due to the low energy density and transient nature of solar energy, designing appropriate heat transport system is important in increasing the solar fraction for stand-alone or simulated hot water production systems. Employing heat pipes for solar water heating application is at its young stage and extensive studies are required to integrate heat pipe in solar collector systems so as to improve the heat transport. Since the advent of heat pipes in 1960, their importance in solar application such as solar collectors for domestic water heating, space heating and cooling has received increasing attention (Dunn and Reay, 1994). As the demand of energy conservation increases, heat pipes become more and more attractive for an increasing number of various applications. Heat pips have low thermal resistance for heat transfer than any other metals have (Dunn and Reay, 1994). Most of the above limitations of conventional solar collectors can be overcome by using a compact heat pipe solar collector system. For solar system application, very high thermal conductance (phase change heat transfer), ability to act as a thermal flux transformer, and an isothermal surface of low thermal impedance are very important properties of heat pipe.

Several studies have been reported on the use of heat pipe for solar water heating systems. Mostafa Keshavarz Moraveji et.al [1] has study the effect of using aluminum oxide nanofluid on the thermal efficiency enhancement of a heat pipe on the different operating state was investigated. The heat pipe was made of a straight copper tube with an outer length of 8 and 190 mm and a 1 mm wick-thickness sintered circular heat pipe. In the heat pipe tube, there is a 90° curve between the evaporator and condenser sections. The concentration levels of nanofluid used are 0%, 1% and 3%wt. Results show that nanofluid charge heat pipe gives better thermal performance. The thermal efficiency of heat pipe charged with pure water is compared with nanofluid.

Tooraj Yousefia, et.al [3] has studied effect of Al2O3 water nanofluid , as working fluid, on the efficiency of a flat-plate solar collector .. The composition of nanoparticles used was 0.2% and 0.4%. The diameter of particles used was 15 nm. He has varied the mass flow rate of nanofluid from 1 to 3 Lit/min. The results show that, addition of nanopartical increase the efficiency in comparison with water as absorption medium.. For 0.2 wt% the increased efficiency was 28.3%. He also concluded that that the because of surfactant there is increase in heat transfer

Chougule et al. [5] has studied Performance the solar water heater by charging nanofluid. He used the two identical with same dimensions, experimental set up of flat plate solar collectors using -heat pipes. The set p consist of three identical wickless copper heat pipes having length 620 mm and outer diameter of 18 mm. Result shows that, both collectors gave maximum instantaneous efficiency at the 50° for with and

without tracking. The collector gave the better performance in the all conditions by using nanofluid as working fluid

II. Experiment

2.1. Nanofluid preparation

In this experiment Spherical copper oxide nanoparticles having nominal diameter 30–50 nm, density 6.4 g/cc are utilized and pure water was used as the base fluid to prepare the nanofluid. The required amount of the nanoparticles required to attain a 0.9, 0.6 and 0.3% volume concentration solution is calculated. Then the nanoparticles are mixed in deionized water and the solution is vibrated in an ultrasound device for 90 min in order to obtain a uniformly dispersed solution. The mixture was created by using an ultrasonic homogenizer.

2.2 Experimental Set-up

Fig 1 shows the experimental setup. The heat pipe used in this experiment is made by bending copper tube having Outer Diameter 12mm and inner diameter 10mm The length of condenser evaporator, adiabatic section is 65mm, 480mm, 50mm and respectively. Water and cuo-water nanofluid is used as working fluid for filling heat pipe. Black painted 0.5mm thick is given to copper plate whose dimension is 480 mm * 560 mm. A condenser section used for water heating in this experiment is made rectangular cross-section having dimension 25mm*65mm. 30 mm thick glass wool insulation is used from Bottom and side wall of setup and top side is cover with transparent glass cover to reduce convention heat loss. The experimental solar collector was installed on tilted stand facing south at yeola nashik, India (latitude 20.0420° N, longitude 74. 4890° E) and tested at outdoor condition. By taking Coolant (Water) flow rate 8kg/hr 4kg/hr.,.and 5 different angle of inclination (20°, 31. 5°, 40°, 50°, 60°) of collector the experiment is carried throughout the day.

Fig. 1 Experimental setup

2.3 Experimental Procedure

In order to test the performance of solar collector a test is conducted with water and nanofluid with different concentration (0. 9, 0. 6, and 0.3 wt. %) as a working fluid. The continuous drain of test was conducted from 9 a. m. to 5 p. m. on sunny days. During the complete test outlet cooling water temperature (Two), inlet cooling water temperature (Twi), solar intensity (It), and ambient air temperature (Tamb) was measured with the interval of half hour. Water supplied to condenser was measured and control by using flow control valve. The temperature of ambient air and Inlet and outlet temperature of condenser water was measured by using K-type thermocouple having accuracy ± 0. 1°c. Solar intensity was measure by using pyranometer.

2.4 Solar Collector Efficiency

Performance evaluation of solar collector can be done by calculating efficiency, which can be calculated

ɳ = Useful Heat Gain (Qw) / Heat supplied (Qs)…….(1)

Amount of useful heat gain can be calculated by considering water temperature variation flowing though condenser, taking into account the water flow rate and its specific heat

$Qw = m \times Cp \times \Delta T$ …….. (2)

Total heat supplied to collector is depend on solar intensity (It) and collector area (Ac)

$Qs = It \times Ac$……...…….. (3)

III. Result and Discussions

Results include effect of coolant rate, tilt angle, working fluid and nanomaterial concentration on performance of heat pipe solar collector. These results are broadly classified on the basis of working fluid i.e. water and nanofluid

3.1 Water as a Working Fluid

3.1.1 Effect of coolant rate

Figure 2 shows that variation of average efficiency with respect to coolant rate for collector tilt angle 31.5° and 50°. The graph shows that efficiency variation is same in nature for both angle of inclination. Efficiency of solar collector is minimum at coolant rate 2kg/hr. and it increase with increase in coolant rate and comes to steady at coolant rate 8kg/hr. Large enhancement was observed when coolant rate increase to 4 kg/hr. from 2 kg/hr. It happens because high coolant rate draws large heat from condenser section and avoids raising pressure inside the pipe which reduces its working temperature and then reduces loss which raises the efficiency of collector. From the above result it was conform that 4kg/hr. were lower limit and 8 kg/hr. were the higher limit of coolant rate. So these limits are used for further experimentation

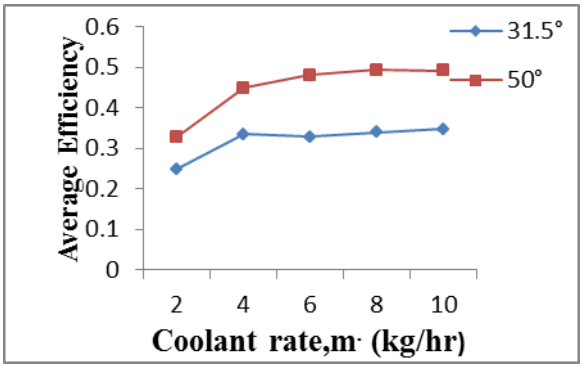

Fig 2 variation of average efficiency with respect to coolant rate

3.1.2 Effect of inclination angle

Figure 3 and Fig 4 shows the effect of inclination angle on collector efficiency. Fig 3 and Fig 4 shows the performance of collector with coolant rate 4kg/hr. and 8kg/hr. respectively for various tilt angle. The efficiency for both the coolant rates is low at lower tilt angle and it increases with increase in tilt angle. The maximum efficiency is found to be at 50° tilt angle. The maximum instantaneous efficiency obtained at 4 kg/hr. are 54% and at 8 kg/hr. is 63% at tilt angle 50° and further increase in tilt angle reduces efficiency. Increasing the tilt angle increases buoyancy force on up going vapors and gravity force on down coming liquid which gives rise to enhancement in performance with angle. But after 50° increase in angle (60°) reduces the performance of collector.

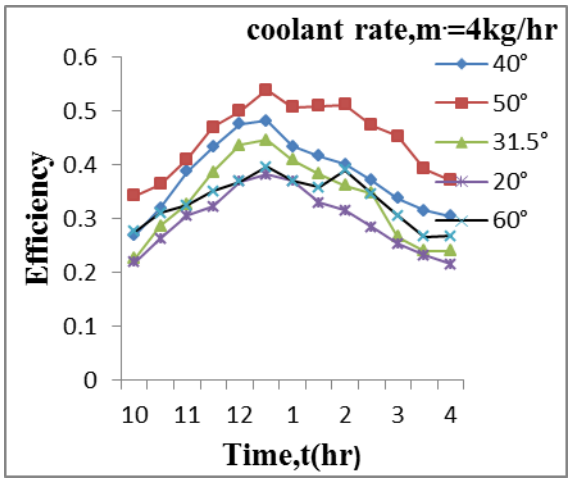

Fig.3 effect of inclination angle on collector efficiency

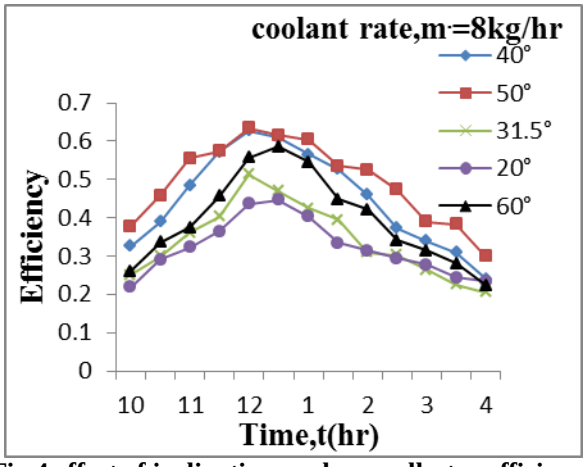

Fig 4 effect of inclination angle on collector efficiency

3.2 Water-CuO Nanofluid as a Working Fluid

3.2.1 Effect of coolant rate

Maximum Performance of heat pipe solar collector was observed at 50° tilt angle. So graph of effect of coolant rate at 50° tilt angle is drawn for nanomaterial concentration 0.3wt%, 0.6wt% and 0.9wt%. Figure 5, 6, 7 shows the comparison between the instantaneous efficiency of collector at different coolant rates at tilt angle 50°. These indicate that the maximum instantaneous efficiency of the collector is at the coolant rate 8kg/hr for all concentration of nanofluids because at high coolant rate condensation process of working fluid is better which enhance the performance. The maximum instantaneous efficiency for 0.3wt%,0.6wt%, 0.9wt% are 64%, 67% and 69% respectively for 8kg coolant rate and 56%, 61%, 62% for 4kg/hr coolant rate respectively.

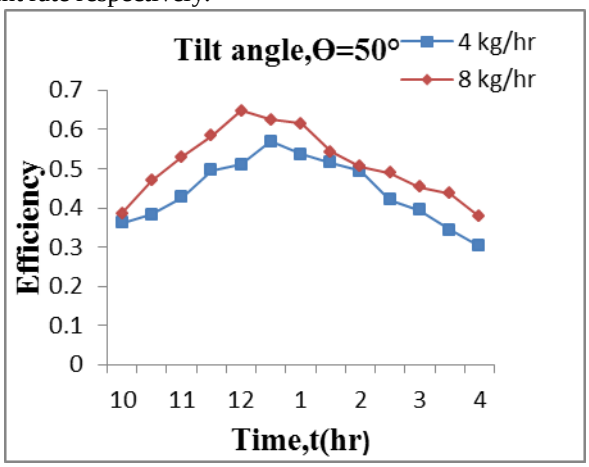

Fig 5 variation of efficiency with time for 0.3wt% Cuo nanofluid at 4 and 8kg/hr. coolant rate

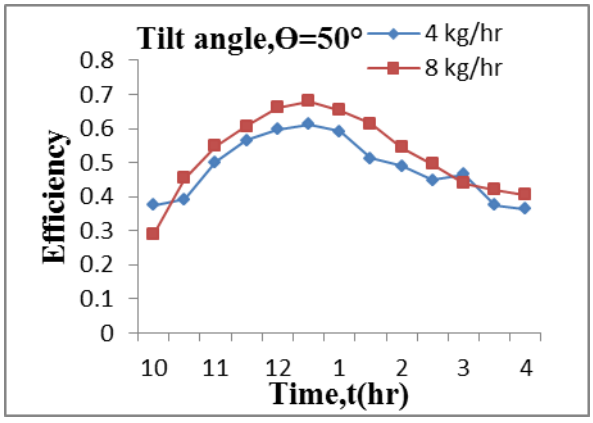

Fig 6 Variation of efficiency with time for 0.6wt% Cuo nanofluid at 4 and 8kg/hr. coolant rate

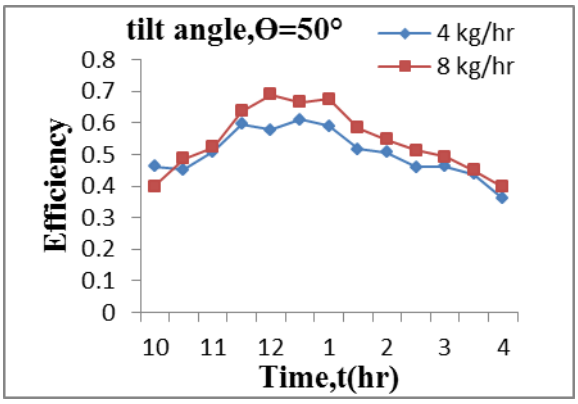

Fig 7 Variation of efficiency with time for 0.9wt% Cuo nanofluid at 4 and 8kg/hr. coolant rate

3.2.2 Effect of inclination angle

Figure 8,9,10 shows the effect of inclination angle on collector efficiency with Cuo nanofluid as a working fluid. All

result is drawn at 50° inclination angle because it shows better performance. Fig 8, 9 and 10 shows the variation of instantaneous efficiency for 0.3wt%, 0.6wt%, 0.9wt% CuO nanofluid respectively for 8kg/hr. coolant rate. The Efficiency for both the coolant rates is low at lower tilt angle and it increases with increase in tilt angle. The average collector efficiency for 4kg/hr. coolant rate at 20°,31.5°, 40°, 50°and 60° tilt angle are 41%, 45%, 48%, 50% and 36% respectively. The average collector efficiency for 8kg/hr. coolant rate at 20°, 31.5°, 40°, 50°and 60° tilt angle are 44%, 48%, 50%, 54% and 41% respectively for 0.9wt% CuO nanofluid. Also maximum efficiency is found to be at 50° tilt angle. Increasing the tilt angle increases buoyancy force on up going vapour and gravity force on down coming liquid which gives rise to rise in vapour velocity which cause enhancement in performance with angle. But after 50° increase in angle (60°) reduces the performance of collector .

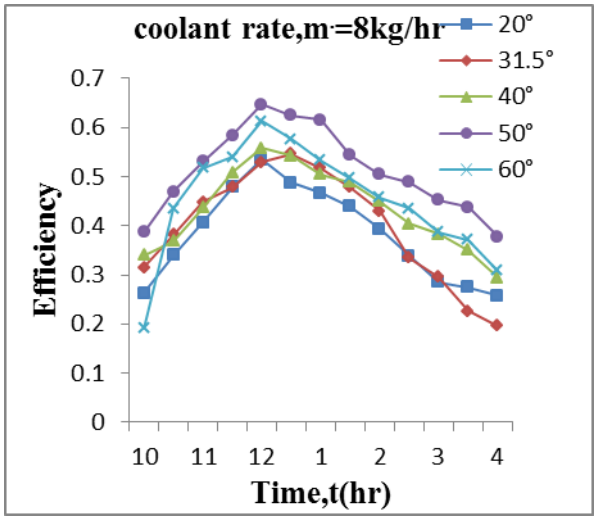

Fig 8 variation of efficiency with time for 0.3wt% CuO nanofluid

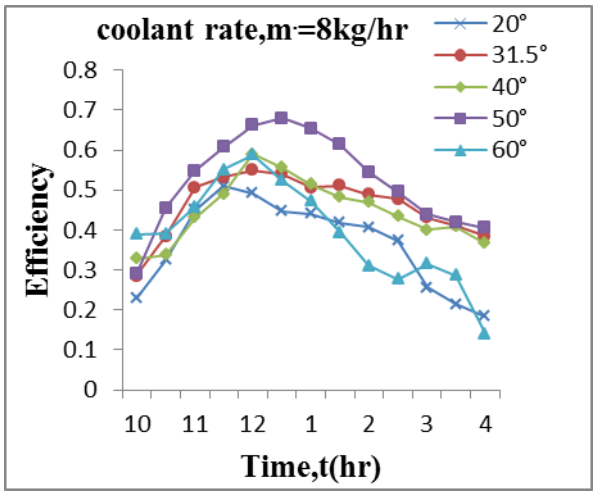

Fig 9 variation of efficiency with time for 0.6wt% CuO nanofluid

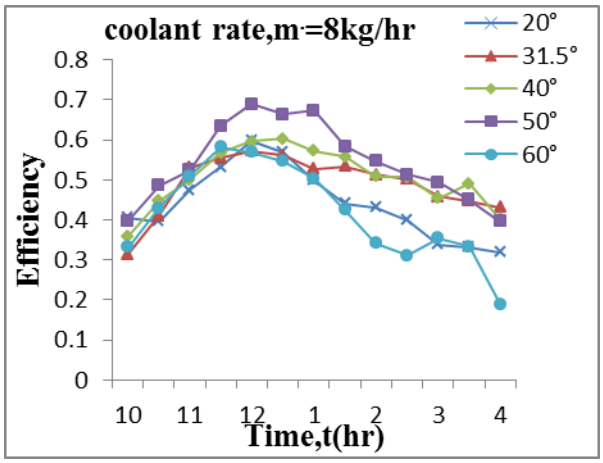

Fig 10 variation of efficiency with time for 0.9wt% CuO nanofluid

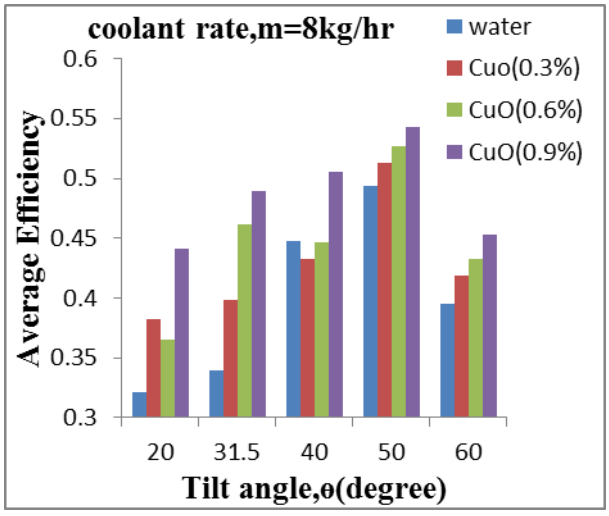

Fig.11 Effect of inclination angle and concentration of CuO on average efficiency

3.3.3 Effect of concentration

Figure 12 and Fig 13 shows the variation of instantaneous efficiency for water and different concentration of Cuo nanofluid with 4 and 8kg/hr coolant rate. Result shows that increase in concentration of nanomaterial in base fluid enhances the performance of solar collector. 8 kg/hr. coolant rate shows higher performance than 4kg/hr. water shows lower performance and 0.9 wt% nanofluid shows highest performance for both coolant rates. Fig 14 shows the variation of average efficiency for 50° tilt angle. It shows that increase in concentration increases the average efficiency of collector

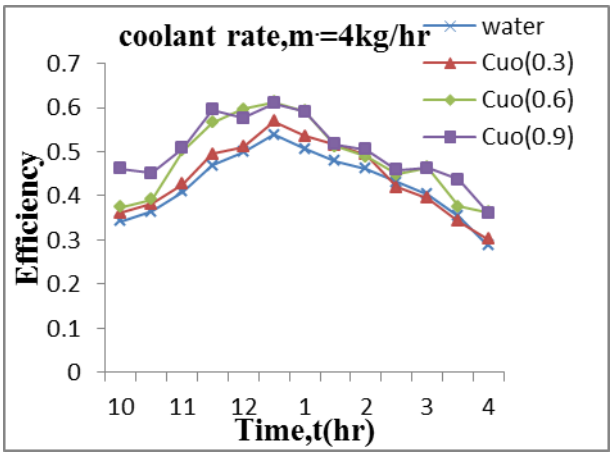

Fig 12 Variation of instantaneous efficiency for CuO nanofluid with 4kg/hr coolant rate

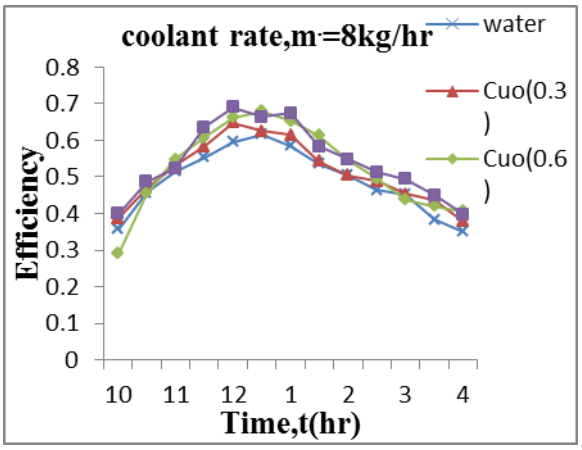

Fig 13 Variation of instantaneous efficiency for CuO nanofluid with 8kg/hr coolant rate

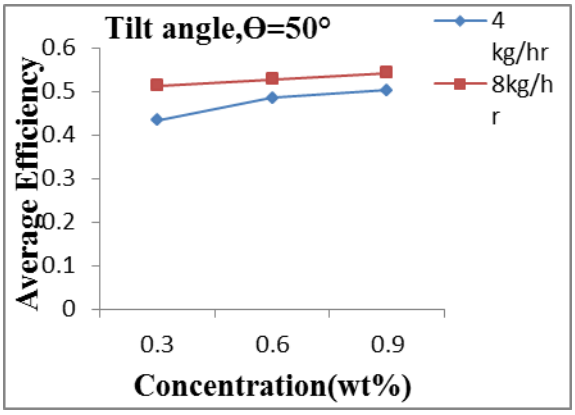

Fig 14 variation of average efficiency for different concentration of Cuo nanofluid at 50° tilt angle

IV. Conclusion

From the experimental analysis following conclusion are drawn for wickless heat pipes flat plate solar collector, it is concluded that,

1) The solar collector Performance depends on coolant flow rate, heat flux at evaporator, working fluid and inclination angle.

2) The thermal performance of heat pipe collector increases as the coolant rate increases up to certain level after that increase in coolant rate has no effect on performance.

3) As inclination angle increases from 20° to 50° the heat transfer rate through heat pipe collector with water as a working fluid is increases while further increase in angle reduces the heat transfer rate.

4) CuO nanofluid has greater potential to enhance the performance of heat pipe collector than that of water and it increase as concentration of nanomaterial increases up to certain level.

References

[1] M. K. Moraveji and S. Razvarz, "Experimental investigation of aluminum oxide nanofluid on heat pipe thermal performance", International Communications in Heat and Mass Transfer, vol-39 (2012), 1444–1448

[2] Y.Chen, P.Wang and Z.Liu, "Application of water-based SiO2 functionalized nanofluid in a loop thermosyphon", International Journal of Heat and Mass Transfer, vol-56 (2013),59–68

[3] T. Yousefi, F .Veysi, E. Shojaeizadeh and S.Zinadini, "An experimental investigation on the effect of Al2o3-H2O Nanofluid on efficiency of flat-plate solar collectors", Renewable Energy,vol-39 (2012), 293-298

[4] R.R. Riehl and N.D.Santos, "Watercopper nanofluid application in an open loop pulsating heat pipe", Applied Thermal Engineering,vol-42 (2012),6-10

[5] S. Chougule "Performance enhancement of two phase thermosyphon flat-plate solar collectors by using surfactant and nanofluid" Frontiers in Heat Pipes (FHP), 4, 013002 (2013)

[6] G.Huminic, A. Huminic, I. Morjan and F.Dumitrache, "Experimental study of the thermal performance of thermosyphon heat pipe using iron oxide nanoparticles", International Journal of Heat and Mass Transfer,vol-54 (2011) ,656–661

[7] J. Qu, H.Wu and P.Cheng, "Thermal performance of an oscillating heat pipe with Al2O3–water nanofluids", International Communications in Heat and Mass Transfer, vol-37 (2010),111–115

[8] J.S.kim, S.jung ha, S.lee and B.jeong, "The study of evacuated solar collector using pulsating heat pipe", frontiers in heat pipes, vol- 3, (2012)

[9] S.H. Noie, S. Z.Heris, M. Kahani and S.M. Nowee, "Heat transfer enhancement using Al2O3-water nanofluid in a two-phase closed thermosyphon", International Journal of Heat and Fluid Flow vol-3700–705

[10] S.A. Nada, H.H. El-Ghetany and H.M.S. Hussein, "Performance of a two-phase closed thermosyphon solar collector with a shell and tube heat exchanger", Applied Thermal Engineering,vol-24 (2004) , 1959–1968

[11] G. Huminic and A.Huminic, "Heat transfer characteristics of a two-phase closed thermosyphons using nanofluids", Experimental Thermal and Fluid Science,vol-35 (2011) ,550–557

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Determinants of Employees Attitude towards Retirement in the Energy Sector in Kenya; a Case of Kenya Pipeline Company

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Abstract- The main aim of the project is to investigate the determinants for employees' attitude towards retirement in the energy sector. In this study, the target population is 500 respondents from the departments of Kenya Pipeline Company. A descriptive case study was adopted for this research. Stratified random sampling method was used for the study. There was inclusion, in the sample, of sub groups, which otherwise would be omitted entirely by other sampling methods because of their small number of population. Research instrument were questionnaires. Data collected was edited to ensure that it is correct and complete thus reducing biases, increase the precision and achieve consistency. Data was then analyzed by the use of descriptive statistics, inferential statistics and regression analysis which was presented using mean, correlation, standard deviation and percentages. The analysis was then visually displayed using frequency tables. The study found out that occupation factors to affect employee's attitude towards retirement. Economic factors were found to have major influence on employee's attitude towards retirement. Environmental factors greatly influenced employee's attitude towards retirement in the energy sector. Social factors were indicated to influence employee's attitude towards retirement. The study recommended that employers should prepare employees to retire early in their careers by offering education on retirement planning. Employers should encourage employees to take up pension schemes to prepare employees for a happy retirement. The organization in energy sector should discourage some cultures which have negative influence to employees work life and attitude towards retirement. Organizations in the energy sector should encourage social interaction between employees which should prepare them for the retirement life.

I. INTRODUCTION

1.1 Background

Attitude toward retirement has been found to influence employees decision to retire (Adams & Lax, 2002), in one's planning for retirement and in one's satisfaction with retirement. However, there have been some few systematic efforts aimed to define the concept or to create instruments that will adequately assess attitude toward retirement. Many of whom have used attitude toward retirement have assumed the definition is understood (Ayala, Vonderharr-Carlson, & Kim, 2005).

Study by Chosewood, L & Casey M (2011*)* examined attitude toward retirement have conceptualized it at as global post-retirement life satisfaction assessment. That definition is not congruent with the conceptualization of attitude toward retirement central to the current study. Therefore, only previous literature that has defined attitude toward retirement as a positive or negative feeling specifically related to the retirement experience itself will be reviewed here.

To many employees, retirement has become an expected part of the adult life cycle. A study was conducted in United States of America on dimensions of retirement. Ninety percent of the adult workers in the United States expect to retire most of them prior to the age of 65 described under four dimensions of retirement, activity, physical potency, emotional evaluations, and moral evaluations. The adults of this study, all of whom were over the age of 45, reported very positive attitudes toward retirement regardless of age or gender (Lundberg, 2006). The only exception to this positive attitude toward retirement came from those individuals who had been forced to retire when they would have preferred continuing working. Preparing for and anticipating retirement is a phase of preretirement. Anticipation and/or preparation for retirement have been associated with attitudes toward retirement. Studies suggest that those who are better prepared for their own retirement have more positive attitudes than those who are not (Hardy, 2006).

The anticipation and preparation for retirement variables were measured in different ways (Maples & Abney, 2006). Measurements which included proximity; pre-retirement involvement scales such as talking with family members and reading articles; preparedness for retirement; knowledge of retirement issues; retirement planning such as financial planning, home equity planning, locational planning and employment planning; financial pre-retirement planning, including health insurance, social security, and pension contributions and retirement fund calculation and retirement savings (Putney & Bengtson, 2012).

Further, Putney & Bengtson (2012) measured retirement planning with questions addressing various topics such as discussing retirement with others; retirement education; by attending a preretirement program, lecturing, or seminars; and actively planning for retirement by calculating retirement expenses and income. Thus, multiple variables, such as proximity to retirement, retirement fund calculation, savings amount, confidence in government program such as Social Security, and workplace financial education seem to be

indicative of anticipation and/or preparation for retirement (Randall, 2009).

II. Summary of the Major Findings

2.1 Occupational Factors

Majority of respondents indicated occupational factors affect employee's attitude towards retirement when employees choose to continue working or retire depending on their occupational attainments. The findings collaborates with Spence (1999) who found that occupational choices has also been found to influence a person's level of risk tolerance and savings, consumption patterns and the decision to retire. According to the findings majority of the respondents agreed that work environment issues play a key role in a person's decision to retire, stressful work environment may lead to early retirement for the staff members while employees in less stressful environment may choose to work longer.

The study findings collaborate with Kim & Feldman (2000) who found that situation at the work place can have a significant impact on a person's decision to retire or continue to work. The study found out that the level of education greatly affected employees attitude towards retirement, the study findings collaborated with study by Joo and Pauwel (2002) who found that those who had higher levels of education had higher levels of retirement confidence. Most respondents indicated that financial education greatly influenced employee's attitude towards retirement, the study findings collaborates with the study by Groth-Marnat (1999) who argued that financial education on behavioral change, retirement investment, and retirement confidence.

Most respondents agreed that labor market situation influencing attitudes towards retirement and retirement decisions. The study findings collaborates with Putney & Bengtson (2001) who argued that labour market situation, and its impact on the economy, role of human resources policies; labour force participation as well as the retirees individual orientation to work are factors influencing attitudes towards retirement and retirement decisions. The findings of the study on the Job satisfaction has been found to influence decision to retire by majority of respondents which collaborates with Taylor & Hartman-Stein (1995) who argued that satisfaction with income positively influences decision to retire.

2.2 Economic Factors

Economic factors were found to have major influence on employee's attitude towards retirement. The study findings collaborate with research by Williamson & Shaffer (2001) who demonstrated a strong positive relationship between personal finances and retirement decisions. According to the findings, majority of the respondents agreed that pensions at work has been positively related to retirement attitude, the study findings collaborates with study by Adams & Lax, (2002) who argued that having pensions at work has been positively related to retirement attitude. The findings of the study revealed that majority of the respondents agreed that, being older with more income has a significant impact on retirement benefits which collaborates with Foster (1998) who found that being older with more income has a significant impact on retirement benefits.

The respondents also agreed that financial education program appears to be related to the decision to save and invest for retirement which collaborates with Groth-Marnat (1999) who reported that the presence of a financial education program appears to be related to the decision to save and invest for retirement. The findings of the study revealed that respondents agreed that, social Security and Medicare programs could influence an individual's retirement attitudes and behaviors Friedman & Schnurr (1995) who argued that social Security and health insurance coverage are some of the key factors influencing retirement decisions. Most respondents agreed that, investment uncertainty negatively affects retirement decisions, the findings collaborates with study by Menon, (2001) who stressed that population aging, investment uncertainty and different retirement policies have all heightened the significance of retirement preparedness.

2.3 Environmental Factors

Majority of respondents indicated environmental factors to greatly influence employee's attitude towards retirement in the energy sector, the study findings collaborates with Putney & Bengtson, (2001) who argued that environmental influences like culture, social class, personal influence, family, and employment situation impacts on the decision to retire. From the findings the study established that majority of the respondents agreed that employees with high demanding jobs choose to retire early which collaborates with Skarborn & Nicki, 2000 who argued that job demands which includes burdens such as overload or time pressure influences employees decision to retire.

The respondents also agreed that work-family conflict leads to early retirement among employees when most employees may choose to retire to have time with their family members the study findings agrees with Ulrich & Brott (2006) who argued that perceived spillover of stress from the family into the work domain (i.e., family-to-work conflict) and from work into the family realm (work-to-family conflict) to affect retirement preferences independently of stressful work and family characteristics. The findings also established that cultural practices influence decision to retire when some cultural practices prohibit employees from working to a certain age especially women, the study findings collaborates with Taylor & Hartman-Stein (1995) who argued that cultural differences account for disparate experiences among the groups which shows that all populations found retirement planning to be daunting. The study also established that, agreeing with social status of a worker unavoidably declines at retirement which collaborates with Stephens & Franks (1999) who argued that retirement involves fears and worries about the future of the individual as a result of the cessation in active working life.

2.4 Social Factors

Social factors were indicated by majority of respondents to influence employee's attitude towards retirement which collaborates with Mutran et al., (1997) who argued that retirement challenges may result in feelings of isolation and loneliness, and anxiety for those who do not manage it. According to the findings majority of the respondents agreed that older employees have negative attitude towards retirement which

collaborates with Robison & Moen (2000) who identified that belief about retirement age of the retiree, as a major factor affecting attitudes towards retirement. The respondents also agreed that males were likely to have a more positive attitude toward retirement than females. Majority of employees agreed that attitude towards retirement vary with race. Majority of employees agreed that pull factors may attract workers into retirement, such as having a partner who is retired. Most respondents agreed that Married individuals were likely to have more positive attitudes toward retirement.

III. Conclusions

Occupational factors affected employee's attitude towards retirement when employees were to make decision whether they should retire or continue working which was dependent on their career attainments. Working environment influences employee's decision to retire when employees in stressful jobs preferring to retire early while employees in less stressing jobs preferring to work longer. Employees with low level of education may have negative attitude towards retirement since they would like to continue working and attain higher level of education. Employees who have better financial education may choose to retire early since they have planned their future well. Unpredictable labour market may have negative influence on employee's decision to retire. Employees who are satisfied with their job may have positive attitude towards retirement as they are able to plan for their retirement.

Economic factors influenced on employee's attitude towards retirement when employees plan their finances early. Employers who have pension schemes are better prepared to retire and have positive attitude towards retirement. Employees who have higher income at an older age perceive retirement positively as they will not encounter financial challenges during their retirement. Employees with financial education are able to plan their financial future and therefore perceive retirement in a positive way. Employees with social security programs and Medicare perceive retirement in a positive way.

Environmental factors may influence employees attitude towards retirement when the employees working environment may be favorable for employees to work in. Employees who have less time with the family may choose to retire early to spend time with their family. Cultural practices have an effect on attitude towards retirement especially women, some cultures prohibit women from working for long. Most employees fear to retire since they may feel isolated by the society which makes them work for longer period.

Social factors influence employees towards retirement when retiring employees find it difficult to be integrated into the society. Age of the residents determined employees towards retirement when younger employees preferred to retire while older employees preferred to carry on working. Certain races have positive attitude towards retirement while others have negative attitude towards retirement. Pull factors affected the attitude towards retirement when employees determined to retire under the influence of their peers. Married employees' perceived retirement more positively as compared to their unmarried counterparts since they enjoyed support from their family members.

ACKNOWLEDGMENTS

My sincere acknowledgement goes to my supervisor for the guidance and support while preparing this project. Credit goes to my classmates who guided me where to acquire past information concerning the study. I am also grateful to the entire management of Jomo Kenyatta University of Agriculture for their cooperation towards providing library facilities where I accessed much information concerning the research study thank you all for your time; not forgetting the Kenya Pipeline Company for granting me permission to conduct the study; it was all through your endless support that I managed to complete my project.

References

[1] Antolín P.H and Scarpetta S.K (2008). Microeconometric Analysis of the Retirement Decision3rd edition, John Wiley & Sons, Inc publishers, USA, New York.

[2] Ayala, R. J., Vonderharr-Carlson, D. J., & Kim, D. (2005). Assessing the reliability of the beck anxiety inventory scores. 1st Edition, Foresight Publisher, U.S.A. Ohio.

[3] Brown P.M, Jeffrey R.S, Courtney C.K and Scott J.S & Weisbenner M.N (2006). The Effect of Inheritance Receipt on Retirement1st Edition, Foresight Publisher, U.S.A. Ohio.

[4] Chosewood, L & Casey M (2011). "When It Comes to Work 1st Edition, Foresight Publisher, U.S.A. Ohio.

[5] Coile M.N, Courtney B.S, Phillip B.S & Levine B.M (2009). The Market Crash and Mass Layoffs 3rd edition, Oxford University Press, USA, New York.

[6] Cox, H. (2012). Work/retirement choices and lifestyle patterns of older Americans. 4th Edition, Pearson Publisher, U.S.A, Boston.

[7] Dhaval, D., I, Rashad, and J.S & Spasojevic.P.K (2006). "The Effects of Retirement on Physical and Mental Health Outcomes" 1st Edition, Foresight Publisher, U.S.A. Ohio .

[8] George, D., & Mallery, P. (2005). SPSS for windows step by step. 4th Edition, Pearson Publisher, U.S.A, Boston.

[9] Gruber P.N, Jonathan P.K & David F.H (2009). Social Security and Retirement around the World. 4th Edition, McGraw-Hill, Publisher, U.S.A, New York.

[10] Harari, M. J., Waehler, C. A., & Rogers, J. R. (2005). An empirical investigation of a theoretically based measure of perceived wellness. Journal of Counseling Psychology, Vol 5, 93-103

[11] Hardy, M. (2006). Handbook of aging and the social sciences 1st Edition, Pitman Publisher, London, UK.

[12] Hildingh, C., Luepker, R. V., Baigi, A., & Lidell, E. (2006). Stress, health complaints, and self-confidence: A comparison between young adult women in Swedish and USA. Scandinavian Journal of the Caring Sciences, Vol 2, 20-28.

[13] Juster, F.K; Thomas P.N; Suzman S.K, Richard P.P (2005). "An Overview of the Health and Retirement Study". The Journal of Human Resources Vol 9, 4-9.

[14] Kombo M.N & Tromp P.H (2006), Research Methods,3rd Edition, McGraw-Hill Publisher, New York, U.S.A.

[15] Kothari, .C. R. (2006), Research Methodology: 1st Edition, Pitman Publisher, London, UK.

[16] Lawler, C., Ouimette, P., & Dahlstedt, D. (2005). Posttraumatic stress symptoms, coping and physical health status among university students seeking health care. Journal of Traumatic Stress, 18, 741-750.

[17] Liebman M.N, Jeffrey B.S, Erzo F.P. Luttmer P.N & David G. Seif P.P (2008). "Labor Supply Responses to Marginal Social Security Benefits: Evidence from Discontinuities. 5th Edition, Macmillan. Publishers, U.S.A. New York.

[18] Lundberg, U. (2006). Stress, subjective and objective health. International Journal of Social Welfare, Vol 5, 41-48.

[19] Maples, M. F., & Abney, P. C. (2006). Baby boomers mature and gerontological counseling comes of age. Journal of Counseling & Development, Vol 8, 3-9.

[20] Mugenda&Mugenda, (2003).Research Methods: 1st Edition, Published by ACTS, Nairobi, Kenya.

[21] Mugenda and Mugenda (2008), Research Methods: 2nd Edition, Published by ACTS, Nairobi, Kenya.

[22] Myers, J. E., Sweeney, T. J. (2005). The indivisible self: An evidence-based model of wellness. Journal of Individual Psychology, Vol 6, 69-79

[23] Ohman, L., Bergdahl, J., Nyberg, L., & Nilsson, L. (2007). Longitudinal analysis of the relationbetween moderate long-term stress and health. Stress and health: Journal of the International Society for the Investigation of Stress, Vol 3, page 31-38.

[24] Peil S.K (2005). Research Methodology and Design, 5th Edition, Macmillan. Publishers, New York, U.S.A.

[25] Powers, E. A. (2012). Social roles and social participation 3rd edition, University of Minnesota Press. Minneapolis, USA.

[26] Putney, N. M., Bengtson, V. L. (2012). Families, intergenerational relationships, and kinkeeping in midlife. 3rd edition, John Wiley & Sons, Inc publishers, USA, New York.

[27] Randall, P. M. (2009). Whither retirement education: A wellness approach. Training and Developmental Journal, Vol 3, 46-51.

[28] Rashad P.N & Mehbaliyev P.S (2009), Determinants of retirement status 4th Edition, Pearson Publisher, U.S.A, Boston.

[29] Resnick, H. S., Acierno, R., Kilpatrick, D. G. (2007). Medical and mental health outcomes: Part 2. Health impact of interpersonal violence. Behavioral Medicine Journal, Vol 3, page 65-78.

[30] Robison, J.T., Moen, P. (2010). A life-coarse perspective on housing expectations and shifts in late midlife. Research On Aging Journal, Vol 2, 49-53.

[31] Skarborn, M., Nicki, R. (2010). Worry in pre- and post-retirement persons. International Journal of Aging and Human Development, Vol 5 page 61-71.

[32] Spence, A.P. (2009) Biology of human aging. 1 st edition, Springer, Press New York, USA.

[33] Stephens, M. A., & Franks, M. (2009). Intergenerational relationships in later-life families: 1 st edition, Springer Press, USA, New York.

[34] Stevens, J. (2009). Intermediate statistics. 5Th edition, LEA Publishers, USA, New York:

[35] Taylor, G. P., Hartman-Stein, P. E. (2005). Providing psychological services to older adults: 1 st edition, Springer, Press New York, USA.

[36] Tytherleigh, M. Y., Jacobs, P. A., Webb, C., Ricketts, C., & Cooper, C. (2007). Gender, health, and stress in English university staff - exposure or vulnerability? Applied Psychology: An International Review Journal, Vol 6, page 67-87.

[37] Ulrich, L. B., Brott, P. E. (2006). Older workers and bridge employment: Redefining retirement. Journal of Employment Counseling, Vol 4, page 59-72.

[38] Weckerle, J. R., Shultz, K. S. (2009). Influences on the bridge employment decision among older USA workers. Journal of Occupational and Organizational Psychology, Vol 7, page 37-49.

[39] Williamson, G. M., & Shaffer, D. R. (2011). Relationship quality and potentially harmful behaviors by spo http://www.healthypeople.gov/About/usal caregivers: How we were then, how we are now. Psychology and Aging Journal, Vol 6, page 17-26.

[40] Whitmer, J. M., & Sweeney, T. J. (2012). A holistic model for wellness and prevention over the lifespan. Journal of Counseling and Development, Vol 71, page 40-48.

[41] Zapolsky, S. (2013). American Association of Retired Persons. Edition Oxford University Press. New York: USA

[42] Zikmund, W., (2010). Business Research Methods 8th Edition. McGraw-Hill Publishers. U.S.A. New York.

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APPENDICES

APPENDIX I: INTRODUCTION LETTER

Dear Respondent,

My name is Lillian Wata, a student at the Jomo Kenyatta university of Agriculture and Technology pursuing masters of Science in Human Resources Management. I am working on a project, which is a requirement in the partial fulfillment for the degree of Masters of Science in Human Resources Management.

Below is a questionnaire: I would like you to either tick where appropriate or fill in. All data and information gathered is purely for academics purpose and will be treated with confidentiality. I thank you in advance for your cooperation in this regard and may God bless you.

Yours Faithfully,

Lillian Wata

APPENDIX II: QUESTIONNIARE

Please tick the most appropriate response to questions that give possible answers and write down your answers in the spaces provide open ended questions. Your response to the questions will be held with utmost confidentiality and will not be revealed to anyone. For that reason you do not need to write your name in this questionnaire.

SECTION A: DEMOGRAPHIC INFORMATION

Please tick appropriately

1. What is your Gender?

Gender :

Male

☐

Female

☐

2. What is your age bracket?
   - ☐ 18-30 yrs
   - ☐ 31-40 yrs
   - ☐ 41-50 yrs
   - ☐ Above 51 yrs

3. What is your highest education level?
   - ☐ Secondary level
   - ☐ College level
   - ☐ University level

Any other please specify.....

4. What is your working experience?
   - ☐ Below 1 year
   - ☐ 1-5years
   - ☐ 6-10 years
   - ☐ 11-20 years
   - ☐ 21 and above

SECTION B: ATTITUDE TOWARD RETIREMENT

Please state the extent to which you agree or disagree with the following statements regarding attitude toward retirement. (*1 Strongly Disagree, 2 Disagree, 3 Neutral, 4 Agree and 5 Strongly Agree*)

	1	**2**	**3**	**4**	**5**
1. Better prepared for their retirement have more positive attitudes toward retirement.					
2. The organization retirement is a voluntary process					
3.There is compulsory retirement in the organization					
4. People might feel optimistic about their retirement despite inadequate retirement savings					
5.Psychological stress affects employees attitude toward retirement					

SECTION C: OCCUPATIONAL FACTORS

Please state the extent to which you agree or disagree with the following statements regarding occupational factors (*1 strongly Disagree, 2 Disagree, 3 Neutral, 4 Agree and 5 strongly Agree)*

	1	**2**	**3**	**4**	**5**
6. Work environment issues play a key role in a person's decision to retire					
7. Low level of education has negative effect on retirement decision					
8. Financial education and employee education is considered a part of learning that affects behavior and attitude changes					
9..Labor market situation influencing attitudes towards retirement and retirement decisions					
10.Job satisfaction has been found to influence decision to retire					

11.How does occupational Factors affect employees attitude towards retirement (Explain)……
……..

SECTION C: ECONOMIC FACTORS

Please state the extent to which you agree or disagree with the following statements regarding Economic Factors**(***1 strongly Disagree, 2 Disagree, 3 Neutral, 4 Agree and 5 strongly Agree)*

	1	**2**	**3**	**4**	**5**

12. Pensions at work has been positively related to retirement attitude					
13. Being older with more income has a significant impact on retirement benefits					
14. Financial education program appears to be related to the decision to save and invest for retirement					
15. Social Security and Medicare programs could influence an individual's retirement attitudes and behaviors					
16. Investment uncertainty negatively affects retirement decision					

17.How does retirement Economic Factors affect employee's attitude towards retirement? (Explain)……
……

SECTION D: ENVIRONMENTAL FACTORS

Please state the extent to which you agree or disagree with the following statements regarding Environmental Factors **(***1 strongly Disagree, 2 Disagree, 3 Neutral, 4 Agree and 5 Strongly Agree***)**

	1	**2**	**3**	**4**	**5**
18. Employees with high demanding jobs choose to retire early					
19. Work-family conflict leads to early retirement among employees					
20. Cultural practices positively influence decision to retire					
21. Social status of a worker unavoidably declines at retirement					
22. Retirement's anxiety affects social well-being or condition of the retiree					

23. How does environmental factors affect employees attitude towards retirement? (Explain).....
.....

SECTION E: SOCIAL FACTORS

Please state the extent to which you agree or disagree with the following statements regarding Social Factors**. (***1 Strongly Disagree, 2 Disagree, 3 Neutral, 4 Agree and 5 Strongly Agree***)**

	1	**2**	**3**	**4**	**5**
24. Older Employees have negative attitude towards retirement					
25. Males were likely to have a more positive attitude toward retirement than females					
26.Attitude towards retirement vary with race					
27. Pull factors may attract workers into retirement, such as having a partner who is retired					
28. Married individuals were likely to have more positive attitudes toward retirement					

29. How does Social Factors affect employee's attitude towards retirement? (Explain).....

Ergonomic Aspects and Workers Subjective Complaints on Martapura Diamond Polishing at Banjar Regency

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Abstract- Diamond polishing is a type of work that requires high accuracy therefore it requires adequate supporting facilities in order to avoid the possibility of potential interference / complaints occurring as the result of non-ergonomic working facilities. This is a descriptive research to describe the state of the working desks and chairs used by the workers on Martapura diamond polishing. The research purposes were to identify the dimensions of working-desks and chairs that are being used and the perceived impact by workers on Martapura diamond polishing business unit. The working-desk and chairs measurement was conducted by using gauge instrument while the data of working-desks and chairs utilization impact was collected by observation and interview to all workers on working site. The measurement result showed that working-desks and chairs at Martapura diamond polishing business unit were not ergonomic yet. Those non-ergonomic conditions have several impacts on diamond polishing workers in the form of fatigue (14.28%), back pain (87.5%), and scoliosis (14.28%). The efforts that should be made to reduce the subjective complaint is with the use of designated working-desks and chairs appropriate with the results of anthropometry calibration in Martapura diamond polishing workers in example for the working-desks is 51-62 cm high and 63-76 cm width, while the chairs is 47-54 cm high, 33-42 cm width, 50-55 cm length and equipped with a backrest. In addition, the workers need to perform relaxation movements such as changing sitting position once in a hour, doing light movement to avoid tingling and also always to work in the upright sitting position to minimized back pain experience. This research was expected could be used as an input and consideration in creating a safe working environment and meet the health requirements, particularly in the diamond processing industry.

Index Terms- ergonomic aspects, subjective complaints, diamond polishing

I. Introduction

In the globalization era, competitions between industries are barely unavoidable. Diamond polishing, as one of informal field of works also facing a competition challenge to increase their productivity and competitiveness But in order to achieve maximum productivity and competitiveness, this industry still had to deal with unproductive workers cause by non-ergonomics working facilities such as working-desk and chairs. The working facilities that cannot fulfill the worker anthropometric conditions also give bad influences to workers health, which are fatigue, back pain and scoliosis.

Basically diamond polishing industries required an extra skills, precision and expertise. Those kind requirements will have an impact on workers condition. Therefore an ergonomic working position becomes a necessity to improve the performance of workers. Work performance is a function of working posture and work productivity. With the ergonomic working postures, then a worker will be able to work with effective, convenient, safety, healthy and efficient while the opposite condition, working posture can cause pain and tired quickly than an ergonomic working postures[1]. Health problems such as fatigue also can be prevent by using a suitable and ergonomic working tools, that can impact to higher working efficient and productivity.[2]

South Kalimantan has a the one and only diamond craft industry located at Banjar Municipal in the form of Martapura Diamond Polishing Working Unit. In their main activity, the diamond polishing workers perform their work in sitting position. The treated materials were placed in front of the worker body, than the workers posture was adjusted with materials positions. This kind working conditions forcing workers to always be in a static and unnatural position for a long term. Several researches have shown that working in non-ergonomic conditions could cause low back pain, fatigue event accident. A research conducted by Richard (2001) has shown that 80% of adult peoples have suffered back pain caused by non-ergonomic working positions and 40% of them shown absenteeism on their work[3]. Working in a static position on a long term also can cause a faster complaint regarding *musculoskeletal* system.[4]

II. Research Method

This is a descriptive research that describe the condition of working-desk and chairs and the workers anthropometric condition. The research population was all of 12 workers at Martapura Diamond Polishing Working Unit. Samples were taken with purposive sampling; generate 8 workers that meet inclusive criteria as research sample. The research inclusive criteria were (1) Workers did not work in other places beside Martapura Diamond Polishing Working Unit as a diamond craftsman (2) Homogeneous type of work performed was shaping and polishing the underside of diamonds.

III. Results and Discussion

Diamond formation process starts from the raw materials that undergo a Brutting process of diamonds (round shaped) then the top is formed into 33 parts (including the flat section / table) and the bottom is formed into 24 sections so that when the polished diamond that has been formed into 57 facets / angle then that is what is called the diamond. 37.5% of respondents in the research were categorized as productive age (26-30 years old). Overview of the respondents working period can be seen in Table 1 below

Table 1. Working period of Martapura diamond polishing workers

No	Working Period (years)	Frequency (peoples)	Percentage (%)
1	1-5	1	12.5
2	6-10	1	12.5
3	11-15	5	62.5
4	16-20	1	12.5
Total		8	100.0

Working hours of all workers is 8 hours per day with a working time of at 08.00-16.00 pm punctuated by breaks for 1 hour which was made during the time of prayer and lunch. Working conditions in the Martapura diamond polishing working unit can be seen in Table 2 below:

Table 2. Conditions of Workers Working Environment

No	Working Conditions	Yes	(%)	No	(%)
1	Insufficient lighting	8	100	0	00.0
2	Workplace atmosphere noisy	3	37.5	5	62.5
3	Room coloring is blinding	0	0	8	100.0
4	Comfortable air temperature	8	100	0	00.0
5	Adequate fresh air supply	8	100	0	00.0
6	The layout of the working-desks and chairs make space for workers to move narrowed	5	62.5	3	37.5

Based on interviews conducted to eight workers, working environment is considered quite feasible due to sufficient lighting vision that the workers need in addition of table light. The sound of diamonds polishing machines considered quite un-noisy, un-blinding room's color, sufficient fresh air requirements while the layout of working-desk felt too narrow to move by the workers. From 8 interviewed workers, 7 of them feel the presence subjective complaints. Type of subjective complaints experienced can be seen in Table 3 below

Table 3. Type of subjective complaints experienced by the workers of Martapura diamond polishing working unit

No	Type of subjective complaints	Frequency	Percentage (%)
1	Fatigue	1	11.1
2	Back pain	7	77.8
3	Scoliosis	1	11.1

From the table above shows that most perceived subjective complaints by the workers is back pain (77.8%). From interview data, the workers stated that the perceived of subjective complaints related to the use of working-desks and chairs mostly happened when they were working (71.4%). For detail can be seen on the table below

Table 4. The time of the workers subjective complaints emerged

No	The emerge time	Frequency	Percentage (%)
1	Before work	0	00.0
2	While working	5	71.4
3	After work	2	28.6

Working-desk that used by workers in diamond polishing scrubbing section is made of iron, in which the table is provided by the manager of Martapura Diamond Polishing Working Unit and adjusted based on the size of the working-desk used by the craftsmen in Continental Europe (Netherlands) with a homogeneous size. There are twelve working desk that are used in polishing the diamonds and almost activities carried out on the working desk. The result of measurement can be seen in table 5 below

Table 5. The diamond polishing working-desk size

No	Criteria	Measurement result (cm)	Standard (cm)
1	High	89	68-75
2	Width	94	± 80
3	Thickness	9	± 5
4	Surface	qualify	flat, not blinding
5	Footrest	as required	As required

In doing their work 100% of activities performed in a sitting position in a chair. From the observation, the used chairs all made of iron with the same size (homogeneous). The results of measurements on worker chairs can be seen in table 6 below:

Table 6. The diamond polishing chairs size

No	Criteria	Measurement result (cm)	Standard (cm)
1	Cushion high	63	38-43
2	Cushion long	49	36
3	Cushion width	38	40-44
4	Backrest	not available	Not exceed the lower edge of the tip of the scapula and the bottom as high as the hip line

From the anthropometric measurement data to eight workers gained the data as shown in Table 7 below:

Table 7. The diamond polishing workers anthropometric size

Respondent no.	Anthropometric size					
	Sh	Eh	Hw	Hl	Dwk	Dkf
1	90	28	36	73	55	49
2	85	24	33	71	50	49
3	76	21	36	63	50	37
4	79	27	42	76	52	50
5	82	28	34	67	53	47
6	82	32	38	75	55	54
7	79	25	38	66	51	46
8	78	28	35	73	54	45

Remarks
Sh: Sitting height Hl: Hand Length Hw: Hips width
Eh: Elbow height Dwk: Dent the waist to knee Dkf: Dent the knee to feet

Various diseases can occur due to poor jobs or working facilities that are less congenial. Health problems that arise can be physical and mental health disorders. The non-ergonomic working tools will cause rapid muscle fatigue and when the work equipment and manpower are appropriate, then the fatigue can be prevented and the results will be more efficiently. The results of an efficient work process means to obtain high productivity[2]. Several studies have shown that working in non-ergonomic conditions can cause various problems, such as: pain, fatigue, and even accidents. This is also proved by a research conducted by Richard (2001) which states that there are currently 80% of people live as adults experience back pain, and resulted in 40% of them were absent from their work.[3]

Work equipment design principles should be able to solve problems that arise in the reality of human interaction with equipment comprehensively. The ergonomics requirement of a working-desk is adjustable on height according to the concerned workers, so workers with different heights can use the working-desk. The working-desk settings should work not only based on height only, but to the size of the body itself. If the working-desk height cannot be adjusted according to the height of worker, the working-desk height can be adjusted to the size of the highest worker rather than the shortest one. For the shortest worker can wear a higher pads so that it can adjust to the plains of the workplace.[5]

The position of working desk is quite too high, if used continuously, it can cause fatigue in the muscles of the wrist and forearm. This is proven by research that 12.5% of diamond polishing workers feel tired because the position of desk that is not ergonomic. Supposedly if the of working-desk was adjustable, then the existence of footrest is not necessary anymore, while working-desk that is too low can cause the body lying too bent down so effected on the related muscles to such as pain in back, shoulders and the waist.[6]

The ergonomic requirement of a work chair is capable of creating a stable sitting posture and provides relaxation of the muscles that are not being used for work and did not experience the emphases on the body that can interfere with blood circulation and sensibility of these parts.[5] A good working chair high is designed in accordance with the worker's body anthropometry. The size of the seat that is too low or too high can cause new problems in the spine due to the burden resting on the bottom of the thigh, so that the blood flow to the legs to a standstill.[6]

Based on the existing provisions, the backrest should exist in a working chair design, adjusted to the workers physiology and anatomy as well as adjustable backrest for keeping the state of waist curvature straight. But if the backrest cannot be adjustable, then usually the worker working attitude tend to up straight, so it cannot support the back perfectly.[4] Backrest becomes important to support the back weight towards the back (lumber spine). It must be designed so that the backrest can be moved up and down as well as forward and backward. In addition it should also be able to set its flexibility to fit the shape of the back. This measure can reduce muscular effort required to maintain a rigid or tense posture. Backrest on chair able to stabilize posture and produce a reaction to the movement slightly pushed forward during the work.[6]

As much as 71.43% of workers feel their subjective complaints while performing their work and will gradually disappear when the work has finished, although for the other 28.57% stated that they still feel the subjective complaints even they have returned to their homes. This indicates that these complaints was indeed caused by the used of non-ergonomic working-desk and chairs. This condition would influentially affect the emergence of fatigue and the decrease of workers concentration level.

To obtain an ergonomic working-desk and chair it is necessary to design an anthropometrical calibrated working-desk and chairs so that both the workers with small or large body can use the working-desk and chairs as can been seen on the table 8 below

Table 8. Calibrated workUniting desk and chairs in Martapura Diamond Polishing Working

Objects	Measurement	Actual size (cm)	Recommended size (based on average worker anthropometry)
Working Desk	Height	89 cm	51 to 62 cm (include th desk thickness)
	Width	94 cm	63 to 73 cm
Chairs	Height	63 cm	47 to 54 cm
	Length	49 cm	50 to 55 cm
	Width	38 cm	33 to 42 cm
Using 5 and 95 percentile			

In addition there is the possibility of other factor that may cause the occurrence of subjective complaints, which is the lack of relaxation movement that can reduce fatigue caused by continuously carried of work. Moreover the potential boredom is a manifestation of their monotonous atmosphere especially for workers who are almost 100% of their work is done in a sitting position. Psychological factors often arise because of the repeated working conditions.[6]

IV. Conclusion

From the research that has been conducted, it can be concluded that the size of working-desk and chairs in Martapura Diamond Polishing Working Unit has not meet with the anthropometrical standards for diamond polishing worker (non-ergonomic), the workers body size (anthropometry) vary greatly, with the average of seat high is 81.38 cm, 26.13 cm elbow high, 52.13 cm knees high, 36.50 cm hips wide, 30.35 cm length of upper arm, 40.25 cm length forearm, 52.50 cm waist to knee dent and knee to feet 47.13 cm curved, the working conditions in Martapura Diamond Polishing Working Unit is quite feasible due the sufficient lighting, unnoisy sound generated from polishing machines, unblinding room colors, and sufficient air temperature and fresh air supply for the workers need, the most subjective complaints felt by workers is low back pain (87.5%), follow by fatigue (14.28%) and Scoliosis (14.28%).

References

[1] http://whitehouse-consulting.com/work-performance. Access on February 2nd, 2013.

[2] Notoatmodjo, Soekidjo. Ilmu Kesehatan Masyarakat. Jakarta: Rhineka Cipta. 1997

[3] Santoso, Gempur, Dr, Drs, M.Kes. Ergonomi Manusia, Peralatan, dan Lingkungan. Jakarta: Prestasi Pustaka. 2004.

[4] Grandjian, Fitting the Task to Man : Ergonomic Approach. Taylor & Francis Group. Jerman. 1980.

[5] Suma'mur, Dr, MSc. Ergonomi Untuk Produktivitas Kerja. Jakarta : CV. Haji Mas Agung. 1989

[6] Nurmianto, Eko. Ergonomi, Konsep Dasar dan Aplikasinya. Jakarta: Guna Widya. 1996

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The Factors Influencing the High Quality Service Environment in the Private Sector Banks in Sri Lanka

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Abstract- The physical service environment plays an important role in shaping the service experience and delivering customer satisfaction. High quality service environment can influence critical customer relationship goals from the initial attraction of the customers through retention and even enhancement of relationship. It is important to identify how the service environment ties up into customer's perception. This indicates the need of understanding staff expectations and perceptions as the first step in achieving organizational performance. Generally, all customers and staff wish to work or obtain services within a high quality environment.

Customers frequently use service environment as an important quality proxy and firms take great pains to signal quality and to portray the design image. Thus, the bank environment has to be geared towards facilitating both the utilitarian and hedonic desires of a customer. Traditionally, researches have studied the effect of service environment on cognitive evaluations of customers. These cognitive evaluations include perceived service quality, perceived reliability, and perceived reputation. This study broadens the scope of bank environment research to affective evaluation as well. The main purpose of the study is to examine the role of bank environment on customer's internal evaluations which constitute both utilitarian and hedonic evaluation, and how these evaluations lead to the customer's judgment of overall service environmental value. Also, for some customers the primary drivers of value will be utilitarian benefits whereas for others they are hedonic benefits. Customer's banking motivation was identified as the moderating factor in the model.

Data were collected mainly by administering a questionnaire. Sample size of 120 respondents was used for the study. Random sampling method was used to determine the sample. Bank managers were asked to volunteer their participation in collecting data. Response rate for the questionnaire is 96%. Based on the analysis of customer's responses, it is clear that the customers are interested in the physical appearance of the service organization. (Mean: 3.7522, SD: 0.49053, n:50 and significance 99%). Also, the result indicates that ambience is also an influencing factor in case of quality service environment. (Mean: 3.4900, SD: 0.55949, n: 100 and significance 99%). Further, it has been proved by the respondents that customers expect social cues in a high quality service environment. (Mean: 3.3845, SD: 0.50341, N: 100 and significance 99%). Moreover, the factors such as parking light, air condition and color scheme were identified as the factors that largely contribute to have a high quality service environment.

Index Terms- ambience, Quality perception, Perceived reliability, Environmental value, in- house designing.

I. INTRODUCTION

1.1 Background of the Study

The customer is the key to success of an organization. Hence it is noteworthy to make special concentration on customer's views and behavioral aspect in designing the service rendered by any organization. Besides, in shaping and reshaping the service experiences and delivering satisfaction to customers, an attempt must be made on physical environment which plays a vital role in getting customer satisfied. High quality service environment can influence critical customer relationship goal from the initial attraction of the customers through retention and even enhancement of relationship. In this context, really it is worthwhile to verify the way of trying up customer's perception as well as cognition to the service environment in an organization. In achieving organizational prosperity at first getting understanding of staff expectations and their perception and cognitive nature is almost required and essential. In general not only the customers but also employees would prefer to deal with a high quality service atmosphere.

Customers frequently use environment as an important quality proxy and firm take great pains to signal quality to portray the desired image. Thus the ban environment has to be geared toward facilitating both the utilitarian and hedonic desires of customers. Traditionally researchers have studies the effect of service environment on cognitive evaluations include perceived service quality, perceived reliability, and perceived reputation.

Put in the simplest terms, services are deeds, processes and performances. Our opening vignette illustrates what is meant by this definition. The services offered by IBM are not tangible things that can be touched, seen and felt, but rather are intangible deeds and performances. To be concrete, IBM offers repair and maintenance service for its equipment, consulting service for IT and e- commerce applications, training service, web designing and hosting, and other services. These services may include a final tangible report, a website or in the case of training, tangible instructional materials. But for the most part, the entire service is represented to the client through problem analysis activities, meeting with the clients, follow–up calls, and reporting a series of deeds, processes and performance. Similarly, the core offering of hospitals, hotels, banks and utilities comprise primary deeds and actions performed for customers. The variety of definitions can often explain the describing industries that comprise the service sector of the economy.

Customer service is critical aspect of what we mean by "service". Customer service is the service provided in support of a company's core products. Companies typically do not charge for customer service. Customer service can occur on-site (as where a retail employee help a customer find a desired item or answers a question) or it can occur over the phone or via the internet. Many companies operate customer service call centers, often around the clock. Quality customer service is essential to building customer relationships. It should not, however, be confused with the services provided for sale by the company.

Looking for the recent past, it is apparent how technology has been the basic force behind service innovations now taken for granted; automated service mail, interactive voice response systems, for machines, Automated Teller Machines and other common services were possible only because of new technologies. Just think how dramatically different the world would be without these basic technology services.

Most recently, people have seen the explosion of the internet, resulting in a host of new services and established companies find that internet provides a way to offer new services as well.

Many new technology services are on the horizon. Already many cars are equipped with map and routing software that direct drivers to specific locations. In the future, in car systems may provide recommendations for shopping by informing drivers when they are within a certain number of miles of their preferred retailer. On a road trip, the system may provide weather forecasts and warnings, and when it is time to stop for the right, the car's system could book a room at a nearby hotel, recommended a restaurant and make dinner reservations.

In addition providing opportunities for new service offerings, technology is providing vehicles for delivering existing services in more accessible, convenient, productive ways. Technology facilities basic customer service functions (bill paying, questions, checking account records, tracking orders), transactions (both retail and business-to- business) and learning or information seeking. Technology spotlight traces how, through history, evolving technologies have changed customer service forever. Companies have moves from face-to face service to telephone based service to widespread use of interactive voice response systems to internet based customer service and now to wireless service. Interestingly, many companies are coming full circle and now offer human contact as the ultimate from of customer service.

Technology also facilitates transactions by offering a direct vehicle for making purchases. Technology enables both customers and employees to be more effective in getting and providing service. Through self-service technologies, customer can serve themselves more effectively via online banking, customers can access their accounts, check balances apply for loans shift money among accounts and take care of just about any banking need they might have all without the assistants of the bank employees. These online banking services are just one example of the types of self-service technologies that are proliferating across industries.

For employees, technology can provide tremendous support in making them more efficient and effective in delivering service. Customer relationship management and sales support software are broad categories of technology than can aid frontline employees in providing better service. By having immediate access to information about their product and service offerings as well as about particular customers, employees are better able to serve them. This type of information allows employees to customize service to fit the customer's needs. They can also be much more efficient and timely than in the old days when most customer and product information was in paper files or in the heads of sales and customer service representatives.

Another role that customers can play in services co-creations and delivery is that of contribution to their own satisfaction and the ultimate quality of the services they receive. Customers may care little that have increased the productivity of the organization through their participation, but they likely care a great deal about whether their needs are fulfilled. Effective customer participation can increase the likely hood that needs are met and that the benefits the customer participation; in these service; unless the customer perform their roles effectively, the desired service customers are not possible. Service depends upon expertise capacity, resource capacity, time capacity, economic rewards, psychic rewards, trust and control. The important thing to remember is that in many service scenarios customers can and often do choose to fully or partially produce the service themselves. Thus, in addition to recognizing that customers can be productive resources and co-creators of quality and value, organizations also need to recognize the customer's role as a potential competitor.

1.1 Problem of the study

It is proven that in reviewing the service quality of different private banks there are certain differentiations in their service from bank to bank. Thus it has a problem here that due to what circumstances these differentiations take place in different service climates. In selecting the respective researchable area, private sector banks were mainly highlighted as it makes a large contribution to Sri Lankan economy today. When this sector was noted an attempt was made to identify the salient problem in this particular sector. For this purpose, though further attempt was made to make a preliminary data survey, unfortunately, it was unable to find out recorded data relevant to the nature of services provided by different private banks. So, it was intended to extend the preliminary data survey towards respective leading customers. In doing so, a pilot study with randomly selected respondents were made and through that survey, existing hidden problem was identified from the customers. Accordingly, it was defined that the salient problem relating to service rendered by private sector banks is heterogeneity of their service from bank to bank. In customers' point of view, they say that qualities wise certain banks at moderate level while some are at low level. In particular, in house service is rather different from bank to bank. This is almost related to quality of service. Quality means fitness for use. That fitness is moderated by each bank. This is main shortcoming given by the customers. Accordingly, it was the focal problem of this study that due to what circumstances such an uneven service pattern is appeared in private sector banks in Sri Lanka.

1.3 OBJECTIVES OF THE STUDY

Objectives were set with two dimensions leading to principal objective and specific objectives.

1.3.1 Principal objective

To examine the role of banks environment on customers internal evaluation which constitute both utilitarian and hedonic evaluations.

1.3.2 Specific objectives

- To identify how these evaluations lead to the customers judgment on overall service environmental value.
- To identify the primary and other drivers of environment values.

1.4 SIGNIFICANCE OF THE STUDY

Much of the discussions about designing the service help to achieve organizational success due to the fact that customer is the active and vital component by which the dignity of an organization is specified. So applying behavioral concepts to enhance customer perception leads to equip with the keen competition emerging from the dynamic market domain. Thus, the degree of customer contact is particularly relevant to process design and internal environment design of banks and other service organizations. In this case customer becomes the central focus on the design of processes and interior climate as well. As this study focuses on the influencers which shape and reshape the environmental condition which affects highly the quality expected by the customers coming to the private banks it possesses a commercial validity as well as notional economic value. So it bears a lifelong significance.

With the introduction of the open economic policy in Sri Lanka, total economic structure was dramatically transformed and it results to emerge service sector service sector as vital and dominant sub system in the country. Accordingly, insurance, banking and other services revolutionarily changed and spread out all over the country with mix of both public and private sector services. Of them banking sector takes noticeable and great place. Banking system plays a vital and dominant role in the overall financial market. It can deviate economy optimistically or pessimistically because of its fuels to the economy to steer towards desired end. To smoothen the function of an economy as a prior requirement financial stability is needed. In this case, banking sector plays a decisive role. Thus, is noteworthy to make a consideration about this particular sector. Having taken this salient point into consideration, it was supposed to conduct a study along with the selected topic. Accordingly it is views here that this study would fill up any gap which might prevail due to lack of studies done so far in this connection. So this study would bear an invaluable significance.

Furthermore, this study addresses the problem of service offering patterns in different private banks. Addressing this kind of problem would fulfill the need of era. In that sense it is supposed that this study conveys a long living validity. Also, the finding and conclusion made under this study may help to respective bankers, policymakers, respective authorities, exiting customers, potential customers, stakeholders and general public as a whole. Besides the recommendations made under this study would be great help to those who are interested to get a sound feed- back to get this particular sector developed. In considering all above situations this study bears a lifelong validity and significance.

1.5 HYPOTHESES OF THE STUDY

The overall study of conducted based on the following hypotheses.

$\mathbf{H_1}$ – Design cues influence on high quality service environment.

$\mathbf{H_2}$ - High quality service environment is determined by ambient cues.

$\mathbf{H_3}$ - Delivery of high quality service environment is thoroughly influenced by social cues.

1.6 METHODOLOGY

1.6.1 Sources of data

As this study empirical in nature a great attempt was made to collect primary data which were gathered by administering a detailed questionnaire. Meanwhile certain secondary data were also associated when and where all over the survey.

1.6.2 Sample

For the convenience of analysis it was supposed to restrict the study to Hatton National Bank and the number of respondents selected was 120. For this purpose,

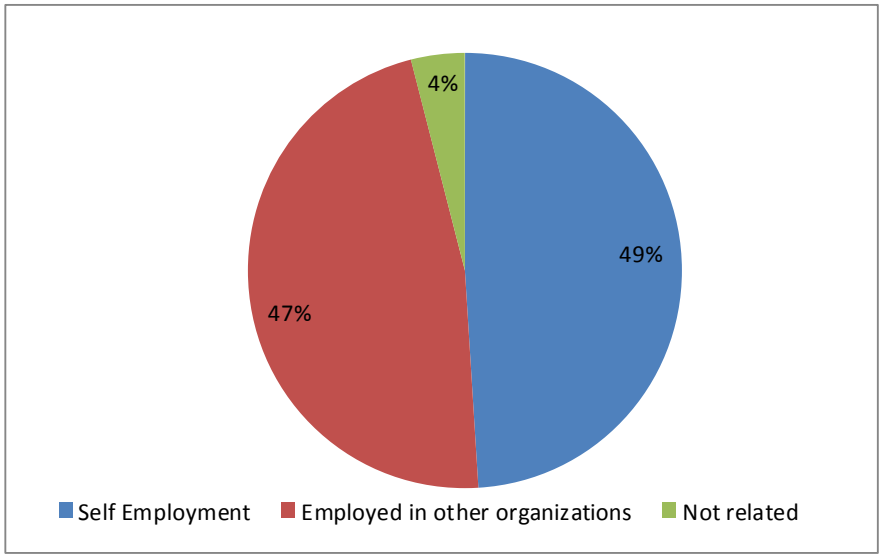
The technique random sample was employed. The respective sample population consisted of customers and managers were requested to volunteer their participation in collecting data. At the end, only 115 questionnaire answers were selected and due to the rejection 15 answers eventually 100 papers were selected for analysis.

1.6.3 Data presentation and analysis.

The unit measure employed to ranked data was derived from the Likert Scale having ranged value from 1 to 5. In order to secure the consistency of the analysis, mean values above 3.0 within which the evaluation of scale were either answered agree or strongly agree were concerned as high. Mean values below 3.0 were therefore concern as low. For the purpose of checking the reliability of questionnaire Cronbach's Alpha () was applied and ultimate outcomes were serially tabulated. And also the measurement of central tendencies and correlation analysis were applied here for presenting and analyzing data.

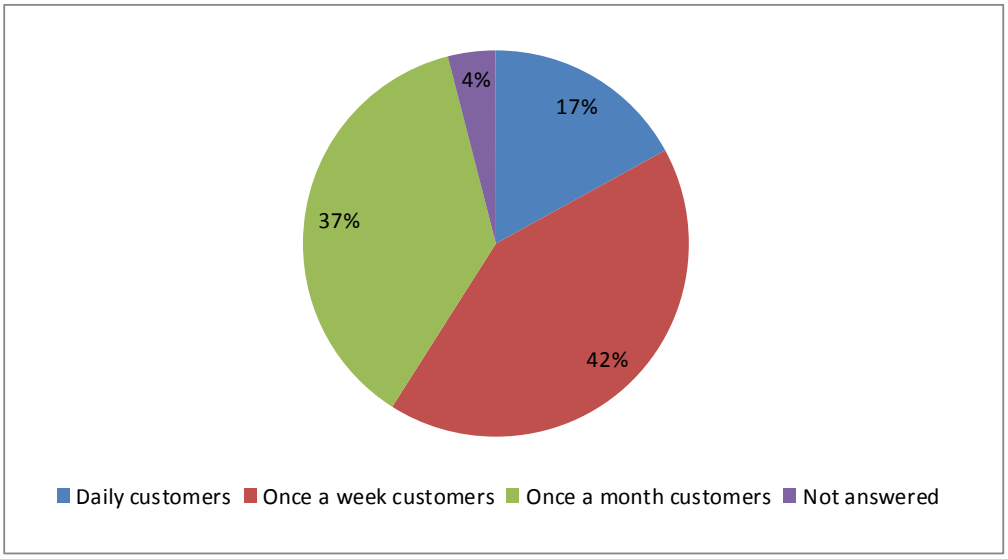
1.7 DATA PRESENTATION AND ANALYSIS

The following pie chart was constructed based on the data collected in respects of customer's occupation.



As indicated by the above chart it is notable that out of 100 respondent 49% are self-employed while 47% are employed in private and public sector organizations. And also 4% of the respondents did not reveal their occupation profile. In this case the sample was not bias one and it was the population as it is represented both employed and unemployed respondents on comparable basis.

Customer frequency of banking



17% customers used to visit the bank daily and 42% and 37% once a week once a month respectively. The majority of the customers are pertaining to regular basis (Daily 37% + Once a week 17% = 54%)

1.8 RELIABILITY ANALYSIS OF THE QUESTIONNAIRE

The reliability of the questionnaire was tested by using Cronbach's Alpha (∑) and results were tabulated as indicated below. The questionnaire is reliable because Alpha ( ) is ranging from 0.94 to 0.95.

Overall reliability of the questionnaire

Cronbach's Alpha	NO. of Questions
0.940	66

It was found that the overall reliability of the questionnaire Cronbach's Alpha ( ) is 0.940 (> 0.6) and it is at highly acceptable level. This gives a better assurance to prove the reliability of the questionnaire.

Reliability of the questionnaire – physical appearance improved branches.

Cronbach's Alpha	NO. of Questions
0.945	66

It was found further that the reliability of the questionnaire in physical appearance in improved branches Cronbach's Alpha ( ) is 0.945 (> 0.6) and it is at highly acceptable level.

Reliability of the questionnaire – Branches physical appearance not improved.

Cronbach's Alpha	NO. of Questions
0.836	66

The reliability index, cronbach's Alpha, of the questionnaire in physical appearance in non-improved branches is 0.836 (>0.6) and it is at highly acceptable level.

1.9 TESTING THE VALIDITY OF THE QUESTIONNAIRE

Researchers check the validity of the questionnaire by using correlation analysis

Convergent validity

The following table consists of the information relevant to the correlation between the same sub variables and different sub variables. Among the independent variables of interests to the study, the sub variables on building exterior and building interior ($r = 0.746$, $p < 0.01$), Employee perception and customer perception ($r = 0.721$, $p < .01$) are having very strong correlation and significantly related to each other.

Discriminate Validity

Building exterior and customer perception ($r = .680$, $p < .01$) are having very strong correlation and significantly related to each other.

1.10 TESTING HYPOTHESES

H_I – Design cues influence on high quality service environment

Building exterior, parking, interior layout and signage are the elements considered to measure the design cues.

Design Cues

All branches (physical appearance improved and not improved)		**Physical appearance improved branches**		**Physical; appearance not improved branches.**	
Mean	Std. Deviation	Mean	Std. Deviation	Mean	Std. Deviation
3.3309	.61077	3.7522	0.49053	2.9096	.38843

Hypothesis H_I – Effect of Design Cues

This hypothesis is relevant to the physical appearance of enhancing the customer perception for service environment. Building exterior, parking, interior layout, signage and finishing are considered as components of design cues. It was revealed that favorable design of a bank optimistically facilitates the efficiency for a customer. Also it was noted that the bank interior and exterior designs enable to capture customers. Layout and parking style strategically planned to facilitate the customer's arrivals.

H_2 – Ambient cues influence to provide high quality service environment

Light, air conditioners, sounds and music all together with color schemes were the elements considered to measure the ambient cues.

Hypothesis H_2 – Effect of Ambient Cues

Ambient Cues become the sensory cues in branch. Light, Air Conditioners, Sounds and misic including the color schemes were the four components of ambiance considered in the study. The hypothesis presented in the section relates to the combined effect individual cues. Hypothesis H2 states a positive relationship between favorable perception of ambient cues and customer satisfaction.

All branches (physical appearance improved and not improved)		**Physical appearance improved branches**		**Physical; appearance not improved branches.**	
Mean	Std. Deviation	Mean	Std. Deviation	Mean	Std. Deviation
3.4900	.55949	3.7183	0.52243	3.2617	.50311

H_3 – Social cues influence to provide high quality service environment

Employee's perception, customer perception, service and employee uniforms were the elements considered to measure the social cues.

Social Cues

All branches (physical appearance improved and not improved)		**Physical appearance improved branches**		**Physical; appearance not improved branches.**	
Mean	Std. Deviation	Mean	Std. Deviation	Mean	Std. Deviation
3.3845	.50341	3.5408	0.56457	3.2283	.37874

Hypothesis: H_3 effect of social cues.

Social cues are sensory cues in employee perception, customer perception, service and employee uniforms were the four components of social considered in this study. The hypothesis presented in the section relates to the combined effect individual cues. Hypothesis H3 states a positive relationship between favorable perception of social cues and customer.

1.11 ANALYSIS OF SUB FACTORS.

Design Cues

Mean and SD in all braches.

Braches with Physical appearance improved & not improved
(No. of participants 100)

Sub Variables	Mean	Std. Deviation
Building exterior	2.9800	1.14574
Parking	4.2233	.59752
Interior layout	3.1162	.42360
Signage	3.2400	.78579
Furnishing	3.0950	.88009

Researchers found that customers are more concerned about the parking facilities. And also it was clear that the building exterior is less attractive to the customers with minimum mean and standard deviation.

Mean and SD physical appearance improved and not improved

Sub Variables	Physical appearance improved branches (No of respondents 50)		Physical appearance not improved branches (No of respondents 50)	
	Mean	Std. Deviation	Mean	Std. Deviation
Building exterior	3.6800	.89077	2.2800	.92670
Parking	4.3000	.56444	4.1467	.62510
Interior layout	3.3709	.41956	2.8615	.23258
Signage	3.6533	.71891	2.8267	.61809
Furnishing	3.7567	.58244	2.4333	.57637

Analysis shows that there is a notable difference in response between appearance in improved and non-improved branches. It was found that customer are more concern about building Exterior, signage, furnishing and interior layout and parking facility of the physical appearance in improved branches. Parking has been given the highest priority by both types of branches.

Ambient cues
Mean and SD in all branches

Braches with Physical appearance improved & not improved (No. of participants 100)		
Sub Variables	Mean	Std. Deviation
Light	3.5067	.66747
Air Conditioner	3.7800	.60343
Sound and Music	3.3367	.78065
Color Scheme	3.2050	.91406

Researchers found customers are more concerned about the Light and Air conditioner of the service environment and have given less concern on color scheme. The standard deviation of the color scheme and sound and music is relatively high.

Mean and SD physical appearance improved or not improved

Sub Variables	Physical appearance improved branches (No of respondents 50)		Physical appearance not improved branches (No of respondents 50)	
	Mean	Std. Deviation	Mean	Std. Deviation
Light	3.8600	.55160	3.1533	.58403
Air Conditioner	3.8400	.68426	3.7200	.51004
Sound and Music	3.5867	.66517	3.0867	.81318
Color Scheme	3.8367	.58949	2.5733	.72544

Researchers found that mean value of Light, Air conditioner and sound & music are in both type of both branches are having a satisfactory level. Respondents from two types of branches are having different views in terms of light, color, scheme and sound & music.

Social Cues
Mean and SD in all branches

Braches with Physical appearance improved & not improved (No. of participants 100)

Sub Variables	Mean	Std. Deviation
Employee perception	3.5710	.59559
Customer perception	3.1161	.60620
Service	3.3510	.42486
Employee uniforms	3.5000	.77525

It is evident through the analysis that all the factors are in moderate. Researchers found that customers are more concerned about the employee perception, their uniforms and the service provided.

Mean and SD physical appearance improved and not improved.

Sub Variables	Physical appearance improved branches (No of respondents 50)		Physical appearance not improved branches (No of respondents 50)	
	Mean	Std. Deviation	Mean	Std. Deviation
Employee perception	3.7048	.59086	3.4371	.57539
Customer perception	3.4163	.65212	2.8159	.36510
Service	3.4720	.45403	3.2300	.35871
Employee uniforms	3.5700	.88069	3.4300	.65473

The researchers found that the mean value of the employee perception, service and employee uniforms are in both types of branches having satisfactory level. However customer perception might be change with the physical appearance of the branches.

Correlation between variables.

		Design Cues	Ambient	Social
Design Cues	**Pearson Correlation**	1	.578**	.597**
	Sig. (2 - tailed)		.000	.000
	N	100	100	100
Ambient	**Pearson Correlation**	.578**	1	.687**
	Sig. (2 - tailed)	.000		.000
	N	100	100	100
Social	**Pearson Correlation**	.597**	.687**	1
	Sig. (2 - tailed)	.000	.000	
	N	100	100	100

** Correlation is significant at the 0.01 level (2 – tailed)

It was found that Correlation in Design cues, Ambient cues and social cues are at significant level.

Analysis of variables among employed and self-employed customers mean and SD (Employed and Self Employed)

Variables	Employed		Self Employed	
	Mean	Std. Deviation	Mean	Std. Deviation
Design cues	3.2826	.55654	3.4204	.64519
Ambient cues	3.4167	.54257	3.5629	.59354
Social cues	3.3377	.45302	3.4426	.45302

It was found that both employed and self-employed customers are more concerned about the design, social and ambient cues. However employed respondents more concerned but above factors than employed respondents.

Customers who visit branches daily, once a week and others
Mean customers' frequency of visit

Variables	Daily Customers		Once a week customers		Other customers	
	Mean	Std. Deviation	Mean	Std. Deviation	Mean	Std. Deviation
Design cues	3.7693	.63431	3.2343	.48153	3.3075	.65776
Ambient cues	3.8039	.52946	3.4683	.52056	3.398	.58305
Social cues	3.6272	.66404	3.2876	.49099	3.4347	.38224

Daily customers are more concerned about the service environment than other customers.

II. CONCLUSION AND RECOMMENDATIONS

In this case a great attempt was made to identify the influence mad by design cues, ambient and social cues on the high quality service environment by the Hatton National Bank.

According to proven results relating to customer's responses it was noted that the customers are preferred on the physical appearance of the bank. (Mean: 3.7522, SD: 0.49053, n = 50 and significance 99%). Furthermore it was captured here that the customers in high quality service environment highly concern the physical dimensions other than those who are in low quality service environment. Thus the physical aspect of the service environment is highly cared by the customers who come to satisfy their banking requirements from the Hatton National bank.

The outcomes of the study imply that ambience is also an influencing factor in designing high quality service environment (Mean: 3.4900, SD: 0.55949, n= 100 and significance 99%). Moreover it was identified that there is no considerable difference between the responses of customers in high quality service environment and those in less quality environment. This proves that each customer accepts the ambience is as an essential one.

In addition, customers expect the social cues in high quality service environment (Mean: 3.3845, SED: 0.50341, n= 100 and significance 99%). Further there is no considerable difference between the responses made by the customers in high quality service environment and those ion low quality service environment. This indicates that each customer accepts the social cues are vital.

Meanwhile further verification was made that parking, Lighting, Air condition and color scheme play a significant role in high quality service environment.

III. RECOMMENDATIONS

- For design cues, building exterior and parking facilities should be taken into account as dominant and vital factors.
- In improving the customers' perception a great place should be given to designing the service and ambient cues.
- Management in private sector banks should concentrate on color scheme of the service quality environment in stimulating customers towards their service.
- Furnishing design and their respective layout plan should be given a more attention than that is in practice.

REFERENCES

[1] Behara and Chase, 1998, Service Quality Development: International Journal of Service Industry Management 7, No. 4.PP 58-72

[2] Berry L. L., 1993, Ten lessons for improving quality, Marketing science institute report, No. 93-104

[3] Binter M.J., 2001, Self Service Technologies: What do customers expect? Marketing Management, Spring, pp 10-11

[4] Bouding .W., 1993, A dynamic process model of service quality: From expectations to behavioral intentions, Journal of marketing 30,PP 7-27

[5] Donthu, N and Yoo. B, 1998, Culture influence on service expectation: Journal of service research, 1, PP 178- 86

[6] Get 3, D, O' Neill, M and Carlsen. J, 2001, Service quality evaluation at events through service mapping: Journal of travel research 39, pp 300- 90

[7] Gummesson E. and Kingman. J, 1991, Service design and quality: Assen/ Maastricht, Netherlands: Van grocum

[8] Hanser. J.R. and Cluasing D., 1998, The house of quality, Harvard Business Review, pp 63-73

[9] International Marketing review, 2001, 19 No5, pp 450-81

[10] Lucke E. E. and Suther T. W., 1991, Marketing driven quality: A market research and product requirements methodology, IBM technical report

[11] Nelson P, 1970, Information and consumer behavior: Journal of political economy 78, No. 20, pp 311- 29

[12] Parasuraman, Berry and Zeithamal, 1195, Understanding customer expectations, p 41

[13] Reochheld. F.R. and sasser Jr. W. E., 1990, Zero Defection: Quality comes to customer, Harvard Business Review, pp 105 – 7

[14] Rust R. T., Moorman C. and Dickson, P. R. 2002, Getting Return on Quality: Revenue expansion, Cost reduction or both, Journal of Marketing, pp 7 -24

[15] Rus R. T. and Oliver R. L., 2000, should we delight the customer: Journal of the academy of Marketing Science. 28, pp 86- 94

[16] Smith A. M. and Renolds N. L., 2001, Measuring Cross- Cultural Service quality: A framework for assessment

[17] Smith R. A. and Houston M. J., 1982, Script base evaluation of satisfaction with service in emerging perceptions on service marketing, pp 59-62

[18] Tax S. S. and Morgan, F. N. 2004, Towards a theory of service delivery networks: working paper, W.P. care school of business, Arizona State University

[19] Vargo S. L. and Lusch R. F. 2004, the four service marketing myths: Journal of Service research 6, pp 324 -35

[20] Zeitham V. and Prasuramn A., 2004, service quality MSI relevant knowledge services, Canbridge M. A. Marketing Science Institute

[21] Zethaml V. A. Prasuramn A. And Berry L.L. 1990, delivering quality services: balancing customer perceptions and expectations, New York Free Press, pp 28

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Innovative Strategies Influencing Performance of National Hospital Insurance Fund in Nairobi County Kenya

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Abstract- National health insurance is health insurance that insures a national population for the costs of health care and usually is instituted as a program of healthcare reform. In Kenya the only National Health Insurance Fund is the NHIF. The study's specific objectives were to determine the effect of process re-engineering strategy on performance of NHIF, to establish the effect of benefit management strategy on performance of NHIF, to determine the effect of information communication strategy on performance of NHIF and to determine the effect of E-Banking strategy on performance of NHIF. A survey research design technique was used to collect data which involved the use of both primary and secondary data sources. Structured questionnaires were used to collect primary data. The target population of the study consisted of 601 employees of the 6 branches and 4 satellite offices of the National Hospital and Insurance Fund located in Nairobi County. A sample size of 150 respondents from the 10 selected NHIF offices in Nairobi County was drawn. One way analysis of variance was used to test for statistical significance in the difference of the performance means ascribed to the different NHIF strategies from the different branches and satellite offices. The significance probability results for process re-engineering strategy (P = 0.230), benefit management strategy (P = 0.098), information communication strategy (P = 0.578) and E-banking strategy (P = 0.643) were greater than the level of significance of 99% (0.01). This shows there exists statistically significant differences in mean performance between the four strategies at 99% (0.01) level of significance. The 2 way ANOVA illustrated that the distribution of information on process re-engineering (P=0.122), distribution on benefit management strategy (P=0.088), distribution of information communication strategy (P=0.534), and distribution of information on E-Banking strategy (P=0.016) was the same across the different NHIF branches/satellite offices surveyed and operating in Nairobi County. The study findings established that sstrategies play a critical role in improving performance of organizations and giving organizations directions.

Index Terms- Health Information Systems, Out of pocket Health expenditure, Innovative strategies

I. INTRODUCTION

1.1 Background of the study

National health insurance (sometimes called statutory health insurance) is health insurance that insures a national population for the costs of health care and usually is instituted as a program of healthcare reform. It is enforced by law. It may be administered by the public sector, the private sector, or a combination of both. Funding mechanisms vary with the particular program and country. National or Statutory health insurance does not equate to government run or government financed health care, but is usually established by national legislation (NewYorkTimes, 2012). There exist two major models of national health insurance that is, the Beveridge and the Bismarck model. The model was named after William Beveridge, the daring social reformer who designed Britain's National Health Service (Hennock, 2007). In this system, health care is provided and financed by the government through tax payments, just like the police force or the public library. Here, many, but not all, hospitals and clinics are owned by the government; some doctors are government employees, but there are also private doctors who collect their fees from the government. In Britain, you never get a doctor bill. These systems tend to have low costs per capita, because the government, as the sole payer, controls what doctors can do and what they can charge Leichter, 2005).

Countries using the Beveridge plan or variations on it include its birthplace Great Britain, Spain, most of Scandinavia and New Zealand. Hong Kong still has its own Beveridge-style health care, because the populace simply refused to give it up when the Chinese took over that former British colony in 1997. Cuba represents the extreme application of the Beveridge approach; it is probably the world's purest example of total government control (Leichter, 2005). In Australia's Medicare system or the United Kingdom's National Health Services (NHS), contributions to the National Health Insurance (NHI) or Social Health Insurance SHI system are made via taxation and therefore are not optional even though use of the health scheme it finances is (Leichter, 2005). In practice of course, most people paying for national health insurance will join the insurance scheme. Where the national health insurance scheme involves a choice of multiple insurance funds, the rates of contributions may vary and the person has to choose which insurance fund to

belong to. In the United States, the Patient Protection and Affordable Care Act includes a "health insurance mandate" that produces a similar effect as National Health Insurance (NHI) or Social Health Insurance (SHI), though it relies more heavily on the private market than their public sector (Medicare, Medicaid, and S-CHIP) than most countries. Thus the US Federal government has been involved in sponsoring several multi-state insurance plans (NewYorkTimes, 2012).

The Bismark model Named for the Prussian Chancellor Otto von Bismarck, who invented the welfare state as part of the unification of Germany in the 19th century. Despite its European heritage, this system of providing health care would look fairly familiar to Americans. It uses an insurance system- the insurers are called “sickness funds”-usually financed jointly by employers and employees through payroll deduction. Unlike the U.S. insurance industry, though, Bismarck-type health insurance plans have to cover everybody, and they don’t make a profit (Hennock, 2007). Doctors and hospitals tend to be private in Bismarck countries; Japan has more private hospitals than the U.S. Although this is a multi-payer model — Germany has about 240 different funds — tight regulation gives government much of the cost-control clout that the single-payer Beveridge Model provides. The Bismarck model is found in Germany, of course, and France, Belgium, the Netherlands, Japan, Switzerland, and, to a degree, in Latin America (Hennock, 2007). Other countries are largely funded by contributions by employers and employees to sickness funds. With these programs, funds come from neither the government nor direct private payments. This system operates in countries such as Germany and Belgium. These funds are usually not for profit institutions run solely for the benefit of their members. Usually characterization is a matter of degree: systems are mixes of these three sources of funds (private, employer-employee contributions, and national/sub-national taxes). In addition to direct medical costs, some national insurance plans also provide compensation for loss of work due to ill-health, or may be part of wider social insurance plans covering things such as pensions, unemployment, occupational retraining, and financial support for students (Leichter, 2005).

National schemes have the advantage that the pool or pools tend to be very, very large and reflective of the national population. Health care costs, which tend to be high at certain stages in life such as during pregnancy and childbirth and especially in the last few years of life can be paid into the pool over a lifetime and be higher when earnings capacity is greatest to meet costs incurred at times when earnings capacity is low or non-existent. This differs from the private insurance schemes that operate in some countries which tend to price insurance year on year according to health risks such as age, family history, previous illnesses, and height/weight ratios. Thus some people tend to have to pay more for their health insurance when they are sick and/or are least able to afford it. These factors are not taken into consideration in National Health Insurance schemes. In private schemes in competitive insurance markets, these activities by insurance companies tend to act against the basic principles of insurance which is group solidarity (Leathard, 2000).

In Kenya, the NHIF was established through an act of parliament in 1966 as a department in the Ministry of Health to provide health insurance exclusively for those in formal employment. In 1972, an amendment to allow for membership for those in informal employment was made. In 1998, the fund was transformed into a state corporation through an act of parliament that is, NHIF Act no 9 of 1998 (Deloitte, 2012). The mandate of NHIF includes;-registering members, receiving fund contributions and payments, make payments out of the fund to declared hospitals, set criteria for the declaration of hospitals and their accreditation, regulate contributions payable to the fund, the benefits and other payments made out to the fund, protect the interests of fund contributors and advise government on the national policy with regard to national health insurance (Deloitte, 2012). The fund discharges its mandate through 2 major agents that is; - employer’s monthly contributions to the fund and declared hospitals that disperse medical services on credit of NHIF members and later receive reimbursements through hospital claims (Deloitte, 2012).

In terms of the operation of its mandate, the NHIF’s operations are geared towards; - Pooling of funds- collections are done at head offices for purposes of equity and access to all members. Collections are done at branch offices and deposited to a main account. Based on equity and budgets, the contributions are allocated for payment of claims and administration of the service point. Remittance of contributions via online banking for employers and m-pesa for informal sector based contributors for members to enhance operational efficiency the fund has established an online banking facility for the over 50,000 employers registered to remit their contributions rime in reducing the amount of queue time in NHIF offices (Deloitte, 2012).
Concerning Membership to the fund; - the fund covers all adults over the age of 18 and their dependents. This includes the facilitation for universal coverage via legal framework in line with the principles of social health insurance. This fund has implemented measures such as; - online registration and magnetic stripe cards while it is in the process of linking with other government institutions and automatic updates. Registration- the fund has instituted an online registration mechanism that allows for the registration of new members with their dependents subject to fulfilling requirements that include the presentation of identification documents. In addition membership may be verified via SMS (Deloitte, 2011).

Concerning card issuance, in addition to registration - members are issued with portable membership cards that link the fund systems for use in any region of Kenya with fund declared health facilities. This technology increases efficiencies in service to members and allows for the management of fraud (Deloitte, 2011). NHIF seeks to enhance this process, additionally it has enabled the management of fraud. NHIF is currently in the process of improving its card system to include biometric technology for ease of identification as well as the integration of the card system with a bio-data system. Linkage with other government institutions- the fund is currently working on modalities of integrating its systems with those of the national bureau of registration for automatic updates of members details in order to ensure that all births and deaths are updated at the time when such certificates are issued (Deloitte, 2012).

Concerning communication systems on Benefits management, the fund has a surveillance mechanism in place that has reduced the incidences of fraudulent claims, rejected claims and has greatly improved the operational efficiency of the fund in

processing claims such that the average length of stay/ wait for claims processing has come down to 4 days from 11 days in 2004 (KIPRA, 2010). In addition NHIF closely works with health care providers via participation in hospital quality boards and has formed quality improvement teams in all accredited hospitals and empirical result evaluation systems. The fund also conducts clinical and quality audits quarterly for the purpose of evaluating and monitoring hospitals to ensure quality for members as well as the broader Kenyan population (KIPRA, 2010). Health management information systems are used by the fund through a wide network of accredited health care providers. It is the intention of the fund to develop a reference for health data with initial steps that include the adoption of the International Disease Coding Systems ICD-10 which has currently been implemented. This is to provide for easy analysis of disease trends, plan for benefit packages and ease the comparability of the fund to other countries (MOH, 2010).

Currently the NHIF provides 3 benefit packages and these include;- The standard benefits package which is an in-patient comprehensive cover at selected health care providers where members can visit any declared health providers to access services in any of the 500 such facilities in Kenya who provide services to all members based on 3 categories (that is; contract A where the health provider offers comprehensive care for both medical and surgical procedures for inpatient members and their declared dependents with no copayment ; contract B where members receive comprehensive services as per the contracted medical services for the health provider mainly in small private and mission based facilities; Contract C where payment is at the declared rebate rate for the number of days that a patient is admitted. The civil servants medical scheme introduced in 2012 to target civil servants and their dependents, it comprises of both in and outpatient services and an outsourced group life cover and last expense (KIPRA, 2012).

1.2 Statement of the problem

Kenya has a mixed health system with the public sector as the main player, a significant private sector and NGO sector by mainly Faith Based Organizations FBO. The health system in Kenya is characterized by; -under provision of funds, human resources, health commodities (drugs, infrastructure and Technology) as well as resource allocation bottlenecks and perennial leakages (corruption and misallocation). In rural and remote areas especially, these resource constraints coupled up with the pressures on the health system resulting from population increases, technology changes, re-emerging diseases and changing consumer needs has resulted in a weak primary health care system that bleeds into an inefficient referral system (Deloitte, 2011). In membership terms, only 19% of Kenyans have any form of health insurance at all despite the statutory obligation for all Kenyans who earn above KSH1000 to register in the NHIF scheme thus, as of June, 2010, the NHIF has managed to reach 6.6 million beneficiaries (out of a targeted population of 42 million Kenyans) and 2.8 million principle members, thus 82% of Kenyans are yet to have Health Insurance. In terms of claims; the benefits to pay-out ratio has increased from 32% in 2006 to 54% in 2010 i.e. proportion of payouts relative to fund contributions) driven by rapid increases in Claims payout from KSH1.1 billion in 2005 to KSH3.5 billion in 2010(KIPRA, 2010). The investment of ICT to reach members and support the delivery of its mandate with the introduction of Electronic Funds Transfer (m-pesa) for contributions, Swipe Cards, Point of sale POS systems, etcetera that have reduced the claims process form a month to 14-21 days. The rebates on its inpatient package have increased alongside the number of accredited hospitals included in the NHIF network with approximately 645 health facilities on the NHIF network, accounting for 44, 299 beds against a total of 49,000 available beds country wide-making it (NHIF) by far the largest insurer in the country(MOH, 2010).Despite these improvements by the NHIF in both hospital coverage and membership over the past decade, a significant 82% of Kenyans do not have access to any form of health insurance and hence the paper tries to assess and identify the contributing factors to NHIF's improving but avertedly slow expansion. This study therefore sought to examine the effect of innovative strategies on improved performance of the National Hospital Insurance Fund.

1.3 Objectives of the study

The study was guided by the following objectives,

1.3.1 General objective

To determine innovative strategies influencing performance of NHIF

1.3.2 Specific objectives

1. To determine the effect of process re-engineering strategy on performance of NHIF
2. To establish the effect of benefit management strategy on performance of NHIF
3. To determine the effect of information communication strategy on performance of NHIF
4. To determine the effect of E-Banking strategy on performance of NHIF

1.4 Research questions

1. What is the effect of process re-engineering strategy on performance of NHIF?
2. How has the establishment of benefit management strategy influenced the performance of NHIF?
3. How has information communication strategy influenced the performance of NHIF?
4. What is the effect of E-Banking strategy on performance of NHIF?

1.5 Significance of the Study

The study was of important significance to NHIF, researchers, policy makers and private future researchers as was described as follows:

1.5.1 National Hospital Insurance Fund (NHIF)

The results of this study will be of foremost significance to the National Hospital Insurance Fund as well as other providers of health insurance services in Kenya- by providing findings on the effects of innovative strategies on the performance of the NHIF scheme. This will enable competitor health insurance firms to understand the underlying influences on the adoption of innovative strategies such as process re-engineering, benefit

management strategy, information communication strategy and E-Banking strategy adopted on fund pooling, membership increments and other measures of insurance fund success.

1.5.2 Researchers

The results of the study will also be of use to researchers such as; strategic management students at the Jomo Kenyatta University of Agriculture and Technology who aim to understand the dynamic between product innovative and market penetration in this case NHIF proliferation in Kenya.

1.5.3 Policy Makers

Based on the findings which will be presented, the study will benefit policy makers in the health financing industry in Kenya and perhaps even in neighboring east African countries with similar market dynamics -enabling them make relevant decisions involving 3rd party health financing matters such as which benefit packages are appropriate and how to move the market out of a predominantly fee-for-service heath system.

1.5.4 Private Future Researchers

The study will assist private future researchers in the health research and this will aid the expansion of this study focus on other areas of health financing such as community based health insurance, private health insurance, self-insurance etcetera.

1.6 Scope of the Study

The study focused on the effects of innovative strategies on performance of National Hospital Insurance Fund NHIF. The respondents of the study were the relevant staffs of NHIF who were based in Nairobi County.

1.7 Limitations

The study was limited to the National Hospital Insurance Fund. Therefore, the results were not indicative of the operational dynamics of any other insurance fund in Kenya. Information is difficult to access due to cultural biases associated with inquiring about the financial position of an individual and due to institutional preferences for anonymity and client confidentiality. It is also difficult to establish the consent needed to conduct such a study given the tradition of state corporations being bureaucratic about information sharing. This study intended to collect information from a selection of NHIF members as well as its staff -therefore permission was sought from the management of the NHIF. Transportation to the said institutions was also covered by a limited budget as well as payments for research assistants and the purchase of stationary and printing expenses. The timeframe for the completion of this study was also, very limited as is the geographical area of the study.

II. LITERATURE REVIEW

2.1 Introduction

This chapter elaborated on the theoretical framework by discussing the the theories applicable for this research. The conceptual framework and empirical review related to the research problem will also be discussed together with a critique of the existing literature as well as a summary of the chapter and resaerch gaps of the problem.

2.2 Theoretical Review

The study was based on the systems dynamic model theory and knowledge based model theory. The two theories were discussed in detail and were linked to the objectives of the study.

2.2.1 Systems Dynamic Model.

System dynamics (SD) is a methodology and mathematical modeling technique for framing, understanding, and discussing complex issues and problems. Originally developed in the 1950s to help corporate managers improve their understanding of industrial processes, system dynamics is currently being used throughout the public and private sector for policy analysis and design. Many firms report that “people are their best assets.” In the public service realm such as NHIF is, people often are the only income generating asset. Depending on the problems such firm wish to address in order to stimulate value creation through management decision often involves the manipulation of qualitative/soft variables such as morale, productivity or work quality (Zack, 2001).

The systems modeling methodology of system dynamics is well suited to address the dynamic complexity that characterizes many public health issues. The system dynamics approach involves the development of computer simulation models that portray processes of accumulation and feedback and that may be tested systematically to find effective policies for overcoming policy resistance (Richardson, 2004). Although the use of qualitative variables is contentious, in System Dynamics Modelling, questions relating to attractiveness multipliers, human behavior in systems dynamic models SDM, idea mapping and soft variables created robust exchanges among academics and the professionals in the discipline (Homer, 2003).

It is believed that in many cases the challenges of dynamic complexity in public health may be effectively addressed with the systems modeling methodology of system dynamics. The methodology involves development of causal diagrams and policy-oriented computer simulation models that are unique to each problem setting (Sterman, 2001).

A system dynamics model consists of an interlocking set of differential and algebraic equations developed from a broad spectrum of relevant measured and experiential data. A completed model may contain scores or hundreds of such equations along with the appropriate numerical inputs. Modeling is an iterative process of scope selection, hypothesis generation, causal diagramming, quantification, reliability testing, and policy analysis (Forrester, 2004). The refinement process continues until the model is able to satisfy requirements concerning its realism, robustness, flexibility, clarity, ability to reproduce historical patterns, and ability to generate useful insights. These numerous requirements help to ensure that a model is reliable and useful not only for studying the past, but also for exploring possible futures (Forrester and Seng, 2004).

System dynamics modeling has been applied to issues of population health since the 1970s. Topic areas have included the following:-Disease epidemiology including work in heart disease, diabetes, HIV/AIDS, cervical cancer, chlamydia infection, dengue fever, and drug-resistant pneumococcal infections; Substance abuse epidemiology covering heroin addiction, cocaine prevalence and tobacco reduction policy (Robert, 2005); Patient flows in emergency and extended care (Wolstenhome,2004); Health care capacity and delivery in such areas as population-based health maintenance organization planning, dental care, and mental health, and as affected by natural disasters or terrorist act (Hirsh,2004) and Interactions

between health care or public health capacity and disease epidemiology(Homer,2003)

2.2.2 Knowledge Based Model Theory

Sveiby (2010) defines 10 Knowledge based strategies to improve an organizations value creation;-These strategies are defined as knowledge transfers;- between individuals, from individuals to external structure, from external structure to individuals, from individual competence to external structure, from internal structure to individual competence, within external structures, from eternal to internal structures, from internal to external structures, within internal structures and finally the maximization of value creation. These are strategies that seek to improve knowledge transfers between 3 families of intangible assets so that the acting capacity of people both within and outside the organization is enhanced. The three families of intangible assets are external structure, internal structure and individual competence. The combination of internal structure and individual competence can collectively be called Knowledge Capital (KC) (Syed and Kaushar, 2010).

The external structure in knowledge based strategies refers to the external structure of the organization environment and can be referred to as a family of intangible networks such as members in the instance of the NHIF, the public and private hospital system, employers and beneficiaries of the NHIF fund. The value of external relationships to the firm is based on its ability to resolve customer problems and this, involves an element of uncertainty. Reputations and relationships may be good or bad and can change over time since they are partly dependent on individuals (Alavi and Leidner, 2001).

The internal structure involves; - internally directed actions whose entirety creates internal networks and structures within an organization which manifests itself in form of patents, models, templates, computer systems and other more or less explicit administrative tools and processes. These are create by the by the employees and owned by the organization. In the NHIF system, internal structures within the fund's organizational structure includes employee competences in all the NHIF's various departments such as Human Resources HR, Information technology IT, Management, etcetera. Internal structure is partly dependent on individuals however, even if the most valuable individuals leave the firm, at least part of both the internal and external structure will remain intact and will be a platform for a new start (Sveiby and Lloyd, 2006).

2.3 Conceptual Framework

The conceptual framework illustrates the relationship between the independent variables which include process re-engineering strategy, benefit management strategy, ICT strategy and E-Banking strategy and the dependent variable which in this case is the performance of NHIF.

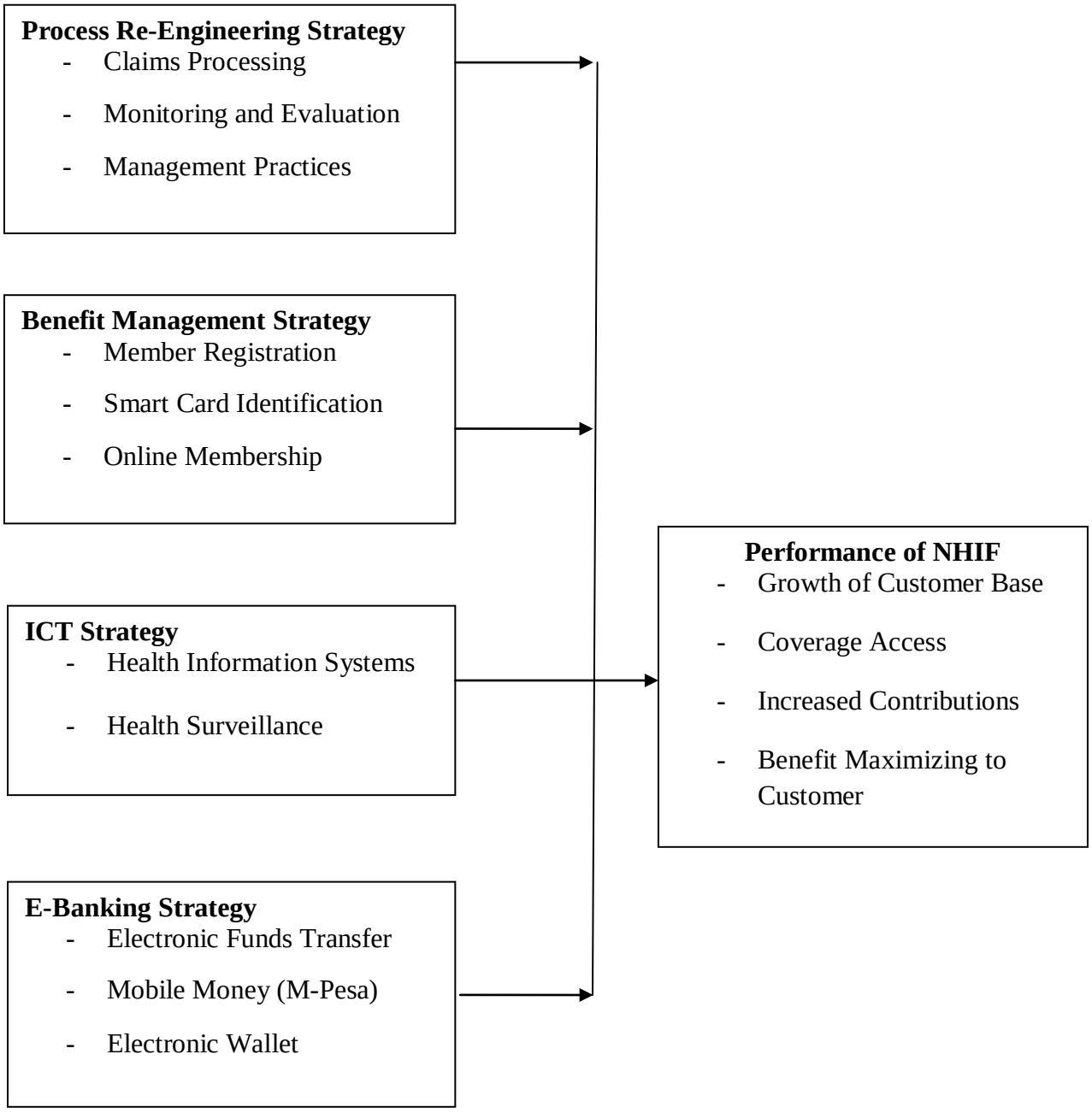

Figure 2. 1: Conceptual Framework

2.3.1 Process Re-Engineering Strategy

Evidence shows that increasing access to health care financing improves performance of national health insurance function. In countries such as Thailand, between 1990 and 2000 inequalities in health had been halved between the rich and the poor. This was attributed in part to the strategies that had been laid in place by the government with increased insurance cover at the fore front. Pro-poor health insurance schemes for instance improved the coverage of health services through initiatives such as subsidized voluntary health insurance and government welfare schemes for children under 12 years and the elderly including efforts to scale up primary and secondary health services via health financing. With this initiatives increased utilization of essential medical services such as vaccination coverage rose from 20%-40% in the early 1980s and to over 90% in the 1990s; and skilled birth attendance rose from 66% to 95% between 1987 and 1999 (Vattanawong et al, 2007; Tangchwensathien, 2004).

In Kenya, subsidized insurance is not a reality yet however the NHIF has come a long way as observed by the steady growth in membership to the scheme. As of 2010, membership had

grown to 2.8 million members with membership split between the informal sector and the formal sector was at 500,000 and 2.5 million members respectively. The informal sector in particular has been a formidable frontier for membership growth with an increase in membership in 2010 compared to in 2005 when membership to the fund among the informally employed was less than 200,000 (NHIF, 2010). Due to this increase in membership, other variables such as the contribution levels have risen for NHIF members and their beneficiaries hence the payout ratio was reported to have improved due to NHIF efforts to increase the level of pay-out to benefits from 32% in 2006 to 54% in 2010 (MOH, 2010).

In terms of the waiting period for claims processing within the NHIF system, it has been a shorter process than private insurers who have traditionally paid over the course of 30 days. However, due to its structural adjustments through process re-engineering strategies on the current claims process, the current waiting period for processing undisputed claims by NHIF is 14 days –down from the previous 21 day wait period standard. In fact within the years 2005-2010, the rebates on inpatient package had been progressively increased by increasing the number of accredited hospitals on the NHIF network. The fund as of 2010 had contracts with 645 hospitals accounting for 44,299 beds in Kenya against a total of the 49,000 beds available country wide. NHIF covers cuts across various categories of hospitals from public to faith based and private hospitals and is by far the largest health insurer in the country (MOH, 2010).

In terms of financial sustainability of the NHIF fund is based around a pay-as you go premise / fee-for-service type arrangement and thus it is critical that that receipts (collections) are prudentially matched to expenditures. In Kenya unlike in other countries such as; - Germany, Chile, Philippines where contributions are from employers and the government, the viability of the NHIF scheme relies upon a matching process of claims to expenditures. Several factors interplay to ensure the long term financial sustainability of the NHIF fund and these are;- the availability of sufficient revenues which depend on the ability to optimize membership contribution as well as a sustainable contribution rate; membership contributions such that the fund has managed to increase coverage at a rate above 10% and especially in the informal sector. However, variations in activity levels have been observed especially with inactivity among the informal sector compounded by the fact that the informal sector receives 33% of payouts besides paying 5% of contributions (GTZ, 2010).

The National Hospital Insurance Fund (NHIF) has negotiated fixed reimbursement rates for in-patient care to level off-peak costs of medical services to ensure the fund's sustainability. The reimbursement amount varies slightly with the level of provider, the diagnosis, and the type of care required. "Contract A" and "Contract B" providers are typically reimbursed through case based or fee-for-service provider payments. "Contract C" providers are reimbursed through a per diem rebate system. Claims are submitted by hospitals directly to the National Hospital Insurance Fund (NHIF), and then hospitals are paid for procedures and users are reimbursed. Most claims are reimbursed within 14 days of the claim received. This process is computerized and is designed to be transparent to the providers (NHIF, 2010). Moving forward, the NHIF intends to increasingly employ case-based payments for inpatient services. As the NHIF adds outpatient care to the benefits package with implementation of the recently gazette changes, capitation to comprehensive-care facilities will be the intended payment mechanisms. The fee-for-service system has been identified as one of the key drivers of escalating health care costs, as it creates incentives to encourage over-servicing and supplier-induced demand (NHIF, 2008). The majority of services covered by the NHIF are delivered through private facilities, indicating a preference by the bulk of salaried workers (who make up the majority of those covered by NHIF) toward private providers rather than public institutions (NHIF, 2009).

Of overall health expenditures in Kenya, Secondary and Tertiary care providers traditionally absorb approximately 70% of health expenditures, though health centers and primary care units provide the bulk of services. Health personnel expenditures are high—accounting for about 50% of the budget—compared to expenditures on drugs, pharmaceuticals, and operations and maintenance. Expenditures for curative care constitute more than 48% of the total MOH budget (MOH, 2007). Health care facilities also receive payments from the Ministry of Health (MOH), which releases funds to the county and national level hospitals. Allocations to the county health centers and dispensaries are in the form of line-item budgets, whereas national level hospitals receive global budgets. Salaries to staff are paid directly by the MOH. Drugs are also procured centrally, by the Kenya Medical Suppliers Agency (KEMSA) and then delivered to county and local level facilities. At the local level, the process of disbursement of funds is slow, which causes uncertainty for the providers, impedes their planning process, and encourages county level managers to await funding before they procure services, and creates an incentive to under-service clients (MOH,2007).

2.3.2 Benefit Management Strategy

Health care organizations world over are working to make their systems more efficient through the implementation of benefit management strategies. In Kenya, the National Hospital Insurance Fund (NHIF) prints member ID cards in-house to reduce fraud and improve patient satisfaction. The NHIF is a government health care organization covering Kenyans for their in-patient medical needs. Workers earning more than a defined amount must contribute to the fund through payroll deductions. Membership is voluntary for self-employed workers. The fund then pays hospital benefits to members and their declared dependants out of the contributions received.

According to the NHIF Web site, the organization "operates under the social principle that the rich should support the poor, the healthy should support the sick and the young should support the old." An upgrade to their card system began in 2003, when NHIF administrators decided to add a magnetic stripe to their members' ID cards. Previously, members received manila cards with stamps affixed to them containing member information. In the formative years, photos were collected and merged into the NHIF database however; -Through this process, it emerged that the intricacies involved in collecting photos, enhancing database security and much, much more required a more efficient process. (NHIF, 2006)

In 2006, the NHIF began using a Fargo DTC500 Series Direct-to-Card Printer/Encoder to produce member ID cards.

NHIF administrators scanned a member's photo, merged it into the badging software and printed in a two minutes process. This has helped the organization save on merging and printing time and has given hospitals better service by making information readily available through an open access database. The initially felt advantages were cost savings from not having to reprint manila cards every year. The new plastic ID cards are more durable. The need to print stamps to affix to the manila cards were an archaic security measure that have been replaced by the magnetic stripe, which displays the contribution status of the member when the card is read by a card reader. The new cards contain less information than before, because the rest of the information is available in the database via the card readers. Because the card readers display the ID cardholder's photo, it's possible to identify the member and his or her dependents. With 480 installed readers in all of its accredited hospitals fraud is curbed. Access to contribution information from members, eligibility of members and confirmation of Customer case studies are enabled. With the introduction of a photo in the database, it is impossible for fraudsters to print forged membership cards. (Deloitte, 2010)

With this information instant decision are possible about whether or not the member is eligible for benefits, thus reducing inappropriate claims. The same information used by the NHIF to analyze the claim for payment is now available to hospitals even before they file the claim. Previously, a member would present a claim to the NHIF for processing, but since his or her dependents were not in the database, the claim might have been rejected. With the introduction of details and photos about dependents, the ratio of rejections to claims has gone down, providing better service to the members. Because the NHIF can easily identify members and their dependents, the incidence of fraud has also gone down.

2.3.3 Information Communication Strategy

Health Management Information Systems have mainly been concerned with the collection of epidemiological data in the past lacking the management subsystems that deal with human resources, finance, essential drugs, public health services such as preventive and promotive services, transport and other logistics, infrastructure, community services, research and laboratory services (EOCHs, 2000).

Data derived from administrative databases, such as claims, billing, vital records and service utilization, are being increasingly used for quality monitoring purposes. However, these databases often lack important patient care information, including physical examination and laboratory results. Nonetheless, there are numerous advantages to drawing on administrative data for quality monitoring purposes. Not only are data typically accessible and inexpensive, they are also available for a wide range of patient services, both inpatient and outpatient. In addition, these data are likely to be up-to-date, a distinct advantage when seeking to measure quality of care thus many countries are adopting electronic health records to improve the organization and accessibility of health care information feeds and processes (Papanicholas and Smith, 2013).

Such developments are crucial, especially in the face of an increasingly complex range of information feeds associated with similarly multidimensional care processes. EHR systems have become an essential component of health systems that are in pursuit of high-quality, efficient and safe health care processes. Assuming that ongoing problems with the development of EHRs, such as the lack of standardization and unstructured text, are adequately addressed, their contribution to monitoring and assessing quality could be enormous. For example, consider the recent automated web-based risk assessment tool used in New Zealand for cardiovascular disease among adults aged 45 and over. While this data collection is primarily for clinical management purposes, the data may potentially also be used for monitoring population health and measuring health care performance (Papanicholas and Smith, 2013).

To this end, Health surveillance through population surveys are common and cover a range of topics, such as health status, living standards, drug use and prevalence of specific diseases. These surveys provide valuable information on health and health trends and also on risk exposure for national health insurance funds because of the large target population (every single citizen) and because the nature of the surveys is longitudinal with data collected over multiple years at both national and subnational levels. Where previously data collection was expensive that is, via post, telephone or personal interviews and the high methodological demands, and un-reliability of validity for certain types of data, due to the efforts by NHIF to integrate medical records to its data base via the introduction of smart cards, the data requirements for more accurate calculations of risk exposure will be possible (EOCHS, 2000).

Since the establishment of prototype Health Management Information Systems HMIS in 1980, several constraints have been an impediment to Health Information Systems growth as a modern management information system in Kenya most notably the lack of a written health information policy to ensure compliance and enforcement in reporting. Reporting from NGO and private health facilities is far lower than their share of health service provision (MOH, 2007).

Problems contributing to this are;- Low reporting rates (under 60% for most of the sub systems), making the data unrepresentative for management, planning and budgeting at all levels; Un-timeliness/late reporting; resulting in delays in data processing, analysis, utilization and outbreak response; Inadequate Health Records and Information Personnel and inadequate capacity for data analysis and management skills; Inadequate financial resources resulting in insufficient printing and distribution of data collection and reporting tools, equipment and its maintenance; Inadequate utilization and feedback of the available data at all levels and lack of management of information to support epidemiological data and inadequate capacity in the existing manpower; Lack of community based information systems in most county's and support for network of counties and by national level; Inadequate supportive supervision and monitoring of HMIS activities in the field leading to lack of verification at the point of collection; with many vertical programs being establishing their own database with no links to the main HIS- this has created disjointed information systems within the ministry and the lack of data repositories/ Data warehouse at all levels (GTZ,2010).

All these were also the pre-stated issues are identified as weaknesses of the current Health Information System HIS in all the clusters and hence the urgent need to strengthen these areas of weaknesses. The Ministry of Health (MOH) is still committed

to rebuilding its HMIS. This commitment is clearly manifested by the recruitment of the following key staff: Medical epidemiologists, Health Records and Information Officers and nurses and deploy them in PHUs to help strengthen the National and sub-national HMIS. The Health Management Information System in Kenya is the principal responsibility of one directorate within the Ministry of Health (MoH). Routine health data collection in Kenya is conducted through a network of some 5,170 peripheral health facilities [Peripheral Health Units or PHUs] and 234 hospitals that are distributed throughout the country in the 48 different health counties.

Within each county there are at least 2 Health Records and Information Officers as well as one Disease Surveillance Officer whose role is to collect data at the county level. Data collection registers are often improvised at the PHUs and reporting forms are not always available at all Public Health Utilities PHUs for monthly reporting of morbidity data and other health statistics. Effective coordination of health information is lacking, resulting in duplication and gaps in data collection, reporting, use and management of data. Consequently, vast amounts of data collected remain mostly incomplete, unreliable and unused. PHUs never receive feedback on the information they collected. . This genuinely affects the willingness of the PHUs staff to collect complete and accurate data. Though most counties have been provided computers for data entry and initial analysis, data is not computerized at county level (GTZ, 2010).

A primary reason for this is the absence of a relevant database for data entry and automatic indicator analysis. To this end the Kenya National Bureau of Statistics KNBS has assigned County Statisticians to each county (GTZ, 2010). The Health Records and information officers have been assigned to a number of key public health programs like malaria, reproductive health, disease surveillance and response, EPI, NASCOP, tuberculosis, nutrition and laboratory including laboratory. Capacity building of staff has not been consistent and not geared to information management and use. There are positions for Health Records and Information Technicians and Officers in all Government hospitals. The report of recent assessments (SAM, 2004 & MOH-FBO assessment 2007 draft reports) of the HMIS states that counties are understaffed and PHUs do not meet the staffing norms as stipulated in the Ministry of Health, Norms and Standards 2006. (GTZ, 2010)

Several key partners are supporting data collection of health data in the country. UNICEF is supporting data collection for the Expanded Program on Immunization (EPI). WHO, World Bank and CDC are supporting surveillance of communicable diseases [through the Integrated Disease Surveillance and Response or IDSR strategy – evaluated in August of 2003; The government of Denmark is supporting HIS through the Health Sector Program Support (HSPS DANIDA). Activities supported by the HSPS Danida include the rolling out of the automated Integrated County Health Management Information System and supporting the National HMIS in co-ordination of these activities. PEPFAR and Clinton Foundation through the MoH/NASCOP is paying salaries for some Key Staff of the Health Information Systems (HIS) deployed in each county. The Government of Kenya supports HMIS through the provision of infrastructure, payment of most staff and some office supplies (GTZ, 2010).

WHO supported the Service Availability Mapping (SAM) initial exercise in 2004 but support to update the database was not guaranteed. Capacity building of national and county staff has not been supported and individual initiatives have taken a leading role in M&E, Database management and Epidemiology. The development of Health Information Systems (HIS) Policy guidelines and a Strategic plan has not been supported since by any of the development partners and is critical to support the HIS linkages, operations and the M&E. USAID through the MoH department of Planning and Policy is supporting a National Health Accounts assessment survey from May 2007 to September 2007. The European Union is supporting HMIS in 2 Provinces (Eastern and Central) through a Health Sector Support Project (HSSP). Work plans for the HMIS are prepared annually. Senior MoH officials acknowledge that the legislation to support the collection, management and dissemination of health information is weak and not enforced. This, is outlined in the report of the needs Assessment study on health management information system for health sector monitoring and evaluation, 2004. “In 2000 - 2005, internal and external consultants undertook several studies of the existing HIS. The assessments identified the following problems: Underreporting; Lack of elaborate feedback at all levels; Lack of integration at various levels ; Inadequate capacities of HMIS staff; Too many data collecting and reporting tools (forms and registers); Too many indicators to monitor the sector; the lack of guidelines and policy to make reports mandatory; the lack of Standard Operating Procedures (SOPs); Inadequate data collection and reporting tools in PHUs; Inadequate supportive supervision to county’s; Majority of HMIS staff are untrained; Presence of many parallel data collection systems established by various programs and agencies, with very poor coordination among them. (NHIF, 2012)

The report also identified 6 priority actions to strengthen HMIS in the country, namely; Institute mandatory reporting from private providers and NGO facilities and this can be elaborated through provision of HIS policy guidelines; Building data collection, analysis and reporting capacity at the health facilities and at the county and national levels; streamlining the data collection process and establishing data warehouses at county levels and national level with linkages with all statistical units such as medical and immigration records and Conducting a census of health providers. The current HMIS system does not take into account the full range of providers in the country and NGO's operations are at times questionable and their contributions not well documented. Thus data mapping by the NHIF in conjunction with other government offices such as the KNBS and the MOH is crucial in order to develop and elaborate integrated harmonized data collection tools; to create a user friendly data capture systems with adequate linkages with all the statistical units; Develop a comprehensive HIS strategic plan which will support the HIS that will be buy in and supported by all stakeholders. Towards this goal the MoH has already conducted the following activities: Develop a list of health indicators through a consultative process; Train county and national Health Records and Information Officers in appropriate planning and basic use of reports for planning and support supervision; Provide computers to some counties for data

management and Mapping of staff from government Health facilities were conducted in 2004(Deloitte, 2010).

2.3.4 E-Banking Strategy

Providers are paid on a fee-for-service basis, with packages defined for each of the covered procedures and interventions. Claims submission and processing is cashless (electronic), allowing hospitals and insurers to submit claims and payments online.

The process for reporting and paying claims is designed to be simple and cashless from the perspective of the provider and beneficiary. In general, the process looks as follows: A patient comes to a provider to receive care and goes straight to the RSBY help desk; the patient's identity is verified via fingerprints; The patient visits the doctor who assesses his/her health condition; doctor prescribes a treatment; Assistant at RSBY help desk checks whether procedure is in the list of pre-specified packages. Procedures are priced/paid to the provider on a case-based payment system (If procedure is on list, appropriate prescribed package is selected, patient is scheduled for procedure, and the amount to be paid out is blocked-If not on list, help desk checks with insurer to price and get approval to conduct procedure, patient is scheduled for procedure, and the pre-determined amount to be paid is blocked); In-patient treatment is provided to the beneficiary; Upon release of beneficiary from hospital, Smartcard is swiped again with fingerprint verification. Beneficiary is paid by the hospital Rs. 100/- as transportation expense at time of discharge. The pre-specified cost of procedure is deducted from the amount available on the card; After rendering service to patient, hospital sends an electronic report and claim to the insurer/TPA; The insurer/TPA reviews the records and information and makes payment to the hospital (electronically) within a specified time period (agreed upon between insurer/TPA and hospital)

At present there are no quality standards being utilized by RSBY, but the national team is working with states and insurers to develop an incentive based quality management system for providers (e.g., a system where hospitals are graded according specific quality parameters and hospitals with better quality are paid at a higher rate by insurers) (NHIF, 2010).

2.3.5 Performance of NHIF

The performance of health financing as a core function of NHIF is about ensuring that sufficient financial resources are made available so that people can access effective health care. With regards to productivity, three specific sub-functions are distinguished: revenue collection, fund pooling and purchasing (WHO 2000). This involves;- Revenue collection (the process by which the health system determines and obtains financial contributions from households, enterprises, and other organizations including donors); Pooling sub-function (contributions are accumulated and managed in order to spread the risk of payment for health care among all members of a pool, instead of requiring that people pay individually for their health services) and Purchasing (the process by which pooled contributions are used to pay providers to deliver a set of health interventions) (WHR,2006).

A 'strategic' approach to purchasing implies a search for those interventions that are most cost-effective in reaching the health system goals i.e a calculated focus on performance criteria within each of the health financing sub-functions that is, the independent variables is appropriate. The analysis of these criteria can be considered as a first step towards the overall evaluation of the performance of the NHIF (KPHSA, 2009).

With regards to external service quality, its generally agreed that efforts to improve NHIF's external service quality/effectiveness must be predicated on objectives related to: increasing coverage, increasing accessibility and improving services offered to members so as to provide real social protection. The key efforts should include:- the pursuit of strategies to enhance membership of targeting the remaining part of the formal sector; continued enforcement so as to reduce levels of inactive members; targeting informal sector in aggregate groups to reduce adverse selection (examples of aggregate groups include;- 'matatu' drivers) (Chacha, 2012)

Thus, the strategic purchasing of healthcare is a performance perspective that the study wishes to brush on. This involves; - moving away from rebates to more innovative and cost effective payment modalities for providers (e.g. fixed reimbursement, diagnostic related groups costing and capitation). This may entail: – moving away from current rebate based payment system that depends on length of stay, to more cost effective payment modalities for providers (fixed reimbursement, capitation). This is already being implemented, for instance through;- the maternity cover where costing is based on the cost of care; Reviewing payment modalities for each category of contract; driving incentive programs with facilities to partner in attracting and retaining members; publishing ratings of facilities to encourage high quality treatment of NHIF members. Utilizing costing data to inform purchasing decisions and negotiations (MOH, 2013).

Such measures have been previously observed to go a long way to increase efficiency and target to reduce the proportion of administrative costs to at least 22% (current internal target) through: Implementation of financial management activity-based costing framework based on the SHI functions. This could allow the NHIF to track and manage costs related to registration, collections, payment, and customer service, etcetera since the Fund should be in a position to know the cost of acquiring each member /beneficiaries and the cost of serving members; Aligning business processes to technology and human resource capabilities: NHIF's personnel expenses account for 71% of total administrative costs –Therefore a reduction in the proportion of administrative expenses requires a thorough review of the HR expenditure / staffing numbers. Aligning business processes to technology and human resource capabilities: NHIF's personnel expenses account for 71% of total administrative costs – Therefore a reduction in the proportion of administrative expenses requires a thorough review of the HR expenditure / staffing numbers. To achieve this, business processes that eliminate redundant manual processing where possible have gone a long way. For example, the claims payment process could potentially be -to a greater degree- paper-less based on NHIF's current technology capabilities. This adjustment results in a reduction of staffing requirements in this area who could be redeployed in other areas as necessary. However; this may be perceived as paradoxical due to the observed fact that such a move would affect employee loyalty and employee satisfaction which are by themselves measures of NHIF performance (Deloitte, 2010).

2.4 Empirical Review

Public health insurance performance is strongly associated with efficiency enhancing, structural changes to national health insurance funds which includes the growth of institutional complexity as well as perceptions towards these public health insurance schemes by both providers and the general public (Barber and Yao, 2010), (Daalingjong and Suklaar, 2012). In china for instance, three separate public insurance funds are run by the Chinese government i.e. New Rural Co-operative Medical Scheme NCMS, Urban Residents Basic Medical Insurance (UR-BMI) and Urban Employees Basic Medical Insurance (UE-BMI). The national health reform emphasizes building on progress achieved with the insurance reforms, and expanding coverage and benefits. Hence Major reforms had been achieved in public health insurance implemented through subsidies from the year 2003. The National Health Service Surveys (NHSS) reported that Chinas national insurance coverage in china had increased from 23 to 87% between 2003 and 2008, with coverage rates of 72% in urban areas and 93% in rural areas in 2008 (Center for Health Statistics and Information, Ministry of Health 2009). Other factors that have been observed to impact the success-or lack thereof of Public/ National Health Insurance Schemes in china were observed to be;-

Funding levels specifically contribution levels and subsidization -In the New Rural Cooperative Medical Scheme NCMS program; prior studies have documented large differences in published and actual reimbursement rates, attributable to insufficient funding. Studies have suggested that, if counties reimbursed patients with catastrophic illness at half of the published benefits, the fund would be exhausted and those with catastrophic illnesses would still face out-of pocket expenses of 80% (Herd et al, 2010).

Regional disparities in socio-economic characteristics - While the government had committed to funding a basic health service package and public health services, the definition of minimum levels of care differed regionally. Disparities were observed between and across urban and rural programs in terms of their financing and benefits, related to local government economic capacity. For the New Rural Cooperative Medical Scheme NCMS, a large share of the financing was borne by individuals and county level governments through tax revenues (Xu et al, 2009).

The design of public health insurance schemes also featured as a key determinant of the performance of public health insurance schemes. In china, significant variation by counties in terms of performance is based on how the New Rural Cooperative Medical Scheme NCMS is designed. Since population size varied widely by county and the risk pool at county level covers approximately 450,000 people on average. Counties that had adopted overall risk pooling perform better in terms of access to health care compared with counties that used individual risk sharing through Medical Savings Accounts MSAs for outpatient coverage and benefits (Xu et al, 2009). Coverage has increased rapidly, particularly for the rural population. Both the rural and urban residents' insurance schemes aim for broad coverage in the initial stages of reform.

Coverage for major catastrophic events featured as one of the most important determinants of the success of these public medical insurance schemes in China. Since at the time, catastrophic events were not covered under the current programs although the reimbursement ceilings were scheduled to increase in 2010. Several studies had demonstrated that higher rates of insurance had been associated with increases in catastrophic expenses. Nationally representative data reported that, between 2003 and 2008, significantly more households had catastrophic health expenses (5.0 to 5.6%).47 This could be attributed to relatively low reimbursement caps and rates, high deductibles and copayments, and the incentives for over prescription and use of technology in the existing health system. High numbers of newly insured individuals were speculated to have accessed hospital care without full information about total costs. Moreover, studies had also documented higher charges for insured patients (Pan et al, 2009).

High hospital utilization rates were hence driven by the reimbursement policy of the residents' insurance programs, which focused on inpatient coverage. Hospital admission rates nearly doubled in 2008 to 6.8% compared with 3.6% in 2003 based on the NHSS household data. Public facilities continued to rely on revenues from medicines and diagnostics for operational costs, and the incentives in provider payment mechanisms led to poor quality health care practices including the overutilization of services and medicines. In example, in 2008, intramuscular and intravenous injection rates were very high: 30 and 35%, respectively, of rural prescriptions and 13 and 32%, respectively, of urban prescriptions.50 The NDRC sets the prices for many basic health care services, medicines, and diagnostics.

Pricing of services where generally the prices for basic services are set below cost, whereas prices for more sophisticated diagnostics and technology are set above costs. The government had at the time emphasized a zero profit mark-up policy for essential medicines, and this was targeted for implementation in 30% of counties. Before 2009, a 15% profit mark-up was permitted on medicines. Under pressure to generate operational costs, the pricing system provides incentives for overutilization of technology and medicines that have higher profit margins. Demand for medicines increase as their prices increase. Some hospitals have been reported to link physician pay directly to the use of sophisticated technologies such as CAT scans and brand pharmaceuticals with higher profit margins (Xu et al., 2010).

A particularly vulnerable group is rural-urban migrants and their families. Several studies have documented serious health problems among migrant families, including lower immunization rates, and higher rates of infectious diseases, occupational health problems, and maternal mortality. The central government is encouraging municipalities to include migrant workers in health insurance programs. Some municipalities that depend on migrant populations for labor have made efforts to address migrant populations into urban programs. Depending on the municipality, migrant workers may have the option of joining either the urban resident health insurance program or the urban basic medical insurance program under their employers (Rao et al, 2010). Typically the benefits packages for migrant workers are not as expansive as the UR-BMI or UE-BMI programs in the same municipality (Rao et al., 2010). Some local authorities have established plans for migrant workers, which amount to 4% of their total wages, rather than 8%, and no MSA.53 However, employers face lower costs by switching migrant workers into the UR-BMI. Payment for services is required in advance, and

the schemes and benefits are typically not portable, which can be a barrier to access.

A focus group study on the performance of the National Health Insurance Fund in Ghana observed strong associations between patient perceptions of insurance providers and provider perceptions of insured patients (Dalinjoong and Suuk Lar, 2012). Various views about the NHIS in Ghana with the insured, uninsured, health care providers and health were varied. A selection of these views was as follows; - Views of insured clients. The insured discussants all agreed that the NHIS is very useful. It made access to health care services very easy. The cited advantages in support of the NHIS were the exemption from out of pocket payments at the point of consumption. Respondents from the focus group discussions were cited to have positive perceptions of the NHIS in Ghana because poor were exempted from selling household assets to pay for health care with the insurance acting as a safe guard from catastrophic health expenditure (FGD, insured men- Builsa). As a disadvantage, views from uninsured clients cited discontent with high premium payments for registration, delays in processing the insurance ID cards after registration, and the yearly renewal of the ID cards. The perceived limited benefit package of the NHIS and the unreliable nature of the insurance agents were other issues the insured were not pleased with. The insurance agents were accused of charging unofficial fees and also causing delays in the processing of the insurance ID cards.

Views of uninsured clients –as much as the uninsured clients also recognized the usefulness of the NHIS, they reported that they had seen insured clients accessing health care services without any payment, even with free feeding for those hospitalized (FGD, uninsured men-Bolgatanga). Others among the uninsured were of the view that the premium paid was high and hence a barrier for them to register with the NHIS (FGD, uninsured women-Builsa). The delay in obtaining the insurance ID cards and their yearly renewal were other issues that the uninsured complained about concerning the NHIS. The above issues therefore do not motivate them (uninsured) to subscribe to the NHIS: We have heard people complaining of delays and the yearly renewal of their insurance ID cards which is a bad thing. This doesn't encourage our registration (FGD, uninsured men-Builsa).

Views of health care providers' -Health care providers in the two districts indicated that the NHIS enabled providers to get funds in bulk to carry out their operations and to undertake minor infrastructural developments in the facilities. It had also made health care services accessible to the insured without any payment at the point of consumption. This was reflected in the high attendance by the insured. They attested to a phenomenal increase in attendance compared to the period when the NHIS was not in operation (In-depth interview, hospital accountant-Bolgatanga).

Providers also perceived that the introduction of the NHIS had led to service abuse by the insured. The insured frequent the facilities with minor ailments and even attend to collect drugs for their uninsured relatives and friends. Some insured clients even offer their insurance ID cards to the uninsured for a fee to use to access health care: (In-depth interview, hospital accountant-Bolgatanga). The high attendance and perceived service abuse by the insured had led to an increased workload for providers. Providers experience long working hours with little or no break times. However, providers were not motivated enough by the NHIS and government to compensate for the heavy workload experienced.

Another major challenge disclosed by providers in the focused group discussion studies was the issue of delays in reimbursement. Providers were not paid for over six (6) months in both districts: For almost six (6) months, the insurance has not paid the hospital (In-depth interview, hospital administrator-Builsa). But the NHI Act (650) stipulates that providers should be reimbursed four weeks following the month for which claims were submitted. This was not the case and hence contravening the NHI Act (650). The main reason for the delay in payment was the inability of the National Health Insurance Authority (NHIA) to provide funds for payment. The NHIA seems to be overwhelmed with the amount of claims submitted by the various DMHIS for payment. This seems to be a result of the introduction of the new GDRG which had higher rates for payment than the previously fee for service charge. Although other possible reasons that could result in delays in payment included inadequate and incompetent staff in the facilities that were responsible for the submission of claims to the District Mutual Health Insurance Scheme DMHIS. For instance, some staff lacked knowledge of the computer software used for submitting claims to the DMHIS. Contentious claims between the facilities and the DMHIS could sometimes result in delays as well.

Due to the delay in reimbursement, providers were unable to procure drug and non-drug supplies for the smooth operations of the facilities: The delay affects our work, because if you don't have the logistics to work with.....tell me, assuming that you have run out of drugs, they (NHIA) have not paid you, where will you get the money to buy the drugs? The delay in payment had made providers resort to the issuance of prescription forms for insured clients to buy drugs out of the facilities. Another consequence of the delay in reimbursement was the fact that it had made some providers prefer clients who would make OOP payments for services to those with the NHIS cards: Some facilities in the South of the country have turned away people who are insured. It is true that some facilities and pharmacies would prefer people who will pay in cash to those with insurance, due to the delay in reimbursement (In-depth interview, hospital accountant-Bolgatanga). These OOP payments from the uninsured assist providers to run the facilities while they wait for the main payments from the NHIS. In addition, providers were handicapped in the payment of their casual employees. For example, cleaners and security men whose names were not on government's payroll are usually paid from internally generated funds mobilized by the facilities. Many studies on public health insurance in sub-saharan Africa were based on Community health insurance and the following contributing factors to the performance of public health insurance funds of the voluntary membership kind were observed.

2.5 Critique of Existing Literature Relevant to the Study

The NHIF is only mandatory for the formally employed thus in some manner it operates more like a community health insurance. CHI is a common denominator for voluntary health insurance schemes, organized at the level of the community, that

are labelled alternatively as mutual health organizations (Atim 2005; Criel and Van Dormael 2005), medical aid societies (Atim 2005), medical aid schemes (van den Heever 2007) or micro-insurance schemes (Dror and Jacquier 1999). The common characteristics are that they are run on a non-profit basis and they apply the basic principle of risk sharing. Recent reviews of CHI have been published in the literature (Bennett 2004; Ekman 2004; Palmer et al. 2004).

Other financing methods for the public health insurance scheme NHIF, which would circumvent political and organizational difficulties at the national level, are thus often under explored in Kenya such as the direct involvement of communities in health financing. In the past, cost recovery for health care via user fees was established in many developing countries as a response to severe constraints on government finance (Deloitte, 2012).

Also, user fee policies have become an expression of community financing. However, most studies alert decision makers to the negative effects of user fees on the demand for care, especially that of the poorest households (McPake 2009; Yao, 2009). The involvement of the community in health financing has thus been spurred by among others, by the Declaration of Alma Ata in 1978 (Bose & Desai 2003), urging maximum community participation in organization of primary health care. Community financing for health is referred to as a mechanism whereby households in a community (the population in a village, county or other geographical area, or a socio-economic or ethnic population group) finance or co-finance the current and/or capital costs associated with a given set of health services which they are expected to gain participation in the management of the community financing scheme and the organization of the health services. Various forms of community financing exist: the most common being the payment of user fees for health care at the point and time of use.

There has been success in social/national health insurance schemes in developing countries such as Mexico, Costa Rica and South Korea (Carrin and James, 2004). However, other scholars' proponents of alternative insurance schemes such as mutual health insurance schemes, argue that these schemes also have the potential to increase access to health care. Mexico has, since the 1980s, implemented various initiatives to extend the coverage of its social health insurance scheme to poorer groups of its population (Frenk et al., 2005). Mexico's supposed success has been paraded as part of current global debates and advocacy for social health insurance. Lloyd-Sherlock (2006) notes that the current popularity of social insurance is related to the fact that it fits into the current development paradigm of social protection and risk management, which highlights the vulnerability of poor households to catastrophic health spending.

However, there is some evidence that social/national health insurance alone cannot significantly contribute to increased coverage rates, provide a wider risk pool and hence increase access to health care. There is equally anecdotal evidence to suggest that poorly designed schemes can have very negative consequences. Studies by Bennett et al (2005), Criel (2005) and Atim (2005) have expressed a similar view and are even less optimistic of community health insurance. They argue that their risks pools are often too small, adverse selection problems are frequent and the schemes are heavily dependent on subsidies, which are most often infrequent and unreliable. Jütting (2003) notes that the schemes that experience managerial and financial difficulties the most are those in the environment of rural and remote areas where unit transaction costs of contracts are often too high.

The financial viability of social/national health insurance schemes is also a matter of concern. For example, Mossialos et al. (2000) report that France's social insurance contributions reached an untenable 55% of wage costs and the government had to propose a gradual shift to taxation, which is being implemented. Argentina was a major focus of externally funded. Lloyd-Sherlock (2006) notes that the Argentine reforms are now universally recognized to have failed, with the World Bank viewing the large public sector deficits generated by Argentina's insurance schemes as a major factor in the country's financial collapse in 2001. Jutting (2001) in a study of community schemes in Senegal also noted that community health schemes offer financial protection to those otherwise excluded but he also noted that the poorest of the poor are usually not covered. Such findings raise questions as to the extent to which national or social health insurance can be efficiently and effectively ran to provide adequate health care cover for all segments of the population and especially for the poorest and most vulnerable.

2.6 Research Gaps

From a performance perspective, there exists limited literature on policy performance of national health insurance schemes. To this end, the ability to develop partnerships to increase membership with financial service intermediaries such as SACCOs as they lobby to reform the NHIF 1998 Act upon being mandated by the Ministry of Medical services; the need develop an operational strategy to cover indigents (Indigent cover will require additional funding from the Government) , the progress on NHIF proposals to the Government such as a strategy on covering indigents; the need to reform the NHIF Act in order to provide additional funding, calculate funding required and work with development partners and other government agencies concerned with indigents and the need to increase the depth of cover are unexplored dimensions (Chacha, 2012)

Also missing from the literary scene is a review of the current benefit package and expansion into out-patient coverage from the existing in-patient cover that is; – reviewing the current benefit package and continuously communicating to all members the benefit packages; negotiating with providers to expand numbers under Contract A and B and the expansion of comprehensive cover to more facilities (Chacha, 2012)

Some studies on Health financing in Sun Saharan Africa observed that CHI can serve to increase access to care and offer financial protection against the cost of illness (Schneider and Diop 2004; Ekman 2004; Waelkens et al. 2004; Schneider & Hanson 2006; Gnawali et al., 2009; Chee et al., 2002; Ju¨tting 2004; Musango et al., 2004). Despite that, a variety of operational difficulties hamper the successful development of health financing options in Africa. Thus it has been suggested that the research community's role in helping policy makers identify these difficulties and search for possible solutions is critical. Although public health insurance schemes were thought to be highly unlikely to become self-sustainable in the short and medium term, investments in CHI offered significant growth potential as a health financing option. The experience of

countries such as Rwanda, which have channeled foreign aid towards CHI development (Logie et al., 2008; Twahirwa 2008), shows how investments in CHI offer a unique opportunity to strengthen an entire health system, by consolidating its financing and promoting community mobilization, in view of the future prospect of achieving universal coverage (Ndiaye et al. 2007; Carrin 2003; Carrin et al., 2001; Waelkens and Criel 2004; Tabor 2005; Huber et al., 2002; Waelkens et al., 2004; International Labour Organisation 2006).

Since the ability of the single schemes to operate successfully is largely dependent upon the existence of a legislative and regulatory framework (Flessa 2006; Vinard and Basaza 2006; Waelkens & Criel 2004; La Concertation 2004; Huber et al. 2002; Letourmy 2006a; Basaza et al., 2007; Ndiaye et al., 2007; Logie et al., 2008), suggest that policy makers should in the very first place invest in the development of such a framework. The existence of a legislative framework in fact, often stands to signify an explicit political commitment towards a given policy. Field experience from Rwanda and Guinea has shown that such explicit political commitment can foster cooperation across schemes and promote foreign investments to enhance technical support for CHI development (Letourmy, 2006). Thus, Community Health insurance and Public Health Policy remain to be comparatively unexplored areas of study that may have a greater more significant bearing on public health insurance than previously thought.

2.7 Summary

The Theoretical Framework employed by this study, 2 models were selected i.e. the systems dynamic model and the knowledge based model. The Systems Dynamic Model was well suited to address the dynamic complexity that characterizes many public health issues. The system dynamics approach involves the development of computer simulation models that portray processes of accumulation and feedback and that may be tested systematically to find effective policies for overcoming policy resistance (Richardson, 2004). The Knowledge based model was defined by Sveiby (2010) as 10 Knowledge based strategies to improve an organizations value creation. These strategies were defined as knowledge transfers; - between individuals, from individuals to external structure, from external structure to individuals, from individual competence to external structure, from internal structure to individual competence, within external structures, from eternal to internal structures, from internal to external structures, within internal structures and finally the maximization of value creation.

Concerning the conceptual framework employed in this paper; -The conceptual framework illustrates the relationship between the independent variables which include Claims Processing, Magnetic Card System, Communication system and Electronic payment system and the dependent variable which in this case is the performance of NHIF.

Concerning the empirical review in this paper; -the paper reviews findings on public health insurance from China and Ghana. It takes on 2 approaches i.e.;-the view that Public health insurance performance is strongly associated with efficiency enhancing, structural changes to national health insurance funds which includes the growth of institutional complexity as well as perceptions towards these public health insurance schemes by both providers and the general public (Barber and Yao, 2010).
Concerning the critiques of the reviewed literature in this paper;- The NHIF is only mandatory for the formally employed thus in some manner it operates more like a community health insurance. Thus, it is difficult to evaluate its performance on the same standard as state funded public health insurance schemes since it operates more like a mutual health insurance scheme such as a community health insurance scheme is (Bennett 2004; Ekman 2004; Palmer et al. 2004; Barber and Yao, 2010). User fee policies have become an expression of community financing. despite the fact that many studies alert decision makers to the negative effects of user fees on the demand for care, especially that of the poorest households (McPake 2009; Yao 2009) Voluntary contribution public health schemes box out the most vulnerable groups such as those in absolute poverty from accessing health financing and thus public health financing of this nature is limited in coverage growth to middle income and low income earners (Frenk et al., 2005). There is also evidence that social/national health insurance alone cannot significantly contribute to increased coverage rates, provide a wider risk pool and increase access to health care.

III. RESEARCH METHODOLOGY

3.1 Introduction

This section elaborated on the methodology which was used in the study. it will begin by describing the research design, target population, sample size, sampling procedure, research instruments, instruments validity and reliability, data collection procedure and data analysis and presentation.

3.2 Research Design

The study adopted the use of the survey research design. Mugenda and Mugenda (2003) defined survey as a method used to investigate populations by selecting samples from different occurrences. The main reason for selecting survey design for this study is because it allowed for cross referencing of responses from several respondents using the survey instrument.

3.3 Target Population

Francis (2005) defines population as the abstract idea of a large group of many cases from which a researcher draws a sample and onto which results from a sample are ultimately generalized. The target population of the study consisted of 601 employees of the 6 branches and 4 satellite offices of the National Hospital and Insurance Fund located in Nairobi County. See Table 3.1 below.

Table 3. 1: Target Population

Name	Status	Branch/Satellite Location	No of Employees
NHIF Head Quarters	Branch	Ragati Road	253
Westlands Office	Branch	Bandari Plaza	44
Nairobi Area Office	Branch	Laipha House	123
Rurarаka Office	Brach	Rurarаka	36
Buru Office	Branch	Mumias South Road	42
Industrial Area Office	Branch	Lunga Lunga Road	51
Kenyatta Hospital Office	Satellite	Kenyatta Hospital	21
Eastleigh Office	Satellite	Eastleigh	20
Gikomba Office	Satellite	Gikomba	5
Kangemi Office	Satellite	Kangemi	6
	Total		**601**

3.4 Sample and Sample Techniques

In places of large target population, sampling enables the study of relatively small number of units. The use of sampling method was employed in this study so as to select a limited number of respondents from the entire population.

3.4.1 Sampling Frame

The study acquired information from National Hospital Insurance Fund which was used to develop the sampling frame. The sampling frame as previously mentioned included 6 branches and 4 satellite offices operating in Nairobi County. The target population of the study was the different employees working in the 6 branches and 4 satellite offices located in Nairobi County.

The study sampling frame consisted of a total of 601 employees from the 10 NHIF offices operating in Nairobi County. According to Mugenda and Mugenda (2003) when the population of a study is more than 10,000 individuals, 384 of are recommended for as the desired sample size given that the Z statistic is 1.96 at 95% confidence level as shown in the following formula.

$$N=Z^2Pq/d^2$$

Where:

N = the desired sample size (When population is less than 10,000)

Z = the standard normal deviate at the required confidence level

P = the proportion in the target population estimated to have characteristics being measured

q = 1-p

d = the level of statistical significance set

$$384 = \frac{1.96^2(0.5)(0.5)}{(0.05)^2}$$

But since the target population was less than 10,000, the required sample size was calculated using the following formula:

nf = n/(1+n)/N

Where:

NF = the desired sample size (When population is less than 10,000)

n = the desired sample size (when population is more than 10,000)

N = the estimate of population size

599 = 384/(1/384)/601

Since resources and time are a major constraint in deciding the sample size, the above procedure above procedure (target population less than 10,000) helped guide the study in determining the sample size. Gay suggests that at least 20%-30% of the accessible population is normally required for descriptive studies and 10% of the accessible population is required for experimental studies.

Therefore, as indicated above, the study being descriptive will use a sample of 20% of the desired sample size (599) as the actual sample size.

150 = 25% X 599

Therefore the actual sample size that the study considered was 150 respondents from the 10 selected NHIF offices in Nairobi County. See Table 3.2 below.

Table 3. 2: Sample Size

Name	Status	Branch/Satellite Location	No of Employees	%	Sample Size
NHIF Head Quarters	Branch	Ragati Road	253	43%	64
Westlands Office	Branch	Bandari Plaza	44	8%	10
Nairobi Area Office	Branch	Laipha House	123	21	31
Rurarаka Office	Brach	Rurarаka	36	6%	9
Buru Office	Branch	Mumias South Road	42	7%	11
Industrial Area Office	Branch	Lunga Lunga Road	51	9%	13

Kenyatta Hospital Office	Satellite	Kenyatta Hospital	21	3%	5
Eastleigh Office	Satellite	Eastleigh	20	3%	5
Gikomba Office	Satellite	Gikomba	5	1%	1
Kangemi Office	Satellite	Kangemi	6	1%	1
	Total		**601**	**100%**	**150**

3.4.2 Sampling Techniques

Random sampling technique was employed in the study to achieve a desired representation of respondents from the 6 and 4 branches and satellite offices located in Nairobi County respectively. According to Francis (2005), random sampling technique ensures that each and every member of the population under consideration has an equal chance of being selected as part of the sample. The random sampling technique used ensured that subjects were selected in such a way that existing sub groups in this case NHIF employees from the different branches and satellite offices. The study then calculated the proportion of the population in each branch or satellite office and finally combined the results to obtain the required sample.

3.5 Data Collection Instruments

Primary data was collected using questionnaires. According to Mugenda and Mugenda (2003) a questionnaire is a set of systematically structured questions used by a researcher to obtain needed information from respondents. The main reason for choice of use of questionnaires is because they are very easy to administer to respondents and are moreover convenient for collecting information within a short period of time (Francis, 2005). The questionnaires will be used to collect primary data which will be obtained from the respondents which will be in the form of values obtained from operational definition of the variables in the study.

3.6 Data Collection Procedures

The study used self -administered questionnaires to collect primary data from the respondents. The main reason from use of the questionnaires is because it collects important information from the population since each item in it is developed to address the specific objectives and research questions of the study.

The questionnaires were distributed by the researcher to the 6 branches and 4 satellite offices of NHIF operating in Nairobi County. The researcher randomly selected employees at the different branches when administering the questionnaires. The questionnaires were accompanied by a brief introduction of the study and purpose of the study for the respondent. According to Mugenda and Mugenda (2003), breaching confidentiality, is a matter of concern to all respondents. In view of this, the study withheld the names of the respondents and their respective view with utmost confidentiality. During the data collection emphasis was given to the primary and secondary data.

3.7 Pilot Testing

The questionnaires were pre-tested to establish their reliability and validity before conducting the actual study. A Pilot study of 8% (12 respondents) of the desired sample size of 150 respondents was carried out at NHIF Head Quarters Offices: Ragati Road. According to Mugenda and Mugenda (2003) the purpose of the pilot study is mainly to pretests the instrument to ensure that the items in the instrument are stated clearly and have the same meaning to all the respondents. The pretest also enabled the researcher asses the clarity of the instrument and asses the time taken to administer the instrument. The reason for choice of NHIF Head Quarters Offices: Ragati Road is because it has similar characteristics and features as the other NHIF offices located and operating in Nairobi County. The pretest will be subjected to the internal consistency technique using the Kunder-Richardson (K-R) 20 Formula which is as follows:

$$\mathbf{KR_{20} = (K)\ (S^2 - \sum s^2)\ /\ (S^2)\ (K-1)}$$

Where:

KR_{20}= Reliability coefficient of internal consistency

K = Number of items used to measure the concept

S^2 = Variance of all scores

s^2 = Variance of individual items

A high coefficient will imply that items correlate highly among themselves indicating that there exists consistency among the items in measuring the concept of interest (Mugenda & Mugenda, 2003).

3.8 Data Analysis and Presentation

Data obtained from the study was analyzed and presented as follows:

3.8.1 Data Analysis

Data obtained from the field was cleaned, coded and key-punched into a computer and analyzed. Data was analyzed using quantitative techniques.

Quantitative data was analyzed using both descriptive and inferential statistics. The first step analyzed Descriptive statistics which was to meaningfully describe the distribution of results depending on the variables in the study and the scale of measurements used. Descriptive statistics such as Measures of central tendency (Mean, Mode and Median) and Measures of variability (range, standard deviation, frequency distribution, histograms, frequency polygons, bar charts, percentages and relationships) will be used in analyzing the data.

The study also sought to make inferences about the population based on results obtained from the survey. In this study, the researcher used inferential statistics one way and two way analysis of variance test (ANOVA) in analyzing whether there is a significant difference between two or more groups or samples at a selected probability level. This sought to analyze the probability that the variation among a group of sample means had occurred as a result of randomly selecting the samples from a common population Mugenda and Mugenda, 2003). Two way analysis of variance (ANOVA) was carried out in the study which made three types of comparisons based on the different groups being analyzed.

The variables were rated in Likert scales which was used to measure perception, attitude and behaviour of the respondents. The numerical scales helped to minimize the subjectivity and made it possible to use quantitative analysis. The Likert scale

was in declarative form and it comprise of 5 response categories which will be in the following form:
1= Strongly Disagree, 2= Disagree, 3=Neutral, 4=Agree and 5=Strongly Agree.
The study used SPSS V-20 statistical softwares to analyze quantitative data.

3.8.2 Data Presentation

Quantitative data was presented using instruments such as charts, tables and graphs. According to Mugenda & Mugenda (2003) quantitative data analysis involves presenting results in tables with explanations. Charts took into account the use of pie charts and bar charts. Graphs took into account the use of line graphs and tables took into account the use of frequency tables, pivot tables and contingency tables among others.

IV. RESEARCH FINDINGS AND DISCUSSIONS

4.1 Introduction

This chapter elaborated on data presentation, data analysis and discussion of the survey results. The presentation of the survey results was based on the order of the research objectives. Data collected was entered in MS excel, coded and exported to SPSS V 20 which was used to run the analysis.

4.2 Response Rate

The study administered 150 questionnaires to the target population. A total of 120 of the questionnaires were filled and returned. This indicated that the study achieved a response rate of 80% which was high enough for analysis as stated in Mugenda and Mugenda (2003). The survey covered the 10 branches and satellite offices of NHIF operating in Nairobi County.

4.3 Pilot Test Results

A pilot test on 8% (12) of the respondents from NHIF Head Quarters was carried out before the actual survey was undertaken. The results are shown in Table 4.2.

Table 4. 1: Pilot Test Results

Research Question	F Statistic One Way Anova	Sig of P Value One Way Anova	Sig of P Value Two Way Anova
What is the effect of process re-engineering strategy on performance of NHIF?	1.239	0.29	0.154
How has the establishment of benefit management strategy influenced the performance of NHIF?	1.754	0.076	0.055
How has information communication strategy influenced the performance of NHIF?	0.867	0.517	0.531
What is the effect of E-Banking strategy on performance of NHIF?	0.711	0.788	0.022
Kunder-Richardson Reliability Test Coefficient=0.8			

The score obtained in one item was correlated with scores obtained from other items from the research instrument. The study obtained a Kunder Richardson reliability coefficient of KR_{20}=0.8. This showed that the survey items in the questionnaire were highly correlated among themselves thereby indicating a high level of consistency. This results obtained from the pilot study were also established to be highly reliable with high validity as well.

4.4 General and Background Information

This section dealt on the background information of respondents.

4.4.1 Gender of Respondents

54% (65) of the respondents interviewed were male whereas 46% (55) of the respondents interviewed were female.

4.4.2 Distribution of Respondents by Organization

Table 4.2 illustrates distribution of respondents by organization.

Table 4. 2: Distribution of Respondents by Organization

Branch Name	Frequency	Percentage %	Cumulative Percentage%
NHIF Head Quarters (Branch)	51	42%	42%
Westlands Office (Branch)	9	8%	50%
Nairobi Area Office (Branch)	25	21%	71%
Rurarаka Office (Branch)	7	6%	77%
Buru Buru Office (Branch)	8	7%	83%

Industrial Area Office (Branch)	10	8%	92%
Kenyatta Hospital Office (Satellite)	4	3%	95%
Eastleigh Office (Satellite)	4	3%	98%
Gikomba Office (Satellite)	1	1%	99%
Kangemi Office (Satellite)	1	1%	100%
Total	**120**	**100%**	

The survey carried out by the study focused on both the NHIF branches and satellite offices operating in Nairobi County. 42% of the respondents were from NHIF Headquarters (Branch) and 21% were from Nairobi area office (Branch). A total of 29% of the respondents were from Westland's office, Ruaraka office, Burur buru office and Industrial area office. A total of 8% of the respondents were from the satellite offices which included Kenyatta hospital office, Eastleigh office, Gikomba office and Kangemi offices respectively.

4.4.3 Education Level of Respondents

The survey results showed that 56% of the respondents interviewed had attained a University degree whereas 22% and 13% had attained Diploma and Certificates respectively. a paltry 9% of the respondents had attained a Masters Degree. Table 4.3 illustrates the Educational Level of Respondents.

Table 4. 3: Education Level of Respondents

Educational Background	Frequency	Percentage	Cumulative Percentage
Certificate	15	13%	13%
Diploma	26	22%	35%
Masters Degree	11	9%	44%
University Degree	68	56%	100%
Grand Total	**120**	**100%**	

4.4.4 Age Bracket of Respondents

Most (53%) of the employees of NHIF interviewed were between the ages of 31-35 years. Those between 25-30 years and 36-40 years were 21% whereas only 5% of the respondents were above 41 years old. Table 4.4 shows the Age Bracket of Respondents interviewed.

Table 4. 4: Age Bracket of Respondents

Age Bracket	Frequency	Percentage	Cumulative Percentage
31-35 Years	64	53%	53%
25-30 Years	25	21%	74%
36-40 Years	25	21%	95%
Above 41 Years	6	5%	100%
Grand Total	**120**	**100%**	

4.4.5 Respondents Duration of Service in Organization

40% of the respondents interviewed had served in the organization for 3 years, 28% had served in the organization for more than 4 years whereas 22% and 10% had served in the organization for 2 years and 1 year respectively. Figure 4.1 illustrates the Respondents Duration of Service in Organization.

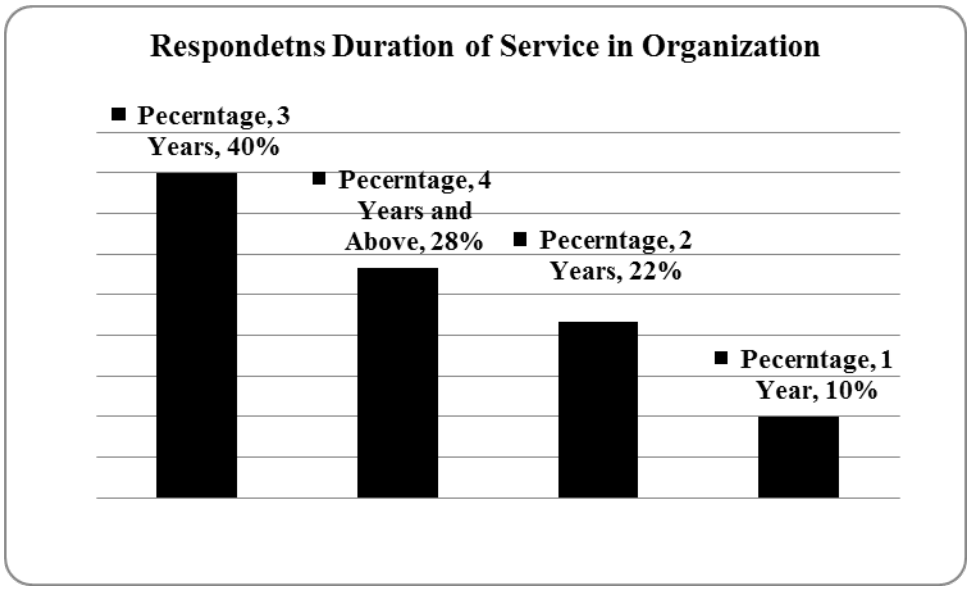

Figure 4. 1: Respondents Duration of Service in Organization

4.5 Descriptive Statistics

The study used frequency tables and percentages to describe the data.

4.5.1 Information on Process Re-Engineering Strategy

In an effort to establish the effect of process re-engineering strategy on performance of NHIF, the respondents were asked whether the new NHIF claims process had reduced the waiting period on NHIF reimbursement. 59% of the respondents were in agreement with 32% agreeing and 27% strongly agreeing. 29% of the respondents were in disagreement with 22% strongly disagreeing and 7% disagreeing. A paltry 12% were neutral on the matter.

On whether the new NHIF claims process had aided in the monitoring and evaluation of the scheme, 83% of the respondents were in agreement with 45% agreeing and 38% strongly agreeing. Few of the respondents were in disagreement with 5% strongly disagreeing and 3% disagreeing. A paltry 9% were neutral on the matter.

On whether the new NHIF claims process introduced had improved management practices within the scheme. Most of the respondents were in disagreement with33% of them disagreeing and 22% of them strongly disagreeing. 24% of the respondents were in agreement with 15% of them strongly agreeing that the NHIF claims process had improved management practices within the organization. 6% of the respondents were neutral about the matter. Table 4.5 illustrates the survey results on information on process re-engineering.

Table 4. 5: Information on Process Re-Engineering

No	Items on Information Technology	Strongly Disagree	Disagree	Neutral	Agree	Strongly Ag
1	The new NHIF claims process reduced the waiting period on NHIF reimbursement	22%	7%	12%	32%	27%
2	The new NHIF claims process has aided in the monitoring and evaluation of the scheme.	5%	3%	9%	45%	38%
3	The new NHIF claims process improved management practices within the scheme.	22%	33%	6%	24%	15%

4.5.2 Information on Benefit Management Strategy

In an effort to establish the effect of benefit management strategy on NHIF performance, the respondents were asked whether the membership registration in NHIF had improved due to the new strategy. Most of the respondents were positive on the matter with 44% agreeing and 17% strongly agreeing to the matter. 23% of the respondents disagreed and 4% of the respondents strongly disagreed on the matter with 12% of the respondent s being neutral.

The respondents were asked whether smart card identification had reduced the incidence of fraud in the NHIF scheme, 52% of them were in agreement with 11% strongly agreeing that the NHIF card had helped reduce fraud. 22% of the respondents were in disagreement whereas 6% of the respondents strongly disagreed that smart card identification had helped reduce fraud in NHIF. Approximately 9% of the respondents were neutral concerning whether the strategy had had an effect on reducing fraud in NHIF.

The respondents were asked whether online registration had helped improve membership to the NHIF scheme. 44% of the respondents were in agreement with 32% of them strongly agreeing that online registration of respondents had an effect in growing membership for the scheme. 15% of the respondents were however in disagreement with 4% of them strongly disagreeing and 6% being neutral on the matter. Table 4.6 illustrates the survey results on information on benefit management strategy.

Table 4. 6: Information on Benefit Management Strategy

No	Items on Benefit Management Strategy	Strongly Disagree	Disagree	Neutral	Agree
1	Membership registration in NHIF has improved due to the new benefit management strategy.	4%	23%	12%	44%
2	Smart card identification has reduced the incidence of fraud in the NHIF scheme.	6%	22%	9%	52%
3	Online registration has improved membership to the NHIF Scheme	4%	15%	6%	44%

4.5.3 Information on Information Communication Strategy

In an effort to establish the effect of Information Communication Strategy on NHIF performance, the respondents were asked whether the adoption of health information systems had reduced the waiting period on NHIF reimbursement. 33% of the respondents were in agreement and 30% of them strongly agreed that the adoption of health information systems had reduced waiting period on NHIF reimbursement. 21% of the respondents were in disagreement with 7% strongly disagreeing and 9% were neutral about the adoption of health information systems in reducing waiting period on NHIF reimbursement.

On whether the adoption of health information system had helped reduce the incidence of fraud in NHIF scheme, 30% of the respondents strongly agreed whereas 21% of them agreed that incidence of fraud had drastically reduced within NHIF. 34% of the respondents disagreed, 6% strongly disagreed and 9% of the respondents stated were neutral about the incidence of fraud having reduced mainly because of the adoption of the new health information system.

On whether health surveillance through demographic surveys had led to an improvement of the ICT strategy within the scheme. 37% of the respondents were in agreement, 3% strongly agreed, 14% disagreed, 11% strongly disagreed and 5% were neutral on whether the health surveillance through demographic surveys had led to an improvement in the ICT strategy within NHIF scheme. Table 4.7 illustrates survey results on information communication technology.

Table 4. 7: Information on Information Communication Technology

No	Items on Information Communication Technology	Strongly Di
1	The adoption of health information systems have reduced the waiting period on NHIF reimbursement	7%
2	The adoption of health information systems have reduced the incidence of fraud in the NHIF scheme	6%
3	Health surveillance through demographic surveys have led to an improvement in the ICT strategy within the NHIF scheme.	11%

4.5.4 Information on E-Banking Strategy

In an attempt to establish whether information on E-Banking strategy had an effect on NHIF performance, the respondents were asked whether E-Funds transfer had eased the process of NHIF reimbursement. 29% of the respondents strongly agreed, 24% agrees, 22% disagreed, 21% strongly disagreed and a paltry 4% of them were neutral on whether E-Funds transfer had eased the process of NHIF reimbursement.

On whether Mobile money transfer had eased the process of NHIF contribution payments, 35% of the respondents strongly agreed, 33% of them agreed, 21% of the respondents disagreed, 7% strongly disagreed and 4% of the respondents were neutral.

On whether E-Money transfer had eased the process of reimbursement, 32% of the respondents were in agreement, 23% of them strongly agreed, 19% strongly disagreed, 17% disagreed and 9% of the respondents were neutral. Table 4.8 illustrates survey results on E-Banking strategy.

Table 4. 8: Information on E-Banking Strategy

No	Items on E-Banking Strategy	Strongly Disagree	Disagree	Neutral
1	E-funds transfers have eased the process of NHIF reimbursement.	21%	22%	4%
2	Mobile money transfer (eg. M-Pesa) has eased the process of NHIF contribution payments.	7%	21%	4%
3	E-money transfers have eased the process of re-imbursements	19%	17%	9%

4.5.5 Information on Performance of NHIF

In terms of performance of NHIF, the survey results indicated that NHIF customer base had grown due to its innovative strategies with 37% strongly agreeing, 33% agreeing, 12% strongly disagreeing, 11% disagreeing and 7% being neutral.

The survey results also indicated that NHIF coverage in terms of supported hospitals had grown due to its innovative strategies with 41% of the respondents agreeing, 34% strongly agreeing, 9% disagreeing, 6% strongly disagreeing and 10% being neutral.

Finally, in terms of contribution, the survey results indicated that NHIF contribution had grown due to its innovative strategies with 44% of the respondents agreeing, 33% strongly agreeing, 13% strongly disagreeing, 7% disagreeing and 3% being neutral. Table 4.9 illustrates information on Performance of NHIF.

Table 4. 9: Information on NHIF Performance

No	Items on Performance of NHIF	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	NHIF customer base has grown due to its innovative strategies	12%	11%	7%	33%	37%
2	NHIF coverage in terms of supported hospitals has grown due to its innovative strategies	6%	9%	10%	41%	34%
3	NHIF contribution has grown due to its innovative strategies	13%	7%	3%	44%	33%

4.6 Inferential Statistics

The study used one way analysis of variance and two way analysis of variance test results to infer more on the results.

4.6.1 One Way Analysis of Variance

One way analysis of variance test was carried out on the dependent and independent variables representing NHIF performance which was mainly attributed to the employees of NHIF scheme.

The one way analysis of variance was used to test for statistical significance in the difference of the performance means ascribed to the different NHIF strategies from the different branches and satellite offices.

The level of significance used in this study was 99%(0.01) mainly because of the high level of uncertainty which is attributed to using parametric hypothesis testing on data of ordinal origins despite the fact that Likert responses were converted into scores and interval estimates.

There was a statistically significant difference in performance means for each innovative strategy (independent variable) between groups (NHIF Branches and Satellite Offices) as determined by one-way ANOVA significance probability results for process re-engineering strategy ($F(9, 110) = 1.329$, $P = 0.230$), benefit management strategy ($F(9,110) = 1.698$, $P = 0.098$), information communication strategy ($F(9,110) = 0.843$, $P = 0.578$) and E-banking strategy ($F(9, 110) = 0.772$, $P = 0.643$) at 1% (0.01) level of significance. The shows that, process re-engineering, benefit management, information communication technology and e-banking strategies positively influence the performance of NHIF across all branches and satellite offices. Table 4.10 below illustrates the results from the one way analysis of variance test.

Table 4. 10: One Way Anova Test Results

Independent Variable	One Way Analysis of Variance	Sum of Squares	Df	Mean Square	F	Sig.of P Value
Information on Process Re-Engineering Strategy	Between Groups	57.915	9	6.435	1.329	0.230
	Within Groups	532.451	110	4.840		
	Total	590.367	119			
Information on Benefit Management Strategy	Between Groups	94.111	9	10.457	1.698	0.098
	Within Groups	677.481	110	6.159		
	Total	771.592	119			
Information on information communication technology strategy	Between Groups	46.589	9	5.177	.843	0.578
	Within Groups	675.378	110	6.140		
	Total	721.967	119			
E-Banking Strategy	Between Groups	37.838	9	4.204	.772	0.643
	Within Groups	599.362	110	5.449		
	Total	637.200	119			

Dependent Variable: NHIF Performance Level of Significance 99%

4.6.2 Two Way Analysis of Variance

The two way analysis of variance was performed to determine the effect of the independent variables (process re-engineering strategy, benefit management strategy, information communication strategy and e-banking strategy) on the performance of NHIF which is the dependent variable. The level of significance considered for the two ways analysis of variance was 0.05 at 95% confidence interval. The groups considered for this analysis were the different branches and satellite offices of NHIF operating in Nairobi County. The independent samples/kruskal wallis test was carried out on each research question.

The results in Table 4.11 were generated from SPSS V 20 and they illustrated that the distribution of information on process re-engineering (P=0.122), distribution on benefit management strategy (P=0.088), distribution of information communication strategy (P=0.534), and distribution of information on E-Banking strategy (P=0.016) was the same across the different NHIF branches/satellite offices surveyed and operating in Nairobi County. E-Banking strategy was observed to be statistically insignificant but SPSS V-20 still retained the research question. This could be explained by the fact that E-Banking strategy is spearheaded by the fiancé department and the responses from that department indicated that the strategy has positively influenced the performance of NHIF. Therefore, it can be concluded that there was no statistically significant difference in mean between process re-engineering strategy, benefit management strategy, information communication strategy and E-Banking strategy and therefore, all the research questions were retained according to the independent/Kruskal Wallis test.

Table 4. 11: Two Way Analysis of Variance Test Results

No	Research Question	Test	Significance	Decision
1	The Distribution of Information on Process Re-Engineering Strategy is the same across the different NHIF Branches/Satellites	Independent Samples/Kruskal Walis Test	0.122	Retain the Research Question
2	The Distribution of Information on Benefit Management Strategy is the same across the different NHIF Branches/Satellites	Independent Samples/Kruskal Walis Test	0.088	Retain the Research Question

3	The Distribution of Information on Information Communication Strategy is the same across the different NHIF Branches/Satellites	Independent Samples/Kruskal Walis Test	0.534	Retain the Research Question
4	The Distribution of Information on E-Banking Strategy is the same across the different NHIF Branches/Satellites	Independent Samples/Kruskal Walis Test	0.016	Retain the Research Question

Dependent Variable: NHIF Performance: Level of Significance 0.05

V. SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

This chapter will focus on presenting the summary of findings per objective, the conclusion, recommendations and areas for further research which are based on the results of the study. These findings will be presented in a chronological sequence based on the objectives and study questions.

5.2 Summary of the Findings

The number of respondents of the study was 120 with a sampling rate of 80% from the NHIF branches and satellite offices operating in Nairobi County. To ensure the collection of rich information, the study focused on respondents who had diverse education backgrounds, different age brackets and who were from different branches and departments and had different duration of service in NHIF.

5.2.1 Process Re-Engineering Strategy

On the first specific objective, the study was to determine the effect of process re-engineering strategy on performance of NHIF. The study measured how the respondents rated the list of information on process re-engineering strategy presented by strongly agreeing, agreeing, strongly disagreeing or neither agreeing nor disagreeing. The results indicated that few respondents strongly disagreed with the information provided indicating that process re-engineering strategy had a positive impact on the performance of NHIF.

5.2.2: Benefit Management Strategy

On the second specific objective, the study was to establish the effect of benefit management strategy on performance of NHIF. The study measured how benefit management strategy is pursued in the following ways; whether membership registration in NHIF had improved due to the new benefit management strategy, whether smart card identification had reduced incidence of fraud in NHIF scheme and whether online registration had improved membership to NHIF scheme. The study used Likert scale to measure how the respondents rated the above information by strongly agreeing, agreeing, disagreeing, strongly disagreeing and neither agreeing or disagreeing (neutral). The results indicated that few respondents strongly disagreed with the information provided indicating that benefit management strategy had a positive impact on the performance of NHIF.

5.2.3 Information Communication Strategy

On the third specific objective, the study was to determine the effect of information communication strategy on performance of NHIF. The study measured how the adoption of health information systems had helped in reducing the waiting period on NHIF re-imbursement, incidence of fraud and whether health surveillance through demographic surveys had led to an improvement in the ICT strategy within NHIF scheme. The study used Likert scale to measure how the respondents rated the above information by strongly agreeing, agreeing, disagreeing, strongly disagreeing and neither agreeing or disagreeing (neutral). The results indicated that few respondents strongly disagreed with the information provided indicating that information communication technology strategy adopted had a positive impact on the performance of NHIF.

5.2.4: E-Banking Strategy

On the fourth specific objective, the study was to determine the effect of E-Banking strategy on performance of NHIF. The study measured whether E-Funds transfer had eased the process of NHIF reimbursement, whether mobile money transfer had eased the process of NHIF contribution payments and whether E-money transfer had eased the process of re-imbursements. The study used Likert scale to measure how the respondents rated the above information by strongly agreeing, agreeing, disagreeing, strongly disagreeing and neither agreeing or disagreeing (neutral). The results indicated that few respondents strongly disagreed with the information provided indicating that E-banking strategy adopted had a positive impact on the performance of NHIF.

5.3 Conclusion

In view of the findings, this study established that the effects of different strategies employed towards the improvement of NHIF performance. Strategies play a critical role in improving performance of organizations and giving organizations directions. The study brought into light some of the main effects of the different strategies employed by NHIF in improving its performance.

Majority of respondents indicated that process re-engineering strategy has contributed positively to improvement of NHIF performance alongside the identified parameters that formed the basis of the questionnaire. Process re-engineering strategy is a vital component in enhancing the performance in terms of the growth of customer base, supported hospitals and NHIF contributions. On benefit management strategy, some of the key contribution factors for enhanced NHIF performance were membership registration, smart card identification and online registration of members. Most of the respondents indicated that benefit management strategy employed by NHIF has positively improved its performance in terms of the growth of customer base, supported hospitals and NHIF contributions.

On information communication technology strategy, what contributed to improvement of NHIF performance was the adoption of health information system which contributed to the reduction in waiting time and incidences of fraud. Also health surveillance through demographic surveys in improving ICT strategy was also a major contributor to NHIF performance. Most of the respondents indicated that information communication strategy adopted by NHIF has positively improved its performance in terms of the growth of customer base, supported hospitals and NHIF contributions.

On E-Banking strategy, what contributed to improvement of NHIF performance was the use of E-funds transfer which had eased the process of NHIF re-imbursements, Mobile money transfer which had eased the process of NHIF contribution payments and E-funds transfer which had eased the process of re-imbursements. Most of the respondents indicated that E-Banking adopted by NHIF had positively improved its performance in terms of the growth of customer base, supported hospitals and NHIF contributions.

5.4 Recommendations

The following are recommendations of the study based on the objectives and study questions.

Process Re-Engineering Strategy should be regularly applied especially at the branch and satellite level so as to enhance the performance of NHIF in terms of the growth of customer base, supported hospitals and NHIF contributions. Benefit management strategy is vital to the operation of organizations. This is key in helping with registration process, identification process and online services. This should as well be regularly applied and monitored so as to ensure the improvement of performance of NHIF in terms of the growth of customer base, supported hospitals and NHIF contribution. Information communication technology strategy is fundamental in enhancing efficiency in an organization. NHIF should regularly ensure that its ICT strategy and systems are fully functioning with minimal hitches as this contributes positively towards the improvement of its performance in terms of the growth of customer base, supported hospitals and NHIF contribution. E-Banking strategy deals with E-funds transfer easing the process of NHIF reimbursements, mobile money transfer through NHIF contribution and payments and E-Funds transfer in receiving re-imbursements. NHIF should enhance this system so as to ensure that its performance in terms of customer base, supported hospitals growth and NHIF contribution continues to improve.

5.4.1 Suggestions for Further Research

The research gaps of this study were its focus on innovative strategies that contribute towards the improvement of NHIF performance. The study proposes that future research should be carried out in the following areas: To investigate effect of process re-engineering strategies on increased membership contributions to the NHIF scheme in Kenya and To investigate the effect of benefits expansion on NHIF membership in Kenya.

REFERENCES

[1] B.Ekman. (2004). Community-based health insurance in lowincome Countries: A Systematic Review of The Evidence. Journal of Health Policy Plan, 3(1), 249-270.

[2] C.Tank-Nielsen. (2004). Sensitivity analysis in system dynamics. (4th Ed.), Elements of the System Dynamics Method. Cambridge: MIT Press.

[3] Cambridge, F. J. (2004). Urban Dynamics. (3rd Ed, Vol. 2). Boston: Mass: MIT Press.

[4] Carrin, G., M.Desmet, & R.Basaza. (2001). Social health insurance development in low-income developing countries: new roles for government and nonprofit health insurance organizations in Africa and Asia. (S. Adlung, Ed.) Journal of Health Policy Planning, 3(2), 125-150.

[5] Chacha, M. (2012). Expanding Insurance Cover Through NHIF. Journal of Health Policy , 3(1), 32-43.

[6] D.Arhin-Tenkorang. (2005, May 24). Experience of community health Financing in Africa Region (4th Ed.)Washington: The World Bank.

[7] Deloitte. (2010). Strategic Review of the NHIF. World-Bank Report. Nairobi: World Bank Publication.

[8] Deloitte. (2011). Market Assesments of Pre-paid Schemes in Kenya. Deloitte and Tousch Report on Market Assesments. Nairobi: Deloitte. Retrieved February 22, 2015

[9] Deloitte. (2012). Strategic Review of the NHIF fund in Kenya. World-Bank Report. Nairobi: International finance Corporation-World Bank Group Press. Retrieved February 2015, 22nd

[10] Forrester, J. (2004). Industrial Dynamics (3rd Ed.). Cambridge: MIT Press.

[11] Francis, A. (2005). Business Mathematics and Statisitcs (2nd Ed, Vol. 4). Nottingham: Martins Printer Limited Press.

[12] German.Technical.Corporation. (2010). Are we reaching the poor and vulnerable? German Technical Corporation Report. Nairobi: GTZ Press.

[13] Hennock, E. P. (2007). The origin of the welfare state in England and Germany 1850–1914: Social Policies Compared. (4th Ed, Vol. 2). Cambridge: Cambridge University Press.

[14] Herd R, H. Y. (2010). Improving China's health care system. Journal of Health Policy Planning, 4(2), 44-89.

[15] KIPRA. (2010). Comprehensive and critical analysis of the Health Situation 1994-2010. Kenya Institute of Public Policy Research and Analysis Report. Nairobi: Government of kenya Press. Retrieved February 22, 2015

[16] Leathard, A. (2000). Health care in Britain: pre-war provision, 1900–1939 (2nd Ed.). London: Cheltenham Press.

[17] Leichter, H. M. (2003). A comparative approach to policy analysis: health care policy in four nations (3rd Ed.). Cambridge, United Kingdom: Cambridge University Press.

[18] Lloyd-Sherlock, P. (2006). When Social Health Insurance Goes Wrong: Lessons from Argentina and Mexico,. Journal of Social Policy & Administration, 40(2), 117-138.

[19] Lu, Y. (2009). Labor Migration and People Left Behind in China: Evidence from the 2008 China Migration and Health Survey (3rd Ed.). Detroit: MIT Press.

[20] May, E. B. (2008). Health insurance in low-income countries: Where is the evidence that it works?,. Journal of Health Insurance, 4(2), 12-30.

[21] McPake, B. (2009). User charges for health care in developing countries: a review of the economic literature. Journal of Social Science and Medicine, 36(11), 1397-1405.

[22] Ministry.of.Health. (2008). China Health Statistical Yearbook. Peking Union Medical College Report. Beijing: Communist Government of China Press.

[23] Ministry.of.Health. (2008). Facts and Figures on Health and Health Related Indicators. Kenya Ministry of Health Report. Nairobi: Government of Kenya Press.

[24] Ministry.of.Health. (2010). Accessible and Affordable High Quality Healthcare Services- Financing Options for Universal Cover. Kenya Ministry of Health Report. Nairobi: Government of Kenya Press.

[25] Ministry.of.Health. (2010). Facts and Figures. Kenya Ministry of Health Report. Nairobi: Government of Kenya press. Retrieved February 22, 2015

[26] Ministry.of.Health. (2010). Major Work Arrangements in 2010. China Ministry of Health Report, Department of International Cooperation,. Beijing: Communist Government of China Press.

[27] Ministry.of.Public.Health.and.Sanitation. (2013). Kenya Ministry of Public Health and Sanitation Disaster Preparedness plan. Kenya Ministry of Public Health and Sanitation Report. Nairobi: Government of Kenya Press.

[28] Mugenda, O. M., & Mugenda, A. G. (2003). Research Methods: Quantitative and Qualitative Approaches (2nd Ed.). Nairobi: Acts Press.

[29] NewYorkTimes. (2012, October 28). New York Times Health. Retrieved from New York Times: http://www.nytimes.com/2012/10/28/health/us-to-sponsor-health-insurance-plans-nationwide.html?_r=2&hpw&

[30] NHIF. (2004). National Social Health Insurance Concept Paper/cabinet paper 2004. National Health Insurance Fund Report. Nairobi: NHIF.

[31] NHIF. (2005). NHIF Strategic Plan 2005 -2010. National Health Inusrance Fund Report. Nairobi: Government of Kenya.

[32] NHIF. (2006). NHIF Annual Report & Financial Statements for the year ended 30th June 2006. National Health Insurance Fund Report. Nairobi: Government of Kenya Press.

[33] NHIF. (2007). NHIF Annual Report & Financial Statements for the year ended 30th June 2007. National Health Insurance Fund Report. Nairobi: Government of Kenya.

[34] NHIF. (2008). Health Rights Advocacy Forum. National Health Insurance Fund. Nairobi: Civil Society of kenya Press.

[35] S.Bennett (2004). The role of community-based health insurance within the Healthcare Financing System: A Framework for AnalysisJournal of Health policy and Planning32157-185

[36] Sarah L Barber, L. Y. (2010). Health Insurance Sysstems in China: A Briefing Note. Journal of Health Insurance Systems, 3(2), 56-75.

[37] Sterman, J. (2001). System dynamics modeling: tools for learning in a complex world. Journal of Calif Manage Review, 48(4), 8-25.

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APPENDICES

APPENDIX 1 : Introduction Letter

Dear Respondent

My name is Faith Mbogori. I am a Masters student at Jomo Kenyatta University of Science and Technology carrying out a research titles: Innovative Strategies influencing the Performance of NHIF in Nairobi County. Kindly assist me by filling this questionnaire for the completion of my research project. All information gathered will be treated with strict confidentiality since it is for study purposes.

Thank You.

APPENDIX 2: Questionnaire

Section I: Background Information

Name of NHIF branch Office: _____

Age; □25-30 yrs. □31-35 yrs. □36-40yrs □above 41yrs

Which department do you represent?

□Sales & Marketing □Contact Centre □Administration □ IT

How long have you served in your current organization?

□ 1yr □ 2yrs □ 3yrs □ above 5yrs

How long have you served in your current position?

□ 1yr □ 2yrs □ 3yrs □ above 5yrs

Section II:

A. Information on Process Re-Engineering Strategy

For this section, use a Likert Scale ranging from 1 to 5 (Where 5- strongly agree, 4- Agree, 3-Neither Agree nor Disagree, 2-Disagree, 1-Strongly disagree)

Process Re-Engineering Strategies		5 **Strongly Agree**	4 **Agree**	3 **Neither Agree nor Disagree**	2 **Disagree**	1 **StronglyDisagree**
1	The new NHIF claims process reduced the waiting period on NHIF reimbursement					
2.	The new NHIF claims process has aided in the monitoring and evaluation of the scheme.					
3.	The new NHIF claims process					

	improved management practices within the scheme.					

In your professional opinion what other sub-processes in the new NHIF claims process (not captured above) impact NHIF performance?

B.Information on Benefit Management Strategy

For this section, use a Likert Scale ranging from 1 to 5 (Where 5- strongly agree, 4- Agree, 3-Neither Agree nor Disagree, 2-Disagree, 1-Strongly disagree)

Benefit Management Strategy		5 **Strongly Agree**	4 **Agree**	3 **Neither Agree nor Disagree**	2 **Disagree**	1 **Strongly Disagree**
1	Membership registration in the NHIF has improved due to the new benefit management strategy.					
2	Smart card identification has reduced the incidence of fraud in the NHIF scheme.					
3	online registration has improved membership to the NHIF Scheme					

In your professional opinion what other functions of Smart card identification are not captured above that affect NHIF performance?

C. Information on information communication technology strategy

For this section, use a Likert Scale ranging from 1 to 5 (Where 5- strongly agree, 4- Agree, 3-Neither Agree nor Disagree, 2-Disagree, 1-Strongly disagree)

ICT Strategies		5 **Strongly Agree**	4 **Agree**	3 **Neither Agree nor Disagree**	2 **Disagree**	1 **Strongly Disagree**
1	The adoption of health information systems have reduced the waiting period on NHIF reimbursement					
2	The adoption of health information systems have reduced the incidence of fraud in the NHIF scheme					
3	Health surveillance through demographic surveys have led to an improvement in the ICT strategy within the NHIF scheme.					

In your professional opinion what other contributions to NHIF performance have communication systems made that have not been captured above?

D. E-Banking Strategy

For this section, use a Likert Scale ranging from 1 to 5 (Where 5- strongly agree, 4- Agree, 3-Neither Agree nor Disagree, 2-Disagree, 1-Strongly disagree)

E-Banking Strategies		5 **Strongly Agree**	4 **Agree**	3 **Neither Agree nor disagree**	2 **Disagree**	1 **Strongly Disagree**
1	E-funds transfers have eased the process of NHIF reimbursement.					
2	Mobile money transfer (eg.					

	M-Pesa) has eased the process of NHIF contribution payments.					
3.	e-money transfers have eased the process of re-imbursements					

In your professional opinion what other contributions (not captured above) have Electronic Payment Systems made that affect NHIF performance?

_____

E. Information on Performance of NHIF

For this section, use a Likert Scale ranging from 1 to 5 (Where 5- strongly agree, 4- Agree, 3-Neither Agree nor Disagree, 2-Disagree, 1-Strongly disagree)

Performance of NHIF		5 **Strongly Agree**	4 **Agree**	3 **Neither Agree nor disagree**	2 **Disagree**	1 **Strongly Disagree**
1	NHIF customer base has grown due to its innovative strategies					
2	NHIF coverage in terms of supported hospitals has grown due to its innovative strategies					
3	NHIF contribution has grown due to its innovative strategies					

In your professional opinion what factors could contribute to NHIF performance In Kenya?

Women's Representation and Participation in District Assemblies in Ghana: Analysis of Supply-Side and Demand-Side Framework

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Abstract- The quest for increased female representation and participation at the local level government in Ghana has not been obtained probably because we have neglected the demand and supply side factors that account for the paucity of policies and programmes to promote participation of women in the local government system in Ghana. Women involvement in decision-making processes in governance for sustainable development is very critical not only because they constitute majority of the Ghanaian population but they are discriminated and under-represented in the socio-economic and political development activities thereby bringing about not only a gender gap but also exclusion of women and their needs, interests and perspectives from governance. This paper examines the demand and supply side framework so as to prompt stakeholders in their bid to enhance the presence of women in the local government system in Ghana. It also looks at the concept of local government system in Ghana and examines the statistics of women's representation in the district assemblies. It concludes that women must strive to empower themselves by acquiring the knowledge, skills, resources (i.e. time, money) and motivation. NGOs, political parties as well as government and its agencies should put in place positive discriminatory policies and programmes as well as legislations that will bring social change to encourage and attract women in local level governance.

Index Terms- Women, Representation, Participation, Supply and Demand Sides, Local governance

I. Introduction

There are various arguments when it comes to the concept of political representation and participation of women in decision-making positions. Whiles gender representation focuses on the number of women in decision-making positions, participation looks at what women do when they get into these decision-making positions (Kurebwa, 2014).Women's position in the political sphere was invoked by women activists in the United States as early as 1848, when they convened the first women's right Convention in Seneca Falls, New York (Ballington et al., 2012). Since then, political representation and participation of women in governance systems have been one of the major issues in the international community. Representation and participation of women in political position vary within and among countries. In its decision on the universal declaration on human rights and women's rights, the United Nations incorporate in their goals, conventions, resolutions and treaties tasking member countries to ensure gender equality by having fair representation of women in decision making positions and governance systems.

The role of women has become discernible in every sphere of life. In Sweden and Rwanda, there is a remarkable progress when it comes to women's representation and participation in governance (IPU, 2013). In fact, equal representation of men and women in decision-making bodies in the local level administration of countries can be used to measure the country's level of development (Jayal, 2005). According to Kurebwa (2014), fair representation of women and men in the local government system is also very important to ensure potential development change among the people at the grassroots level administration. In Ghana, the call to enhance gender equality in political decision making begun in the 1960s when the first President of the First Republic, Dr. Kwame Nkrumah, through a Parliamentary Act, appointed 10 females into the National Assembly. By 1980s and early 1990s, the call for the increase in women's representation had been intensified in the whole of the sub-Saharan Africa (Manuh, 2011).

However, gender inequality across all elected and appointed positions persists (Paxton, Kunovich, & Hughes, 2007).After one and half centuries, women's representation in the decision-making position is still not encouraging. For example, in Saudi Arabia, after four years of the granting of equal voting right was granted, it was only in 2015 that the women in the country were allowed to register to vote for the first time (al-Yami, 2015). This implies that women were under represented in the decision-making processes during the period when women were not voted into political positions ((Paxton et al., 2007). In an African country like Senegal, women have not realized same gains in political decision making positions as observed in Rwanda, Mozambique and South Africa (Bauer & Britton, 2006)

Similarly, in Ghana, women are not equally or fairly represented in the District Assemblies in Ghana even though they constitute majority of the population, (Baah-Ennumh, Owusu, & Kokor, 2005; GSS, 2012; Tsikata, 2009). The under representation of women in governance is a matter of grave concern. For instance, the 2010 District Assembly elections in Ghana recorded 412 (7.95%) female representatives, which is not even up to ten percent of the total number of 6093 persons elected into the 216 District Assemblies (Yobo, 2012a). What influencing factors supported the election of the 412 (7.95%) female representatives? Is it that these few elected women had financial resources, communicative skills and showed interest to engage in

the local government system? Ghana's local government system is a non-partisan governance system. There is no legally binding affirmative action policy to enhance gender equality in the decision-making processes in Ghana and there are also no laws that prohibits women from engaging in public spheres of life (Sam 2010). Both women and men are given the opportunity to contest in an electoral system(Baah-Ennumh et al., 2005). In a patriarchal society like Ghana, without legally binding affirmative action policies, women with skills, financial resources, training, self- esteem and interest have to contest in an election. Probably when policies and gender friendly electoral systems are put in place such as quota and reserved seats to support women, perhaps they will develop the more interest and engage in the local government system.

The paper considers the local government system in Ghana by examining the nature of women's representation and participation in the district assemblies since 1988. It further analyses the factors influencing women's engagement in local politics with reference to the supply and demand side framework. Also conclusion and suggestions are made for further study.

Local Government System in Ghana

In Ghana, district assemblies are the highest administrative authorities at the local level of governance. The local level governance and for that matter, a district assembly in Ghana is the level of government that is close to the day-to-day lives of ordinary people. The people's habitation, markets, food, basic services, sanitation, environments, social interactions and even civic duty is largely the business of the district assembly (Offei-Aboagye, 2015). Article 240 of the 1992 Ghanaian Constitution established the Local Government System and Act 1993, Act 462 section 10, 1-3 of the system sanctions the district assemblies to be responsible for the overall development in the districts in Ghana through the exercise of deliberative, legislative and executive powers. The system plays very central roles in administration and development of communities. It is directly linked to the central government in an intricately balanced five-tier system of public administration and allocation of functions (Ahwoi, 2010).

Below is the structure of the local government system in Ghana.

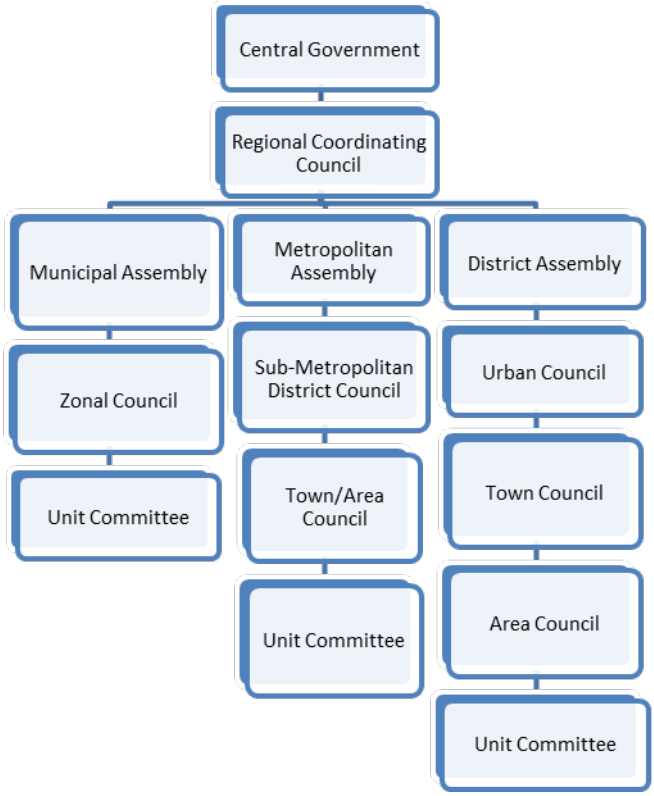

Figure 1: Ghana's Local Government Structure
Source: (Ahwoi, 2010)

Decentralizing authority to the local levels means establishing a system of government that breaks open the inertia associated with rigid centralized government and its bureaucracy. Decentralized approach to governance means three key things namely, the transfer of responsibility, resources (human and financial) and accountability from central government to local self-governing entities. This involves a long process of political, fiscal and administrative decentralization, which leads to local self-governance (Local Government Act, 1993, Act 462). The relationship between central government and local government influences the provision of public services and the expenditure of public funds between the two levels. This relationship takes the form of collaboration and/or control, which can be found at various levels and in different sectors. It is therefore assumed that in all these sectors, women would be involved in the development of their localities.

Ghana's local government system has been in operation since 1988 with the aim of ensuring more equitable participation of ordinary people in governance (ABANTU, 2003) yet district assembly elections continue to record low level of female representation. There are a number of factors, including the existence of patriarchal culture, causing this gender inequality in political representation and participation (Baah-Ennumh et al., 2005; Bauer & Britton, 2006). In order to provide a clear picture of female representation since 1994 to 2015, Table 1 presents a representation of elected females and males in the district assemblies in Ghana.

Table 1: Female Representation in District Assemblies in Ghana (1994-2015)

	Contested			Elected				
Year	Female	Male	Total	Female	%	Male	%	Total
2015	1182	17756	18938	N/A	N/A	N/A	N/A	N/A
2010	1376	15939	17315	412	7.95	5681	92.05	6093
2006	1772	13084	14856	478	10.1	4254	89.9	4732
2002	965	12625	13590	341	7.4	4241	92.6	4582
1998	547	14696	15243	196	4.1	4624	95.9	4820
1994	N/A	N/A	N/A	122	2.9	4082	97.1	4204

Source: Adopted from (ABANTU, 2003; Tsikata, 2009; Yobo, 2012b)

Since 1994, none of the District Assembly elections in Ghana has recorded more than ten percent (10%) representation of women. Thus, in 1994 out of the total number of 4204 elected members of the Assembly, only 122 (2.9%) were females. The 1998 District Assembly elections recorded 4820 elected members, out of which were 196 (4.1%) females. During the 2002 District level elections, 13590 contested, including 965 females, of which 341 won. The 2006 and 2010 results from the District Assembly elections recorded a total number of 478 and 412 elected females out of a total number of 4732 and 6093 respectively (Ahwoi, 2010; Yobo, 2012b). Again, out of 216 District Chief Executives in 2013, only 11 were women (Ministry of Local Government and Rural Development, 2006). The percentage representation is less than the UN bench mark of thirty percent (30%) (Manuh, 2011). After the September 1, 2015 District Assembly elections, there was a record of 1182 females who contested the election as against 17756 males (Coalition of Domestic Election Observers, 2015).The situation reflects gender exclusion from electoral participation and equality in representation (Rai, 2005), which the world have recognized that a government is more democratic when more women are present (Krook, 2010). However, the availability of women to aspire for political position can be as a result of the forces of supply and demand; women availing themselves and they being recognized by stake holders like political elites and governments through policy directives.

Supply and Demand-Side Factors to Women's Representation and Participation in political positions

The concepts of supply-side and demand-side factors were employed by earlier feminists to explain the patterns of female representation in political decision, which is associated with the pioneering study on *Recruitment: Gender, Race, and Class in the British Parliament,* authored by Pippa Norris and Joni Lovenduski (Norris & Lovenduski, 1995). According to these scholars, the supply-side factors are the two key factors that shape the supply of aspirants. These included (1)resources, like time, money, skills, talent and experience; and (2) motivation, such as drive, training, networking, mentoring, ambition and interest in politics (Krook, 2010; Paxton et al., 2007).To these scholars, potential candidates who willingly come forward to contest for political office are influenced by the supply-factors. These factors might have come to play to shape an aspirant for her to convince herself that she is capable to compete against any contender; be it male or female to enhance female representation in elected office. The supply-side factors therefore have a strategic influence to enhance women's representation in elective office (Krook, 2010). Ghanaian women who have been trained, educated, mentored, resourced, networked, have more capacity to engage in politics. In other words, "women's representation is unlikely to increase without significant shifts in the resources and motivations of women to wage political campaigns" (Krook, 2010, p. 159).

The demand-side factors on the other hand are features of countries; electoral systems, or political parties that influence the probability that a woman will be drawn to engage in political activities from the supply-side and the willing candidates (Krook, 2010; Paxton et al., 2007). Aspirants who are desired by political elites are influenced by the demand-side factors (Krook, 2010). In other words, these factors shape the rules of the game in a country. However, in real terms, not all type of people participate in politics (Paxton et al., 2007).

The argument has been that irrespective of the impact of the supply-side factors, a woman's ability to succeed in breaking the 'political glass ceiling' to become a potential aspirant, compared to a man, the female is more likely to rescind her decision to engage in electoral process (Krook, 2010). This is because gender affects political ambition(Lawles & Fox, 2012; Norris & Lovenduski, 1995). For the reason that the enduring nature of traditional gender socialisation, gender-specific family roles and expectation like household responsibilities and reproductive roles of caring for a child, continue to be an obstacle to a woman's opportunity to engage well in public spheres of life (Lawles & Fox, 2012; Norris & Lovenduski, 1995). Simply, the supply of women available for political office is determined partly by gender socialization, which influences women's interest, knowledge, and ambition regarding politics.

Gender is a socially constructed relationship between women and men in a society. The gendered social and cultural norms determine the rights, resources and decision-making

power that women and men have. These constructed relationships make men and women play different roles at home and in society (Kabeer, 2001). The result is that the two persons are being valued differently and the female experience unequal opportunities and life chances (Kabeer, 2001). There are discriminatory practices and many informal systems such as customs, traditions, adages and institutional relationships that are deeply patriarchal, which cut across local government (Beall, 2004). As a result of how gender has been constructed to position women and men in terms of their roles and responsibilities in patriarchal societies resulting in inequality in the gender, there are several calls for the increase in the representation of women in both local and national government. The participation of women therefore can mostly be the result of a process of socialization that leads them to think of political activity in a different way than men (Chhibber, 2003).

Paxton et al. (2007) also posit that gender socialization influences women's interest, knowledge and ambition regarding politics. Thus, seeing that political participation requires supply-side factors; personal characteristics such as interest, ambition, and knowledge as well as other resources like networks, civic skills, education and economic resources, women's availability to engage in politics will depend partly on these supply-side factors. Women's availability to be in politics can also be influenced by the demand-side factors; social structures, which improve or limit women's opportunities for education and employment (Roza, 2010a). In other words, as women have access to these supply-side factors and or resources, they are empowered to resist any obstacles to their participation and representation in politics. It is therefore explicable that as women continue to socialize, they are more likely to be empowered to resist any hindrance to their socio-economic development in society and participate in decision-making positions at the local level of governance. In general, the levels of women's political representation within a country and across the globe are determined by the supply-side and demand-side factors. Supply-side factors contribute in bringing more women into the political landscape as women express the willingness and committed experience to compete against men for political position (Roza, 2010b).

One must not lose sight of the fact that culture, beliefs and attitudes influence both the supply-side and demand-side factors for female candidates. For instance, a patriarchal society is likely to negatively influence women's political representation as the structures in these societies are endemic with traditional and cultural barriers to women's decision to engage in politics (Bauer & Britton, 2006). Other factors that can influence women's representation include the role of international actors and institutional regulations such as gender quotas (Krook, 2010).

Supply and demand side framework and women's representation

In Ghana, as a result of a social change and reforms in customary practices; equal opportunity for girls and boys as against the hitherto believe in the preference for male child education, gender advocates work within institutions to "level the playing field" through changing laws, education, and socialization to bring about gender equality (Antrosio, 2015). Making reference to the elected women in the district assemblies in Ghana from 1994 to 2010, the percentage of women elected into the district assemblies increased, though it decreased in 2010 (see Table 1). These could be attributed to changes in the patriarchal society to deconstruct some domineering systems that used to restrict women to engage in public spheres of life. Ghana attained goal 2 of the Millennium Development Goal (MDG) of equality in primary and basic education. For instance, the 2014 Global Gap Index Report indicated an equal enrolment in primary education for both males and females in Ghana (Schwab, 2014). This is significant because the supply side of the framework emphasizes on women to educate themselves to acquire knowledge and skills to enable them develop interest in electoral system. As part of its effort to achieve goal 4 of the MDG; promote gender equality and empower women, an affirmative action bill is laid before Parliament pending its enactment into law (Yobo, 2012b), had been as a result of vociferous advocacy for gender equality in the governance systems. Again, in collaboration with the Institute for Local Government Studies, the Ministry of Local Government and Rural Development organize training workshop for female aspirants during the District Assembly Elections. Through the efforts of NGOs such as ABANTU for Development, NETWRIGHT, Ghanaian women are being encouraged to engage in public spheres of life.

Taking into consideration the measurement of gender inequality index of a country, the World Economic Forum (WEF)measures how men and women have unequal access to income, education, health and political decision-making in every country (Hausman, Tyson, Bekhouche, & Zahidi, 2013). Some of these dimensions like income and education are factors under the supply side factors to women's representation and participation (Krook, 2010). These dimensions complement each other to ensure gender equality. For instance, access to income, education and health contribute to a woman having an opportunity to occupy political decision-making positions (these factors are also a dimension to measure gender inequality). In the 2013 Global Gender Gap Index (GGGI) Report, Ghana ranked better at 24th in Economic Participation (Hausman et al., 2013). This economic ranking position of Ghana can also be attributed to the economic empowerment of women in the informal economic sector that enhance their economic opportunities (Asmah, 2004). Women's economic opportunity is defined as a set of laws, regulations, practices, customs and attitudes that allow women to participate in the workforce under conditions roughly equal to those of men, whether as wage-earning employees or as owners of a business (Economist Intelligence Unit Limited, 2010). For instance, micro credit schemes such as Women Development Fund (WDF) have continued to be used to improve the economic condition of women in Ghana. The WDF was established by the Ministry of Gender, Children and Social Protection (MGCSP) to offer credit to women in Agriculture, food processing and petty trading. The Ghana Cooperative Credit Union (CUA) with 40 percent membership of women extends credit to its members based on their contribution to the fund (Asmah, 2004).

However, the Ghana was ranked 95th in Political Empowerment and placed 111th in Educational Attainment in the GGGI Report. The expectation is that with women in the majority of Ghana's population, they would be fairly represented in government, but that has not been the case. However, these

elected women in the district assemblies achieved this political success through empowerment, which also helped them to resist this patriarchal culture in Ghana to be able to get elected into the district assemblies. One will then associate this political success of the women to social change within the Ghanaian society, which was so patriarchal in nature. Social change can also be as a result of the call for gender equality. Gender is being reconstructed as a result of social change and therefore the Ghanaian woman is becoming empowered through education, economic opportunities, skill training and the recognition of women's contribution to improving other people's life (Shanker, 2014).

II. CONCLUSION

The purpose of the paper was to examine the supply and demand sides' factor framework to enhance women's representation and participation in decision-making positions at the local level of governance. It is clear from literature that women are under-represented at the local level decision-making processes. The unfair representation of women has the tendency to deny them the chance to contribute their bid towards local and national developments, which also affect Ghana's ranking in almost all gender empowerment indexes. In view of this, the supply and demand side factor framework is critical to both women and all stakeholders to address the under-representation and participation of women. Since the supply side factors are within the domain of women, they should endeavour to equip themselves with the needed skills and capacities that will make them more marketable in the field of politics. The proponents of the supply and demand factors failed to recognize that the factors in the framework operate in a complex structured in a patriarchal society like Ghana. The Ghanaian society therefore needs to create the needed ambiance to aid Ghanaian women have the desire and interest to develop themselves. In addition, NGOs, political parties, government and its agencies are required to put in place the needed positive discriminatory policies and legislative framework to engineer social change that will help de-construct and also reconstruct gender in the Ghanaian society. Addressing the discriminatory structures will help attract women to represent and participate in decision-making positions at the local level.

REFERENCES

[1] ABANTU. (2003). Positioning Women and Their Concerns in Governance Processes. Accra: ABANTU For Development IBIS: Education for Devlopment.

[2] Ahwoi, K. (2010). Rethinking Decentralization and Local Government in Ghana-Proposal for Amendment. In I. o. E. Affairs (Series Ed.) Constitutional Review 6, Retrieved from http://www.ieagh.org/images/pdf/crs-6.pdf

[3] al-Yami, A. (2015). First Saudi women register to vote. http://www.aljazeera.com/news/2015/06/saudi-women-register-vote-150621081535058.html

[4] Antrosio, J. (2015). Anthropology, Sex, Gender, Sexuality: Gender is a Social Constructionj. Anthropology-Understanding-Possibility Living Anthropologically. http://www.livinganthropologically.com/2012/05/16/anthropology-sex-gender-sexuality-social-constructions/

[5] Asmah, G. (2004). Ghana's Second Progress Report on the African and Beijing Platform of Action and Review Report for Beijing+10 (C. a. S. P. Ministry of Gender, Trans.) (pp. 96). Accra.

[6] Baah-Ennumh, T. Y., Owusu, S. E., & Kokor, J. Y. (2005). Participation of Women in Local Governance in Ghana: A Case Study of Ashanti Region. Journal of Science and Technology, 25(1), 1-13.

[7] Ballington, J., Davis, R., Reith, M., Mitchell, L., Njoki, C., Kozma, A., & Powley, E. (2012). Empowering Women for Stronger Political Parties. In M. Popovici (Series Ed.) M. Popovici (Ed.) A GuideBook to promote Women's Political Participation (pp. 128).

[8] Bauer, G., & Britton, H. E. (2006). Women in African Parliaments (G. Bauer & H. E. Britton Eds.). United States of America: Lynne Rienner Publishers, Inc.

[9] Beall, J. (2004). Decentralization and Engendering Democracy: Lessons From Local Government Reform in South Africa. 24.

[10] Chhibber, P. (2003). Why some women are politically active: The Household, Public Space, and Political Participation in India.

[11] Development, M. o. L. G. a. R. (2006). Know your Assembly Members. http://ghanadistricts.com/home/?_=15

[12] GSS, G. S. S. (2012). 2010 Population and Housing Census (G. S. Service, Trans.) (pp. 117). Accra: Ghana Statistical Service.

[13] Hausman, R., Tyson, L. D., Bekhouche, Y., & Zahidi, S. (2013). The Global Gender Gap Report 2013. Geneva Switzerland: World Economic Forum.

[14] IPU, I.-P. U. (2013). Proportion of seats held by women in National Parliaments Retrieved from The World Bank: Working for a World free of Poverty website: http://data.worldbank.org/indicator/SG.GEN.PARL.ZS

[15] Jayal, G. N. (2005). From Representation to Participation: Women in Local Government.

[16] Kabeer, N. (2001). Gender Mainstreaming and Poverty Eradication and Millennium Development Goals: a handbook for policy makers and other stakeholders.

[17] Krook, M. L. (2010). Why Are Fewer Women than Men Elected? Gender and the Dynamics of Candidate Selection. Political Studies Review, 8, 155-168. doi: 10.1111/j.1478-9302.2009.00185.x

[18] Kurebwa, J. (2014). Rural Women's Representation and Participation in Local Governance in the Masvingo and Mashonaland Central Provinces of Zimbabwe (Doctor of Philosophy Dissertation), Nelson Mandella University (NMMU), South Africa. Retrieved from http://www.researchgate.net/publication/264754889

[19] Lawles, J. L., & Fox, R. L. (2012). Men Rule: The Continued Under-Representation of Women in U.S., 32.

[20] Manuh, T. (2011). Towards Greater Representation of Women in National Governance. Governance Newsletter, 17(6), 4.

[21] Norris, P., & Lovenduski, J. (1995). Political Recruitment: Gender, race and class in the British Parliament (pp. 336).

[22] Observers, C. o. D. E. (2015, September 2). Arrangements for Assembly, Unit Committee polls adequate, Daily Graphic. Retrieved from www.graphic.com.gh

[23] Offei-Aboagye, E. O. (2015). THEME "IMPROVING THE PERFORMANCE OF THE LOCAL GOVERNMENT SYSTEM IN THE ERA OF E-GOVERNANCE" Paper presented at the Annual New Year School, University of Ghana, Legon.

[24] Paxton, P., Kunovich, S., & Hughes, M. M. (2007). Gender in Politics. Annual Review Sociology, 33, 263-270.

[25] Rai, S. (2005). "Equal Participation of women and men in decision-making processes, with particular emphasis on political participation and Leadership". 38.

[26] Roza, V. M. A. (2010a). Gatekeepers to Power: Party-Level Influence on Women's Political Participation in Latin America. (Doctor of Philosophy), Georgetown University, Washington, DC.

[27] Roza, V. M. A. (2010b). Gatekeepers to Power: Party-Level Influences on Women's Political Participation in Latin America. (Doctor of Philosophy Dissertation), Georgetown University, Washington DC.

[28] Schwab, K. (2014). The Global Competitiveness Report 2014 (pp. 551).

[29] Shanker, R. (2014). Measurement of Women's Political Participation at the Local Level: India Experience. Journal of Rural Development.

[30] Tsikata, D. (2009). Affirmative Action and The Prospects for Gender Equality in Ghanaian Politics. 69.

[31] Yobo, D. A. (2012a). Women's Place in the Ghana Government. Retrieved from Foundation For Security and Development in Africa website: http://www.fosda.net/db/what-we-do/gender/72

[32] Yobo, D. A. (2012b, 01/03/2012). Women's Place in the Ghana Government. Foundation for Security and Development in Africa. Retrieved 05/02/2014, 2014, from http://www.fosda.net/db/news-a-events/fosda-in-the-news/72-womens-place-in-the-ghana-government

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Factors Affecting Employees' Commitment to an Organization: A Case Study of Jodan College of Technology (JCT), Thika

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Abstract- The objective of this study was to find out the factors influencing the employees' commitment to the organization. Commitment is the feeling of loyalty and oneness that an employee feels towards the organization. This is normally based on personal experiences with regard to the organizations policies and procedures, the receipt of rewards and the interaction the employees have with the agents of the organization. It therefore focused on identifying the factors influencing employees' commitment in Jodan College of Technology- Thika. The researcher was to identify the factors influencing commitment of employees at different levels that include: the teaching staff, the non-teaching staff and the management. This study targeted 45 employees and a census was conducted on the population and structured questionnaires were used to collect data. The data collected was analyzed and presented, where findings and recommendations were made. The study found out that work environment greatly influenced the employees' commitment to the organization. There was a strong relationship between work environment and employees commitment. Motivation influenced how employees performed their duties. Frequency of motivation methods had no relationship with employee's commitment. There was a strong relationship however, between the type of motivation method used and employees' commitment. Training and development was indicated to affect employee's commitment. Correlation analysis shows that there was no relationship between training and development and employees commitment. The study concluded that work environment is a key motivator to employee commitment; good working environment enables employees to work harder and achieve organization goals. Motivation is a factor in employee commitment. Induction/orientation is an important part of welcoming new employees to the organization and it needs to be properly handled. The study recommended that the organizations management should equip employees with the right tools and equipment for the job. All employees should have binding contracts which should define what the organization expects from employees and also, the organization should come up with an effective induction/orientation program for employees joining the organization.

Index Terms- Employees' Commitment, Working Environment, Motivation, Training

I. INTRODUCTION

1.1 Background

Human resource or labour is seen to be the important resource since it drives all the other factors which include; capital, equipments, information and financial resources. This encompasses intangible assets which includes culture, skill, competence, and social interaction between people, teams and even business units (Armstrong, 2009). If handled well human resource can provide a competitive advantage, but when mishandled, they lead to corporate stress (Armstrong, 2005). The way organizations handles human resources determines how the organization will be. In the current world of globalization, organizations should perform for them to survive and remain effective. The good performance and effectiveness is not achieved without the assistance and hard work of the human resources (Ainsworth & Smith, 1993).

In Money and Career (2011) article, for an organization to perform well and meet its goals, there is needs to satisfy the needs of the employees. It states that employment in the private sector is dangerous because the employers do not pay very well, they do not treat their employees' right and there is no job security. JCT and all the other privately owned institutions should rise above this poor image. Colleges are vested by the society with the task of imparting values and socializing students to contribute to social progress and advancement of knowledge.

To make this possible, a hard working workforce is very important. If the employees feel supported by the organization, feelings of loyalty and commitment are developed, which makes them work hard towards achievement of the organizations goals (Eisenberger, 1986). Workers performance is limited only by the management's ability to use the human resources effectively. This therefore this implies that the managers' role within the organization cannot be manipulated by the employees' but rather to create an atmosphere in which workers can use their commitment and loyalty to satisfy their personal needs as well as those of the organization (Armstrong, 2005).

An organization that is supportive is committed to its workers. This makes employees feel safe in organizational contexts perceived to be trustworthy, secure, predictable and clear in terms of behavioral consequences. Therefore employees with trusting interpersonal relationships are supportive organizational environments are able to take risks, expose their real selves and try and perhaps fail, without fearing the

consequences. Supportive management and interpersonal relationships foster feelings of psychological safety that increases willingness of employees to engage fully in their work roles (Eisenberger, 1986).

There need for employees need support at work if they are expected to deliver the performance and the citizenship that result from engagement. Support may be financial or non-financial. Counseling for example can be used by a firm to show people that it cares for individuals. When employees believe that they work for an organization that does not value their contributions, or care about their well being, they will not feel safe enough to fully engage in their work (Ëisenberger & Huntington, 2001).

5.2 Summary of the Major Findings

5.2.1 Working Environment and Employee Commitment

The working tools and equipments were rated to be poor by majority of the respondents. There was poor relationship between employees and the supervisor as expressed by majority of the respondents. Majority of respondents indicated lack of good relationship between employees and the supervisor and among the peers. The communication channels employed were indicated to be poor by majority of respondents. The working space was indicated by majority of respondents to be inadequate. Facilities were indicated by majority of respondents to be poorly maintained which compromised the health and safety of employees and exposed employees to disasters. There were no clear methods of work in the organization. There was strong relationship between work environment and employees commitment.

5.2.2 Motivation and Employee Commitment

Majority of respondents indicated to have written contract with the organization. Majority of the respondents were aware what was expected of them while working in the organization. Most respondents indicated that the remuneration system was not fair. Majority of respondents indicated that involvement and participation was never used in the organization. Most respondents indicated that consultation on planned changes was rarely used in the organization. Autonomy on their work was indicated by majority of respondents never to be used. Majority of respondents indicated that disclosure of important information about the company was never used. Majority of respondents indicated that negotiation and participation in union activities was never used. Majority of respondents indicated that work was not interesting and had no varied responsibilities. On rating of the motivation methods employed. On share options, majority of respondents indicated poor, on consultation; majority of the respondents indicated poor, on job enrichment, majority of respondents indicated average, on delegation, majority of the respondents indicated average, on collective bargaining, majority of the respondents indicated poor, on work councils, majority of respondents indicated average, on employees directors, majority of respondents indicated average which shows that the rating methods employed were ineffective. Frequency of motivation methods had no relationship with employee's commitment. There was a strong relationship between the rate of motivation methods and employees commitment.

5.2.3 Training and Development and Employee Commitment

Majority of employees indicated that induction/orientation was not conducted to all employees. Most respondents indicated that training was not regularly conducted in the organization which affected employee's performance. Majority of respondents indicated that employees were not well trained. Majority of respondents indicated that the training conducted had benefits to some of the respondents. Majority of respondents indicated that employees benefited from training. Majority of respondents indicated that the organization did not pay any attention to training needs of the employees. Correlation analysis shows that there was no relationship between training and development and employees commitment.

5.3 Conclusions

5.3.1 Working Environment and Employee Commitment

The study concluded that respondents involved in the organizations held positions in the organization. There was gender disparity in the organization since there more men than women working there. A large number of respondents working in the organizations were young people who answered questions on the factors that influence employees' commitment in tertiary colleges in Kenya. Majority of respondents involved in the study were educated and have the required knowledge on the factors that influence employees' commitment in tertiary colleges in Kenya. Majority of respondents were have been working in the organization and earning salaries. Majority of respondents were respondents had worked in the organization for some time and had the required knowledge on the factors that influence employees' commitment in tertiary colleges in Kenya.

Work Environment is a key motivator to employee's commitment, good working environment enables employees to work harder and achieve organization goals from the findings work environment was not enabling for employees commitment. Providing employees with proper tools and equipments reduce injuries and improve efficiency. Clear communication channels improves relationship between employees and supervisors, improves teamwork. Well maintained facilities reduce cases of sicknesses and improve health and safety of employees. Clear lines of work encourage employees to work harder to meet the set targets. Proper disaster preparedness improves the organization capacity to deal with emergencies and overall impacts on commitment.

5.3.2 Motivation and Employee Commitment

Contractual agreements are evidence of employee's commitment to the organization course. Remuneration is a key employee motivator, the findings shows that employees were not properly remunerated which led to increased turnover and low levels of commitment. Employee's involvement, consultations and participation were rarely used methods to motivate employees. From the findings, autonomy, disclosure of important information concerning the organization, negotiations and participation in union activities were not allowed.

5.3.3 Training and Development and Employee Commitment

Induction/orientation is an important part of welcoming new employees to the organization. It needs to be properly handled.

From the findings induction/orientation was not conducted to all employees. Training and development equips employees with the required skills to deal with challenges that come with the job, from the findings training was not regularly conducted in the organization which negatively affected employee's performance. Training need analysis is key to identifying areas that employees require improvement. Training contributes to employee's commitment if conducted on regular basis. Training is effective when it's conducted to all employees in the organization.

ACKNOWLEDGMENT

First and foremost, I would like to acknowledge my supervisor, Dr. Mike Iravo, for providing unlimited, invaluable and active guidance, his patience and support throughout the study. I also want to acknowledge Sarah Wanjiku, for assisting me with text books to do my research.

REFERENCES

[1] Ainsworth, M., & Smith, N. (2003). Making it Happen: Managing Performance at Work, Victoria: Prentice Hall.

[2] Armstrong, M. (2005). Human Resource Management Practices (9th Ed). London: Kogan Page.

[3] Armstrong, M. (1999). A Handbook of Human Resource Management (7th Ed). London: Kogan Page.

[4] Bain, D. (1982). The Productivity Prescription: The Managers Guide to improving Productivity and Profits, New York: Mc Graw-Hill.

[5] Beardwell, I., Holden, L., & Claydon, T. (2004). Human Resource Management: A Contemporary Approach (4th Ed). London: Prentice Hall.

[6] Budd, J. (2004). Employment with a human face, Ithaca, New York: Cornell University Press.

[7] Cascio, F. W. (1995). Managing Human Resources: Productivity, Quality of Life, Profits (4th Ed). New York: Mc Graw-Hill.

[8] Cole, G.A. (2002). Personnel and Human Resource Management (5th Ed). China: C&C Offset.

[9] Dessler, G., & Varkkey, B. (2008). Human Resource Management (11th Ed). India: Dorling Kindersley.

[10] Goss, D. (1994). Principles of Human Resource Management, London: Routledge.

[11] Hodgetts, C., & Kuratko, D. (1988). Management (2nd Ed). Orlando Florida: Harcout Brace Jonovich Inc.

[12] Hornby, A.S. (1999). Oxford Advanced Learners Dictionary (9th Ed). Hong Kong: Sing Cheong Ltd.

[13] Jodan College of Technology. (2015). Prospectus 2014-2015.

[14] Kothari, C. R. (2003). Research Methodology, methods and techniques (2nd Ed). New Delhi: Prashakan Publishers.

[15] Malhorta, N., & Peterson, M. (2002). Basic Marketing Research: A Decision Making Approach, New Jersey: Prentice Hall.

[16] Marchington, M. (2001). Employee Involvement at Work (2nd Ed). London: Thompson Learning.

[17] Mullins L.J. (1993). Management and Organizational Behaviour (3rd Ed). London: Pitman.

[18] Money and Career. (2011, Nov 25). Daily Nation, P. 26.

[19] Tertiary Education in Kenya. (2014, Sep 19). Standard Newspaper, P. 13.

[20] Rose, E. (2001). Employee Relations, London: Prentice Hall.

[21] Sherman, A., Bohlander, G., & Snell, S. (1996). Managing Human Resources, Ohio: South Western College Publishing.

[22] Torrington, D., Laura, H., & Taylor, S. (2008). Human Resource Management (7th Ed). London: Prentice Hall.

[23] Torrington, D., & Weightman, J. (1994). Effective Management, Hertfordshire: Prentice Hall.

University of Bristol: Positive Working Environment downloaded from; http://www.bris.ac.uk on 14th July 2015.

[24] Laferla, R. (2008). The Management Edge, Kenya: Longhorn Publishers Kenya Limited.

[25] Mugenda, A. G (2008). Social Science Research: Theory and Principles, Nairobi: Applied Research & Training Services.

[26] Ng'an'ga, S., Kosgei, Z., & Gathuthi, E. (2009). Fundamentals of Management Research Methods, Nairobi: Printwell Industries Ltd.

[27] Kisilu, D., & Tromp, L. (2009). Proposal and Thesis Writing: An Introduction, Nairobi: Paulines Publications Africa

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APPENDIX I: QUESTIONNAIRE

Introduction

This instrument is aimed at gathering information from the employees of Jodan College of Technology on the factors influencing employee commitment. The information gathered will be treated with utmost confidentiality.

SECTION A: GENERAL CHARACTERISTICS OF THE RESPONDENTS

(Please tick where appropriate)

1. Employment category

a) Management ☐

b) Teaching staff ☐

c) Non-teaching staff ☐

2. Gender ☐

a) Male ☐

b) Female ☐

3. Age

a) 21 – 25 yrs ☐

b) 26 – 30 yrs ☐

c) 31 – 35 yrs ☐

d) 36 – 40 yrs ☐

e) 41 – 45 yrs ☐

4. Education level

a) Primary ☐

b) Secondary ☐

c) Certificate ☐

d) Diploma ☐

e) Higher diploma ☐

f) Degree ☐

5. Terms of service

a) Permanent ☐

b) Contract ☐

c) Part-time ☐

d) Casual ☐

e) Probation ☐

6. Period of service

☐

a) 0 – 2 yrs

b) 3 – 5 yrs ☐

c) 6 – 10 yrs ☐

SECTION B: EMPLOYEES' COMMITMENT

Please state the extent to which you agree or disagree with the following statements regarding employee commitment**. (1 Strongly Disagree, 2 Disagree, 3 Neutral, 4 Agree and 5 Strongly Agree)**

	1	**2**	**3**	**4**	**5**
I desire to remain a member of the organization					
I understand the goals of the organization					
My commitment to the organization has led to high productivity					
I am satisfied with my work					
I feel valued in the organization					

SECTION C: WORKING ENVIRONMENT

1. Kindly indicate how you rate the following elements of the working environment in the organization;

   NB: 1 GOOD 2 AVERAGE 3 POOR 4 VERY POOR

	ELEMENT	**1**	**2**	**3**	**4**
1	State of working tools and equipment				
2	Relationship with supervisor				
3	Relationship with peers				
4	Communication channels				
5	Working space				
6	Safety				
7	Maintenance of facilities i.e. toilets, offices e.t.c.				
8	Welfare services				
9	Methods of work				
10	Preparedness to handle disasters				

2. Suggest what you think the college management should do to improve the working conditions_____

SECTION D: MOTIVATION

1. Do you have a written contract indicating the terms and conditions of employment?

a) Yes ☐ b) No ☐

2. Are you aware of the organizations expectations towards you?

a) Yes ☐ b) No ☐

3. Do you think the remuneration system used in the organization is fair?

a) Yes ☐ b) No ☐

4. Kindly indicate on the frequency of use of the following motivation methods;

NB: 1 ALWAYS 2 OFTEN 3 RARELY 4 NEVER

	METHOD	**1**	**2**	**3**	**4**
1	Involvement and Participation				
2	Consultation on planned changes				
3	Autonomy				
4	Disclosure of important information about the company				
5	Negotiation and participation in union activities				

5. Do you feel that your work is interesting and has varied responsibilities?

a) Yes ☐ b) Maybe ☐ c) Not sure ☐ d) no ☐

6. Kindly indicate how you rate the following motivation methods as used in the organization;

NB: 1 Excellent 2 Very Good 3 Good 4 Average 5 Poor

	METHODS	**1**	**2**	**3**	**4**	**5**
1	Share Options					
2	Consultation					

3	Job Enrichment					
4	Delegation					
5	Collective Bargaining					
6	Work Councils					
7	Employee Directors					

SECTION E: TRAINING AND DEVELOPMENT

1. Did you undergo induction/orientation training on joining JCT?

a) Yes ☐ b) No ☐ c) Not Sure ☐ d) Not Know ☐

2. How many times have you undergone training since you joined JCT?

a) Nil ☐ b) 1-2 times ☐ c) 3-4 times ☐ d) Over 5 times ☐

3. State the period that has elapsed since your last training after joining JCT?

a) Have not been trained ☐ c) 3-4 years ☐

b) 1-2 years ☐ d) Over 5 years ☐

4. Comment on the relevance of the training to your job description.

a) Very Relevant ☐ c) Irrelevant ☐

b) Relevant ☐ d) Totally Irrelevant ☐

5. Did the skills gained through training contribute to better performance of your job?

a) Yes ☐ b) No ☐ c) Do not know ☐ d) Not sure ☐

6. Does your department undertake staff training needs analysis?

a) Always ☐ b) Often ☐ c) Rarely ☐ d) Never ☐

7. What other training would you recommend for yourself? ----------

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Effects of Workplace Stress on Employee Performance in the County Governments in Kenya: A Case Study of Kilifi County Government

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Abstract: The Public Service department is the nerve of service delivery to the public and due to the high demand and expectations from the public, staff needs to work over and beyond the normal routine, be able to multitask and get out of the confront zone for them to delivery. This has created a stressful environment as most staff are not used to the new system which has a lot of uncertainties and pressures. The purpose of this study was to research the impact of stress on the performance of employees of the County Government of Kilifi. The main objective was to determine workplace stress and its effects on performance. To establish the effects of Job demand of the job, salary, job security and time pressure on employees performance. The research design was a descriptive survey design and the target population research was the 2300 employees of Public Service department in the seven sub counties of the County Government of Kilifi. The study shows that Job demand was a stress fact that hindered employee's performance though the stress levels were manageable thus did not affect their performance. A strong positive correlation existed between performance and Job demand. Time pressure was a major stressor as most employees felt due to working for long hours was a major challenge in that dual responsibility of dividing their time as working long hours denies them time with their family and this posed as a big challenge. A strong positive correlation existed between time pressure for the job and performance was noted. Employee felt that to some extent Salary was inadequate but it was not a stressor which hinders their performance. Majority of employee considers their job secure and do not find job security stressful. They also noted that Job Security influence their commitment to their employer. It is therefore concluded that workplace stress affects the performance of Kilifi County employees especially time pressure. The study recommends that Kilifi County government should organize for burnout sessions for its employees and create sufficient time for them to be with their families.

Key Terms - Distress, Employee Performance, Eustress, Stress, Work place Stress.

I. INTRODUCTION

Stress is a universal element experienced by employees around the globe. Stress has become major problem for employer particularly in developing nations where the employer does n0t realize the impact of stress on employee performance. It is important to recognize and address properly job stress because it badly affects the employee's mental and physiological health. As there are so many resources for employees to perform excellent in their jobs but there is also some factors that hinders in their way. These factors lead to negative employee performance. Stress at work is seen as one of the major psychosocial risks of work. Work-related stress is one of the problems confronting employees. It is of great concern to employees, employers and psychologists, because of its high growing rate in ill- health, as a result of long working hours of some employees (Joseph, 2007).

According to Sayeed (2001), stress also continues to jeopardize the health of organizations. Unhealthy organizational climates reduce employee involvement and negatively affect performance at the individual and corporate level. The experience of work and stress is certainly not new in Kenya. Kenyans continue to experience stress as a result of poor environmental conditions, political uncertainty, poor working conditions and extreme levels of poverty. Ngeno (2007) concurs and further points out that employee in Kenya have to contend with low salaries, lack of involvement in decision making, heavy workload, and few opportunities for promotion. Research conducted by Munali (2005) reveals that employees are reporting increased levels of stress which has led to poor health and consequently performance. Globalization has left Kenyan suppliers facing stiff competition and aggressive cost cutting. Work place pressure is growing day by day, people face changing economic and business situations, changing customer expectations and changing expectations from their own role and position in the organization (Mohan, 1995).

This study focused on Kilifi County which is one of the six counties in Kenya. The county Government has ten department being Health, Agriculture, Education, Finance and Economic Planning, Works and Transport, Water, ICT, Industrialization and Cooperative, Lands and Public Service. The County has a total number of 2300 employee public Service being second largest

after health department. Since Public Service department is the central and the nerve of delivery to the public it is very crucial for the employees in the department to supersede the public expectations and provide efficient and effective service.
Most staff in this department are those inherited from the Former Local Authority and the culture of getting out of their confront zone to deliver was a dream. Due to this the staffs in the Public Service department feel pressured and stressed in order to deliver. This study is meant to identify the effects of workplace stress on performance, and come up with proper and workable recommendations that will be able to satisfy the Public Service employees and create the right culture for them to provide excellent services. Kilifi County Government, being a devolved county requires excellent personnel who work wholeheartedly and are committed toward giving their best while at work, in order for the County to meet its mission of to provide an enabling environment and participatory resource management for efficient and effective service delivery for all.
Service delivery is very crucial as the demand and expectations of Devolution is very high. The public Service department is the nerve of service delivery to the public and due to the high demand and expectations from the public, staff needs to work over and beyond the normal routine, be able to multitask and get out of the confront zone for them to delivery. People are becoming more familiar with what work-related stress is and how to manage it (International Stress Management Association and ACAS in conjunction with the HSE, 2004). Work stress is ubiquitous and has become a universal phenomenon in every work place. Work stress has become a major challenge facing organizations (Donaldson-FeilderE. Yarker J. & Lewis R (2011) and now becoming the global issue which is affecting all the countries, all categories of employees and societies (Haider & Supriya, 2007). Interest in the phenomenon of work-related stress has increased markedly during the last few years because researches have suggested an increase level of work stress among employees (Vanishree, 2014). International research efforts continue in an attempt to reduce the human and economic costs of work-related stress (Dollard, Winefield, &Winefield, 2003). The literature has shown much research works, in developed countries with regard to work related stress. However, no researches have been conducted in specific areas of work stress of employees in Kilifi County government, therefore, it is imperative to assess the impact of work stress on employees in Kilifi.

The main objective of this study will be to assess the effects of workplace stress on employees performance in the County Government in Kenya with specific focus in Kilifi County Government. The specific objectives are: (1) To establish the effects of job demand on employees performance in Kilifi County Government; (2) To determine the time pressure on employee performance in Kilifi County Government; (3) To determine the effects of salary on employee performance in Kilifi County Government; and (4) To establish the effects of Job security on employee performance in Kilifi County Government.

II. LITERATURE REVIEW

Many researcher argue that stress at workplace has an impact to performance in one way or another. Occupational stress inadvertently consequences low organizational performance (Folkman & Lazarus, 1991), Job stress although has belittling impact on any organization and individual's performance but can shape dire consequences when related to health care. (Margolis, Kroes, & Quinn, 1974). The importance of stress is highlighted nowadays by the employers to manage and reduce stress through practical guidelines in public sector but not in private organizations (Rolfe, 2005).

Systemic Stress – Selye's Theory: The popularity of the stress concept in science and mass media stems largely from the work of the endocrinologist Hans Selye. In a series of animal studies he observes that variety of stimulus events (e.g., heat, cold, toxic agents) applied intensely and long enough are capable of producing common effects, meaning not specific to either stimulus events. According to Seyle, these nonspecifically caused changes constitute the stereotypical i.e. specific response pattern of systemic stress. Selye (1980) defines stress as a nonspecifically response of the body to any demand, whether it is caused by or results in, pleasant or unpleasant conditions. Selye identifies three stages of adaptation which a person goes through in his General Adaptation Syndrome 1936.They are Alarm, Resistance, and Exhaustion. These stages are associated with particular biological markers such as changes in hormone patterns and the production of more "stress hormones" and the gradual depletion of the body's energy resources.
In the Alarm stage the body recognizes a challenge or threat and goes into a "fight or flight" was actually first coined by Walter Cannon another important pioneer in modern stress theory. In resistant stage the body attempts to adopt to a challenging situation which is persisting. The coping or adaptation required physiological resources, which may eventually get depleted. If the Exhaustion stage occurs, the stressful challenge has persisted too long. The immune system is impaired, long term damage and illness result.

Psychological Stress – The Lazarus Theory: According to Lazarus stress is experienced when a person perceives that the "demands exceed the personal and social resources the individual is able to mobilize." This called the transactional model of stress and coping. Neither the environment event nor the person's response defines stress, rather the individuals perception of the psychological situation is the critical factor. According to Lazarus, the effects that stress has on a person are based more on that persons feeling of threat, vulnerability and ability to cope than on the stressful event itself. He defines psychological stress as a "particular relationship between the person and environment that is appraised by the person as taxing or exceeding his or her resources and endangering his or her wellbeing. According to his theory there are two things that a person thinks when they are faced with a situation. These are called the primary appraisal and the secondary appraisal

The conceptual framework to be used in this study discusses the stress factor that can effect employee performance.

Independent Variables Dependent Variables

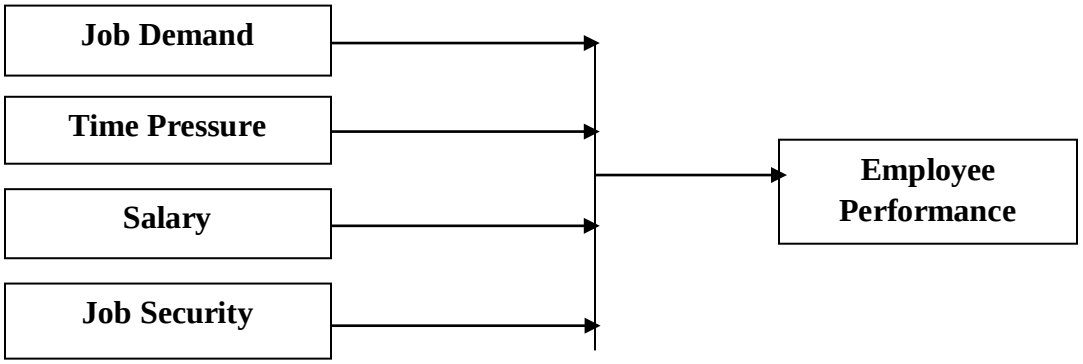

Figure 1: Conceptual framework

The diagram above shows that performance is affected by the physical job demand, time pressure, salary and job security the staff are exposed to. At a certain level the independent variable causes the staff to be in a stressed mode which hinders performance. This framework shows the relationship between staff performance and the factors that influence to their productivity.

Job demand: Most of the literature examining reduced hour (or workload) arrangements, which involve a reduction in workload or hours with a commensurate pay reduction, focus on employer interest in retaining human capital, in particular top talent (Jones & Kidman, 2001).Even if, or when, there is no effect on employees work life balance, flextime are often associated with improved organizational performance (Beauregard & Hendry, 2009).
A study in UK indicated that the majority of the workers were unhappy with the current culture where they were required to work extended hours and cope with large workloads while simultaneously meeting production targets and deadlines (Townley, 2000).

Time Pressure: Work plays an important role in the lives of most people. After all, a salaried job pays the bills and enables us to survive. Work, whether paid or unpaid, also helps us to shape our identity, gives a purpose to our existence, allows us – or forces us – to structure our time, gives us a useful way to spend our days, contributes to our social status, and finally, brings us into contact with others (Siegrist, 2010).
When an employee is unable to meet the demands of work (within the time available), a work pressure problem arises that can lead to work stress. Work stress can eventually cause the employee to feel excessively tired, exhausted and depressed, as well as to suffer physical ailments. The employee can become overstrained or, if the situation persists for a lengthy period of time, start to suffer from burn-out.

Salary: Stress is created where the employee lacks information regarding his authorities, tasks to be performed, duties and powers. Alexandros-Stamatios et al. (2003) also argued that “factors intrinsic to the job” means explore workload, variety of tasks and rates of pay. The combination of high effort and low reward at work has been found to be a risk factor for cardiovascular health, sickness absence as well as self-reported symptoms (Tsutsumi & Kawakami, 2004). Rewards are distributed to employees in three different ways: money that is adequate salary, esteem that is respect and support and security that is Job security, promotions and status consistency.
Money is an extrinsic reward and it can used to influence employees behaviors (Darmon, 2004). Extrinsic rewards are granted but another individual, and can include salary, fringe benefits, and so on (Kreitner, 2005). Organizations that reward their members in accordance with performance typically experience fewer problems than organizations that do not. (Muczyk, et al., 2004). Bonuses, as extrinsic rewards, can be good tool to motivate workers for better performance. When management ties their performance in with their bonuses, they take it as a challenge to generate greater performance for receiving bigger financial reward. Money is important, but it is not the ultimate tool for performance. For a lot of people, the feeling of being recognized and valued appears more important than money (Laurie, 2007).

Job security: Employees want to feel confident about their organization’s future and they want stability and steady work so they can meet their financial obligations. An employee’s sense of job security is related to whether or not they trust the leaders in the organization. To engender trust, leaders need to show consideration for the morale, welfare and well-being of their team. Leadership behavior is extremely important because there is a direct link between the perceptions that employees have of their

leaders and the performance of the organization. Job security is defined as employees desire to be retained in their current job till their retirement. Human dignity is directly related to job security as it affected the ability of employees to satisfy the basic physiological and security needs. Psychologists have recognized job insecurity as an imperative cause of stress which involved anxiety and panic.(Salami et al., 2010).

Lack of job security and job changes are source of pressures due to fear of skill redundancy and future job change. Undoubtedly uncertain job security and the fear of layoff is also an important source of psychological stress for some, especially during times of economic contraction (William, 1995).

Performance: Performance of an employee at his/her workplace is a point of concern for all the organizations irrespective of all the factors and conditions. Consequently the employees are considered to be very important asset for their organizations. (Qureshi & Ramay, 2006) A good performance of the employees of an organization leads towards a good organizational performance thus ultimately making an organization more successful and effective and the vice versa (Armstrong, 2009). The problems arise for the organizations when they start perceiving that their organizations are already performing at their level best and with great efficiency furthermore, there is no need for further improvement in their organizations (Summers & Hyman, 2005).

III. METHODOLOGY

The study adopted a descriptive survey design to investigate the effects of workplace stress on performance. Descriptive research studies are designed to obtain precise information concerning current status phenomena and wherever possible draw conclusion from facts obtained. Information was collected from different respondents on their perception of their performance and to access the impact that stress could have in their lives.

Public service department staff from the seven sub counties in Kilifi County Government accounted for 2300 staff as the population size. The sampling technique used was random sampling with s sampling size of 10% as recommended by Mugenda et al. (1999). The study focused mostly on primary data using self-administered questionnaire and one-on-one interviews with staff who are semi- illiterate. The results from the study were analyzed using statistical package for Social Science (SPSS) and Mean average statistical procedures.

IV. RESEARCH FINDINGS AND DISCUSSION

Physical Demands of Job: 30% of the respondents said that they found their job highly strenuous. 34% said that the workload was overwhelming and 36% said that their job involved multiple tasks. This shows that although the respondents found their jobs demanding but the stress levels were manageable. As shown in the figure below.

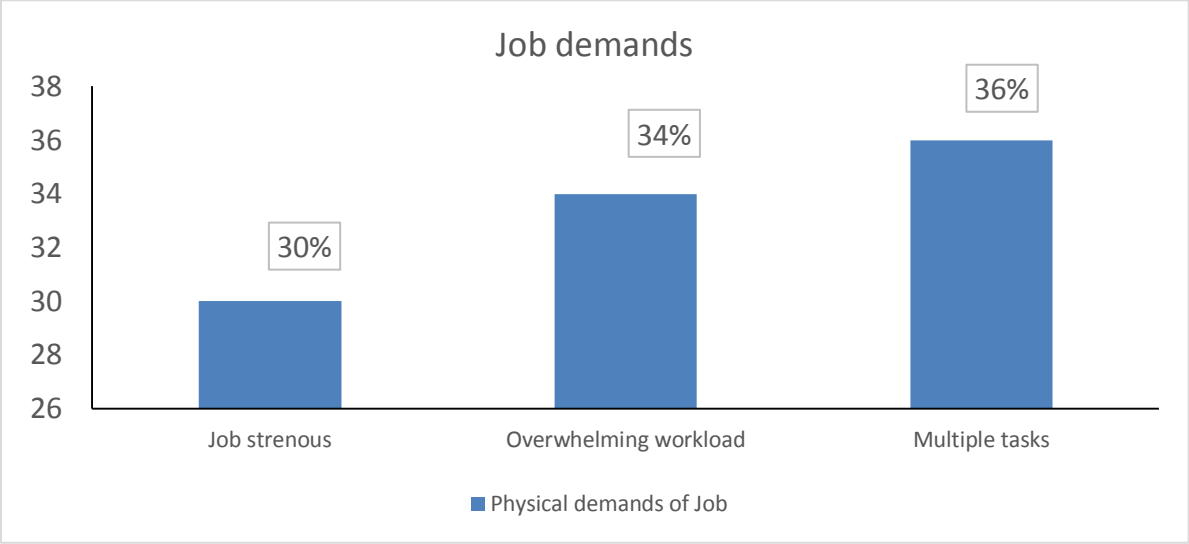

Figure 2: Job demands

Time Pressure: 22% of the respondents said that they rarely have rest periods. 10% said that working for long hours makes them less effective and 68%said that working long hours denies them time with their family. This shows that the majority are stressed with dual responsibility of dividing their time between their work and their family as shown in the table below:

Table 1: Time Pressure

Time Pressure	Frequency	Percentage
Rarely have rest periods	51	22%
Working for long hours makes them less effective	23	10%
Working long Hours denies them time with my family	156	68%
Total	230	100%

Salary: 9% of the respondents said that they would like to find a better paying job. 14% said that they consider their pay low43% said that they consider their pay inadequate and 34% said that they consider their benefits inadequate. This shows that the majority consider their pay inadequate. However very few would like to find a better paying job. Therefore as much as their salary seems to stress them, but the stress is manageable. The findings are shown in Table 2 below.

Table 2: Salary

Salary	Frequency	Percentage
I would like to find a better paying job	21	9%
I consider my pay low	32	14%
I consider my pay inadequate	99	43%
I consider my benefits inadequate	78	34%
Total	230	100%

Job Security: 72% of the respondents said that they feel secure in their job. 10% said that Job Security makes me want to look for another job and 8% said that they Job Security influence my commitment to my employer. This shows that the majority considers their job secure and do not find job insecurity stressful.

Table 3: Job Security

Job Security	Frequency	Percentage
I feel secure in my job	166	72%
Job Security makes me want to look for another job	23	10%
Job Security influences my commitment to my employer	18	8%
Total	230	100%

General Contribution of the Factors to Performance: 20% of the respondents said that low pay is the main cause of performance in their work place.50% said that it was time pressure. 20% said that it was job security and 10% said that it was physical job demand. This shows that the majority considers their time pressure as the main performance stressor in Kilifi County government jobs and do not find job insecurity stressful.

Table 4: General Contribution of the Factors to Performance

	Frequency	Percentage
Low Pay	46	20%
Time Pressure	115	50%
Job Security	46	20%
Physical Job demand	23	10%
Total	230	100%

Table 5: Regression model

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-.316	.241		-1.309	.192
	Demand	.226	.039	.337	5.771	.000
	Pressure	.522	.072	.419	7.251	.000
	Salary	.071	.030	.118	2.365	.019
	Security	.050	.027	.096	1.890	.060

a. Dependent Variable: Performance

$$Y = -0.316 + 0.226\,X_1 + 0.522\,X_2 + 0.071_3\,X_3 + 0.050\,X_4,$$

The relationship between the variables can be depicted with above multiple regression equation (Table 5) which as per the ANOVA test (Table 6) is significant (i.e. p-value is less than 5%) implying that we reject null hypothesis that states:- H_0: $\beta_1 = \beta_2 = \beta_3 = \beta_4$

Table 6: Analysis of Variance

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	37.782	4	9.446	45.623	.000[a]
	Residual	46.583	225	.207		
	Total	84.365	229			

a. Predictors: (Constant), Security, Pressure, Salary, Demand

b. Dependent Variable: Performance

In other words, the test affirms the validity of the "entire regression" at the 5% level i.e. the model "passes the *F*-test" or at least one of the $\beta i \neq 0$

Table 7: Model Summary

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics					Durbin-Watson
					R Square Change	F Change	df1	df2	Sig. F Change	
1	.669[a]	.448	.438	.45501	.448	45.623	4	225	.000	1.044

a. Predictors: (Constant), Security, Pressure, Salary, Demand

b. Dependent Variable: Performance

The *R*-square = R^2 = 44.8% which means the model is able to account for 44.8% of the variation in Performance from the three independent variables. The Adjusted *R*-square is 43.8% . This is the coefficient of determination adjusted for degrees of freedom, which is a different version of R^2. It has been adjusted to take into account the sample size and the number of independent variables.

Table 8: Correlation Analysis

Correlations

		Performance	Demand	Pressure	Salary	Security
Pearson Correlation	Performance	1.000	.532	.592	.128	.056
	Demand	.532	1.000	.494	.035	-.165
	Pressure	.592	.494	1.000	.015	.057
	Salary	.128	.035	.015	1.000	-.078
	Security	.056	-.165	.057	-.078	1.000
Sig. (1-tailed)	Performance	.	.000	.000	.026	.201
	Demand	.000	.	.000	.298	.006
	Pressure	.000	.000	.	.410	.193
	Salary	.026	.298	.410	.	.120
	Security	.201	.006	.193	.120	.
N	Performance	230	230	230	230	230
	Demand	230	230	230	230	230
	Pressure	230	230	230	230	230
	Salary	230	230	230	230	230
	Security	230	230	230	230	230

Table 8 shows that there is strong positive correlation between performance and Time pressure for the job (i.e. 0.592) followed by performance and physical demand for the job (i.e. 0.532). However, although a significant correlation exist between Performance Vs Salary and Performance Vs Security; it is relatively weak compared to the first two.

V. SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

Physical Demand Vs Employee Performance: Respondents that found their job highly strenuous were 30%. Those that found workload was overwhelming were 34% and 36% said that their job involved multiple tasks. This shows that although the respondents found their jobs demanding but the stress levels were manageable and thus did not affect their performance. A strong positive correlation was also noted between performance and physical demand of the job at 0.532. Physical demand does have significant effect on employee's performance as the p-value for Physical Demand is 0.000 which is less than 5%.

Time Pressure Vs Employee Performance: Respondents that said they rarely have rest periods were 22%. Those that found working for long hours makes them less effective were 10% and 68%said that working long hours denies them time with their family. This shows that the majority are stressed with dual responsibility of dividing their time between their work and their family. A strong positive correlation of 0.592 between time pressure for the job and performance was noted in the correlation analysis. It was also observed that there was a significant effect between Time pressure and employees performance.

Salary Vs Employee Performance: Respondents that said that they would like to find a better paying job were 9%. Those that consider their pay low were 14% and 43% said that they consider their pay inadequate while 34% said that they consider their benefits inadequate. This shows that the majority consider their pay inadequate. However very few would like to find a better paying job. Therefore as much as their salary seems to stress them, but the stress is manageable. There is a weak positive correlation of 0.128 between Salary and Employees Performance. However it was noted that there was a significant effect between Salary and Employees Performance.
Security Vs Employee Performance: The respondents that felt secure in their job were 72%. 10% said that Job Security makes them want to look for another job while8% said that Job Security influence their commitment to my employer. This shows that the majority considers their job secure and do not find job insecurity stressful. It was also noted that there was a weak positive correlation between Security and Employees performance of 0.056. Job security does not have significant effect on employee performance.

Conclusions

In determining workplace stress and its effects on employees performance the study revealed that time pressure is one of the main factor that hinders performance due to the fact employees reach a burnout level that they can no longer produce effectively. Furthermore they lack work life balance and thus stressed on how to balance the two which hinders their performance in a huge percentage. Physical Demand of the Job also affect employees performance to a certain level though not as much as time pressure however if the physical demand increases higher it will have a direct impact on the Time Pressure. Salary has some impact on employee's performance but it is at a manageable level as much as employees are not satisfied with their pay but they are not thinking of looking for a better paying job. This is as a result that Government Salaries are structured and governed by Salary and Remuneration Commission and not like private organization that they can increase at their discretion. Due to this the employees as much as they feel they are not well paid to a certain level it does not affect their performance. Most employees feel that their Job is secured thus Job Security does not have a significant effect on employee's performance. That is, there is very low turnover rate at the Government and most staff are comfortable once they join they serve until they retire.

Recommendations

The study recommends that Kilifi County Government should organize for burnout sessions for its employees and create sufficient time for them to be with their families. Kilifi County should also redesign jobs that are overwhelming in order to reduce workloads in one cadre and spread it out evenly. Flextime working can also be considered in the County in some events so as one shall be to work from home as long as outputs are achieved. Better communication channels to be used so as information reaches employees in time for better preparation instead of last minute communication where requires staff to spend long hours at the workplace to complete a task. A skills analysis and job evaluation to be conducted in order to identify the staffing gaps so as work is distributed evenly. This will improve their performance and job satisfaction.

VII. REFERENCES

1. Alexandros - Stamatios G.A., Matilyn J.D., and Cary L.C. (2003). Occupational stress, job satisfaction, and health state in male and female junior hospital doctors in Greece, *Journal of managerial psychology*, 18 (6), pp.592-621
2. Armstrong, M (2009). Armstrong handbook of *Human Resource Management Practice*. (11th Edition). London, philadelphia: Kogan page
3. Beauregard, T.A.; Henry, L.C. (2009). Making the link between work-life balance practices and organizational performance. *Human Resource Management Review*, 19, 9 – 22
4. Coetzer, W. &Rothrnans, S. (2006). Occupational Stress Of Employees Inn An Insurance Company. *South African Journal of Business Management*, 37(3), 29-39.
5. Darmon, Rene Y. (2004). The Measurement of Sales Force Motivation Revisited, ESSEC Business School
6. Dollard F. M., Winefield R. H. Winefield H. A, Jonge de J. (2000). Psychosocial job strain and productivity in human services workers: A test of the demand-control-support model. *Journal of Occupational and Organisational Psychology* 73, 501-510. *Journal of School Health*, 26, 33-37

7. Donaldson-FeilderE. Yarker J. & Lewis R (2011).*Preventing stress in organizations:how to develop positive managers.* John Wiley & Sons Ltd.
8. Folkman, S., & Lazarus, R.S. (1991). Coping and emotion. In A. Monat & R.S. Lazarus (Eds) *Stress and coping: An anthology (3rd ed)* (p. 207–227).New York: Columbia University Press
9. Haider, Y. &Supriya, M. V. (2007). Career management: A view through stress window.
10. *International Review of Business Research Papers*, 3(5): 182-192. International Stress Management Association and ACAS in conjunction with the HSE (2004).*Working together to reduce stress at work.* A guide for employees.
11. Jones,F.I. and Kidman,G. (2001). Approaches to studying stress. In F.I. Jones & J. Bright (Eds), *Stress: Myth, theory and research.* Harlow, UK: Prentice Hall.
12. Joseph R. Bardeen. (2007) Experiential avoidance as amoderator of the relationship between anxiety sensitivity and perceivedstress JR Bardeen, TA Fergus, HK Orcutt Behaviour theraphy 44 (3), 459-469
13. Kreitner (2005), Organisational Behaviour, 2nd ed., irwin, Boston, MA
14. Laurie, mullins. J. (2007), "Management and organizational behavior". Practice Hall, Inc.
15. Margolis, B., Kroes, W., Quinn, R. (1974). Job stress: An unlisted occupational hazard. *Journal of Occupational Medicine, 1 (1 6), 659-66 1.*
16. Mohan, V. (1995).*Stress Management for You.* Pelanduk Publications (M) Sdn. Bhd. Selangor.
17. Muczyk, J.P. The strategic role of compensation. Human Resource Planning, (2004), 11(3),225–39.
18. Mugenda, (1999)Research methods:: Olive M Publication: Nairobi acts 1999 256p
19. Munali, J. (2005). Stress and individual performance of workers in hotels at the Kenyan coast. (*Unpublished Doctoral dissertation).* Thesis. Andra pradesh open university, Hyderbad state. India.
20. Ngeno, G. (2007). causes of burnout among primary school teachers with Kericho municipality, Kenya. Journal of technology and education in Nigeria, 12(2), 19-18.
21. Qureshi, M. T and Ramay, I. M. (2006). Impact of Human Resource Management Practices on Organizational Performance in Pakistan. Muhammad Ali Jinnah University: Islamabad.
22. Rolfe, M. (2005). Attitudinal organizational commitment and job performance: Ameta analysis. *Journal of Organizationa1 Behavior,* 23,257-266
23. Salami, A., Ojokuku, R., &Ilesanmi, O.(2010). Impact of Job Stress on Managers Performance. *European Journal of Scientific Research,* 45(2), 249-269.
24. Sayeed, O.M. (2001) . Organisatinal commitment and conflict. New Dehli: Sage Publication
25. Selye, H. (1980).*The stress concept today.* New York: McGraw Hill.
26. Selye, H. (1983). The stress concept: Past, present, and future. In C. L. Cooper (Ed.), *Stress research: Issues for the eighties* (pp. 1-20). New York, NY: John Wiley & Sons.
27. Siegrist, J. (2010). A Theory of occupational stress.1n J. Dunham (Ed.) *Stress in the workplace*(pp.52-66). Philadelphia, PA: Whurr
28. Summers J., and Hyman J. (2005) Employee participation and company performance; *A review of the literature*, University of Aberdeen. Joseph Rowntree Foundation.
29. Townley, G. 2000. “Long hours culture causing economy to suffer”, Management Accounting, 78 (6), 3-5
30. Tsutsumi, A. and Kawakami, N. (2004) A review of empirical studies on the model of effort-reward imbalance at work: *Reducing occupational stress by implementing a new theory. Social Science & Medicine*, 59, 2335-2359.
31. Vanishree, P. (2014). The impact of Role Ambiguity, Role Conflict and Role Overload on Job Stress in Small and Medium Scale Industries. *Research Journal of Management Science*, Vol. 3(1), 10-13.
32. Williams S, Sandler RL (1995). W ork Values and Attitudes: Protestant and Confucian Ethics as Predictors of Satisfaction and Commitment,

Factors Influencing the Adoption of Mobile Banking in Kenya's Commercial Banks: A Case of Kenya Commercial Bank (KCB) Kilindini Branch

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Abstract- Across the developing world, there are more people with mobile phones than with bank accounts (Portteous, D. 2007). In 2007, there were over 3.3 billion phone users, and close to 60% of the subscribers lived in the developing world (UNCTAD, 2007-2008). Thus, many entities with a global development focus have turned to the mobile phone as a potential platform for delivering financial services to the "unbanked". It's against this background that the researcher saw the need to pursue this study. The uptake of mobile phones in Kenya has been unprecedented. Of vital significance is the rapid absorption of mobile based banking services. This trend of continued dependence on mobile devices to accomplish monetary transactions is steadily gaining thrust. The objective of this study was to assess the factors affecting the adoption of mobile banking at the KCB Kilindini Branch, Mombasa, Kenya. The specific objectives of the study were to: assess the component of perceived risk with regard to mobile banking adoption, explore how customers at the KCB Kilindini branch perceive the impact of cost to mobile banking adoption, and determine how perceived ease of use influenced the adoption of mobile banking at the KCB Kilindini Branch. The study adopted a descriptive research design. A sample size of 169 respondents was used in the study. Data from the target population was collected from account holders in KCB, Kilindini Branch. Respondents included business people, personal account holders and corporate customers. Interviews were conducted concurrently with observations. The collected data was then be cleaned, coded and analyzed using SPSS version 20.0 software. On the first specific objective of assessing the effect of perceived risk on adoption of mobile banking, the study found perceived risk to be one of the key factors impeding the adoption of mobile banking. The second specific objective sought to establish the effects of perceived impact of cost on adoption of mobile banking. The study concludes that cost was a key factor stopping people from adopting mobile banking. Lastly, on the influence of perceived ease of use of mobile banking on mobile banking adoption, the study concludes that perceived ease of use of mobile banking did not affect mobile banking adoption. The study recommends more studies on mobile banking adoption to be conducted in other areas of the country to find out if there could be any similarities.

Index Terms- Mobile Banking, Innovation, M- Pesa

I. INTRODUCTION

Entrepreneurship and innovation are of fundamental importance to our economy as they spur economic growth and wealth creation (Barringer and Ireland, 2008). There is wide agreement among economists that entrepreneurship is a crucial factor in the diffusion of new technologies (Science, 2001), international competitiveness and the creation of new jobs.

Innovation has become more globalized over the last decade and its importance as a driver of competitive advantage in economies has increasingly grown. It is a very critical element in entrepreneurship since it is the ticket to delivering better unique products and services, new and more efficient production processes, and improved business performance. Innovation involves the creation of new designs, concepts and ways of doing things, their commercial exploitation and subsequent diffusion through the rest of the economy and society (Wickham, 2006). The great expansion of information and communication technologies that has taken place during the last decade has set the stage for a new age of opportunities and challenges. The adoption of internet, mobile telephony and broadband networks in many developed countries has been found to have positive effect on firms' performance. They provide speedy, inexpensive and convenient means of communication. According to the World Bank (2006), firms that use ICT grow faster, invest more, and are more productive and profitable than those that do not.

Schumpeter in his theory of economic development constructed a theory in which the entrepreneur is the source of all dynamic change in the market. In 1934, Schumpeter, whose contribution to entrepreneurship development is globally recognized, emphasized the process of creative destruction, indicating how entrepreneurial innovations make current products and technologies obsolete and fuel economic activity for new products. Kizner (1973) who is also widely recognized for his contribution to entrepreneurship development, put emphasis on two main aspects: alertness to new opportunities and seizing an opportunity by taking further innovative actions. According to his theory, he suggests that alertness leads to the discovery of new opportunities and innovative actions.

Mobile banking is a service provided by financial institutions in cooperation with mobile operators. The essence is all about getting banking services to the unbanked, those who do not have bank access or bank accounts, and those who are at the bottom of the economic pyramid, often living in remote areas. They receive the benefits of banking services such as being able

to save and borrow in a cost-efficient and secure way. The services include viewing account balances, making transfers between accounts, or paying bills via a mobile device such as a mobile phone. In recent time Mobile banking is most often performed via SMS or the Mobile Internet but can also use special applications downloaded to the mobile device (Salzaman, Palen & Harper, 2001).

Across the developing world, there are more people with mobile phones than with bank accounts (Portteous D. 2007). In 2007, there were over 3.3 billion phone users, and close to 60% of the subscribers lived in the developing world (UNCTAD, 2007-2008). Thus, many entities with a global development focus have turned to the mobile phone as a potential platform for delivering financial services to the unbanked.

Current literature hypothesizes that mobile phones have the potential to become low cost accessible accounts or delivery channels for financial services, in particular electronic money and mobile banking (Boateng & Duncombe, 2009). The reason for this is that there exists an inherent need by the poor for low-cost financial services that could be delivered by the mobile phone (Boateng & Duncombe, 2009). Some examples of successful mobile banking implementations in developing countries can be seen in Pakistan with Easy Paisa and T-Cash in Haiti (Acharya & Kshetri, 2012). Mobile payments or branchless banking have become a key catalyst for financial inclusion and make use of agents to penetrate areas where the poor live and work (Dermish *et al.*, 2012).

Business practices in Kenya have gone through many changes as well, the most important being the introduction of Information Communication and Technology (ICT). The mobile phones have been a key ICT product that has affected business practices. This is manifest in various areas including advertisements, marketing, emergence of new products, and new methods of payments. The methods of payment through the use of mobile phones have been the most recent development in Kenya and have revolutionized how business is conducted among the small-scale business holders. Micro-businesses have embraced the use of mobile payment technology in their operations. They view this mode of payment as an easier form of cash delivery to their suppliers and business partners, a system which is relatively affordable, personal and can be used anywhere and at any time (Anurag, Tyagi and Raddi, 2009). There is appeal and utility of mobile

M-Pesa in Kenya has proven to be a resounding success with Safaricom having over 77% market share in the mobile network environment, and a 9.7 million M-Pesa user base (GSMA, 2012). It has a powerful brand presence and marketing has been geared to reflect national sentiment, as well as delivering a clear message aimed at the customer needs for financial services (Mas and Morawczynski, 2009; Dermish *et. al.*, 2012).

In the banking world, developments in information technology have had an enormous effect in development of more flexible payment methods and more user-friendly banking services (Akinci *et. al.*, 2004). The remarkable gains made towards mobile phone access have seen a steady progress in the scope of innovations emanating from exploitation of these fairly new technologies. What has characterized the Kenyan mobile landscape is a rapid uptake of various services key among them the mobile based products. Mobile banking is one innovation which has progressively rendered itself in pervasive ways cutting across numerous sectors of economy. An appropriate banking environment is considered a key pillar as well as an enabler of economic growth (Koivu, 2002).

The remarkable gains made towards mobile phone access have seen a steady progress in the scope of innovations emanating from exploitation of these fairly new technologies. New innovations are challenging the idea that development requires handling ideas down from developed to developing countries. In banking and finance, the big ideas in cashless transfers and mobile flexible exchanges are not to be found in Geneva, London or New York. A revolution in mobile money transfer has occurred, but not in these financial centers. Instead, it happened in Kenya with M-pesa. The service was developed between Safaricom and Vodafone, and launched in 2007. This is not just something used in cities or big commercial interests. By 2010, over 50% of Kenyan's population had used it. This means rural villagers haggling over produce, and then using their phones to make the final deal (Olivia O'sullivan, 2012).

The latest survey by the Kenya Bankers Association (KBA) shows that six out of every ten Kenyans interviewed send and receive money through their mobile phones. Only three out of every ten Kenyans go to banking halls, while only eight per cent use the Automated Teller Machines. The study, which was conducted in collaboration with Think Business Ltd, shows that the lenders have increased the usage of mobile banking platforms in their banking transactions with 60 per cent of Kenyans now using mobile phones for financial or banking transactions (James Anyanzwa and Anjellah Owino 2014).

This project will be carried out as a research on Kenya Commercial Bank's (KCB's) Mobile banking service. KCB is a fully-fledged commercial Bank offering savings and lending services to individuals, entrepreneurs and companies of all sizes. It has the largest branch network in East Africa and enjoys dominance as the Bank with largest balance sheet and capital base, respectively, in the region. It is a publicly quoted company with its shares trading at the Nairobi Securities Exchange (NSE), Uganda Securities Exchange, Dar es Salaam Stock Exchange and Rwanda over the Counter (www.kcb.co.ke).

In 1997, KCB set up business in Tanzania before expanding further to Southern Sudan in 2006 and to Uganda in 2007. The youngest subsidiary, Rwanda began operations in 2008. The Bank has a network of 210 outlets and over 400 automated teller machines across East Africa that are strategically located to provide synergies across markets. During the reporting period a total number of 73 new branches were opened across the region, raising the number from 137 branches to the current 210 branches. 41 new outlets opened in Kenya, 11 in Uganda, 5 in Tanzania, 6 in Southern Sudan while KCB Rwanda which began operations in 2008 has 9 outlets. Most of the branches are located in rural administrative and business centers. KCB has over two billion authorized shares held among Kenyan, East African and foreign investors (www.kcb.co.ke)

The Bank also introduced a mobile telephone banking facility for its customers in 2009. The product commonly known as KCB Connect is a mobile telephone Bank that has changed the lives and financial lifestyle of mobile subscribers in Kenya estimated at 17million. The mobile Banking service provides full Banking services on the mobile telephone handset at the touch of

a button, including enquiries, Banking instructions, funds transfers and utility bill payments. A key differentiator between KCB Connect and other offerings in the market is the ability of all mobile telephone subscribers to open accounts on their phones that will enable them to transact with KCB. Working with one of Kenya's major mobile telecommunications service provider, the Bank has put in place the necessary infrastructure to enable customers to transfer funds from one KCB account to another, from KCB to the revolutionary and trendsetting M-pesa service and vice versa and from any KCB account to any phone account of the customer's choice (www.kcb.co.ke).

One can easily access his/her accounts through the mobile banking service by dialing *522# and following the prompts. KCB connect Services include checking KCB account balance, buying credit/airtime, Sending money to M-Pesa account, Transfer funds to other KCB accounts, Withdraw cash, Get mini statements, Service request i.e. Cheque book request, Foreign exchange rates, Full statement request, Stop cheque and paying bills (www.kcb.co.ke).

Statement of the problem

In the past, studies have addressed conceptual issues and conducted general consumer surveys (Pousttchi, 2003; Taga and Karlson, 2004). However, there is little research available in the literature on factors affecting the adoption of mobile banking in Kenya. People's level of experience with technology is higher than a decade ago. The future of Mobile banking looks encouraging and bright, if obstacles are overcome.

In October 2013, the KCB launched M-Benki, a mobile banking platform targeted at the unbanked population, which allows customers to open a bank account without physically visiting a branch. The bank (KCB) posted a 17 per cent rise in net profit for the year ended December 2013 helped by increased lending and lower loan losses provisions through mobile banking (Business daily, Thursday, June 12, 2014). Efforts in place to ensure uptake of mobile banking has really gone up, with the many advertisements which of course is a huge investment .The uptake and adoption of mobile banking has since not matched up with the level of investment vested in the program. Since the launch, customer numbers have increased to nearly three million out of estimated seventeen million account holders, the projection for year-end is five million customers.

Based on the stated problem, the purpose of this study is to establish whether the reasons for the uptake of mobile banking at Kilindini KCB branch are similar to those in the other parts of the country and also to investigate factors influencing the adoption of mobile banking at the KCB Kilindini branch, Mombasa. The unique characteristic with most customers at the branch is that majority are fully employed in the clearing and forwarding and especially international road freight industry. Most of the customers do not get time to go to the physical bank facility. The assumption is that this mobile banking product would be ideal for them.

II. RELATED LITERATURE

Introduction

This chapter mainly contains literature review of the past studies and written documents on mobile banking as relates to factors influencing mobile banking in Kenya. The chapter has the following sections; factors influencing the adoption of mobile banking, perceived risk with regard to mobile banking, perceived cost of mobile banking, perceived usefulness and ease of use influence the adoption of mobile banking in KCB, trust in mobile banking, theoretical and conceptual framework for the study.

Theoretical framework

a. Rogers's Classical Normal Distribution Model

The Rogers's (1983) model of diffusion is based on the classical bell-shaped normal distribution curve. The curve represents the frequency of consumers adopting a product over time. If the cumulative number of adopters is plotted, the result is an S-shaped (sigmoid) pattern. Rogers (1983) contended that the adoption curve was normally distributed because of a learning effect due to personal interaction within social systems. As the number of adopters in the system increased so did the level of interpersonal influence on non-adopters. The result of this influence on adoptions was held to follow a binomial expansion, a mathematical function that follows a normal curve when plotted over a series of successive periods.

Rogers (1983) stated that many human traits are normally distributed, whether the trait is a physical characteristic, such as weight or height, or a behavioural trait such as intelligence or the learning of information. Hence, a variable such as innovativeness might be expected to be normally distributed.

Rogers (1983) further defined innovativeness as the degree to which an individual or other unit of adoption is relatively earlier in adopting new ideas than other members of a social system. On this basis, he proposed that adopters of an innovation can be classified into five categories. As shown on Figure 1, these categories were defined in terms of the number of standard deviations from the mean time of adoption for the population.

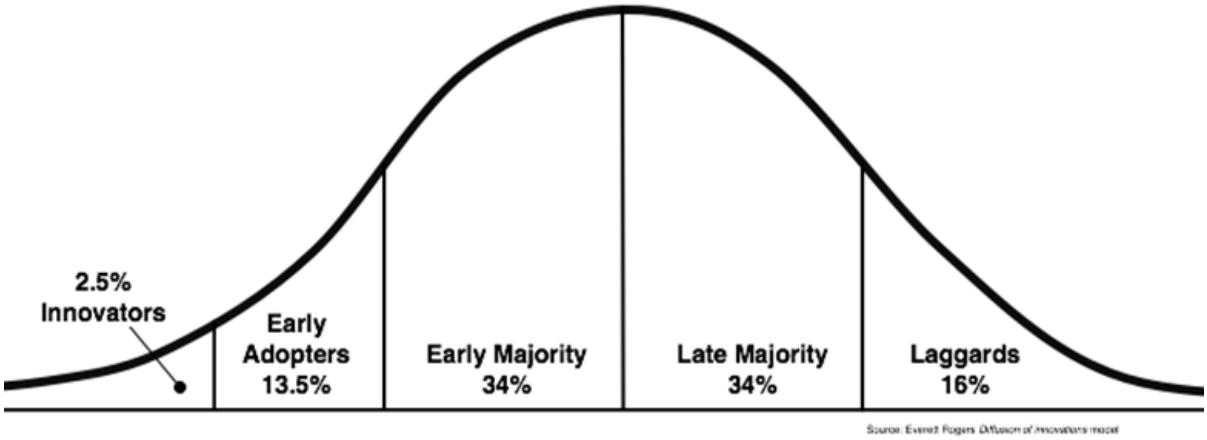

Figure 2.1. Adopter Categorisation on the Basis of Innovativeness

Rogers (1983) also developed a detailed profile of ideal types for each of the adopter categories on the basis of demographic, socioeconomic and personality characteristics. The adopter categories were analogous to the grouping of consumers in a market segmentation study. For example, innovators are venturesome, cosmopolitan in outlook, tend to be better educated, willing to take risks and are more socially mobile than their peers. In a similar manner, each of the five adopter categories was given a consumer profile (Rogers, 1983; Hawkins, Best & Coney, 1989).

A considerable amount of research has been conducted to validate the profiles of these adopter categories. The majority of this research is based on major and discontinuous innovations and examined the correlation between variables such as age, education, dogmatism, social participation, and income with time of adoption. From these studies, Rogers (1983) developed thirty one generalisations of adopter characteristics. Early adopters were found to have more years of education than later adopters. In marketing, these generalisations have been used as the basis of a prescriptive guideline for speeding up the diffusion process by using differential communications programs to reach innovators versus later adopters (Gatignon & Robertson 1985).

Hawkins, Best and Coney (1989) described this as a moving target market approach. According to this approach, once overall target market for the innovation or new product is selected, the firm should specifically target the innovators and early adopters in this target market. As the product gains acceptance, the focus of attention should shift to the early and late majority, who are now more inclined to adopt the innovation because of word of mouth reports from innovators and early adopters. Advertising themes and media vehicles should be progressively tailored to appeal to each new adopter category targeted, and the net effect is to speed up the diffusion process, resulting in increased first time sales and earlier repeat purchases.

b. Extended Technology Acceptance Model (TAM2)

The variables (risk, trust and cost) are added to the extended technology acceptance model (TAM2) (Venkatesh and Davis, 2000) to develop a research model to investigate factors influencing adoption and usage of mobile banking by the Kenya's Commercial Banks.

Since the late 1980s, technology adoption research has focused on exploring the determinants of user intentions to use new technologies. Many theories have been developed to study Information Technology (IT) adoption issues, including the theory of reasoned action (TRA) (Fishbein and Ajzen, 1975), the technology acceptance model (TAM) (Davis, 1989), the extended technology acceptance model (TAM2) (Venkatesh and Davis, 2000), the theory of planned behavior (TPB) by Ajzen (1991), the innovation diffusion theory (Rogers, 1995) and the unified technology acceptance user technology (UTAUT) (Venkatesh *et. al.*, 2003).

Literature sources suggest that financial institutions and telecommunication companies worldwide are facing a new loop on the telecommunication-information technology convergence spiral. Mobile banking has emerged as a promising new application of the next generation electronic commerce - mobile commerce. Siau *et. al.,* (2001) pointed out that mobile commerce adoption strongly depended on the user infrastructure (user-accessible mobile devices) and on the available network infrastructure (mobile telecommunications networks). Authors like Pitruzzello (1998), Lan *et. al.,* (2000), Guardini *et. al.,* 2000) and Kiesnoski (2000) argued that commerce applications, including mobile banking, cannot be implemented successfully without an integrated and seamlessly converging underlying infrastructure, and suggest approaches towards achieving coexistence and transparent handoff in a global coverage perspective. Bansai (2001) pointed out that a co-factor for the successful usage of mobile banking is the timely development of value-added mobile banking services.

Venkatesh and Davis (2000) on the other hand introduced social and organizational factors such as subjective norms, impression, quality of output and work relevance into the TAM model, and proposed the so-called extended TAM model (TAM2). TAM suggested that perceived usefulness (PU) and perceived ease of use (PEOU) were the two most important factors in explaining individual user adoption intentions and actual usage (Davis, 1989). Davis (1989) further defined PU as the degree to which a person believed that using a particular system would enhance his or her job performance. In addition, PEOU referred to the degree to which the person believed that using the system would be free of effort (Davis, 1989).

Luarn and Lin (2005) also conducted a study in Taiwan, where TAM and the theory of planned behavior (TPB) by Ajzen (1991) were combined. The study investigated the possible factors affecting the behavioral intentions of mobile banking users. These factors included perceived ease of use (PEOU), perceived credibility, self-efficacy, and perceived financial cost (Luarn & Lin, 2005).

For the purpose of this study, a research model will be developed combining relevant constructs from across the literature, as outlined in the Figure 2.2. The model consists of the original determinants of TAM2, which are PU and PEOU as well as the dependent variables Adoption of mobile banking and Actual Usage (AU). It also adds additional determinants from the literature which includes Perceived Cost, Trust, and the five facets of Perceived Risk, which are each explained in further detail below.

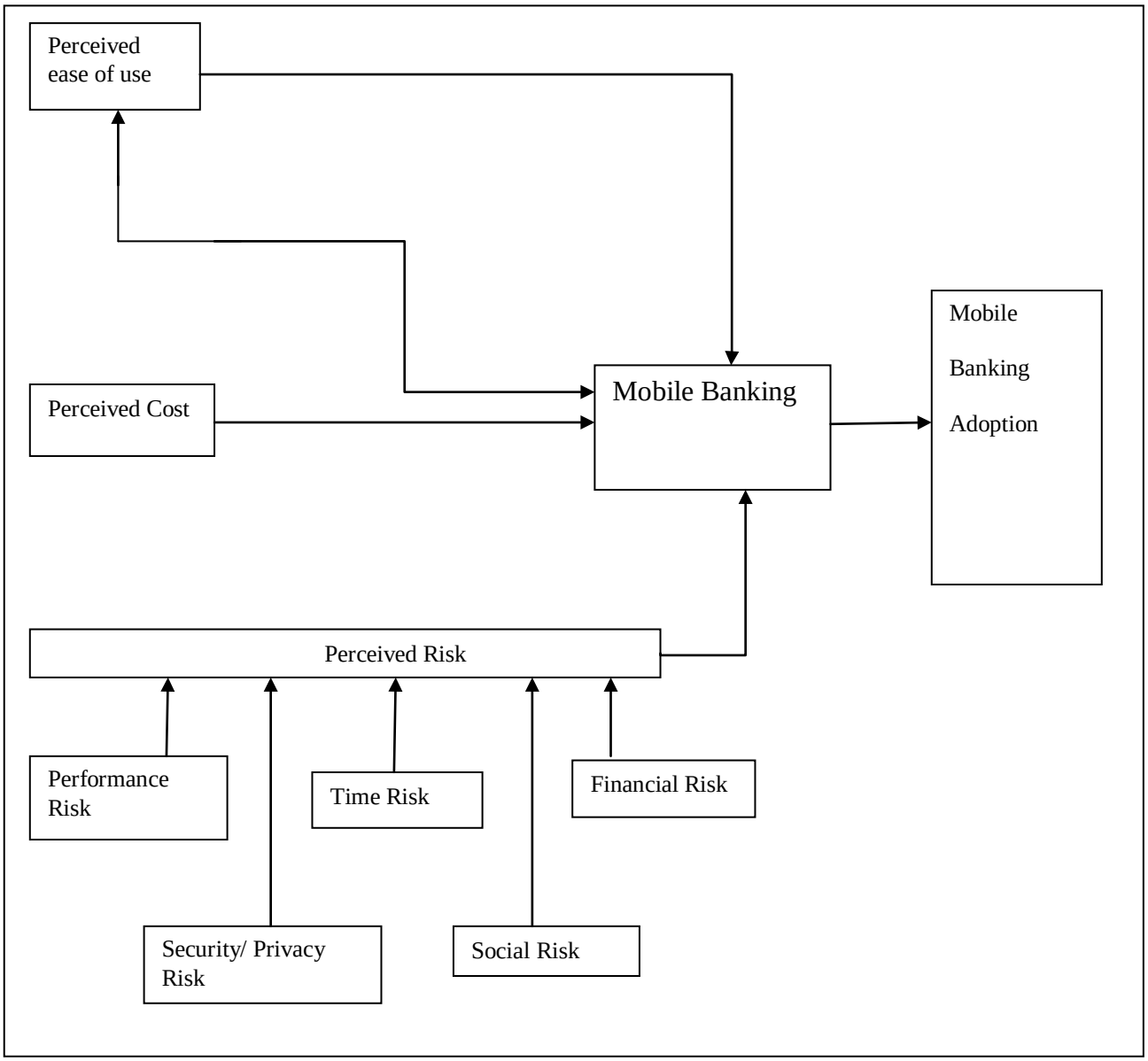

Figure 2.2 Research Model based on TAM2 with perceived risk, Trust and Perceived Cost

Conceptual framework

The conceptual framework in this study shows the relationship between different variables in the research. The study conceptualizes the dependent variables as Risk of mobile banking, Attitude on the perceived cost of mobile banking, perceived usefulness and use of mobile banking. The moderating variables are the government interventions and other active agencies in the banking sector and mobile service providers.

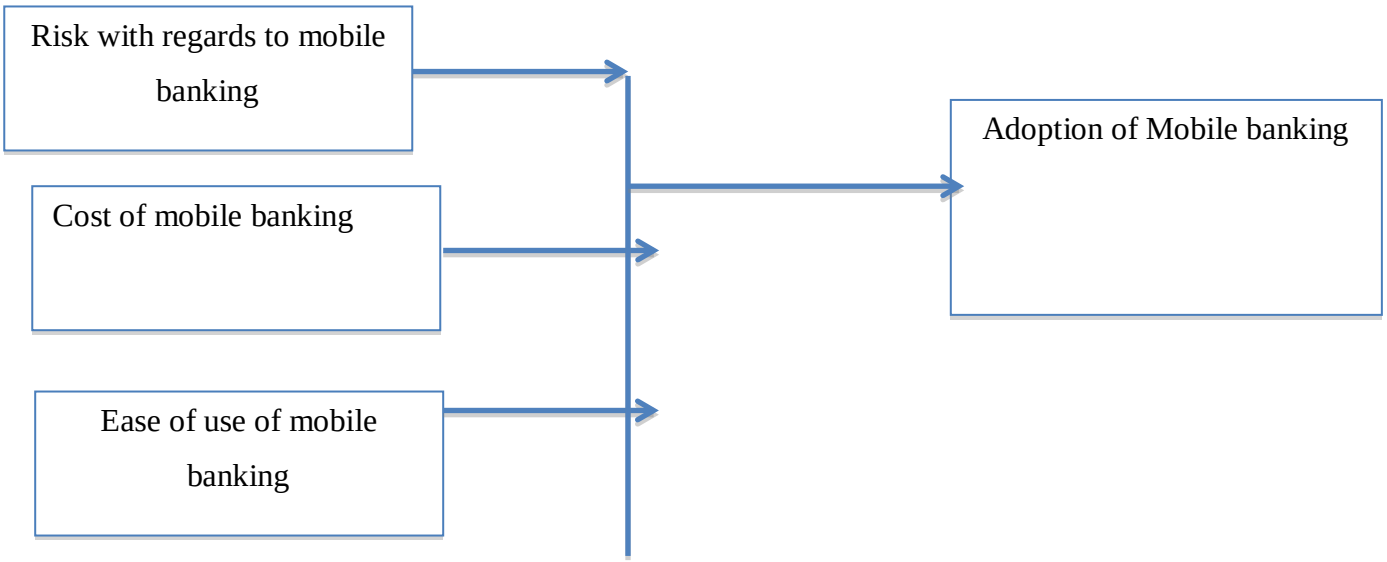

Figure 2.3 Conceptual frame work of factors influencing adoption of mobile banking

Perceived risk of mobile banking

Various studies on consumer perceptions of risks have been conducted in the context of online banking (Tan and Teo, 2000; Im, Kim & Han 2008; Wu and Wang, 2005), but the perceived risk variable has only been modeled as a single construct, which fails to reflect the characteristics of the perceived risk (Lee, 2009).

Lee (2009) conducted a study on perceived risk in the context of Internet (online) banking adoption. In this study, risk was divided into five facets; performance risk, social risk, financial risk, time risk and security risk. Given the similarities between mobile banking and Internet banking (Brown *et. al.*, 2003), these five risk facets were also used for the purpose of this study. As defined by Lee (2009), these five risks were described for mobile banking as follows.

Performance risk was referred to losses incurred by deficiencies or malfunctions of mobile banking servers (Lee, 2009). According to Littler & Melanthiou (2006), a malfunction of a banking server would reduce customer willingness to use Internet banking services, and the same applies for mobile banking, this will in turn influence the adoption of mobile banking. Security/privacy risk was defined as a potential loss due to fraud or a hacker compromising the security of a mobile banking user. In a similar study, Luarn and Lin (2005) used the construct perceived credibility‘, which is defined as the extent to which a person believes that using mobile banking will have no security or privacy threats. For this study, security/privacy risk will be considered to be similar to a lack of credibility. Time/convenience risk referred to a loss of time and any inconvenience incurred due to delayed payments or difficult navigation (Lee, 2009). Considering poor network coverage in other areas sometimes.

Social risk is referred to as the possibility that using mobile banking may result in disapproval by one‘s friends/family/work group (Lee, 2009). Financial risk was defined as the potential for monetary loss due to transaction errors or bank account misuse (Lee, 2009). Lee (2009) & Lee, Lee and Kim (2007) found that all five risks: security, financial, time, and social and performance risks emerged as negative factors in the intention to adopt online banking. However, social risk was found to have an insignificant effect on the intention to adopt online banking (Lee, 2009) and therefore does not directly affect adoption and usage of mobile banking and hence adoption.

Im *et al.* (2008) further found out that when deploying a technology perceived by users to be high risk, managers need to emphasis ease of use. When deploying a technology perceived to be low risk, managers need to focus on communicating the usefulness of the technology.

A study by Tan and Teo (2000) on the adoption and use of Internet banking revealed that perceived risk was a significant determinant. Brown *et al.* (2003) also applied Tan and Teo's Internet banking adoption framework to the mobile banking context. Brown *et. al.*, (2003) found out that perceived risks was a significant factor affecting mobile banking adoption. However, in their studies, perceived risk was modeled as a single construct.

For this study, all the five risk facets will be adapted as antecedents of perceived risk in the research model. As per the literature review, it is hypothesized that security, financial, time, social and performance risks are more likely to have a negative effect on the uptake of mobile banking, usage and eventually influence negatively the adoption of mobile banking.

Perceived cost.

Perceived cost is defined as the extent to which a person believes that using mobile banking will cost money (Luarn and Lin, 2005). The cost may include the transactional cost in the form of bank charges, mobile network charges for sending communication traffic including SMS or data and mobile device cost.

A study by Wu and Wang (2005) on mobile commerce acceptance showed that perceived cost had minimal significance when compared to other variables such as perceived risk, compatibility and perceived usefulness. A further qualitative investigation on the same study was conducted, which revealed that perceived cost is normally a major concern when a technology is first introduced (Wu and Wang, 2005). However, when there is an emergency or sudden need, the utility benefits outweigh the cost issues. The study by Wu and Wang (2005) was conducted on respondents with an average income level of US$650 per month which was equivalent to approximately Ksh 55,250. This income level was regarded as being appropriate, implying that the users could afford mobile commerce.

Technological development has provided opportunities for service providers to develop their services and offer customers more flexibility. As a consequence, banks have launched multiple service access methods via new delivery channels like ATM, internet and mobile phone (Laukkanen & Pasanen, 2007). Low-cost banking can bring into its fold a considerable group of consumers who formerly could be served only at too high a cost (Datta, Pasa, & Schnitker, 2001). One issue driving future mobile banking is the cost efficiency pressures from supply side. Payment transaction costs vary. Quite often wireless capability is built into financial institution's software platform, leaving maintenance and upgrades as the only added costs (Mattila and Pento 2002; McCall, 2002).

Relative advantage is concerned with the degree to which an innovation is perceived as being better than the idea it supersedes. The degree of relative advantage is often expressed as economic profitability, social prestige, and savings in time and effort, immediacy of the reward or as decrease of discomfort (Rogers, 1995). According to Mallat (2007), the cost of a payment transaction has a direct effect on consumer adoption and usage if the cost is passed on to customers. Transaction costs should be low to make the total cost of the transaction competitive. The transaction costs of sending money through the mobile payment technology are lower than those of banks and money transfer companies.

In their studies in India, Rajanish & Sujoy (2011) found that the cost of availing the mobile financial services was a common matter of concern among the villagers who were interviewed. People wanted to know whether they would need to purchase a new handset for using mobile financial services (MFS) and were also eager to know the cost of transaction for availing this service. People were ready to pay a small amount (in the range of one rupee to two rupees) per transaction for using MFS. They were aware and appreciated the fact that using MFS would save them a lot of time, effort and money that they currently spent for accessing banking and financial services through the existing channels of delivery. Hence, cost of the MFS is an important factor that would determine the adoption of the services among the rural population. Given the fact that majority of the rural population falls within the lower income group, the total cost of availing the services need to be minimized for ensuring faster adoption and enhanced usage of mobile banking.

This study however focuses on a population with low (Middle class) disposable income. According to Karnani (2009), people with low income have very low purchasing power and are price sensitive. According to Guesalaga and Marshall (2008), the consumption pattern of the people with low income in developing countries concentrates mainly on basic needs such as food, housing and household goods; with less spending on information and communication technology (ICT). Therefore, perceived costs should be considered with regards to the factors influencing mobile banking. For this study, perceived cost of mobile banking is included in the research model as having a direct effect on the mobile banking performance. Hence, it is anticipated that the perceived cost of mobile banking services is likely to negatively influence the adoption of mobile banking.

Perceived ease of use

Perceived ease-of-use (PEOU); Davis defined this as "the degree to which a person believes that using a particular system would be free from effort" (Davis 1989).

Perceived ease of use is a significant factor affecting acceptance of a new technology or even information systems.

Prior research has empirically found positive relationship between ease of use and usefulness on the use of e-banking .W.C Poon (2008).

With mobile commerce users can use their mobile phones to send and receive messages and make transactions any time from any places without having to be in a specific location.

N. Mols, P. Bukh (1999) stated that the diffusion of electronic banking is more determined by customer acceptance than by seller offers. Not enough is known about the perception and evaluation of customers on the ease of use and customer satisfaction with regard to mobile banking. A number of people who have tried mobile banking services will not be active users, due to the perception they have. The study also examines the impact perceived ease of use has on mobile banking adoption. Individual expectation regarding accuracy, network speed, user friendliness and convenience play a big role on how the user will perceive usefulness and ease of use of mobile banking.

Empirical Review

Al-Jabri (2012) studied adoption of mobile banking by looking at the application of diffusion and innovation theory. A set of technical attributes was investigated in the study and how mobile banking adoption is influenced by the attributes in a developing nation like Saudi Arabia.

The study used diffusion of innovation as a base-line theory to investigate factors that may influence mobile banking adoption and use. The objective of this research was to examine the potential facilitators and inhibitors of mobile banking adoption. The study was guided by six hypothesis including: relative advantage having a positive effect on mobile banking adoption; Complexity having a negative effect on mobile banking adoption; Compatibility having a positive effect on mobile banking adoption; Observability having a positive effect on mobile banking adoption; Trial ability having a positive effect on

mobile banking adoption; and perceived risk having a negative effect on mobile banking adoption.

The findings suggest that banks, in Saudi Arabia, should offer mobile banking services that are compatible with various current user requirements, past experiences, lifestyle and beliefs in order to fulfill customer expectations. With better mobile banking support and provision of variety of services, the more useful customers perceive mobile banking to be and to increase their level of adoption. Hence, bank's attention should focus on understanding customer behavior and designing reliable mobile banking systems that will meet their needs and provide useful and quality services. In addition, banks should focus on communicating information that emphasizes the relative advantage and usefulness of mobile banking compared to other banking channels like physical presence to the bank or using ATM machines. Banks must seek to reduce risk perceived by their customers by offering specific guarantees protecting them and taking their complaints seriously and urgently. According to Koivu (2002) uptake of mobile phone in Kenya has been unprecedented. The trend of continued reliance on mobile devices to execute monetary transaction is steadily gaining momentum though there are factors influencing the adoption of mobile banking.

Yang, K.C.C., (2005) in his study on exploring factors affecting adoption of mobile banking, use the Technology acceptance model (TAM), touched on these factors; attitude, innovativeness and perceived usefulness. Part of this study suggested that apart from TAM factors there were other key factors that affect the adoption of mobile banking .Factors like, consumer innovativeness, past adoption behavior technology cluster adoption age and gender.

Luarn, P. & Lin, H-H., 2005 ,on their study titled toward an understanding of the behavioral intention to use mobile banking, used the TAM model and Theory of planned behavior(TPB).They looked at several factors including perceived credibility, perceived self efficacy and perceived financial cost.

The researchers had the view that TAM overlooks a very key construct; trust in mobile commerce, hence there were extensions of TAM that were introduced in the study to focus on the mobile users intentions to uptake the technology.

III. RESEARCH METHODOLOGY

Research design

A Descriptive cross sectional study design was used in this research. The study aimed at collecting information from the respondent in relation to their access to Mobile banking services in KCB Bank mobile banking services. The research was conducted using a purely quantitative method. Data was gathered through interviewer administered questionnaires.

Target Population

The target population was account holders in KCB Kilindini branch which offers mobile banking services. Non account holders were included in the survey in order to help find out the factors that influence adoption of mobile banking services. The study included all the account holders operating under KCB's M-Banking service platform in Kilindini branch. Respondents included business people, personal account holders, and corporate customers. This study was carried out within Kilindini area. Purposive sampling was used to select the study location.

Sample and sampling technique

A simple random Sampling Method was used to choose the study participants from a sampling frame of 300 customers, both corporate and individual customers. From this sampling frame, a sample of 169 respondents were chosen, according to Krejcie and Morgan (1970) sample determination table as shown in Appendix V.

Instruments and the validity and Pilot testing

The questionnaire was written in English to ease data collection. There was a random call back of five percent of five percent of respondents, and a questionnaire was re administered to check the consistency of the answers given. The questionnaire was standard for all respondents. Data was collected in the banking hall by well trained research assistants, who interviewed respondents using a pre tested interviewer administered questionnaire.

Data entry and analysis.

Data was entered for completeness, comprehensibility and reliability before coding. Data was entered and analysed using SPSS. Frequencies and proportions were used for descriptive analysis. The study used regression analysis method, where the dependent variable were factors influencing the adoption of mobile banking in Kenya's Commercial Banks; and the independent variables was the component of perceived risk, perceive the cost and its impact and perceived ease of use.

Regression analysis was used for analytical statistics and the following analytical model was adopted:

$Y = ą + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + C$

Where;

Y Adoption of mobile banking in Kenya's Commercial Banks

X_1 is a component of perceived risk

X_2 perceive the cost and its impact

X_3 perceived ease of use.

ą Constant value of y when x = 0

β Coefficient of variables X_1, X_2, X_3, X_4

C Error margin

Results were presented in the form of tables.

IV. RESEARCH FINDINGS AND DISCUSSION

Questionnaire return rate

Out of the 169 questionnaires prepared and send out to respondents, only 103 questionnaires were fully filled and returned. The response rate was therefore 60.9%. According to Mugenda and Mugenda, (2003), a population response above 30% is considered sufficient. The response rate was therefore sufficient to make informed decision from the analysis.

Reliability Analysis

This study adopted Cronbach's Alpha as a reliability measure. The reliability of an instrument refers to its ability to produce consistent and stable measurements. The reliability is expressed as a coefficient between 0 and 1.00. The higher the coefficient, the more reliable is the test. The findings indicated that risks with regards to mobile banking had a coefficient of 0.908; Cost of mobile banking had a coefficient of 0.905, and ease of use had a coefficient of 0.849. All constructs depicted that the value of Cronbach's Alpha are above the suggested value

of 0.5 thus the study was reliable (Nunnally & Bernstein, 1994; Nunnally, 1974). On the basis of reliability test it was supposed that the scales used in this study is reliable to capture the constructs.

Background information

The study sought to establish the background information of the respondents in an effort to ensure the sampling was done effectively. The study sought to determine the gender, age, level of education and how long they have worked in their current positions. The findings were presented in table 4.1 below;

Table 4.1 Section A

	Frequency	Percent
Gender		
Male	81	78.64
Female	22	21.35
Total	103	100
Age		
18 - 24	27	26.2
25-34	37	35.9
35-44	31	30.1
Above 45	8	7.8
Total	21	100
Mobile phone ownership		
Have a mobile phone	96	93.2
No mobile phone	7	6.8
Total	103	100
Bank Account		
Have a bank account	90	87.4
No bank account	13	12.6
Total	103	100
Subscription to Mobile Banking		
Subscribed	21	20.4
Not subscribed	82	79.6
Total	103	100
Ease of use of mobile banking technology		
Complicated and difficult to use	98	97
Easy to use	5	3
Total	103	100
Risk of using mobile banking technology		
Very risky	41	40
Risky	34	33
Slightly risky	1	1
Not risky	6	6
No idea	21	20
Total	103	100
Satisfaction with verification process		
Satisfied	70	71
Not satisfied	33	30
Total	103	100

Source; Researcher (2015)

The findings on the age of the respondents indicated that majority of the respondents 78.6% were male while 21.3% were female. This implies balanced gender representation.

The findings on the age bracket of the respondents indicated that majority of the respondents 35.9% were of age between 25-34 years, 30% were aged between 35-44years, 26.2% were of age between 18-24 years and 7.8% were above 45 years. This implies that study collected data from informed respondents who understood their banking needs.

The findings of the study on mobile phone ownership indicate that 93.2% had mobile phones while only 6.8% lacked mobile phones. On bank accounts ownership, the study found that 87.4% of respondents had bank accounts while 12.6% lacked access to banking services. These findings imply that the respondents were informed banking product consumers who made informed decisions

The findings of the study on the number of years the respondents indicate that a cumulative 73% of the respondents associated a high level of risk with use of mobile banking. 20% of the respondents did not understand the risks associated with mobile banking. These findings indicate that the respondents who had some understanding on the uses and benefits of mobile banking found the platform risky for their money.

Section B: Analysis of key variables

Table 4.2: Section B

Statement	Mean	%Mean	SD
I think that interaction with mobile banking does not require a lot of mental effort	3.86	77.2	1.22
I think that it is easy to use mobile banking to accomplish my banking tasks	4.54	90.8	0.58
When transaction errors occur, I worry that I cannot get compensation from banks	4.14	82.6	1.04
It would take me lots of time to learn how to use mobile banking services	3.55	74.2	1.31
I would not feel totally safe providing personal privacy information over mobile banking	4.61	94.3	0.56
When transferring money through mobile banking, I am afraid that I will lose money due to careless mistakes such as wrong input of account number and wrong input of the amount of money	4.10	82.0	1.01
I'm worried about use mobile banking because other people may be able to access my account	4.06	81.2	1.03
I think the transaction fee (bank charges) is expensive to use	4.23	84.6	0.84
I would not feel secure sending sensitive information across mobile banking	4.04	80.8	1.08
I think the mobile phone cost for mobile banking is expensive	4.53	90.4	0.58
It is easy to use and learn how to use Mobile banking system	3.97	79.4	1.14
It requires sufficient skills to operate on Mobile banking platform	3.86	77.2	1.22

People feel totally unsafe providing personal privacy information over mobile banking. The 94.3% respondents who agreed that they would not feel totally safe providing personal privacy information over mobile banking can imply this. The cost of mobile banking is expensive and hence a big hindrance to adoption of mobile banking. This is evident by the 90.4% of respondents who felt that mobile phone cost for mobile banking is expensive.

The other interesting finding is that respondents interviewed dissociated the notion that low mobile banking adoption could be as a result of complexity associated with use of mobile banking protocol. 90.8% of respondents interviewed felt that it was easy to use mobile banking to accomplish their banking tasks. That implies that the adoption rate has nothing to do with ease of operation but other pertinent reasons.

Stated differently, but with the same meaning, respondents felt the transaction fee (bank charges) for using mobile banking was expensive to use. That is quite agreeable, with 84.6% of respondents agreeing that use of mobile banking was more costly comparatively. The other biggest worry that most respondents had was that when transaction errors occur, they worry that they may not get compensation from banks. 82.6% of the interviewed respondents shared this sentiment. The worry can be fully justified bearing in mind that whenever an error occurs during the conventional in-hall banking, a customer can always seek further clarification from a bank official. In mobile banking, any ambiguity in user prompting instructions could end up giving different messages to different customers, and this can easily lead to costly mistakes on their side. To further re-confirm the fear, 82.0% of respondents interviewed feared that through transferring money through mobile banking, they would easily lose money due to careless mistakes. This is a true reality since majority of mobile money transfers either through *Mpesa*, or *Airtel* money transfer, has at one point or another sent money to the wrong destination at least once or even twice. That fear according to findings has been a stumbling block in the mobile banking adoption process.

The other impediment is the fear of giving out sensitive personal information when you don't know the end recipient. 80.8% of respondents interviewed felt that they would not feel secure sending sensitive information across mobile banking platform. There have been reported cases where customers have been conned through shady phone conversations, with fraudsters posing as bank officials. 79.4% of respondents were in agreement that it was easy to use and learn how to use mobile banking system. Therefore this further re-affirms the earlier notion that it is not the complexity of use that was deterring customers from adopting mobile banking. Even so, a further 77.2% of respondents thought that it required some sufficient skills to operate on mobile banking platform. This is true with all banking products. 77.2% of respondents agreed that interaction with mobile banking does not require a lot of mental effort. Therefore, this implies that the skill level threshold for using the mobile banking technology was not high at all, and that most people could easily learn to use it.

V. SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

Summary of findings

This chapter presents summary, conclusions and recommendations about this study. The general objective of this study was to establish factors influencing the adoption of mobile banking in Kenya's Commercial Banks: A case of Kenya commercial bank (KCB) Kilindini branch. The study sought to specifically assess the component of perceived risk, perceived impact of cost, and perceived usefulness of mobile banking, on mobile banking adoption.

On the first specific objective of assessing the impact of perceived risk on adoption of mobile banking, the study had the following. People feel totally unsafe providing personal privacy information over mobile banking. The 94.3% respondents who agreed that they would not feel totally safe providing personal privacy information over mobile banking can imply this. Most respondents worry that they may not get compensation from banks if they lost their money through erroneous transactions-related mistakes, associated with mobile banking. The other impediment is the fear of giving out sensitive personal information when you don't know the end recipient. 80.8% of respondents interviewed felt that they would not feel secure sending sensitive information across mobile banking platform. The study therefore found perceived risk to be one of the key factors impeding the adoption of mobile banking.

The second specific objective sought to establish the effects of perceived impact of cost on adoption of mobile banking. The cost of mobile banking was high and hence a big hindrance to adoption of mobile banking. This was evident by the 90.4% of respondents who felt that mobile phone cost for mobile banking was expensive. The study therefore concludes that cost was a key factor stopping people from adopting mobile banking.

The third objective was to establish the influence of perceived usefulness and perceived ease of use of mobile banking, on mobile banking adoption. 79.4% of respondents were in agreement that it was easy to use and learn how to use mobile banking system. Therefore this further re-affirms the earlier notion that it is not the complexity of use that was deterring customers from adopting mobile banking. Even so, a further 77.2% of respondents thought that it required some sufficient skills to operate on mobile banking platform. This is true with all banking products. 77.2% of respondents agreed that interaction with mobile banking does not require a lot of mental effort. Therefore, this implies that the skill level threshold for using the mobile banking technology was not high at all, and that most people could easily learn to use it. The study therefore concludes that perceived usefulness and ease of use of mobile banking did not affect mobile banking adoption.

Conclusion based on findings

On the first specific objective of assessing the effect of perceived risk on adoption of mobile banking, the study found perceived risk to be one of the key factors impeding the adoption of mobile banking. The second specific objective sought to establish the effects of perceived impact of cost on adoption of mobile banking. The study concludes that cost was a key factor stopping people from adopting mobile banking. Lastly, on the influence of perceived ease of use of mobile banking on mobile banking adoption, the study concludes that perceived ease of use of mobile banking did not affect mobile banking adoption.

Limitations of Study

Limitations to this study include the small sample size, which may not allow for generalization of the study to other parts of the country. The study is also expected to be constrained by financial resources and time limitations. A lot is expected to be undertaken within limited time that is available and not all respondents can respond to the study and that might affects the amount of data collected. The researcher will try as much as possible to obtain information from the respondents' interventions.

Recommendations based on findings

i. The study recommends that commercial banks invest more in promotional communication drives to educate and reassure the market of the safety of using mobile banking.
ii. The study also recommends that commercial banks focus more on ways of profitably bringing down the cost of mobile banking transactions to entice more people into adopting the technology.
iii. The study also recommends that commercial banks come up with safety security features to ensure that consumers feel secure conducting business on the mobile banking platform
iv. Lastly, the study only focused on Kilindini KCB branch, which is a very small area compared on the vast mobile banking market countrywide. Therefore the study recommends more studies on mobile banking adoption to be conducted in other areas of the country to find out if there could be any similarities.

REFERENCES

[1] Acharya, S. & Kshetri, N., (2012). Mobile Payments in Emerging Markets. IT Pro, (July/August 2012), pp.9–13.

[2] Andjelkovic, M. (2010). The future is mobile. SAIS Review, 30(2), 121–133.

[3] Acharya, S. & Kshetri, N., (2012). Mobile Payments in Emerging Markets. IT Pro, (July/August 2012), pp.9–13.

[4] Ajzen, I. (1991). The theory of planned behaviour. Organizational Behavior and Human Decision Processes, 50(2), 179-211. doi: 10.1016/0749-5978(91)90020-T

[5] Akinci, S., Aksoy, S and Atilgan, E. (2004).Adoption of Internet banking

[6] Akinci, S., Aksoy, S and Atilgan, E. (2004).Adoption of Internet banking

[7] Barringer, B.R. & Ireland, R.D. (2008). Entrepreneurship: Successfully launching new ventures, Pearson Prentice Hall.

[8] Camner, G., Pulver, C., & Sjöblom, E. (2009). What makes a successful mobile money implementation?

[9] Learnings from MPESA in Kenya and Tanzania. London:GSMA

[10] Destinypendia: www.hahopedia.org/kilindini

[11] Drexelius, K. & Herzig, M., (2001). "Mobile Banking and Mobile Brokerage – Successful Applications of Mobile Business?", International management & Consulting, Vol.16, No. 2 (2001): 20-23.

[12] Dermish, A. et al., (2012). Branchless and Mobile Banking Solutions for the Poor: A Survey of the Literature. 6(4), pp.81–98.

[13] Duncombe,R. & Boateng, R., (2009). Mobile Phones and Financial Services in Developing Countries: a review of concepts, methods, issues, evidence and future research directions. Third World Quarterly, 30(7), pp. 1237–1258.

[14] Duncombe,R. & Boateng, R., (2009). Mobile Phones and Financial Services in Developing Countries: a review of concepts, methods, issues, evidence and future research directions. Third World Quarterly, 30(7), pp. 1237–1258.

[15] Kizner. I. M. (1973). Competition and Entrepreneurship. Chicago: University of Chicago press.

[16] Ngugi, B., Pelowski, M. & Ogembo, J.G., (2012). ―m-pesa: a case study of the critical early adopters' role in the rapid adoption of mobile money banking in kenya. ejisdc, 43,3(2010), pp.1–16.

[17] Schumpeter, J.A. (1934). The Theory of Economic Development, Harvard University Press, Cambridge, MA.

[18] Science.O. (2001). Technology and Industry Outlook: Drivers of Growth: Information Technology, Innovation. Paris: OECD.

[19] Salzaman M,Palen L, Harper R. (2001). Mobile Communication: Understanding Users, Adoption and Design. (Lecture) Paper presented in CHI workshop.

[20] Porteous, D. (2007). Just how transformational is m-banking? Retrieved October 17, 2013, from

[21] http://www.finmarktrust.org.za/accessfrontier/Documents/transformational_mbanking.pdf

[22] UNCTAD (2008). Information Economy Report (2007-2008) Science and Technology for Development - The New Paradigm of ICT, Geneva: United Nations Conference on Trade and Development, 2008.

[23] GSMA (2012). ―Mobile money for the unbanked: Safaricom M-PESA's H1 FY13 Results: A portrait of a maturing mobile money service

[24] Mas, I. & Morawczynski, O., (2009). Designing Mobile Money Services Lessons from M-PESA. (March 2007), pp.77–91.

[25] Koivu T (2002). Do efficient banking sectors accelerate economic growth in transition countries?

[26] www.kcb.co.ke

[27] Salzaman M,Palen L, Harper R. (2001). Mobile Communication: Understanding Users, Adoption and Design. (Lecture) Paper presented in CHI workshop.

[28] Taga, K. and Karlsson, J. (2004). Arthur D. little Globa l M-Payment Report, Vienna, Austria. Omwansa, T. (2009). "M-Pesa progress and prospects": Innovations case discussion. <http://www.strathmore.edu/pdf/innov-gsma-omwansa.pdf. >Accessed 6th May, 2014.

[29] Tobbin, P., (2012). Towards a model of adoption in mobile banking by the unbanked: a qualitative study, Vol. 14 Issue: 5, pp.74 –88

[30] Pousttchi, K. (2003). "Conditions for acceptance and usage of mobile payment procedures". MPRA Paper 2912.

[31] Porteous, D. (2007). Just how transformational is m-banking? Retrieved October 17, 2013, from

[32] http://www.finmarktrust.org.za/accessfrontier/Documents/transformational_mbanking.pdf

[33] UNCTAD (2008). Information Economy Report 2007-2008: Science and Technology for Development - The New Paradigm of ICT, Geneva: United Nations Conference on Trade and Development, 2008.

[34] Dermish, A. et al., (2012). Branchless and Mobile Banking Solutions for the Poor: A Survey of the Literature. 6(4), pp.81–98.

[35] GSMA (2012). ―Mobile money for the unbanked: Safaricom M-PESA's H1 FY13 Results: A portrait of a maturing mobile money service

[36] Mas, I. & Morawczynski, O., (2009). Designing Mobile Money Services Lessons from M-PESA. (March 2007), pp.77–91.

[37] Bansai, P., (2001). "Mobile Banking Steps up a Gear", The Banker, Vol. 151, No.905 (2001): pp 121-122.

[38] Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and end user acceptance of information technology. MIS Quarterly, 13(3): 319-340. Retrieved from: http://www.jstor.org/stable/249008

[39] Donner, J. & Tellez, C.A., (2008). Mobile banking and economic development: linking adoption, impact, and use. Asian Journal of Communication, 18(4), pp.318–332.

[40] Datta, A., Pasa, M., & Schnitker, T. (2001). Could mobile banking go global? The McKinsey

[41] Quarterly, 71-80.

[42] F. D. Davis, (1989). Perceived usefulness and perceived ease of use and user acceptance of infomation technology, MIS Quarterly, pp319-340

[43] Fishbein, M., and Ajzen, I. (1975). Belief, Attitude, Intention and Behaviour: An Introduction of Theory and Research. Reading, MA, USA: Addison-Wesley.

[44] Guardini, I., D'Urso, P. & Fasano, P., (2000). "The Role of Internet Technology in Future Mobile Data systems", IEEE Communications Magazine, November (2000): 68-72.

[45] http://newswatch.nationalgeographic.com/2012/07/04/the-invisible-bank-how-kenya-has-beaten-the-world-in-mobile-money/ accessed on January 30, 2014

[46] https://www.standardmedia.co.ke/business/article/2000102910/most-kenyans-use-phones-for-banking-study?pageNo=1

[47] Klein, M. & Mayer, C., (2011). Mobile Banking and Financial Inclusion: The Regulatory Lessons. Frankfurt School –Working Paper Series, (166).

[48] Kiesnoski, K.,(2000). "Wireless Banking", Bank Systems & Technology, Vol. 37, No.2 (2000): 40-43.

[49] Koivu T (2002). Do efficient banking sectors accelerate economic growth in transition countries?

[50] Lan, C, Chien, C., Hsieh, M & Chen, I., (2000). A Mobile E-commerce Solution". Proceedings of the International Symposium on Multimedia Software Engineering (2000).

[51] Laukkanen, T., & Pasanen, M. (2007). Mobile banking innovators and early adopters: How they differ from other online users? Journal of Financial Services Marketing, "Do electronic marketplaces lower the price of goods?" Communications of the ACM, 41(1):73-80. R. C.,

[52] Mallat, N. (2007). "Exploring Consumer adoption of Mobile Payments- A Qualitative Study".The Journal of Strategic Information Systems.

[53] Mattila, M. (2002). Factors affecting the Adoption of Mobile Banking Services,

[54] McCall, Margo (2002), "Saving for a Rainy Day," Wireless Internet Magazine. September

[55] 16, 2002

[56] Ngugi, B., Pelowski, M. & Ogembo, J.G., (2012). ―m-pesa: a case study of the critical early adopters' role in the rapid adoption of mobile money banking in kenya. ejisdc, 43,3(2010), pp.1–16.

[57] Pittruzzello, S., (1998). "Integration of Telecommunications and Information Technology in the Finance industry",Telecommunications Journal of Australia, Vol. 48, No. 1 (1998): 10-16.

[58] Porteous, D., (2006). The enalbilg environment for mobile banking in Africa Commissioned by Department for International Development (DFID).

[59] Rogers, E.M. (1995). Diffusion of innovations. (4th Ed). The Free Press, New York.

[60] Siau, K., Lim, E-P., Shen, Z., (2001). "Mobile Commerce: Promises, Challenges, and Research Agenda", Journal of Database Management, Vol.12, No.3 (2001): 4-13.

[61] Tobbin, P., (2012). Towards a model of adoption in mobile banking by the unbanked: a qualitative study, Vol. 14 Issue: 5, pp.74 –88

[62] Venkatesh V. & Davis, F. D. (2000). A theoretical extension of the technology acceptance model: Four longitudinal field studies. Management Science, 45(2): 186-204. Retrieved from: http://www.jstor.org/stable/2634758

[63] Venkatesh, V., Morris, M. G., Davis, G. B. and Davis, F. D. (2003). User acceptance of information technology: Toward a unified view. MIS Quarterly, 27(3), 425-478.

[64] Wickham, P. A. (2006). Strategic Entrepreneurship, Paper bag Publisher: Financial times/ Prentice Hall.

[65] World Bank (2006). Information and Communication for Development: Global Trends and Policies; The World Bank, Washington, DC.

[66] www.kcb.co.ke

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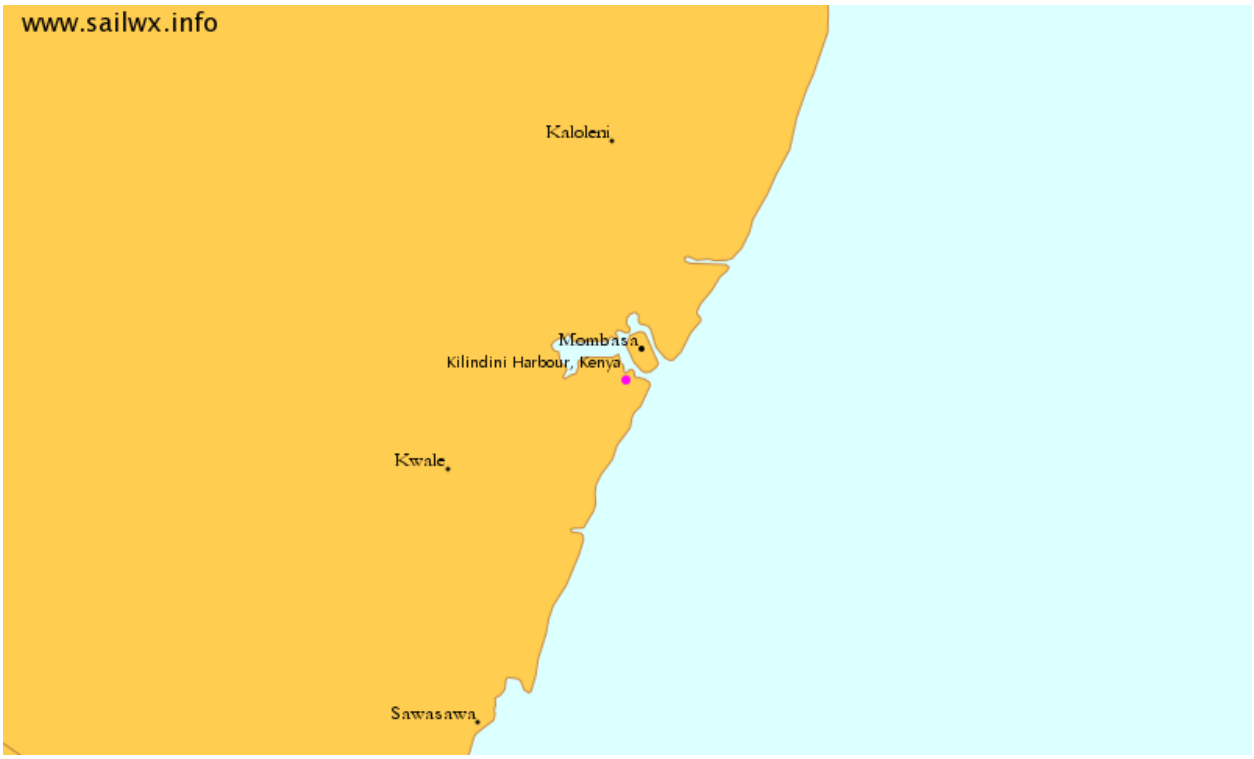
APPENDIX I: A MAP SHOWING KILINDINI POSITION IN KENYA



Source: www.sailwx.info

APPENDIX II: TABLE FOR DETERMINING SAMPLE SIZE FROM A GIVEN POPULATION

TABLE FOR DETERMINING SAMPLE SIZE FROM A GIVEN POPULATION

N	S	N	S	N	S	N	S	N	S
10	10	100	80	280	162	800	260	2800	338
15	14	110	86	290	165	850	265	3000	341
20	19	120	92	300	169	900	269	3500	246
25	24	130	97	320	175	950	274	4000	351
30	28	140	103	340	181	1000	278	4500	351
35	32	150	108	360	186	1100	285	5000	357
40	36	160	113	380	181	1200	291	6000	361
45	40	180	118	400	196	1300	297	7000	364
50	44	190	123	420	201	1400	302	8000	367
55	48	200	127	440	205	1500	306	9000	368
60	52	210	132	460	210	1600	310	10000	373
65	56	220	136	480	214	1700	313	15000	375
70	59	230	140	500	217	1800	317	20000	377
75	63	240	144	550	225	1900	320	30000	379
80	66	250	148	600	234	2000	322	40000	380
85	70	260	152	650	242	2200	327	50000	381
90	73	270	155	700	248	2400	331	75000	382
95	76	270	159	750	256	2600	335	100000	384

Note: "N" is population size
"S" is sample size.

Krejcie, Robert V., Morgan, Daryle W., "Determining Sample Size for Research Activities", Educational and Psychological Measurement, 1970.

Factors Affecting Performance of Corporate Social Responsibility of Equity Group Foundation Kenya Ltd

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Abstract- The research evaluates factors affecting the performance of corporate social responsibility projects by Equity group foundation in order to assist the foundation to overcome performance problems and to improve performance of their corporate social responsibility projects in order to improve the image of the foundation hence increasing its financial performance. The purpose of this study was to establish the factors affecting performance of corporate social responsibility projects in Equity group foundation. The study focused on corporate social responsibility projects undertaken by the Equity Group. The study sought to achieve one objective: to identify the factors affecting the performance of corporate social responsibility projects It has been inspired by the fact that expenditure on corporate social responsibility projects by Equity group foundation has moved up the budget list as a priority vote despite the widespread outcry as regards poor performance of projects. The study will adopted descriptive analysis. Since the study was intended to test rather than generate theory, it adopted a quantitative approach. It will involve descriptive and analytical research designs. It involved drawing up questionnaires relating to CSR projects performance with a target population from these projects. The study will target various projects of corporate social responsibility be undertaken by Equity group foundation within the republic of Kenya. Questionnaires were then distributed and collected the sampled population respondents. From there the gathered data was be analyzed using SSPS version 21.0 to identify those factors that affects the performance of CSR projects by Equity Group Foundation. The results were presented in form of graphs and tables.

The study targeted (88) respondents of social corporate responsibility projects that were undertaken by commercial banks in Uganda. Simple random sampling was used. Findings showed that there were significant positive relationships between Project Communication, individual commitment, Social networks and Perceived Project Performance. It was concluded that effective Project Communication, Social Networks and individual Commitment are pre-requisites for better performance of corporate social responsibility projects in Equity Group Foundation and that Social networks is a better predictor of performance than Project Communication and individual Commitment. It was recommended that for Equity Foundation Group and other commercial Banks to improve performance of corporate social responsibility projects, commitment of individual stakeholders and social net works need to be enhanced through designing communications tailored to the preferences of their varied stakeholders.

Index Terms- corporate social responsibility, project performance, project expenditure

I. INTRODUCTION

Today's business executives are faced with complex strategic resource allocation decisions which are not only based on their financial outcomes, but also have to measure up to a set of societal and emerging stakeholder expectations. Environmental and social concerns are becoming increasingly important influences on corporate strategy (Ebrahimi, 2011). Corporate Social Responsibility (CSR) is defined as the commitment of business to contribute to sustainable economic development, working with employees, their families and the local communities (WBCSD, 2001).

An organization that builds a strong and successful brand will create stronger earnings, and will be more stable in its marketplace performance. Brand performance is defined as the relative measurement of the brand's success in the market place (O'Cass & Weerawardena, 2010). In today's world, running a business is no longer just considering how to make profits, but also includes bearing certain responsibilities in the society. Such issues further extend the companies' view from a business level to a community or society level. This also reflects a fact that consumers' values are changing in the society, companies have to adapt to the changing value of consumers and seek for long term relationship with consumers so as to survive and grow (Yuen et al., 2007). The performance of business organizations is affected by their strategies and operations in market and non - market environments. One construct that might capture a major element of these non market strategies is corporate social responsibility.

Corporate social responsibility (CSR) has become one of the most pressing issues for corporations worldwide. Many consumers and businesses in the U.S. and Europe as well as in Australia are reluctant to purchase goods from manufacturers or retailers who are associated with "sweat-shop" type or other socially irresponsible practices. A socially responsible corporate reputation is, therefore, becoming an important aspect of corporate branding that allows firms to differentiate their marketing mix and obtain a better position in both the business-to-business and the business-to-consumer markets. One of the main reasons to apply CSR is to increase the brand equity of the venture (Van Eard, 2007).

Background of Corporate Social Responsibility (CSR)

Since the concept of Corporate Social Responsibility (CSR) was initiated in 1924 by Sheldon, it has been a worldwide subject of intense controversy and interest for business, society, government, and academia alike. The proverb "business is business" has been criticized and definitions of a more humane and ethical, more responsible and transparent, and more sustainable way of conducting business have emerged (Lindfelt and Törnroos,2006; Marrewijk, 2003). This field has grown significantly, incorporating a great proliferation of theories, approaches and terminologies, such as social issues management, sustainable development, sustainable entrepreneurship, business ethics, eco-justice, stakeholder management, and CSR, etc. (Garriga and Melé, 2004). In management literature, the definitions of such issues are too diverse to form a universally accepted definition of CSR. However, there is an agreed consensus on the principles that CSR is about doing business sustainably and ethically, as well as treating or addressing stakeholder concerns responsibly (Hopkins, 2004; Panapanaan et al., 2003). Although CSR is a concept defined in the West in the 1920s, its principles have long been parts of enlightened business practice world-wide. In China, the responsible business concept can be traced back more than 2500 years ago to the "Confucian entrepreneurs" who pursued profits with integrity and commitment to the community's prosperity (Huang, 2008; Lee, 1996). In the West, there have been debates about the ethical and social responsibilities of business since the Industrial Revolution (1800s). The particular concerns were industrial betterment and the welfare movement, especially about how to make employees more productive (Carroll, 2008; Cacioppe et al., 2008).

According to Cacioppe et al. (2008), the history of CSR up to the 1950s was the "philanthropic" era, during which donation was the major approach. The "philosophical" era was developed after the 1950s (Cacioppe et al., 2008), when there was more recognition and adherence of the behavioural and philosophical fundamentals relating primarily to the principles of CSR (Geva, 2008).

Philanthropy appeared in the late 1800s, often interpreted as a result of wealthy individuals retiring from the corporate arena and setting up foundations and trusts to help social causes (Windsor, 2001) such as the YMCA (Young Men's Christian Association) and the "community chest movement" (Carroll, 2008). The beginning of the 1900s is described as the phase of "profit maximizing management" when people believed that the individual's drive for maximum profits and the regulation of the competitive marketplace would create the greatest public wealth and good (Panwar et al., 2006). The "trusteeship management" phase started in the 1920s and 1930s, reflecting a shift from a mere profit motive, incorporating the maintenance of an equitable balance among other competing claims such as those from customers, employees, and the community (Panwar et al., 2006). The phase of "quality of life management", started in the 1950s, reflecting the emerging issue of the quality of life in society (Hay and Gray, 1974).

The philosophical approach to CSR has been developed in the second half of the 20th century based on notion of philanthropy. According to Murphy (1978), the period 1953-67 was defined as the "awareness" stage, in which companies paid more attention to their overall responsibility and involvement in community affairs (Murphy, 1978). This was followed by the "issue" era (1968-73) in which companies began focusing on specific issues such as pollution control, recruitment/development of minorities, and support for education (Murphy, 1978; Elibirt and Parket, 1973). The "responsiveness" period started in 1974 when companies began taking serious management and organizational actions to address CSR issues, e.g., stakeholder management, business ethics examination, corporate social performance (CSP) assessment and disclosure (Murphy, 1978; Caroll, 2008). Since the 1990s, the CSR movement has become a global phenomenon and experienced remarkable growth, expanding from Europe and North America to the rest of the world with the process of globalization. For example, the CSR movement in China started in the mid-1990s (Myllyvainio and Virkkala, 2006; Zhou, 2006), brought into the Chinese market by multinationals during the 'anti-sweatshop campaign' which opposed the unacceptable conditions in the supply chain in developing countries (Pun, 2003). In recent decades, CSR has attracted increasing attention due to notorious corporate scandals involving Enron, Worldcom, Arthur Andersen, Tyco International, and Adelphia (Berrone et al., 2007). With the current globalization and the complexity of today's business environment, the issue of CSR is more complicated and important than ever.

Corporate Social Responsibility (CSR) concept emphasizes community participation by business enterprises. It proposes that a private firm has responsibilities to society that extend beyond making a profit. It is the obligation of the firm's decision makers to make decisions and act in ways that recognize the relationship between the business and society. It is therefore important for a business to continue in its commitment to behave ethically and contribute to economic development while improving the quality of life of the work force and the surrounding community at large. This can be achieved through the various CSR activities that the business chooses to engage in for the benefit of its stakeholders (such as employees, suppliers, shareholders, government, community/society and customers). Bowen (1953) defines social responsibility of businessmen as to the obligation of businessmen to pursue those policies, to make decision or to follow those lines of action which are desirable to society.

Finance theory differs on who the firm should be responsible to in the course of its business. According to stakeholder theory, firms possess both explicit and implicit contracts with various constituents, and are responsible for honoring all contracts (Freeman, 1984). As a result of honoring these contracts, a company develops a reputation that helps determine the terms of trade it can negotiate with various stakeholders. While explicit contracts legally define the relationship between a firm and its stakeholders, implicit contracts have no legal standing and are referred to in the economic literature as self-enforcing relational contracts. Since implicit contracts can be breached at any time, Telser (1980) argues that they become self-enforcing when the present value of a firm's gains from maintaining its reputation (and, therefore, future terms of trade) is greater than the loss if the firm reneges on its implied contracts. This theory, therefore predicts a positive relationship between CSR and corporate financial performance (CFP). However, stakeholder theory has acquired opponents from various areas including classical economics, industrial relations and management. Sternberg (1997) for example, argues that the principles of stakeholder

theory undermine the property rights of the owners of the company, compromise the mechanism of the free market, destabilize the operations of governments and thus subvert the very nature of capitalism. According to the social contracts theory, businesses must not just act in a responsible manner because it is in their commercial interest, but because it is how society expects the business to behave. Society is a series of social contracts between members of society and society itself (Gray *et al*, 1996). Managers are therefore expected to take decisions in an ethical manner. Donaldson and Dunfee (1999) developed an integrated social contracts theory as a way for managers to use their discretion to make decisions but to ensure their decisions do not have negative effects on others. Businesses are expected therefore, to provide some support to the community under given circumstances. Since the contract is not written, businesses only get to feel its consequences when they fail to do what is expected. Several studies have been carried out on the relationship between CSR and CFP resulting in different conclusions. Klassen and McLaughlin (1996) studied 14 manufacturing sector firms to conclude that environmental management can play a positive role in improving corporate financial performance. In exploring the linkages between environmental performance and financial performance with respect to the market value, Konar and Cohen (2001) argued that a firm with a better environmental performance has a significant positive impact on its market value.

Concept of Corporate Social Responsibility

Corporate social responsibility (CSR) has been debated since the 1950s. The present-day CSR (also called corporate responsibility, corporate citizenship, responsible business and corporate social opportunity) covers the relationship between the corporations and the society within which they interact (Werther & Chandler, 2010). It is a concept whereby business organizations consider the interest of society by taking responsibility for the impact of their activities on customers, suppliers, employees, shareholders, communities and other stakeholders as well as their environment. This obligation shows that the organizations have to comply with legislation and voluntarily take initiatives to improve the well-being of their internal stakeholders as well as for the local community and society at large.

Carol (2003) defines corporate social responsibility, corporate responsibility, corporate citizenship, responsible business, sustainable responsible business or corporate social performance as a sense of responsibility towards the community and environment (both ecological and social) in which it operates. Companies express this citizenship through their waste and pollution reduction processes, by contributing educational and social programs, and by earning adequate returns on the employed resources. The triple bottom line approach to CSR emphasizes a company's commitment to operating in an economically, socially and environmentally sustainable manner. The emerging concept of CSR advocates moving away from a 'shareholder alone' focus to a 'multi-stakeholder' focus. This would include investors, employees, business partners, customers, regulators, supply chain, local communities, the environment and society at large.

Banking Industry in Kenya

Banking business is the accepting from members of the public of money on deposit repayable on demand or at the expiry of a fixed period or after notice and the accepting from members of the public of money on current account and payment on and acceptance of cheques; and the employing of money held on deposit or on current account, or any part of the money, by lending, investment or in any other manner for the account and at the risk of the person so employing the money (Banking Act of Kenya Cap 488) Over the last few years, the Banking sector in Kenya has continued to grow in assets, deposits, profitability and products offering. According to the Price Water House (PWC) Survey of 2008 the growth has been mainly underpinned by an industry wide branch network expansion strategy both in Kenya and in the East African community region and automation of a large number of services and a move towards emphasis on the complex customer needs rather than traditional 'off-the-shelf' banking products.

The Central Bank of Kenya currently recognizes a total of 46 commercial banks in Kenya. The Banking industry in Kenya is governed by the Companies Act, the Banking Act, the Central Bank of Kenya Act and the various prudential guidelines issued by the Central Bank of Kenya (CBK). The banks have come together under the Kenya Bankers Association (KBA), which serves as a lobby for the banking sector's interests and a forum to address issues affecting members.

With increased competition in the industry banks are also embracing technology in their service delivery. To this regard, most banks have installed ATM (Automatic Teller Machines) in order to increase their network coverage. Quite a good number of banks too have also introduced Agency Banking, where they have recruited agents to offer flexible banking services on their behalf in both the rural and urban centres; and especially in areas where the banks do not have branches.

Equity Group Foundation

Equity Bank was founded as Equity Building Society (EBS) in October 1984 and was originally a provider of mortgage financing for the majority of customers who fell into the low income population. The society's logo, a modest house with a brown roof, resonates with its target market and their determination to make small but steady gains toward a better life, seeking security and advancement of their dreams. The vast majority of Africans have historically been excluded from access to financial resources.

Equity Bank's business model and its visionary leadership have continued to earn local, regional and global accolades and recognitions. The model is also studied in some of the leading business schools in the world, as other developing countries in Africa and Asia seek to learn from Equity's low margin, high-volume model. Equity Bank in 2010 established the Equity-Group Foundation. This innovation and creative vehicle has fully transformed the concept of philanthropy and corporate social responsibility. While Equity Group Foundation champions the socio-economic transformation of the people of Africa and seeks partnerships along six cluster thematic areas, Equity Bank provides the infrastructure of delivery hence reducing the operational costs for the Foundation and increasing the rate of return on any social investment.

EGF acts as the institutional home for the Equity Bank Group's social initiatives and interventions. Since its inception, EGF has significantly enhanced the coordination of CSR interventions for Equity Bank Group. EGF's aim is to catalyze the socio-economic prosperity of the people of Africa by giving opportunity to the millions at the bottom of the pyramid to be incorporated into the modern economy. Having demonstrated scalability, impact and high return on investment, EGF started forging partnerships with development organizations who wish to give back to society without duplicating effort and/or investing in infrastructure. This innovative and creative vehicle has fundamentally transformed the concept of philanthropy and corporate social responsibility. While EGF champions the social economic transformation of the people of Africa and seeks partnerships along seven cluster thematic areas, (Education, Financial Literacy, Environment, Agriculture, Innovation, Health and Financial Inclusion), Equity Bank provides the infrastructure of delivery hence reducing the operational costs for EGF and increasing the rate of return on any social investment

Statement of the Problem

It's globally accepted that brand is one of the most valuable assets of any business (Bharadwaj et al. 1993). It is no longer acceptable for a corporation to experience economic prosperity in isolation from those agents impacted by its actions, or failure in its brands management. To promote and achieve profits, a firm must focus its attention on both increasing its bottom line and being a good corporate citizen. Keeping abreast of global trends and remaining committed to financial obligations to deliver both private and public benefits have forced organizations to reshape their frameworks, rules, and business models. To understand and enhance current efforts, the most socially responsible organizations continue to revise their short- and long-term agendas, to stay ahead of rapidly changing challenges.

There is also a growing consensus that corporate social responsibility (CSR) has crossed the line from being a business jargon to becoming a critical business function. The importance of CSR in marketing has been demonstrated both in academic circles and in managerial practice by the growing importance and publicity given to it (Baldauf, Cravens and Binder, 2003).

Recent studies have been done on corporate social responsibility. For example, Muchemi (2010) conducted a study on the attitudes and perceptions of the employees of National Bank of Kenya and reported the employees were apathetic towards participating in CSR activities. Situma (2012) did a study to assess the internal publics' participation in corporate social responsibility activities in the case of selected banks in Kenya. Otieno (2009) carried out a study of the practice of corporate social responsibility by commercial banks in Kenya and found that functional groups like the Marketing Department or the Public Relations departments initiates the banks CSR activities. Gachanja (2011) too conducted a research to examine the impact of corporate social responsibility activities among the urban poor.

Commercial banks have become more involved Corporate Social Responsibility (CSR) Projects both financially and otherwise because superior firm performance is linked with the success of Corporate Social Responsibility (CSR) Projects (Devinney 2009; Hopkins, 2007; Scott, 2007). On average, however, over 70% of Citizenship projects fall short of the expected quality, fail to boost bank awareness, are cost overrun, and are completed behind schedule (Baker, 2007; Hong, Nahm & Doll, 2004; Lester, 2007).

Therefore, this research will evaluate the factors affecting the performance of CSR projects by Equity bank Kenya ltd in order to assist the bank to overcome performance problem and to improve performance of their CSR projects which will go along way of improving the banks performance in the market.

Research Objectives

General objective

The aim of this research is to asses factors affecting the performance of corporate social responsibility projects by Equity Group Foundation.

Specific Objectives

a) To investigate the effect of communication on project performance at Equity Group Foundation.

b) To establish the effect of individual commitment on project performance at Equity Group Foundation.

c) To find out the effect of social networks on project performance at Equity Group Foundation.

II. RELATED LITERATURE

Theoretical Framework of the Study

Social Network Theory:

Social network theory explains the relationships between individuals, groups, organizations, or societies to analyze social structures determined by such interactions. According to Downes (2005) and Scott (2000), social network theory explains social relationships in terms of nodes and ties; nodes are the individual actors within the networks and ties are the relationships between the actors There can be many kinds of ties between the nodes however in its most simple form; a social network is a map of allof the relevant ties between the nodes being studied (Fowler, Dawes & Christakis, 2009). The network can alsobe used to determine the social capital of individual actors (Ntayi, Rooks, Eyaa & Qian, 2010).

Social networks can be examined at micro level, meso level and macro levels. For example a dyad is a social relationship between two individuals at the micro level. When one individual is added to a dyad, a triad is formed. Analyses at this level may concentrate on factors such as balance and transitivity, as well as social equality and tendencies toward reciprocity. This simply implies that the smallest unit of analysis in a social network is an individual in their social setting. In addition, at a Meso-level, network theories study population size that falls between the micro-levels and macro-levels. Examples are formal organizations that are social groups that distribute tasks for collective goals. The focus here is on either intra-organizational or inter-organizational ties in terms of formal or informal relationships. While Macro-level analyses generally trace the outcomes of interactions, such as economic or other resource transfer interactions over a large population. Examples are complex networks which involves substantial non-trivial features of network topology, with patterns complex

connections between elements that are neither purely regular nor purely random.

Social Economic Model

This study presents two models; the social economic and the stakeholder model. Socio-economic model is a classical CSR model which according to Zu (2008) has got two distinctive arguments. The first argument maintains that social responsibility of a business is a single dimensional activity in which businesses have the only responsibility being to supply goods and services to the society at a profit (Friedman, 1989; 1970; Chamberlain, 1973; Bhide & Stevenson, 1990; Gaski, 1985, Zu, 2008). Zu explains that this model has a narrow focus of the role of business to the modern society. Zu further argues that the classical CSR model focuses on the cost of the company's social involvement and sees profit as the only way to measure the efficiency of business operations. This argument according to Carroll (1979) cited in Zu ignores the reality that businesses is part of the bigger society and therefore has the obligation to expand its activity boundaries beyond profit maximization in its short term operations.

Moser (1986) and Carroll (1979) explain that socio-economic models therefore argues that in order to understand the complexity of the social responsibility in the modern business a second dimension of the contemporary views in social responsibility is needed. This is explained by the managers' view of the company and decision making based on their assessment of the role of the company and whether their decision will result in profits. For organizations that practise CSR, the economic benefit outweighs the social interests of the beneficiary communities. So it can be argued that such a model might not appeal to the employees in participating in the CSR activity. In this study the researcher will be exploring the attitude of employees who work with banks that use the socio-economic model.

Stakeholders Model

Corporate Social Responsibility (CSR) management model according to Mallin (2009) suggests that companies have an influence on the various stakeholders such as customers, internal publics, local communities, government and interest groups. According to Zu (2008) Stakeholder model was developed due to the realization of the lack of practicality in the socio-economic models by management scholars. This model postulates that companies should consider the interest of the different stakeholders in their operations, production and decisions. Mallin (2009) explains that as much as stakeholders are recipients of the companies CSR, they also exert some influence on the company's CSR behavior. Acquila and Jackson (2003) cited in Mallin view the creation and transformation of institutions as a result of the mutual interaction of the agency of actors influencing institutions. Mallin explains that consideration of the stakeholders who are related to CSR activity as actors may lead to a conclusion that CSR is a result of the interaction of the different actors. Zu (2008) explains that this model solved the problem of measurement and testing by defining the actors and their positions and functions in relation to one another.

The stakeholder model unlike the socio-economic model focuses primarily on the interests and concerns of the organization's stakeholders over economic interests. From the stakeholder model perspective, the focus becomes how to please and build mutually beneficial relationship with the beneficiary community. Based on this assumption, it can be argued that the underlying philosophy for CSR activities under the stakeholder model can produce positive attitude among employees thereby increasing their participation levels. In this study, the researcher will be examining the influence of the stakeholder model CSR activities on employees in the banking sector in Kenya Mallin (2009).

The Triple-Bottom-line Model

The Triple- bottom line model according to Mullerat and Brennan (2005) refers to the incorporation of financial, economic and environmental into the company's commitment to growth and sustainable profitability. According to Bernejee (2007) the proponents of the triple bottom line approach claim that by using the three parameters, it is possible to map the environmental and social domains of sustainability and ultimately assess the performance of companies in a triple bottom line. According to Bernejee (2007) the interaction of the environment, society and the economic aspects are three shear zones that produce a variety of opportunities and challenges to business. Hence this approach gives a broader view and evaluation of the company performance. In this study, the researcher will explore how the three independent factors can effectively be integrated to motivate employees in their participation of CSR activities.

The business case model to CSR according to Mohr (2010) is primarily driven by the ability of CSR initiatives to create positive business results. The CSR investments are therefore aimed at serving shareholders. This is because of their economic outcome (Mohr, 2010). Mohr et al. point out that companies following this approach may be responding to external drivers, such as threats to regulation, negative publicity and becoming the target of activists among other negative events. Mohr et al. explain that to such companies, CSR is viewed to be only relevant when it translates to competitive advantage in unambiguous way.

Empirical Literature

Werther and Chandler (2010) give the account of CSR in history to originate from the ancient times. Werther and Chandler explain that Ancient Chinese, Egyptian, and Sumerian writings often gave guidelines to promote trade and the protection of the interests of the wider public. Asongu (2007) records the history of CSR to have evidence in 1700BC in Mesopotamia. Asongu explains that under the leadership of King Hammurabi, a code requiring builders, innkeepers, and farmers to be put to death if their negligence led to the death of others or caused major inconvenience to other residents.

Gupta (2009) explains that organizations are members of a society and they take resources for use from the society. Based on this, corporations have moral responsibility to return a value for the resources extracted. Gupta argues that the society have the powers to decide and determine the value to be returned by the corporations. Siltaoja (2009) explains that the works of Carroll (1999) give a description of CSR to include economic, legal, ethical and philanthropic responsibilities imposed on companies. Siltaoja (2009) gave four categories of responsibilities of corporate citizens namely: economic, legal,

ethical and discretionary responsibilities. Siltaoja (2009) explains that economic responsibility requires organizations to be profitable to meet the customers' needs, while legal responsibility is the requirement to work within the legal framework of the business and observe the rules and regulations within the jurisdictions of the business. On the contrary, ethical responsibility refers to following the moral standards in carrying out business while discretionary responsibility refers to the companies' voluntary actions to benefit the society in which they operate in by improving the quality of life of the citizens Siltaoja (2009).

Individual commitment is the willingness by an individual to devote energy and loyalty to a project as expressed in three forms; - affective, continuance and normative (Meyer & Allen, 1997). The net sum of a person's commitment to a project reflects each of these separable psychological states (Meyer & Allen, 1997). Affective commitment is an individual's emotional attachment with (i.e. identification with and involvement in) the project. Continuance commitment refers to the individual's recognition of the benefits of continued association with the project compared to the perceived cost of leaving the project. Normative commitment refers to the employee's feeling of obligation to stay in the project. All three forms of commitment affect the individuals' willingness to remain with a project and their work related behavior. Consistent with Oliver (1980) cognitive and affective theory, when a manager or team member with a high need for self esteem, volunteers to work on a project and communicates his intentions to associate within the project, he emotionally gets attached to ensuring the project succeeds. This is because he derives satisfaction from the success of philanthropic engagements. As long as the project delivers as expected by its stakeholders, they will remain committed to the project's values otherwise stakeholders may become less committed and dissociate themselves from the project (Gakovic & Tetrick, 2003; Conway & Briner, 2002). According to Eisenberger et al. (1990), individuals who perceive that they are cared for, have not only higher levels of commitment but are more conscious about their responsibilities, have greater involvement in the organization and are more innovative.

Project success has been measured differently in the literature (Jugdvev & Muller, 2005; Ika, 2009). Pinto and Slevin (1988) acknowledged three aspects of project performance as the implementation process, the perceived value of the project and client satisfaction with the delivered project outcome. Shenhar et al. (1997) suggest two additional project performance measures: business success and preparing for the future. However, empirical results by Lipovetsky et al., (1997) indicate that the importance of the latter measurement is all but negligible. Project Performance refers to what the project stakeholders like the project sponsor and client make out of the project performance. Usually, various directly and indirectly affected parties perceive the operations of the project differently due to the diversity of interests. What the recipient sees as a failure may be viewed as a success to the implementer of the project. Despite research in project management there is no agreement on project performance. Most times some stakeholders perceive successful projects as failures due to inadequate awareness, if project stakeholders know nothing of what the project is about, they will get the perception that the project is not worthwhile.

Committed project members more often do not have intentions to quit (Addae, Parboteeah & Davis, 2006) which saves the project costs of recruiting and orienting a new member both in form of time and money. Also, costs of supervision are mitigated if the project members are committed to their project tasks. It follows that where project stakeholders are joyful about the project's success, the investing bank's public image will blossom in the case of citizenship projects run by commercial banks. Despite the abundance of research that has examined commitment and performance (Riketta, 2002), very few studies (e.g. Ntayi etal., 2010) have examined this phenomenon in a Kenyan context. Even then, they did not focus on performance of citizenship projects which are gathering more strategic attention as drivers of organizational competitiveness of late (McDonal d & Rundle-Thiele, 2008). It is imperative therefore, that the understanding of individual commitment as an antecedent of project performance is enriched through extending the frontiers of research.

For what and how to communicate companies' CSR activities, previous research has suggested the importance of informativeness (Morsing & Schultz, 2006), credible communication sources (Maignan & Ferrell, 2001; Pomering & Dolnicar, 2009; Schlegelmilch & Pollach, 2005), third-party endorsements (Morsing & Schultz, 2006; Morsing, Schultz, & Nielsen, 2008), stakeholder involvement, media or communication channels (Morsing & Schultz, 2006; Morsing et al., 2008; Schlegelmilch & Pollach, 2005), consistency (Coombs & Holladay, 2011; Pomering & Dolnicar, 2009), and employee commitment (Morsing et al., 2008).

With regard to what should be communicated for companies' CSR, researchers have suggested that stakeholders would be interested in information related to what social causes companies support such as environmental, public education, or health-related causes, and depending on which social causes a company supports, stakeholders' involvement to the company's CSR will vary (Dawkins, 2004; Morsing & Schultz, 2006).

Given that stakeholder involvement is an important factor to determine positive CSR outcomes (Schlegelmilch & Pollach, 2005), communicating the types of supported social causes with stakeholders is fundamental. In addition, some previous research suggested that a company's expertise and its relevance to CSR activities tend to determine publics' perceived CSR motives. It is hypothesized that highly relevant expertise and high perceived fit between a company and its supported CSR cause are more likely to generate positive outcomes of CSR (Nan & Heo, 2007; Trimble & Rifon, 2006). Thus, communicating a company's expertise or fit to support a specific social cause is also important in affecting publics' acceptance of the sincerity of the company's CSR motives. In addition, providing information related to why the company supports a certain CSR cause (i.e., intentions or motives) should be secured in CSR communications.

Previous research has also emphasized the importance of third-party endorsements (Morsing & Schultz, 2006; Morsing, et al., 2008). Whether companies have partnerships with or endorsements from other credible third-party organizations was identified as an important key to reduce consumer skepticism in CSR communication (Coombs & Holladay, 2011). For instance,

information related to 1) Non-governmental organizations (NGOs)' independent ethics audit reports, 2) ethics-related awards received from non-profit organizations or government agencies, and 3) certificates issued by NGOs should add credibility to companies' CSR messages (Crane, 2001; Schlegelmilch & Pollach, 2005). In addition, stakeholder relevance should be secured in CSR communication by providing content with specific examples and events to which stakeholders can relate (Schlegelmilch & Pollach, 2005; Spickett-Jones, Kitchen, & Reast, 2003).

Independent communication sources such as media or experts are considered more trustworthy than company-controlled communication due to third-party credibility (Morsing & Schultz, 2006; Pomering & Dolnicar, 2009; Schlegelmilch & Pollach, 2005). For instance, Pomering and Dolnicar (2009) found that independent sources such as independent experts and news media were trusted the most by the Australian public for CSR communication and that about one-third of the respondents thought news media were most trustworthy. Previous research also suggested that company-generated sources are less credible than media coverage (Schlegelmilch & Pollach, 2005) and that communicating CSR via third-party experts or an endorsed CSR communication process is one way to reduce public skepticism (Morsing et al., 2008). It seems there has been general agreement that directly communicating CSR to the general public is not effective; rather companies should target experts, non-profit organizations, or media for CSR communication for better outcomes (Morsing et al., 2008).

In terms of CSR communication channels, there are various options including company-controlled and uncontrolled media channels. Company-controlled media channels include advertising, brochures, company's website or social media outlets, newsletters, annual reports, etc., while uncontrolled media include news media, experts' blogs or non-company social media. Most of previous studies have suggested that extensive usage of advertising is not effective because it intensifies stakeholder skepticism and lowers credibility of CSR messages (Schlegelmilch & Pollach, 2005; Webb & Mohr, 1998). However, due to different stakeholder interests, preferred CSR communication channels can also vary. For instance, based on secondary data research from national reputation surveys conducted in Denmark, Norway, and Sweden in 2005, Morsing and Schultz (2006) suggested that Northern Europeans tended to have mixed perceptions on CSR communication channels. About 50% of people preferred minimal CSR communication through annual reports and websites, while a little over 40% of people thought that companies should publicize their good deeds through corporate advertising and press releases. Also only a small portion of people answered that companies should not publicize their own CSR activities, indicating strong stakeholder demand for CSR communication. However, based on the analysis of reputation surveys from 2002 to 2005, the authors concluded that public preference toward advertising and press releases as communication channels decreased over time, whereas preference for minimal releases through annual reports and websites increased. Given that these findings are Europeans' preferences for CSR communication channels, Americans' preferences need to be investigated.

Moreover, some scholars pointed out that there are cultural differences in public expectations for CSR communication, suggesting North American CSR approach is more explicit with a stronger tradition of CSR expectations from stakeholders than European approaches (Maignan & Ralston, 2002; Matten & Moon, 2004). Also, North Americans tend to welcome more explicit and conspicuous CSR communication, whereas Europeans tend to have traditions with more implicit and less conspicuous CSR approaches (Morsing & Schultz, 2006). With regard to CSR promotion cost, previous research suggested that companies that spend too much money on promoting CSR tend to be perceived as hypocritical (Schlegelmilch & Pollach, 2005; Stoll, 2002). This public perception is highly related to publics' attributions of self-serving CSR motives to the companies (Rifon, Choi, Trimble, & Li, 2004; Du et al., 2010). That is, when publics notice that a company spends a great deal of money on promoting its CSR activities, they are more likely to attribute self-serving motives to the company for its CSR activities and suspicious of the company's true intentions to support CSR causes. For instance, according to British opinion research (Dawkins, 2004), a majority of the British public (69%) think that companies should not spend significant amounts to promote CSR although they should make an effort to inform the public about CSR.

Downes (2005,) refers to social networks as a collection of individuals linked together by a set of relations. Entities in a network are called "nodes" and the connections between them are called "ties" (Downes, 2005). According to Fowler et al. (2009), social networks can be fundamentally discussed in terms of degree and transitivity. Social network degree is the number of social ties the project has. Network degree is at times referred to as network size. On the other hand, network transitivity refers to the likelihood that two of a persons' contact are connected to each other. It transforms into the level of trust members give themselves. The establishment, development, defence and maintenance of network positions is done by developing multiple relationships in the focal net i.e. in the relevant network in which the firm is active by relating externally and adapting internally. Ntayi et al. (2010) alludes that the strength of the linkage (relationship) grows through a history of interactions in which members of a network develop friendship and trust. The above statement points to the fact that stronger relations in a network could be fostered through effective project communication over time. Herkt (2007) affirms that the project manager's major responsibility is to build supportive social networks (collaborative relationships) among a diverse group of stakeholders. Burt (2001) argues that no social network can be fully depended upon because of the diversity in egocentricity among nodes. He avers that " the fact that an individual can live up to expectations of several others in different places and at different times makes it possible to preserve an inner core, to withhold inner attitudes while conforming to various expectations'.

Maintaining effective communication with the project team over time raises the quantity of social ties and the clustering co-efficient both directly and indirectly. This is consistent with Zhong and Low's (2009) findings that changes driven by the project management are usually unlikely to produce desired effects without coordination and support from a

variety of personnel. Project managers however, are most times preoccupied with addressing the technical issues and fail on soft issues like proper functioning of informal communication. The value of oral communication must be taken into consideration as it affects the interaction patterns among project members. In the current era of the internet, e-mail and instant messaging, the quality of the actual communication can determine the longevity of the group and help predict the likelihood of the group's survival. Face-to-face communication is needed, especially in the early stages, to establish understanding and trust among members.

Social networks act as a vehicle for quickly and easily getting the project message to intended audience thereby enhancing project awareness (Hogg & Adamic, 2004) and the organization‟s public image at large. According to (Burt, 2001), Social networks provide access to timely information and referrals to others in the network. He adds that timely access to information among others creates a deeper understanding of community needs at initiation stage of and project development. This supports the view that ample information at initiation mitigates the possibility of losing out on quality in the later stages as a result of inadequate project planning. Particularly, collaborations create perceived fairness in exchanges there by reducing transaction cost (Hoang & Antoncic 2003) in form of less detailed contracts and less restrictive clauses with stakeholders like the government. Transactions involve cost of discovering who it is that one wishes to deal with, informing people that one wishes to deal and on what terms, conducting of negotiations among others which is cheaply and quickly achieved through social networks

Various researchers support ‘‘environment’’ as a factor affecting the project success (Akinsola et al. 1997; Kaming et al. 1997; Songer and Molenaar 1997; Chua 1999; Walker and Vines 2000). Akinsola (1997) further described ‘‘environment’’ as all external influences on the construction process, including social, political, and technical systems. The attributes used to measure this factor are economic environment, social environment, political environment, physical environment, industrial relation environment, and level of technology advanced

Human Resources Management is the most important and critical to a company. According to Moan and Swaen (2008) good CSR practices relating to workplace and labour relations can help in improving the workplace in terms of health and safety, employee relations as well as result in a healthy balance between work and non-work aspects of employees' life. It can also make it easier to recruit employees and make them stay longer, thereby reducing the costs and disruption of recruitment and retraining

Equal opportunity employer, diversity of workforce that includes people with disability, people from the local community etc., gender policy, code of conduct/guidelines on prevention of sexual harassment at workplace, prevention of HIV/AIDS at workplace, employee volunteering etc are some of the good practices which reflect CSR practices of a company at the work place Moradi and Zaeri (2011). The business process of the company is not just limited to the operations internal to the company but to the entire supply chain involved in goods and services. If anyone from the supply chain neglects social, environmental, human rights or other aspects, it may reflect badly on the company and may ultimately affect business heavily. Thus, a company should use its strategic position to influence the entire supply chain to positively impact the stakeholders.

For a company meeting legal requirements does not comprise CSR but it includes engaging in a way that goes beyond mandatory requirements and delivering environmental benefits. This would include, but not limited to, finding sustainable solutions for natural resources, reducing adverse impacts on environment, reducing environment-risky pollutants/emissions as well as producing environment-friendly goods Moan and Swaen (2008). A major stakeholder to the business is the community in which the company operates. The involvement of a company with the community would depend upon its direct interaction with the community and assessment of issues/risks faced by those living in the company surrounding areas. This helps in delivering a community focused CSR strategy making positive changes to the lives of the people and improving the brand-image of the company. Involvement with the community could be both direct & indirect – through funding and other support for community projects implemented by local agencies.

Conceptual Framework

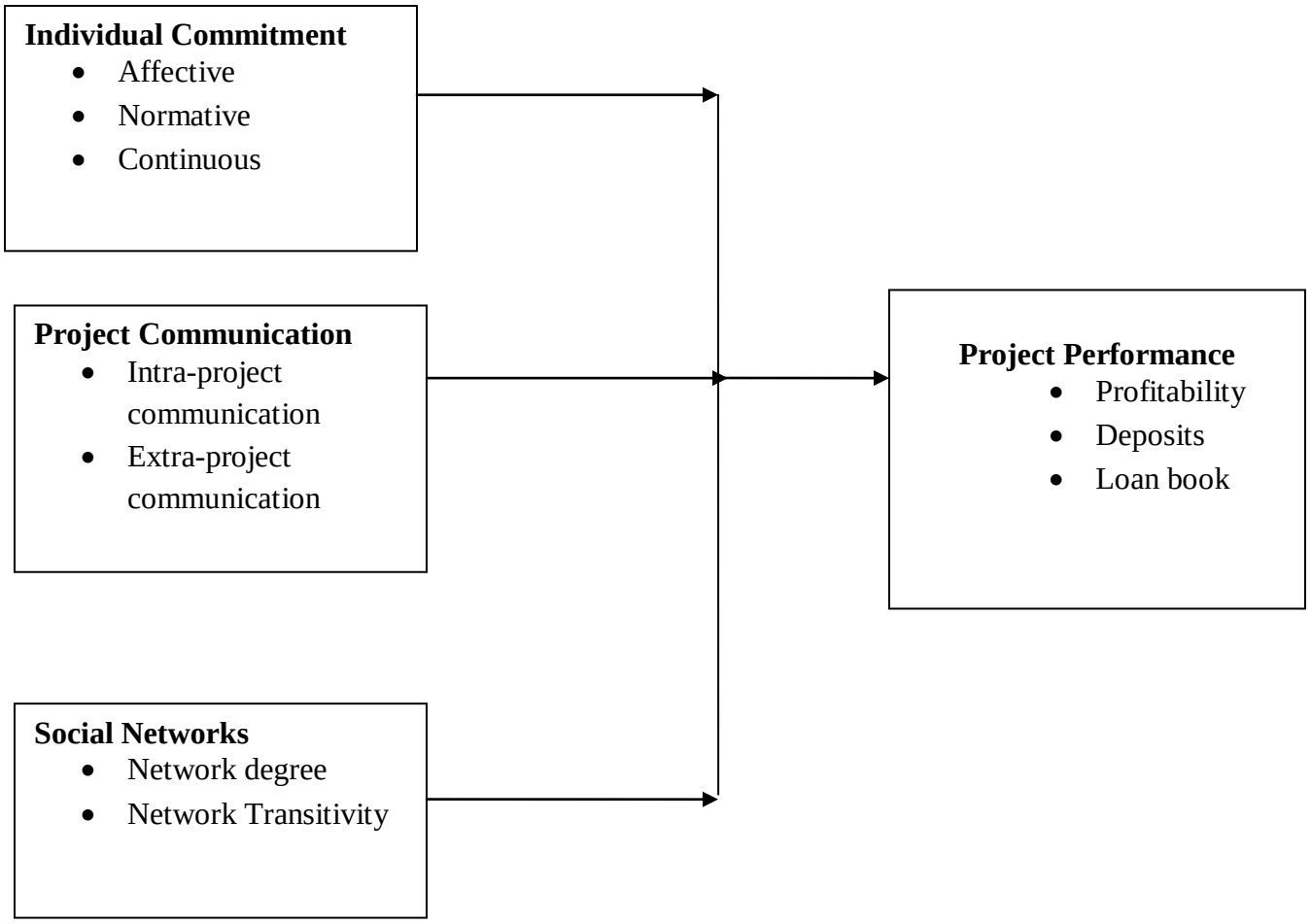

Figure 2.1

Individual Commitment

Research by Bentein, Vandenberg,Vandenberghe, and Stinglhamber (2005) allude to the fact that individual commitment is a "psychological stabilizing or obliging force that binds individuals to courses of action relevant" to a particular citizenship project. Consistent with Kanter (1968) and Porter (1974), for this research, Individual commitment is conceptualized as the willingness by an individual to devote energy and loyalty to a project as expressed in three forms; - affective, continuance, and normative (see also Meyer & Allen, 1997). The 'net sum' of a person's commitment to a project reflects each of these separable psychological states (Meyer & Allen, 1997). Affective commitment is an individual's emotional attachment with (i.e. identification with and involvement in) the project. Continuance commitment refers to the individual's recognition of the benefits of continued association with the project compared to the perceived cost of leaving the project. Normative commitment refers to the employee's feeling of obligation to stay in the project. All three forms of commitment affect the individuals' willingness to remain with a project and their work related behavior.

Project Communication

Project communication refers to information exchanges intended to create understanding amongst project stakeholders (Ruuska, 1996). Stakeholders are any group of individuals who can affect or are affected by the project (Freeman, 1994) including the local communities, regulatory agencies, customers, project team, project sponsor and so on. The above explanation of project communication tends to agree with definitions advanced by many scholars like Baker (2007), and Lester (2007) on this subject. The fact that communication is crucial for project success has been echoed by scholars like (Baker, 2007; and Ramsing, 2009) although up-to-date communication still stands as a major cause of failure of many projects (Ramsing, 2009). Baker (2007) avers that ineffective communication contributes

up to 95% of many project failures. According to Lester (2007), Effective communication is one of the most important factors that accounts for the success of any project. The effectiveness of project communication depends on the quality of the communication flows. The quality of communication all through the project life cycle can be described as the degree to which appropriate information reaches the intended information sources/receivers in an apt time (Rogers & Agarwala-Rogers, 1976). This calls for the need to learn the way of life of those societies that the citizenship projects impact on so as to derive the appropriate channel and message design which most times are overlooked. According to Burt (2000), the most appropriate project communications take place where, during the encoding process, the sender captures the receiver's interests. Ray (1999) argues that such interests could be drawn from culture, past experience, religion, economic and or relations among others. As projects grow large and complex, communication and coordination both within and without the project becomes more and more difficult, yet more vital to the success of the project. In line with Lievens and Moenaert (2000), project Communication was conceptualized as extra-project communication (communication with the external project environment) and intra-project communication (communication flows within the project).

Intra-project communication

According to Carrie`re and Bourque (2009), a project's internal communication practices consist of the full spectrum of communication activities, both formal and informal, undertaken by the project members for the purpose of disseminating information to one or more audiences within the project. Internal communication practices may be undertaken for the purpose of downward, horizontal, or upward communication and may be initiated by anyone within the project. Mintzberg (1973) argues though, that the primary onus of ensuring effective internal communication lies with the project's managers. Therefore, it is still the responsibility of management to ensure that an effective and efficient internal communication system is in place
so as to ensure that all project staff are provided with timely, important, and relevant information (Carrie`re & Bourque, 2009). According to Ruuska (1996), Intra-project communication has two emphases in a project, that is; the steering committee and the project team. The common official ways of communication are the regular project team meetings, memos and follow-up reports (Rasberry & Lamoine, 1986). Effective Intra-project communication is based on the effectiveness of project leaders who spend over 75% of their work day making communications (Mintzberg, 1973).

Extra-project communication

Extra-project communication is the communication between the project and its relevant environment primarily the end-users (Lievens & Moenaert, 2000). It is very common for the project to experience external resistive pressures (Zachary, 2005). Ruuska (1996) advances that often resistance and negative attitudes are a result of the lack of information. Most times the external stakeholders simply don't know why the project has been founded and where it is aiming. Therefore to create a positive profile for itself, a project should keep the stakeholders well informed on its goals and operations. The important dilemma for managers remains what information, and how much of it, needs to be disseminated to project stakeholders (Hargie et al., 2002). While it is obvious that timely, relevant information is essential for high levels of individual commitment to the project by external stakeholders like the community, there is an unknown point at which information overload or underload with the associated negative consequences arise (Eppler & Mengis, 2004; Carrie`re and Bourque, 2009).

Social networks

Although social networks have been interpreted in a variety of lexis, most scholars allude to the fact that social networks are linkages/ (social ties) between entities. Downes (2005), for example, refers to social networks as a collection of individuals linked together by a set of relations. In a more elaborate form, Kempe, Kleinberg, and Tardos (2003), define a social network as a set of people, organizations or other social entities, Connected by a set of socially meaningful relationships, such as friendship, co-working or information exchange, and interactions to better achieve desired outcomes, by sharing expertise, resources, and information. Social networks could also be defined as a "web" where direct or indirect social relationships surround the individuals. Entities in a network are called "nodes" and the connections between them are called "ties" (Cook, 2001). According to Fowler, Dawes, and Christakis (2009), social networks can be fundamentally discussed in terms of Degree and Transitivity

Social network Degree is the number of social ties the project has. Network Degree is at times referred to as Network size. On the other hand, Network transitivity refers to the likelihood that two of a persons' contact are connected to each other. It transforms into the level of trust members give themselves. According to HaÊkansson and Snehota (1989), the establishment, development, defense and maintenance of network positions is done by developing multiple relationships in the focal net, i.e. in the relevant network in which the firm is active by relating externally and adapting internally (HaÊkansson & Snehota,1989).

External Environment that influence performance

For the purpose of this study, focus will be given towards the factors of work conditions, nature of project and organizational factors. Work conditions factors as researched by Katz (1971) as well as Stewart (1967) incorporate the variables of remuneration, job satisfaction, security issues, working hours as well as available project information. The second group of factors concerning the nature of project consists of variables pertaining to project environment, project size, available project duration, project complexity, project team relationships as well as materials and resources. Factors within the organization are made up of variables concerning company size, level of power/authority and type of client.

Measurement of Project Performance

Tangen (2004) obtained that performance measurement is a complex issue that normally incorporates at least three different disciplines: economics, management and accounting. Measurement of performance has garnered significant interest

recently among both academics and practitioners. Tangen (2004) remarked the choice of a suitable measurement technique depends on a number of factors, including the purpose of the measurement; the level of detail required; the time available for the measurement; the existence of available predetermined data; and the cost of measurement.

Corporate Social Responsibility activities are important and cannot be ignored in that it helps create loyalty by the existing customers. The existing customers are proud to be associated with the bank that is having a positive impact on the community and are likely to continue banking with them. Corporate Social Responsibility helps a bank to attract new customers too. This is especially true for members of the community targeted by the bank. The new accounts opened lead to business growth and new opportunities. Corporate Social Responsibilities boosts the morale of the existing employees as they are proud to be associated with such a bank. This pride in the employer increases employee productivity and reduces staff turnover resulting in reduced costs associated with hiring and training of new staff. Corporate Social Responsibilities also singles out the bank as an employer of choice as most potential employees look to them as their ideal employer therefore they are easily able to acquire the best skills in the market.

Corporate Social Responsibility activities act as advertisement opportunities for the banks' products. The products sold to the community are seen more than just bank products but as products that result to corporate Social Responsibility. Corporate Social Responsibilities helps in brand reinforcement among the populace. People generally easily associate such a bank and learnt to trust the bank viewing it as the one that cares for the welfare of the community. Increasing sensitivity of consumers and society to social and environmental issues, corporations will consider their role within the society. By this, they can increase their goodwill (Milanovic et al., 2009). Companies can differentiate their products by focusing on physical and unphysical properties. Competitive advantages, increasing cash flow of organization, providing premium price, profitability and customer loyalty are a result of a strong brand (Moradi, Zaeri, 2011).

Delgado-Ballester and Munuera-Aleman (2005) suggest that brand equity can be developed through brand trust. Brand trust must be maintained not only to foster consumer loyalty and brand equity, but to create a sustainable competitive advantage (Delgado-Ballester and Munuera-Aleman, 2005). Brand Equity is defined as a set of brand assets and liabilities linked to a brand, its name, and symbol that add to or subtract from the value provided by a product or service to a firm and/or to that firm's customers. In Aaker's model (1996), brand equity is composed of five components: brand name awareness, brand loyalty, brand associations, perceived quality, and other proprietary brand assets such as patents and channel relationships. However, because most measures in the past studies did not include the component of "other proprietary brand assets", this study also defines and measures industrial brand equity as composed of four components

III. RESEARCH METHODOLOGY

Research Design

The study adopted a descriptive design. Since the study is meant to test rather than generate theory, it adopted a quantitative approach which focused on describing and drawing inferences from the findings on the relationships between project performance Project Communication, individual commitment, external environment and Social networks Correlation and Regression approaches was used to investigate the relationships between the variables and the extent to which the independent variables explained effects of Corporate Social Responsibility project performance.

Study Population

The targeted population for the research study was total number of Eighty hundred and sixty (860) members of staff for both Equity Group Foundation and Equity Bank Kenya Ltd within the Equity group holdings in Kenya.

Sampling Procedure and Target Sample Size

The unit of analysis comprised of the Corporate Social Responsibility projects and simple random sampling method will be used. The study employed a questionnaire guide as the only data collection tool to collect views on the factors affecting Corporate Social Responsibility Project performance at Equity Group Foundation.

This research study collected data from a sample size of about 120 using purposive sampling as the targeted sample need to be exposed to project management. A questionnaire was used to collect feedback from the potential respondents.

Sample Frame	Population size	Sample Frame
Senior Managers the six pillars	40	12
EGF Headquarters staff	120	5
Branches Staff	700	103
Total	**860**	**120**

3.1 Sampling procedure

Source: Author's Field Work.

Data Processing, Analysis and presentation

After collecting the data using a pre-coded questionnaire, it was edited for inconsistencies. Statistical package for social scientists (SPSS) version 21.0 was used for data entry and analysis. Correlation analysis tools i.e. the Pearson' correlation coefficient was used to establish the relationship between Corporate Social Responsibility project performance in relation to project communication, social networks and individual commitment. Multiple regression analysis was conducted to determine variance in the dependent variable that was explained by the independent variables because there was more than one

study variable affecting perceived project performance. The study findings have been presented in a report.

The multiple regression analysis was used in helping to estimate a linear equation of the form:

$$\mathbf{Y = a + b_1*X_1 + b_2*X_2 + ... + b_p*X_p}$$

In this equation, the regression coefficients (α or *B* coefficients) represented the independent contributions of each independent variable to the prediction of the dependent variable. Another i.e variable X_1 will be correlated with the *Y* variable, after controlling for all other independent variables.

IV. PRESENTATION AND INTERPRETATION OF FINDINGS

Sample Characteristics of the Unit of Inquiry and Unit of Analysis

The results in the table 4.1.1 were generated to describe the sample. They depict the background information about the unit of analysis and unit of inquiry.

Table 4.1.1 Background information on the Unit of inquiry

Description	Frequency	Percentage	Mean
Gender			
Male	43	48.3	1.52
Female	45	51.7	
Total	88	100.0%	
Marital status			
Single	40	45.9	1.57
Married	46	51.7	
Divorced	0	0.6	
Others	2	1.7	
Total	88	100	
Age Bracket			
Below 20 yrs	3	3.5	2.20
20-30 yrs	65	73.3	
31-40yrs	20	22.7	
Over 40 yrs	0	0.5	
Total	88	100	
Highest Education Attained			
Diploma	8	9.3	2.12
Degree	64	72.7	
Professional Masters	13	14.5	
Others	3	3.5	
Total	88	100	
Experience in the Bank			
Less than 3 yrs	33	37.8	1.72
3-6 yrs	48	54.1	
7-10 yrs	6	6.4	
More than 10 yrs	1	1.7	
Total	88	100	
Channels of Communication			
Radio	34	38.4	2.26
TV	31	35.5	
Bill Board	5	5.8	
News Paper	7	8.1	
Face to Face meetings	5	5.8	
Others	6	6.4	
Total	88		
Experience in CRS projects			
Less than 3 yrs	33	37.8	1.72
3-6 yrs	48	54.1	
7-10 yrs	6	6.4	
More than 10 yrs	1	1.7	
Total	88	100	

Position held in execution of CSR			
Manager	9	10.5	2.08
Team Member	69	78.5	
Beneficiary	4	4.1	
Other	6	7.0	
Total	88	100	
Nature of CSR Projects			
Health	13	15	2.68
Education	33	37.7	
Environmental	10	11.1	
Economic	21	24.1	
Rehabilitation	11	12.1	
Total	88		

Source: Primary Data

The results in table 4.1.1above revealed that most of the respondents were female (51.7%) and only (48.3%) were male which could imply that more females take up corporate social responsibilities activities than their male counterparts. The results also show that most of the respondents were either married (52%) or single (46%). Majority of the respondents were in the age bracket of (20-30) years representing (73.3%) of the respondents with a minimal standard deviation of (0.49). The findings also showed that (72.7%) of the respondents had attained at least a Bachelors degree. Basing on mean values, it was found out that the average respondent had between 20-30 years (Mean = 2.20, SD=.49) and had attained a bachelors degree (mean = 2.12). The findings also revealed that of the (88) respondents, only (6) and (25) of them, representing (4%) and (15%) had attained masters and professional qualifications respectively.

As regards the positions held in the execution of corporate social responsibilities projects by individual respondents, majority (78.5%) of them revealed that they held the capacity of team members while (10.5%) were project managers. Only 4.1% respondents indicated that they were project beneficiaries. The study findings showed that (38%) of the respondents had less than three years experience in corporate social responsibilities activities. They also showed that (80) of the (88) respondents had been involved in the execution of corporate social responsibilities projects for a period of (3-6) years (54%). (6.4%) and (1.7%) had spent (7-10) and more than (10) years respectively in the execution of corporate social responsibilities projects. The above results point to the fact that most of the respondents (62.2%) had over three years of experience in their respective bank activities.

Table 4.1.2 Background information on the Unit of Analysis
Source: Primary Data

The results in the table 4.1.1 above indicate that the nature of most of the corporate social responsibilities projects that Equity Group Foundation is involved in are concerned with improving the education of the people in the community (38%) and bettering their economic status (25%). The findings also indicate that Most of these projects have existed for about (3-6) years. The results presented further Count revealed that most corporate social responsibilities projects often use the Radio (38%) and Television (36%) as their predominant channels of communication. The use of news papers and conferences to channel project information respectively was represented by percentages of (8%) and (6%) respectively. About (6%) indicated that they use face to face meetings as a predominant channel of communication. It was also revealed that the percentage of those who testified to using bill boards to channel information about corporate social responsibilities activities to their recipients, was equal to those who said they used face to face meetings often.

The effect of communication on project performance at Equity Group Foundation

Type of the Organization	**Intra communication**	**Extra communication**
Am satisfied with the amount of information I receive from my supervisor(s)	0.758	
The language we use in our correspondences is familiar to all team members	0.847	
We always hold meetings to share information regarding performance of our tasks	0.844	
Supervisors are always attentive to what their subordinates have to say	0.727	
I frequently use electronic means to exchange information with team members	0.727	
I like the channels that we use to share information amongst team members	0.844	

I believe each of my co-workers has the appropriate communication skills	0.562	
Informal communication amongst team members is usually active	0.701	
New Information usually circulates amongst project team members in time	0.664	
Information concerning our CSR activities is widely availed to the public		0.667
We have reliable avenues for receiving reactions about our activities in the community		0.860
Our information is largely shaped by preferences of the communities we serve		0.651
The media we use when communicating with community are those they like		0.652
Our external stakeholders are reliably informed of the progress of our CSR projects		0.540
Our external stakeholders like the way we communicate with them		0.651
Variance %	**52.886**	**11.571**
Cumulative %	**52.886**	**64.457**

Source: primary data

The first objective was to investigate the Nature of project communication and to this effect, Factor analysis was used to extract the factors that measure project communication using the principal component Analysis method. The results that were generated are as presented in the table 4.2 below;-

Table 4.2: The nature of project communication in CSR projects

Factor analysis results from table 4.2 above yielded two components which were interpreted as Intra-project Communication (53%) and Extra-project Communication (12%) explaining (64%) of the variance in project communication. Seven item scales were loaded on the component termed Intra-project Communication. The results indicated that the use of a familiar language in correspondences with project team members is a key pre-requisite for effective intra-project communication (.847). The item with the second highest loading was that concerning communication channels from which it is revealed that the use of communication channels that are preferred by project team members, promotes effective project communication (.844). The next items in their descending order of loadings where amount of information received (.758), the frequency of electronic information exchanges (.727) and the how active informal communication was amongst project team members (.701). The least loaded items related to how first new information circulates (.664) and the attentiveness of supervisors to what their subordinates say (.562). The above imply that team members often use e-mails, telephone calls to communicate although feedback may not be made as soon as a mail is received and that supervisors give moderate attention to contributions from their subordinates.

Of the six loadings on the component termed Extra-project communication, it was found out that reliability of avenues for receiving reactions about a project's activities (.860) and maintenance of timely communication with external stakeholders (.682) are top prerequisites for effective extra-project communication. Also, factors like the extent to which project details are availed to the public (.667) and the degree to which the needs of special publics are satisfied emerged as key inputs to effective extra-project communication with loadings of (.860) and (.682) respectively. The other factors comprised what shaped project information (.651) and the required amount of detail about the progress of the project (.540). These results imply that effective extra-project communication calls for shaping the project information according to the preferences of the communities being served for example, by delivering the massage in a language familiar to them at a time they are convenient with. In the rural areas this could be in the evening after they are back from their farming activities.

Findings on the Relationships among the study variables

The results in the table 4.3 below indicate the relationships between the study variables using the (r) Pearson correlation coefficient.

Table 4.3: The relationships among the study variables

Items				
Intra-project communication	1.00			
Extra–Project Communication	.697**	1.00		
Project Communication	.858**	.838**	1.00	
Continuance-4	.345**	.443**	.325**	1.00

Affective-5	.589**	.478**	.547**	.238**	1.00					
Normative-6	.598**	.562**	.560**	.405**	.514**	1.000				
Individual Commitment	.667**	.640**	.623**	.777**	.767**	.809**	1.00			
Net work Transitivity	.726**	.685**	.680**	.477**	.456**	.564**	.643**	1.000		
Network Degree	.658**	.624**	.619**	.405**	.405**	.505**	.577**	.784**	1.000	
Social Networks	.701**	.596**	.606**	.321**	.430**	.528**	.569**	.831**	.829**	1.000

Source: Primary Data

Findings on the relationship between project communication and individual Commitment

The results in table 4.3 showed that there exists a significant positive relationship between project communication and individual commitment (r =.623**, p<.01). The results revealed further, that Intra-project Communication (r = .667**, p<.01) and Extra project Communication (r= .640**, p<.01) are both positively related to individual commitment. It was also highlighted that project communication had a much stronger relationship with normative commitment (r=.560**, p<.01) than the other components of individual commitment, that is, Continuance and affective commitment whose correlation coefficients were (r =.325**, p<.01) and (r =.547**, p<.01) respectively. As such, the results may imply that were project supervisors pay attention to what project team members have to say, they (project team members) are likely to perceive that they have an obligation to keep corporate social responsibilities activities.

Effect of individual commitment on project performance at Equity Group Foundation

The results in table 4.3 showed that there exists a significant and positive relationship between individual commitment and perceived project performance (r =.672**, p<.01). Specifically, it was shown that improvements in Continuance commitment, affective and Normative commitment are likely to result in improvements in project performance (r =.478**, p<.01), (r =.557**, p<.01) and (r =.530**, p<.01) respectively. These results highlight the fact that if individual team members on a given Corporate Social responsibilities projects are committed to execution of project tasks, the project in question usually succeeds. The results reveal that where project members willingly exert more effort to guarantee the success of Corporate Social responsibilities projects; they will perceive their efforts to have enabled the bank to incur lower costs of operation. The above statement is supported by a coefficient of (r =.530**, p<.01). These findings also imply that there are individuals within project management teams that find it just too hard to exclude themselves from execution corporate social responsibilities projects but they perceive their efforts to positively contribute to performance. This contribution could be in terms of ensuring activities are completed in time and at minimal cost.

Findings on the relationship between Project Communication, Social Networks and Project performance

Project communication and social networks were noted to be positively related (r =.606**, p <.01). The results further revealed that Intra-project and Extra-project Communication are both positively related to Social networks and the values for the relationships were (r = .701**, p<.01) and (r= .596**, p<.01) respectively. The results imply that if elements of project communication are improved, for example, ensuring that internal and external meetings are regularly held to exchange information regarding performance of corporate social responsibilities tasks, the trust amongst team members could be strengthened. This could be reflected through for instance enhanced awareness about the banks' corporate social responsibilities Projects amongst the members of the general public and ease with which new and vital information is provided to the bank by the public.

A positive and significant relationship was observed to exist between social networks and project performance (r =.764**, p<.01). The findings further indicated that transitivity and network degree are both positively related to project performance and the values for the relationships were (r = .815**, p<.01) and (r= .808**, p<.01) respectively. They suggest that if, for example, a wider population of the general public perceive a given bank's corporate social responsibilities activities to have improved their lives, majority of the people in the general public will be willing to contribute to that bank's profitability which could be done through holding active account numbers in that bank. These findings further imply that enhancement in social networks explain about a 76% perceived improvement in quality, time and cost management in corporate social responsibilities projects.

Findings on the Predictive Potential of the components of Project communication, social networks and individual commitment on perceived project performance

The results in the table 4.4.1 and table 4.4.2 below help to assess the level to which Project Communication, Individual Commitment and Social Networks explain Project Performance at the Equity Group Foundation.

Table 4.4.1: Regression of Project Communication, Individual Commitment and Social Networks on Project Performance

	Unstandardized Coefficients		**Standardized Coefficients**	**t**	**sig**	**Collinearity Statistics**	
Model	B	Std. Error	Beta			Tolerance	VIF
Constant	.960	.181		5.292	.000		
Project communication	.272	.063	.292	4.313	.000	.482	2.075
Individual Commitment	.190	.056	.220	3.420	.001	.534	1.873
Social Networks	.281	0.040	.451	7.062	.000	.544	1.838
Dependent variable: Project Performance							
R square	0.703			sig	0.000		
Adjusted R Square	0.697						

Source: Primary Data

The results in table 4.4.1 indicated that Project Communication, Individual Commitment and Social Networks can explain 69.7% of the variance in Project Performance (Adjusted R Square = .697). The table further reveals that Social networks is a better predictor of performance than all the rest of the variables (Beta = .451, Sig. <.01). The regression model was noted to be significant (sig. <.01). The results imply that if project Performance is for instance seen to have improved through cost savings of about five million shillings without decline in quality, then, about three and half million (69.7%) of such savings are attributed to improvements in Project Communication, Individual Commitment and Social Networks.

Table 4.4.2: Regression of the components of the independent variables and Project Performance

	Unstandardized Coefficients		**Standardized Coefficients**	**t**	**sig**	**Collinearity Statistics**	
Model	B	Std. Error	Beta			Tolerance	VIF
Constant	.598	.229		2.612	.010		
Intra-project communication	.024	.066	.026	.360	.719	.459	2.178
Extra-project communication	.187	.062	.213	3.037	.003	.487	2.054
Continuance-commitment	.031	.032	.059	.984	.327	.657	1.522
Affective – commitment	.108	.039	.165	2.810	.006	.691	1.447

Normative-commitment	.082	.047	.111	1.738	.085	.589	1.696
Network Transitivity	.315	.086	.310	3.673	.000	.336	2.978
Network Degree	.251	.054	.358	4.620	.000	.398	2.510
Dependent variable: Project Performance							
R square	0.715			sig			
Adjusted R Square	0.698					significance	0.000

The results shown in table 4.4.2 above indicate that the components of Project Communication, Individual Commitment and Social Networks explain (69.8%) of the variance in Project Performance. It was found that Network Degree (Beta =.358, Sig. <.01) is a better predictor of project performance than all the other components of the independent variables that included;- Intra-project (Beta = .026, Sig. <.01), Extra-project (Beta = .213, Sig. <.01), Continuance (Beta = .059, Sig. <.01), Affective (Beta = .165, Sig. <.01), Normative (Beta = .111, Sig. <.01) and network transitivity (Beta = .310, Sig. <.01). The Variation Inflation Factors was less than 4 indicating that multi-collinearity in this study was not a problem (Garson, 2010) and as such the interpretations of the beta weights and R-squares were reliable.

FURTHER FINDINGS

Table 4.5 Factor analysis table for Individual Commitment

Description	**Continuance commitment**	**Affective Commitment**	**Normative Commitment**
I think no other activities can match the benefits that CSR activities present to me	.666		
It would be very hard for me to abandon CSR activities even if I wanted to	.723		
My life would be upset if I decided not to engage in CSR activities	.695		
It would be too costly for me to quit CSR activities right now	.814		
Taking part in CSR projects is a matter of necessity as much as desire	.600		
I really feel as if the challenges that community faces are my own		.704	
I would proudly accept any job assignments related to serving community		.603	
I find that my personal values and those of CSR projects are very similar		.746	
I feel like part of the family of the CSR project teams		.603	
I feel emotionally attached to CSR projects		.859	
I feel a strong sense of belonging to CSR projects			
I owe a great deal corporate social responsibilities projects			.710
I feel I have an obligation to keep performing corporate social responsibilities activities			.527
I have a sense of obligation to the recipients of corporate social responsibilities projects			.769
			.756

Variance %	**38.146**	**16.022**	**11.809**
Cumulative %	**38.146**	**54.168**	**65.977**

Source: Primary Data

The Factor analysis results in the above table yielded three components which were interpreted as Continuance Commitment (38.146%), affective Commitment (16.022%), and Normative Commitment (11.809%). The trio together explained (65.977%) of the variance in individual commitment.

Of the five items that were loaded on the components termed Continuance Commitment, The results revealed that most of the respondents felt that their continued commitment to performing Corporate social responsibilities activities is because they perceive quitting corporate social responsibilities projects to be costly (.814). This could be in form of totally losing a job due to absconding from such activities. The item the second highest loading was that respondents could not abandon corporate social responsibilities activities even if they wanted to (.723).The third most loaded factor was that respondents felt they could be upset in life in case they abandoned corporate social responsibilities activities (.695). The thinking that no other activities can yield the benefits that corporate social responsibilities activities (.666) and that taking part in corporate social responsibilities projects is a matter of necessity as much as desire (.600) were the other factors that made up continuance commitment. The results imply that there are people on the project team that continue to work because they have no alternative or feel they receive more benefits from this engagement than any other. Affective Commitment featured items like I feel emotionally attached to corporate social responsibilities projects (.859), I feel a strong sense of belonging to corporate social responsibilities projects (.710) and I would proudly accept any job assignments related to serving community (.704) among others. Normative Commitment as the last component of individual commitment studied, featured items like I owe a great deal to this corporate social responsibilities project (.756) and, I feel I have an obligation to keep performing corporate social responsibilities activities.

Table 4.6 Factor analysis table for Social Networks

	Network Transitivity	**Network Degree**
I think that the beneficiaries of our Corporate Social responsibilities projects become our advocates	.823	
I believe that many consumer groups are pleased with our Corporate Social responsibilities projects	.694	
Without hesitation I can act on the information that I receive through my teammates	.651	
Community leaders have always welcomed our Corporate Social responsibilities projects	.808	
In my view, our citizenship activities are liked by people of diverse interests	.547	
We have united many communities through our Corporate Social responsibilities projects	.613	
Many members of the general public know much about our citizenship projects		.659
Through Corporate Social responsibilities projects, we have improved the lives of many citizens		.760
We trust that many societies are in support of our Corporate Social responsibilities projects		.689
This bank's top management strongly supports Corporate Social responsibilities projects		.800
Variance %	**49.170**	**19.102**
Cumulative %	**49.170**	**68.272**

Source: primary data

The two components of social network that were yielded by the results in the table above include transitivity (49.170) and network Degree (19.102). The duo explained (68.272) of the variance in social network. The items that constituted transitivity included among others the uniting of many communities through corporate social responsibilities activities (.808) and the belief that many consumer groups are pleased with the activities of a given corporate social responsibilities project (.823). Four items were loaded on the component named network degree. The most loaded item was that activities to do with corporate social responsibilities project are strongly supported by the bank. The trust that many societies are in support of our corporate social responsibilities activities had a factor loading of (.760).

V. CONCLUSION AND RECOMMENDATIONS

5.3 Conclusions

The study used project communication, social networks and individual commitment to predict project performance. The Research findings revealed a positive and significant relationship between the variables. Project communication and social networks were noted to be positively related (r =.606**, p <.01). A significant positive relationship was observed between project communication and individual commitment (r =.679**, p<.01). Social networks and project performance also had a significant positive relation (r =.764**, p<.01) just as individual commitment and project performance (r =.739**, p<.01). The researcher also concluded that Social networks is a better predictor of performance than all the rest of the variables (Beta = .408, Sig. <.01) as deduced from the regressions that the researcher run during analysis.

As such, unless project sponsors and champions ensure that other project stakeholders have been provided with and are satisfied with the availed project information, the efforts (both financial and otherwise) invested into Corporate Social responsibilities projects could be seen as having been fruitless. In the same vein, where project supervisors are not as attentive to their subordinates' views and no appropriate avenues have been designated to capture feedback from implementers' and beneficiaries of the project, there will be a high chance of failure of Corporate Social responsibilities projects.

5.4 Recommendation

In line with the findings, discussions and the conclusions of the study, the following recommendations were drawn; In line with the finding that a strong positive relationship exists between project communication and individual commitment, project champions, corporate affairs managers and other individuals in the Equity group foundation who comprise the Corporate Social responsibilities projects team, ought to communicate activities that they require their staff to do, in an effective manner. This is likely to be in ways including but not limited to actively listening to their recipient's point of view. There is need to ensure that resourceful persons like the top management within the Equity group foundation involved in execution of Corporate Social responsibilities projects, give due support to Corporate Social responsibilities projects. This should be in ways that include prompt release of funds meant for such activities, top management scrutiny of reports about progress of such projects and increasingly participating in their implementation.

Since the study pointed out a positive relationship between project communication, social networks and project performance, The foundation and other commercial banks that have stepped up investment in Corporate Social responsibilities projects need to ensure effective project communication as an important component of their strategy to ensure success of Corporate Social responsibilities projects. This should include provision of timely information to project staff. The researcher recommends that external project communication be given at most attention since it is a significant predictor of performance of projects.

Since the findings revealed a significant positive relationship between individual commitment and project performance, the Project managers in charge of Corporate Social responsibilities projects in the Equity group foundation and the other commercial banks ought to ensure commitment of project staff to achievement of objects by creating an atmosphere of feeling like they (project staff) are part of the family of the project implementation team. This could be through fulfilling the promises that top management sets forth. In this way, the various stakeholders involved in implementation are likely to perceive the project as a success.

Suggested Areas for Further Research

Further research should be undertaken to test the relationship between Project Communication, individual commitment, Social networks and performance of Corporate Social responsibilities projects in other competitive sectors of the economy like the manufacturing sector. This is because manufacturing industries have a noticeable footprint that raises a lot of questions on how they perceive Corporate Social responsibilities projects and what their other stakeholders think about the industry's Corporate Social responsibilities projects efforts. Further research should also be undertaken to explore the concept of project communication in other areas of study like engineering, construction, and the military among others. This follows from the relatively limited studies that have been made on the concept of project communication in these areas albeit the fact that they run large projects. Future researchers can explore the same concept with a wider sample involving other stakeholders like the regulators, customers, local population, among others. This is so because the study only captured the perceptions of Equity group foundation staff that had taken part in executing Corporate Social responsibilities projects and was intended to justify the continued investment in Corporate Social responsibilities projects by commercial banks yet accommodation of various stakeholders could give a different view.

Since this study did not directly look at the institutional set-up of various stakeholders and how their mental framing affects performance of Corporate Social responsibilities projects, future researchers could explore this area with the purpose of establishing relationship between institutional framework and successful implementation of Corporate Social responsibilities projects in various cultural setting in Equity Group Foundation. This is so since anecdotal evidence has continuously indicated that Corporate Social responsibilities projects can perform differently in different institutional framework. There is need to investigate whether same results could be obtained should the variables be subjected to a longitudinal study. This follows from the argument by some scholars that the benefits of Corporate Social responsibilities projects like enhanced public image and customer loyalty cannot be traced to the very accounting period within which the investment on particular Corporate Social responsibilities projects was made

REFERENCES

[1] Addae, H.M.., Parboteeah, K.P., & Davis, E.E. (2006). Organizational commitment and intentions to quit. International Journal of Organizational Analysis , 14(3), 225-238.

[2] Anderson, J. C., & Gerbing, D. W. (1988) Structural Equation Modelling in Practice: A Review and Recommended Two Step Approach. Psychol. Bull., 103 (3):411–423.

[3] Andrews, R. (2007). Organizational Social Capital and Public Service Performance. Presentation at the 9th Public Management Research Conference, University Of Arizona, Tucson, USA

[4] Asongu, J. J. (2007). Strategic corporate social responsibility in practice. Georgia: Greenview Publishing Company.

[5] Baldauf, A., Cravens, K. S., and Binder, G. (2003), "PerformanceConsequences of Brand Equity Management Evidence from Organization in the Value Chain", Journal of Product & Brand Management, vol.12, No.4, pp.220-236.

[6] Bentler, P. M. (1990). Comparative Fit Indexes in Structural Models. Psychology Bulletin, 107 (2): 238–246.

[7] Bharadawaj, S.G., Varadarajan, R. & J. Fahy, (1993). Sustainable competitive advantage in service industries: a conceptual model and research propositions", Journal of Marketing, 57(Oct.):83-99 Burlington.

[8] Burt, R.S. (2001). Bandwidth and echo: trust, information and gossip in social networks. Integrating the Study of Networks and Markets, New York: Russell Sage Foundation.

[9] Byrne, B.N. (2001). Structural Equation Modeling with AMOS: Basic Concepts, Applications and Programming. Rahwah, NJ Lawrence Erlbaum.

[10] Carrie`re, J., & Bourque, C. (2009). The effects of organizational communication on job satisfaction and organizational commitment in a land ambulance service and the mediating role of communication satisfaction. Career Development International, 14(1), 29-49

[11] Carroll, A.B. (2000). A commentary and an overview of key questions on corporate social performance measurement. Business & Society, 39(4), 466-478.

[12] Chaudhuri, A. Holbrook, Mo. B. (2001) , "The Chain of Effects from Brand Trust and Brand Affect to Brand Performance:The Role of Brand Loyalty", Journal of Marketing, vol.65, No.2, pp.81-93.

[13] Cockburn, A., & Highsmith, J. (2001). Agile Software Development: The People Factor. Computer, 34 (11), 131-133.

[14] Cooke-Davies, T. (2002). The "Real" Success Factors on Projects. International Journal of Project Management, 20 (3), 185-190.

[15] Cooper, D.R and Schindler, P.S. (2003), Business Research Methods (8th edn), McGraw-Hill: New York

[16] D.F. & Hinson, R.E. (2007). Corporate social responsibility (CSR) perspectives of leading firms in Ghana; The journal of corporate governance 7(2),178 – 193

[17] Delgado-Ballester, E. & Munuera-Aleman, J.L. (2005). Does brand trust matter to brand equity? Journal of Product & Brand Management, 14(3), 187-96

[18] Donaldson, T., & Preston, L. (1995). The stakeholder theory of the corporation: Concepts, evidence, and implications, Academy of Management Review, 20: 65-91.

[19] Dowell, G., Hart, S. and Yeung, B. (2000). Do corporate global environmental standards create or destrh oy market value? Management Science, 46(8), 1059-74

[20] Downes, S. (2005). Semantic networks and social networks. The Learning Organization 12 (5),

[21] Earthscan.

[22] Ebrahimi, B.P., (2011). Further evidence of corporate social responsibility and firm performance linkage, 14th international business research conference, April 2011, Dubai, UAE for Business. London: ICSA Publishing.

[23] Freeman, M. and Beale, P. (1992) Measuring Project Success, Project Management Journal, 23: pp. 8 -17

[24] Freeman, R. (1984). Strategic management: A stakeholder perspective. Englewood Cliffs, NJ: Prentice-Hall.

[25] Gray, R., Owen, D. and Adams, C. Accounting and accountability. Prentice-Hall, 1996. (A new edition is forthcoming in 2009) London Reference Collections shelfmark: YK.1996.b.11941 DS shelfmark: 96/29078 DSC

[26] Gupta, A., Wilemon, D. (1988) The Credibility - Cooperation Connection at the R&D - Marketing Interface, Journal of Product Innovation Management, Volume 5

[27] Gurhan-Canli, Z. & Fries, A. (2009). Branding and corporate social responsibility (CSR). In B. Loken, R. Ahluwalia & M.J. Houston (Eds.), Brands & Brand Management: Contemporary Research Perspectives (pp. 91-106). London, U.K: Psychology Press.

[28] Hopkins, M. (2007) Corporate Social Responsibility & International Development. London:

[29] Hoskins, T. (2005) The ICSA Corporate Social Responsibility Handbook: Marking CSR Work

[30] Hunt, S. D., Chonko, L. B. & Wood, V. R. (1985), "Organizational commitment and

[31] Ika, L. (2009). Project success as a topic in project management journals. Project Management

[32] Journal, 40 (4), 6-19.

[33] Jugdvev, K., & Muller, R. (2005). A Retrospective Look at our Understanding of Project Success. Project Management Journal, 36 (4), 19-31.

[34] Lester, A. (2007). Project Management – Planning and Control, Butterworth-Heinemann,

[35] Maignan, I. & Ferrell, O.C. (2004). Corporate social responsibility and marketing: An integrative framework. Journal of the Academy Of Marketing Sciences, 32(1), 3-19.

[36] Maignan, I. & Ferrell, O.C. (2004). Corporate social responsibility and marketing: An integrative framework. Journal of the Academy Of Marketing Sciences, 32(1), 3-19.

[37] Mallin, A. C. (Ed.). (2009). Corporate social responsibility: A case study approach. Chaltenham: Edward Elgar Publishing Limited.

[38] McDonald, M. L., & Rundle-Thiele, S. (2008). Corporate social responsibility and bank customer satisfaction. International Journal of Bank Marketing, 26(3), 170-182

[39] Meredith, J.R., & Mantel, S.J. (2003). Project Management: A Managerial Approach. New York: John Wiley & Sons.

[40] Moan, F., Lindgreen, A., & Swaen, V. (2008). Designing and implementing corporate social responsibility: An integrative framework grounded in theory and practice. Journal of Ethics, 87, (2), 71-89.

[41] Mohr, J. Sengupta, S., & Slater, S. (2010). Marketing of high-technology products and innovations. Upper Saddle River, NJ: Pearson Education.

[42] Mohr, J. Sengupta, S., & Slater, S. (2010). Marketing of high-technology products and innovations. Upper Saddle River, NJ: Pearson Education.

[43] Nangoli, S., (2010). Project communication, individual commitment, social networks and perceived project performance. Unpublished Master thesis report: Graduate Research centre, Makerere University Business School.

[44] Ntayi, J. M., Rooks, G., Eyaa, S. & Qian, C. (2010). Percieved Project Value, Opportunistic Behavour, Interorganisational Cooperation, and contracter Performance. Journal of African Business 11(1), 124- 141.Ofori,

[45] O, Cass Aron, Ngo Liem Viet, (2007), "Market Orientation Versus Innovative Culture: Two Routes to Superior Brand Performance", European Journal of Marketing, vol.41, No.7/8, pp.868-887.

[46] Ogrizek, M. (2001). The effects of corporate social responsibility on the branding of financial services. Journal of Financial Services Marketing, 6(3), 223-28

[47] Pinto, J.K. (2000). Understanding the role of politics in successful project management. International Journal of Project Management. 18, 85-91.

[48] PMI. (2008). A Guide to the Project Management Body of Knowledge (PMBOK Guide) (4th ed.). Project Management Institute.

[49] Podsakoff, P. M., Mackenzie, S. B., Lee, J., & Podsakoff, N. P. (2003). Common methods biases in behavioral research: A critical review of the literature and recommended remedies. Journal of applied Psychology, 88(5), 879-903

[50] Porter, M.E. & Kramer, M.R. (2002). The competitive advantage of corporate philanthropy. Harvard Business Review, 80, 12, 1-15.

[51] Porter, M.E.& M.R.Kramer, (2006). "Strategy and Society: the link between competitive advantage and corporate social responsibility", Harvard Business Review, December 2006, 84(12):78-92

[52] Ramírez, T.M. (2002). Measuring Project Performance. You Can"t Manage What You Don"tMeasure.http://www.pmipr.org/html/Presentaciones/You%20Cant%20Manage%20What%20You%20Dont%20Measure.pdf. Accessed on 30/03/2012.

[53] Ramsing, L. (2009). Project communication in a strategic internal perspective. Corporate Communications: An International Journal 14 (3), 345-357

[54] Ray, C. (2000). Culture Economies. Newcastle, Centre for Rural Economy, University of Newcastle.

[55] Riketta, M. (2002). Attitudinal organizational commitment and job performance: A meta-analysis. Journal of Organizational Behavior, 23, 257-66.

[56] Rosenthal, E. (2007). Social networks and team performance. Team Performance Management jounal,3(4), 288-294.

[57] Sauser, B. J., Reilly, R. R., & Shenhar, A. J. (2009). Why Projects Fail? How Contingency Theory Can Provide New Insights - A Comparative Analysis of NASA's Mars Climate Orbiter Loss. International Journal of Project Management, 27(7), 665-679.

[58] Scott, J. (2000). Social Network Analysis: A handbook. Second edition. London: Sage.

[59] Scott, S. (2007). Corporate Social Responsibility and the Fetter of Profitability. Social Responsibility Journal, 3(4), 31-39

[60] Shenhar, A. J., Tishler, A., Dvir, D., Lipovetsky, S., & Lechler, T. (2002). Refining the Search for Project Success Factors: A Multivariate, Typological Approach. R&D Management, 32 (2), 111-126.

[61] Stoll, L., Bolam, R. & Collarbone, P. (2002). Leading for change: Building capacity for learning. In K. Leithwood & P. Hallinger (eds),Second international handbook of educational leadership and administration. Dordrecht: Kluwer.

[62] Stoll, L., Bolam, R., McMahon, A., Thomas, S., Wallace, M., Greenwood, A. & Hawkey, K. (2006). Professional learning communities: Source materials for school leaders and other leaders of professional learning . London: Innovation Unit, DfES, NCSL and GTC.

[63] Van Donk, D. P & Molloy, E. (2008). From Organising as Projects to Projects as Organizations. International Journal of Project Management, 26 (2), 129-137.

[64] Ven Eard, N., 2007). The influence of CSR communications on brand equity and the effect of gender", Bachelor thesis, University van Tiburg,

[65] Wateridge, J. (1998). How can IS/IT projects be measured for success? International Journal of Project Management, 16(1), 59 – 63

[66] Weerawardena J., Salunke S., JR McColl-Kennedy Journal of Business Research 66 (8), 1085-1097 Competing through service innovation: The role of bricolage and entrepreneurship in project-oriented firms

[67] Werther, W. B., & Chandler, D. (2010). Strategic corporate social responsibility: Stakeholders in a global environment (2nd ed.). Thousand Oaks, CA: Sage Publications, Inc

[68] Yoon, M.H. and Suh, J. (2003), ''Organizational citizenship behavior and service quality as external effectiveness of contact employees'', Journal of Business Research, Vol. 56 No. 8, pp. 597-611.

[69] Yuen, K. (2007). The effect of customer trust on customer loyalty and reputation the moderating influence of perceived CSR, thesis for degree of bachelor of business administration, Hong Kong Baptist University.

[70] Zachary, O. (2005). Standard Chartered Bank's unique approach to CSR. NewsfromAfrica Downloaded on 28. January 2010.

[71] ZHANG, X. (2007) Effects of Project Communication on Project Performance Master degree thesis, dissertation thesis, professional management science and engineering unit of Sichuan University. Thesis network http://www.lw23.com/lunwen_895643392/

[72] Zhong, Y. & Low, S.P. (2009). Managing crisis response communication in construction projects – from a complexity perspective. Disaster Prevention and Management 18(3), 270-282.

[73] Zu, L. (2008). Corporate social responsibility, corporate restructuring and firm's performance: Empirical evidence from Chinese enterprises. Turin: Springer.

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Factors Affecting the Performance of Construction Projects: A Survey of Construction Projects in the Coastal Region of Kenya

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Abstract- Project performance is a critical issue for the construction industry. Project deliverables such as timely completion and client satisfaction are often used as yardsticks to determine success. More often than not, the success of a construction project hinges on the ability of the construction project manager to effectively perform his job functions with the intended efficacy. Because the industry has complexity in its nature because it contains large number of parties as clients, contractors, consultants, stakeholders, shareholders, regulators and others. Construction projects in the Coastal region of Kenya suffer from many problems and complex issues in performance some of which includes cost, time and safety. As such this research evaluated firstly evaluate the factors affecting the performance of construction projects in order to assist owners, consultants and contractors to overcome performance problem and to improve performance of their construction projects secondly to determine the influence to which the external environment affects performance of construction projects thirdly to identify the most significant project procedures that affect performance of projects and lastly to evaluate project management actions project performance. Respondents comprising of project managers clients, contractors and consultants in construction firms throughout the coastal region of Kenya were selected as the sample population. Questionnaires were then distributed and collected from the sampled population respondents. Gathered data was analyzed to identify those factors that affect the performance of construction projects in the Coastal region of Kenya.

A questionnaire survey was conducted and 40 factors were identified, categorized into 8 groups, evaluated and ranked from owners, consultants and constructors perspectives. 180 questionnaires were distributed to owners, consultants and contractors. 132 questionnaires were received. The most important factors agreed by the owners, consultants and contractors were: average delay because of closures and materials shortage; availability of resources as planned through project duration; leadership skills for project manager; escalation of material prices; availability of personals with high experience and qualification; and quality of equipment and raw materials in project.

The degree of agreement between parties regarding the ranking of factors was determined according to Kendall's Coefficient of Concordance. For Cost, Time, Quality, Productivity, Client Satisfaction, People, Innovation and learning factors, and all groups together, there is a significant degree of agreement among the owners, consultants and contractors. On the other hand, for Regular and community satisfaction, and Environment factors, there is disagreement of agreement among the owners, consultants and contractors.

The practices concerning with the Project performance such as time, cost, project owner satisfaction and people were analyzed in order to know the main practical problems of projects performance in the coastal region of Kenya and then to formulate recommendations to improve performance of construction projects in the coastal region of Kenya. It was concluded that projects were delayed and the actual cost of projects was more than the estimated cost because of coastal region of Kenya political conditions and delayed payments which results to unavailability of materials. Overall project safety factors had been moderately implemented in construction organizations.

It is recommended for construction organizations to have a clear mission and vision to formulate, implement and evaluate their performance. A structured methodology and technique should be identified to overcome the effect of economic situations on the performance of construction projects in the coastal region of Kenya. In addition, it is recommended to develop human resources in the construction industry through proper and continuous training programs about construction projects performance. It is necessary for construction organizations in Coastal region of Kenya to evaluate both of market share and liquidity before implementation of any construction project because of difficult economic situation. All of that will assist organizations to perform projects successfully and strongly.

Index Terms- Project planning, project performance indicators, construction projects project performance

I. INTRODUCTION

The construction industry is the sector involved with erection, repair and demolition of buildings and civil engineering structures in an economy. A definition typical of national income accounts in use in most advanced industrialized countries is as follows: the construction industry entails “the assembly of building materials and/or components on site; the materials and components are supplied by a variety of industries in the manufacturing sector; they are delivered to the site by the transportation and trade sectors; the assembly proceeds in accordance with plans, designs, and management procedures

supplied mainly by the business services industry in the service sector; most of the funds required for construction are supplied by the financial services industry in the service sector; and a significant part of the output supplied by the construction sector is delivered to the real estate industry in the service sector" (Bon 1992).

Construction industry plays a major role in development and achievement the goals of society. Construction is one of the largest industries and contributes to about 10% of the gross national product (GNP) in industrialized countries (Navon, 2005).Construction industry has complexity in its nature because it contains large number of parties as clients, contractors, consultants, stakeholders, shareholders and regulators. The performance of the construction industry is affected by national economies. Output from the construction industry is a major and integral part of the national output, accounting for a sizeable proportion in the Gross Domestic Product (GDP) of both developed and underdeveloped countries (Crosthwaite, 2000). Lowe (2003) further stated that the value added of construction is in the range of 7% to 10% for highly developed economies and around 3% to 6% for underdeveloped economies

Worldwide Construction Industry

The construction industry is the sector involved with erection, repair and demolition of buildings and civil engineering structures in an economy. A definition typical of national income accounts in use in most advanced industrialized countries is as follows: the construction industry entails "the assembly of building materials and/or components on site; the materials and components are supplied by a variety of industries in the manufacturing sector; they are delivered to the site by the transportation and trade sectors; the assembly proceeds in accordance with plans, designs, and management procedures supplied mainly by the business services industry in the service sector; most of the funds required for construction are supplied by the financial services industry in the service sector; and a significant part of the output supplied by the construction sector is delivered to the real estate industry in the service sector" (Bon 1992: 120).

The role of the construction industry in the socio-economic development of a country cannot be overemphasized. The industry provides constructed physical facilities which provide space where other activities may take place (Hillebrandt 2000). The monetary value of all the buildings and civil engineering works produced by the industry in a given period of time - normally a year – is referred to as the gross output of the construction industry. In the world as a whole, this output is probably about 10% of the Gross National Product (GNP), on average (Hillebrandt 2000). Although the percentage contribution of construction output to GNP varies considerably amongst various economies and geographical locations, this overall average contribution is large enough to justify a rigorous investigation of the dynamics of workload in the global construction industry. The trend of the relative volume of construction output (i.e. relative to the Gross Domestic Product [GDP] in a country evolves as the country develops from being a less developed country (LDC), through being a newly industrialized country (NIC), and into being an advanced industrialized country (AIC).

Excessive fluctuations in construction output, and by implication, demand have very adverse effects on the reputation of the industry as a whole, the business performance of construction firms and the employment of the industry's production resources.

Construction Industry of Kenya

Kenya lies across the equator on the East coast of Africa. From the map, it can be observed that it borders Somalia, Ethiopia, and Sudan to the North, Uganda to the West, Tanzania to the South and the Indian Ocean to the East. Kenya's current development status could be viewed in light of its post independence history. Kenya used to have one of the most prosperous economies in East Africa but due to government mismanagement and corruption this has led to an erosion of it's former pre-eminence (www.worldbank.org1kenya 2007). Since 2003, the new government's reform efforts have brought a return to economic growth and have made some inroads against corruption (www.worldbank.orglkenya 2007), however, recent events have caused much of the Kenyan public, and the international community to question the depth of progress made. From independence in 1964 to 1980, the average GDP growth rates of six point five percent reflected the pragmatic policies of Kenya's founding President Jomo Kenyatta. During much of this period, the Kenyan public witnessed a buoyant economy, international community support, investor confidence thrived and communities contributed in cash and the co-operative movement allowed small-scale farmers to participate in the formal economy. The results were impressive. Agriculture thrived through a relatively open and export oriented trading system that also gave ``1pre-eminence to the development of a smallholder sector that produced both food crops and major export commodities.

Kenya is a developing country in East Africa, with a population of about 40 Million people, a Gross Domestic Product (GDP - purchasing power parity) of US Dollar 40.77 Billion and a GDP growth rate of 5.5% (CIA2007). Historically, Kenya's economy was mainly agricultural – with agriculture contributing over 50% of the GDP and providing employment of over 80% of the working population (Mbaya 1984) - up to early this decade. Today, though agriculture employs 75% of the country's labour force, its contribution to the GDP is 16.3%, and is lower than contributions of industry or services, which are 18.8% and 65%, respectively (CIA 2007).

Infrastructural support for the country's economy is provided by the construction industry by way of buildings (housing, office space, retail space, factories, etc) roads, railways, irrigation schemes, water supply schemes etc.

Kenya's building and construction sector is amongst the most rapidly growing, experiencing an average growth rate of 14.2% for the period 2006 – 2011. Over the same period, Kenya's economic growth, as measured by the real Gross Domestic Product rate (GDP) averaged only 4.3% declining to 4.38% in 2011 from 6.33% in 2006. Difficult global macro conditions (effects of high oil prices and the August 2007 commencement of the financial crisis) and Kenya's 2008 post election violence in the midst of a high inflation environment (inflation averaged 9.0%) resulted in the country's subdued economic performance during the period. According to the

Central Bureau of Statistics, the construction industry in Kenya contributes 7 percent of the gross domestic product (GDP). Similar to the case with other developing countries, the Kenyan construction industry shares many of the problems and challenges the industry is facing in other developing countries, perhaps with greater severity. Given the critical role the construction industry plays in Kenya and other developing countries, and the poor level of performance of the industry in those countries, improving the performance of the industry ought to be a priority action. As contractors are one of the key players in the industry and the makers of the final product, any development and improvement initiatives in the industry has to consider ways of improving the capacity and capability of the contractors.

Previous, research works by [Adams, (Long (2004) and others] have indicated poor managerial capability of contractors to be one of the critical problems of the construction industry in developing countries. Thus, improving the managerial capability of contractors need be one of the priority considerations for improvement of capability of contractors in developing countries. Researches by (Dlungwana & Rwelamila, 2004), and others have also strongly emphasized the importance of improving the management skills of contractors. As most of the works of contractors is managed as a project, improving the contractors‟ project management capability can significantly contribute to the overall improvement of contractors‟ capability to deliver successful project. There are many realistic reasons such as closures, amendment of drawings and amendment of the design. In addition, there are other different reasons affecting construction projects performance in Coastal region of Kenya such as poor management and leadership; inappropriate participants; poor relations and coordination; absence of motivation, control, monitor or decision making systems; inadequate infrastructure, political problems; cultural problems and economic conditions (The United Nations Relief and Works Agency, UNRWA, 2000).

While individual organizations have been measuring their performance for many years, there has been little consistency in the data, and the way it has been published. The performance can be measured by key indicators for evaluation. The purpose of Key performance indicators (KPIs) is that clients want their projects delivered: on time, on budget, free from defects, efficiently, right first time, safely, by profitable companies. So, Regular clients expect continuous improvement from their construction team to achieve year-on-year: reductions in project costs and time. In addition, the Key Performance Indicators (KPIs) can be used for benchmarking purposes, and will be a key component of any organization move towards achieving best practice. Clients, for instance, assess the suitability of potential suppliers or contractors for a project, by asking them to provide information about how they response to a range of indicators. Some information will also be available through the industry benchmarking initiatives, so clients observe how potential suppliers compare with the rest of industry in a number of different areas. Construction supply chain companies will be able to benchmark their performance to enable them to identify strengths and weaknesses, and assess their ability to improve over time. The KPIs framework consists of seven main groups: time, cost, quality, client satisfaction, client changes, business Performance, health and safety (DETR, 2000)

In Coastal region, there are many construction projects that are failing in performance. In addition, performance measurement systems are not effective or efficient to overcome this problem. Construction projects performance problem appears in many aspects in the Coastal region. There are many constructed projects fail in time performance, others fail in cost performance and others fail in other performance indicators.

Statement of the Problem

It is shown from previous studies (KPI Report),2000; Lehtonen, 2001; Samson and Lema, 2002; Kuprenas, 2003; Cheung, 2004; Iyer and Jha, 2005; Navon, 2005; Ugwa and Haupt, 2007) that the failure of any project is mainly related to the problems and failure in performance. Moreover, there are many reasons and factors which attribute to such this problem. In the Coastal region of Kenya, there are many construction projects which are failing in performance. In addition, performance measurement systems are not effective or efficient to overcome such this problem.

Despite the construction industry's significant contribution to the economy of developing countries and the critical role it plays in those countries' development, the performance of the industry still remains generally low. As Idoko, (2008) noted, many projects in developing countries encounter considerable time and cost overruns, fail to realize their intended benefit oreven totally terminated and abandoned before or after their completion Moreover, the development of the construction industry in developing countries generally lags far behind from other industries in those countries and their counter parts in developed nations. Generally, as [Ofori, (2006) & Jekale, (2004)] concluded, The construction industry in developing countries failed to meet expectations of governments, clients and society as a whole.

Similar to the case with other developing countries, the Kenyan construction industry shares many of the problems and challenges the industry is facing in other developing countries, perhaps with greater severity. Given the critical role the construction industry plays in Kenya and other developing countries, and the poor level of performance of the industry in those countries, improving the performance of the industry ought to be a priority action. As contractors are one of the key players in the industry and the makers of the final product, any development and improvement initiatives in the industry has to consider ways of improving the capacity and capability of the contractors.

Previous, research works by (Long. (2004) and others] have indicated poor managerial capability of contractors to be one of the critical problems of the construction industry in developing countries. Thus, improving the managerial capability of contractors need be one of the priority considerations for improvement of capability of contractors in developing countries. Researches by (Dlungwana & Rwelamila, 2004), and others have also strongly emphasized the importance of improving the management skills of contractors. As most of the works of contractors is managed as a project, improving the contractors' project management capability can significantly contribute to the

overall improvement of contractors' capability to deliver successful projects.

In the Coastal region of Kenya, construction projects performance problem appears through different directions. There are many constructed projects fail in time performance, others fail in cost performance and others fail in other performance indicators. In the recent past there has been many projects which are finished with poor performance because of many evidential reasons such as: obstacles by client, non-availability of materials, roads closure, amendment of the design and drawing, additional works, waiting the decision, handing over, variation order, amendments in Bill of Quantity and delay of receiving drawings (The United Nations Relief and Works Agency, UNRWA, 2007).

In addition there are other indicators of performance in the Coastal region of Kenya such as project managers, coordination between participants, monitoring, feedback and leadership skills. However, there are three important issues related to failures and problems of performance in the Coastal region of Kenya which are political, economic and cultural issues. Therefore, this research will evaluate the factors affecting the performance of construction projects in the Coastal region of Kenya in order to assist owners, consultants and contractors to overcome performance problem and to improve performance of their construction projects. Hence, performance of any construction projects can be evaluated according to key performance indicators.

Research Objectives

General Objective

The aim of this research is to analyze the local factors affecting the performance of construction projects in the Coastal region of Kenya.

Specific Objective

1. To determine the influence to which the external environment affects the performance of construction projects in the Coastal region of Kenya

2. To identify the most significant project procedures that affect performance of construction projects in the Coastal region of Kenya

3. To evaluate the project management actions that affect project performance in the Coastal region of Kenya.

4. To determine the influence to which the project related factors affects the performance of construction projects in the Coastal region of Kenya

II. LITERATURE REVIEW

Theoretical Framework for Factors Affecting Project performance

The various variables affecting the factors are identified in this section. Variables within each group are interrelated and intra-related. A variable in one group can influence a variable in the others, and vice versa. To study how these factors affect project performance separately and collectively, it is hypothesized that Project performance is a function of project-related factors, project procedures, project management actions, human-related factors and external environment
and they are interrelated and intra-related.

It is further hypothesized that the project will be executed will perform more if the project complexity is low; if the project is of shorter duration; the overall managerial actions are effective; if the project is funded by a private and experienced client; if the client is competent on preparing project brief and making decision; if the project team leaders are competent and experienced; and if the project is executed in a stable environment with developed technology together with an appropriate organization structure.

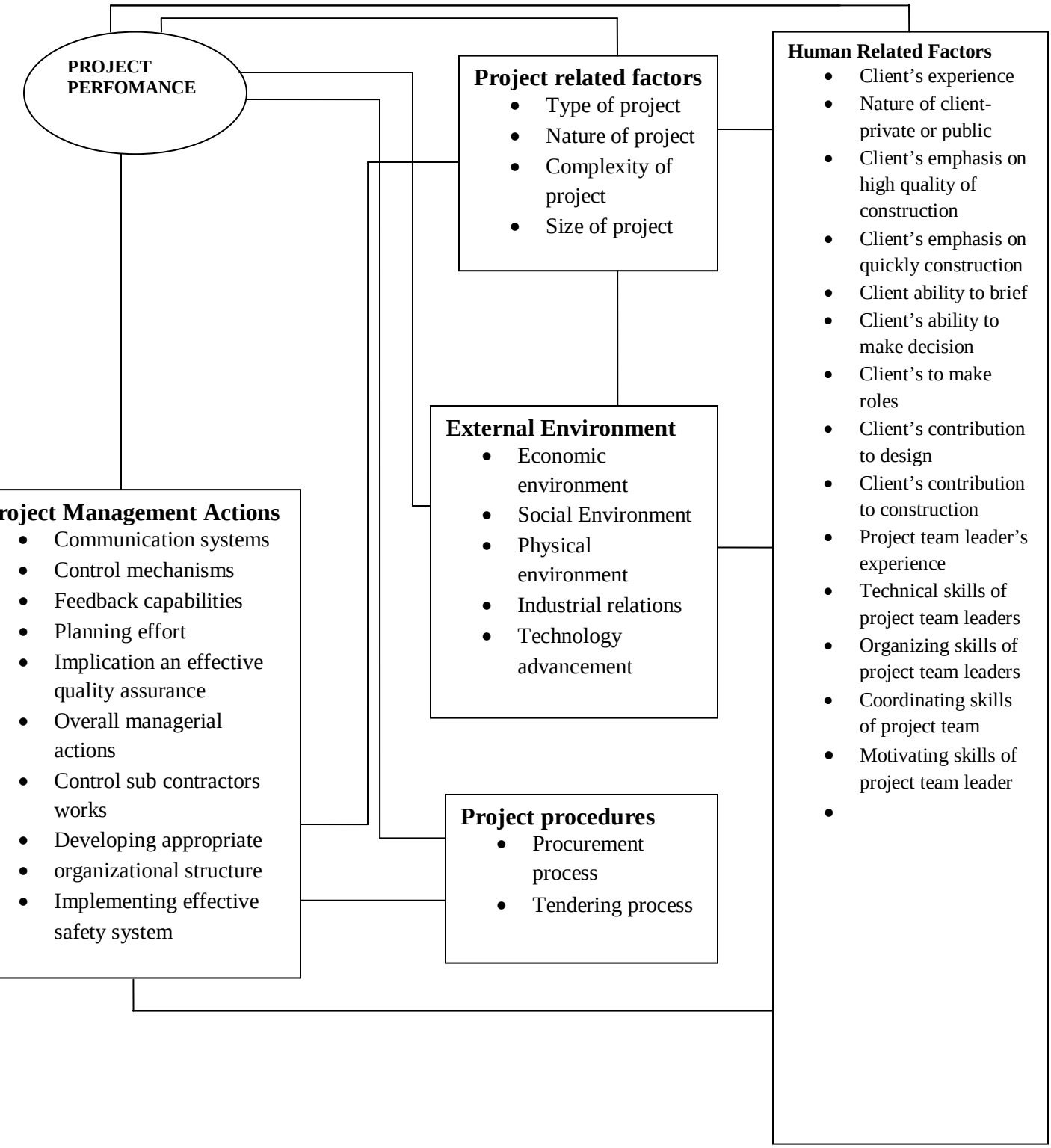

Figure: 2.1 (sources: Albert P. C. Chan; David Scott; and Ada P. L. Chan)

Empirical Literature

Brown and Adams (2000) presented a new approach to the measurement of the effect of Building Project Management (BPM) on cost, time and quality performance outputs using 15 cases' derived from UK data and by developing a path model in order to achieve that. Chan (2001) studied the cost time relationships in public sectors in Malaysia. Time and cost data were collected from 51 public sector projects. Regression analysis was used to identify the relations between time and cost performance. Kuprenas (2003) studied over 270 completed municipal facilities, storm water, sewer, and street projects within the city of Los Angeles as a case study in order to assess the impact of the use of a project management based organizational structure, project manager training, frequency of design meetings, and frequency of design reports on design phase cost performance.

Iyer and Jha (2005) studied that the factors affecting cost performance by considering a questionnaire survey approach. Love et al (2005) examined project time-cost performance relationships by using project scope factors for 161 construction projects that were completed in various Australian States and using multiple regression technique of weighted lest squares. Ugwu and Haupt (2007) studied the key performance indicators and proposed an analytical decision model and a structured methodology for sustainability appraisal in infrastructure projects in a developing country like South Africa. The research was conducted using a combination of structured interviews with industry professionals, case study project data, existing government guidelines on environmental impact assessments and sustainable construction environment, literature on sustainability research, and question naire based survey for indicator validation. It is used the .weighted sum model. Technique in multi-criteria decision analysis (MCDA) and the .additive utility model. In analytical hierarchical process (AHP) for multi-criteria decision.

Dissanayaka and Kumaraswamy (1999) developed a comprehensive model to incorporate all significant procurement sub-systems variables with non procurement variables based on time and cost performance. The multiple regression technique was applied to analyze the data from 32 Hong-Kong building projects and the results were compared with reality. Lehtonen (2001) proposed new framework for measuring construction logistics. Two-dimensional model are grouped by the use of measures and by the focus of measures. The first dimension (use of measures) contains two kinds of measures. One of them is called improvement measures and the other kind is called monitoring measures. The second dimension of the framework is the focus of measures. It clarifies at which organizational level measures can be used.

2002; Kuprenas, 2003; Cheung, 2004; Iyer and Jha, 2005; Navon, 2005; Love et al, 2005; Ugwa and Haupt, 2007) to identify the factors affecting the performance of construction projects. In addition, there are other local factors that have been added as recommended by local experts such as escalation of material prices, differentiation of shilling prices against the dollar, average delay because of closures and material shortage, neighbors and site condition problems, belonging to work and location of project. 63 factors affecting performance of construction projects are selected. These factors are grouped into 10 groups based on literature review. These groups can give a comprehensive summary of the main key performance indicators. The factors, which are considered in the questionnaire, are summarized and collected according to previous studies and other factors are added as recommended by local experts as shown in Table 3.1.

(Omar Osman, 2006). The success of a project is a very critical issue in the industry. Research has been vigorously done on successful projects in the hopes to discover the factors that contribute towards achieving project success. Sayles and Chandler (1971) have listed five critical success factors for construction projects, which are namely, the efficiency of the project manager, the appropriate scheduling of activities, a systematic responsibility and monitoring approach, project supervision and finally continuous project involvement. Martin (1976) on the other hand has identified eight success factors of a project, entailing comprehension of objective, the organizational philosophy, management support, apt job delegation and scope, selection of project team members, sufficient allocation of resources, a practical information mechanism and a review of project planning.

Morris and Hough (1987) through their study have come up with nine project success factors. These factors include a clear project objective, innovativeness towards technological change, community participation, priority based scheduling, finance, legal requisites, contractual ties and problem solving. It is clear that there are numerous factors that can be attributed to project success with a few factors that are mutually emphasized by various researches. These common factors are task and activity scheduling as well as the clear comprehension of a project's objectives. What this study intends to do is to extend these factors to include a vital cog in the implementation of any construction project, i.e., the project manager.

Fryer (1985) has listed skills that a project manager should possess in influencing the success of project, namely skills pertaining to social interaction, decision-making, problem handling, adeptness in identifying opportunities and the ability to adopt managerial change. But the fact remains, a majority of projects still report poor performance even with the presence of capable project manager. This leads to the notion that individual capacity and inherent skills of the project manager alone is insufficient to guarantee project success.

The differentiation of directions and goals of topic as shown previously, required different methodologies. The main methodologies obtained from literature review were: The following topics show summary of the main studies related to performance and their methodologies. Finally, it is shown methodology which is used in this research.

Conceptual Framework

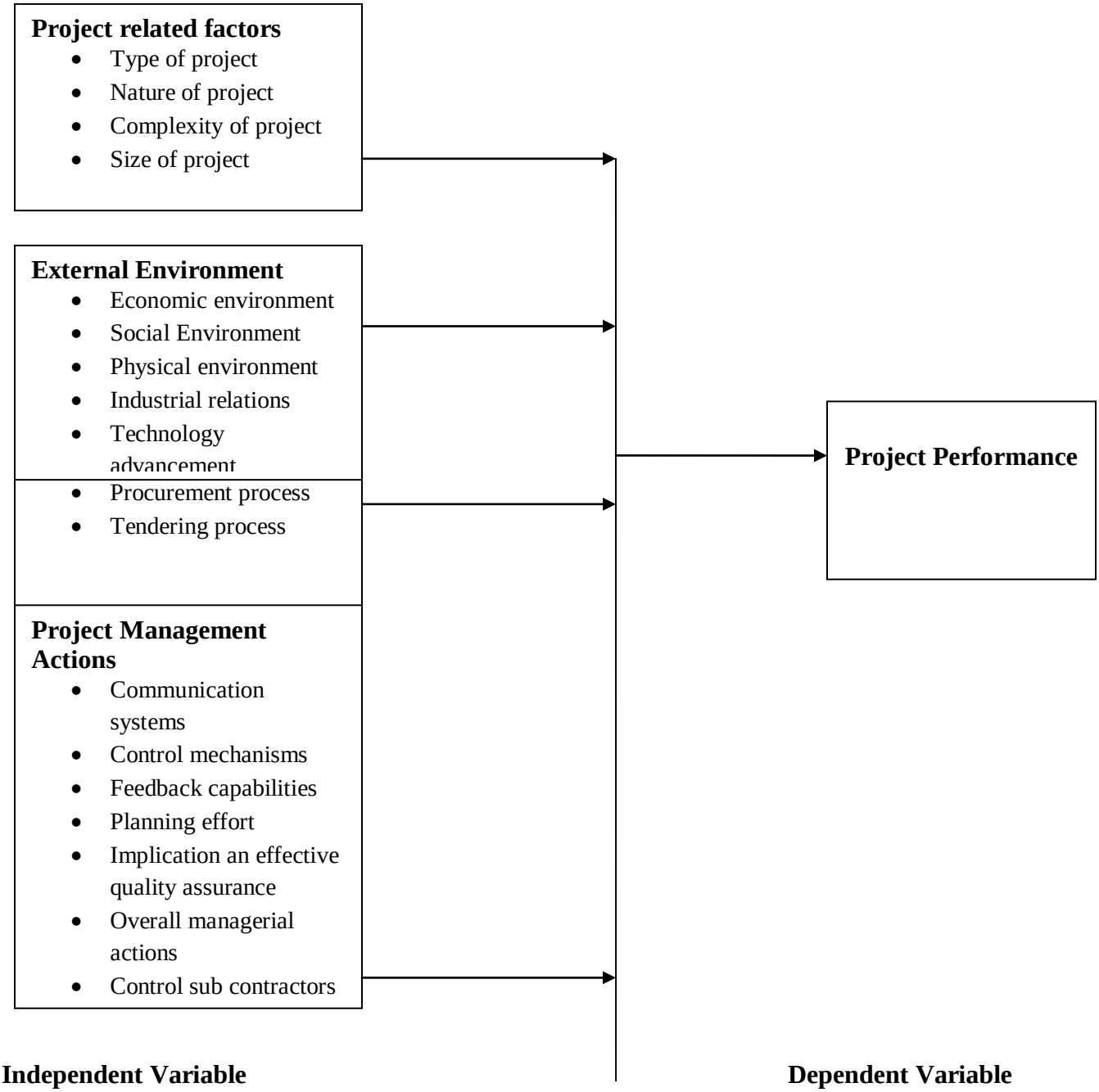

Figure 2.2: Factors affecting performance of construction project.

A new conceptual framework that includes and regroups the identified variables affecting project performance will be developed. It can be used as a base for further detailed investigation on general construction projects, as well as a specific project, such as hospital or hotel. A more systematic way of determining project performance is established. This paper focuses on the CSFs and not on the measurement of project success, i.e., the key performance indicators~KPIs Further study should be directed to identify the KPIs, so that the causal relationships between CSFs and KPIs can be identified. The causal relationships, once identified, will be a useful piece of information to implement a project successfully. It can help in selecting project team members, identifying the development needs of the project team members, and most important for forecasting the performance level of a construction project before it commences

Project Related Factors

Project-Related Factors

A general description of success factors is defined as personal characteristics that is necessary to perform the job, such as knowledge, skills and attitude (Nguyen et al., 2004). Lim and Mohamed (1999) define a factor as any circumstance, fact, or influence which contribute to a result" and further describe factors for project success as influential forces which either facilitate or impede project success. While success criteria is the set of conditions necessary to make a judgment of project success, success factors are something that contribute to the project success (Lim and Mohamed, 1999). The relation between success factors, success criteria and project success described by Lim and Mohamed. In a like manner as Pinto and Prescott (1988), Lim and Mohamed suggest that there are sets of factors relevant for each phase of the project life cycle. From the macro viewpoint of success, the conceptual and operational phases form the basis for success factors. Since, it is in these phases that the project gets conceptualized and tested. From the micro point of view, it is the construction phase and the contractual parties' goals as time, cost, quality and safety that form the basis (Lim and Mohamed, 1999)

External Environment that Influence Performance

Walker and Vines 2000). further described ''environment'' as all external influences on the construction process, including social, political, and technical systems. The attributes used to measure this factor are economic environment, social environment, political environment, physical environment, industrial relation environment, and level of technology advanced

External Factors

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According to a research done by Mustapha and Noaum (1997), there are basically five main categories of factors that will influence or affect the overall performance of a project manager. These five categories are as follows:

Factors related to individual and personal characteristics
Factors related to work conditions
Factors pertaining to nature of the project and its characteristics
Factors concerning the environment
Organizational factors

For the purpose of this study, focus will be given towards the factors of work conditions, nature of project and organizational factors. The second group of factors concerning the nature of project consists of variables pertaining to project environment, project size, available project duration, project complexity, project team relationships as well as materials and resources. Factors within the organization are made up of variables concerning company size, level of power/authority and type of client.

Project Procedures

Procurement Related Factors that Influence Project Performance

A number of researchers identified the importance of procurement factors(Walker and Vines 2000). defined the scope of procurement as the framework within which construction is brought about, acquired or obtained. Therefore, two attributes are used to measure this factor; they are procurement method (selection of the organization for the design and construction of the project) and tendering method (procedures adopted for the selection of the project team and in particular the main contract
Previous studies of Rasid (2006), Eriksson and Westerberg (2009) and Eriksson and Vennstrom (2009) suggest different procurement related factors that can affect project performance. These studies considered different procurement related factors without an area of commonalities. reconstruction time, control of project design and cost and client's control of construction projects are procurement related factors whose influences were found on procurement methods of Traditional, Design and Build and Management Contracting in Malaysia construction industry. Studies of Rasid (2006) also in Malaysia concentrated on allocation of responsibilities, activities sequencing, process and procedure and organizational approach as procurement related factors that affect project performance. Eriksson and Westerberg (2012) indicates important procurement related factors considered at the design stage as bid invitation, bid evaluation, subcontracting. Subcontracting selection, compensation factors and performance evaluation which were termed collaborative procurement procedures were found to have effects on project performance. Eriksson and Vennstrom (2012) also postulate that cooperative procurement procedures of joint specification, limited bid invitation, soft evaluation parameters, joint sub-contractor selection, incentives, collaborative tools, contractor self control and collaboration on project all have various effects on project performance. Procurement related factors identified from these previous studies are also related to selection criteria, tendering methods and variation orders that are considered in this study. Some of these procurement related factors are in ambit of what has been considered in previous studies and hence they are discussed as follows:

Procurement Selection criteria

Different authors have postulated different procurement selection factors that can assist clients to choose the best procurement method. Studies of Masterman and Gameson (1994), Rowlinson (1999), Alhazini and McCaffer (2000), Shiyamni (2006) as cited in Soyombo and Ogunsanmi (2011) have demonstrated that procurement selection factors of client characteristics, project requirements and external environment are in use. However, Shiyamni (2006) re-emphasized the use of the three factors together but expansively considers client requirements to include cost related factors, time related factors and quality related factors. Several variables of client

requirements were measured under cost, time and quality related factors. Project characteristics factors also include project type, size, cost, flexibility, complexity, site risk factors and degree of innovative technology. External environment factors considered are market competitiveness, availability of materials, natural disasters, industrial actions amongst other variables. Client characteristics, project requirements and external factors are considered with general needs for investigating the procurement related factors that affect project performance in this study. Cost related factors of capital cost of the project, maintenance cost, prequalification cost, financial risk amongst other variables can influence a client to select a particular procurement method that meets all these client requirements. Time related factors of planning and design time, construction time, early start of project, speed of construction and time overrun can help client to select an appropriate procurement method. Quality related factors of design reliability, aesthetic appearance of the building, workmanship amongst other variables are considered in this study. General needs factors of involvement of parties, their transparency, accountability, safety requirements and flexibility of the procurement process to client charges are also considered in the study. Project characteristics factors considered in this study are project type, size, cost, degree of flexibility, complexity, time constraints, payment method, finding methods and innovative technology. Moreover, external environment factors considered also include nature of the market, government policies, government as major client, regulating feasibility, technology feasibility amongst other variables. All these above factors can influence the selection of an appropriate procurement method that can also affect project performance.

Tendering Method Related Factors

Tendering is the administrative procedure of sending out drawings and bill of quantities or specification to contractors with the intention to submit a price for the construction of the project.

Besides the price for this project other consideration such as contractor's competence,financial capability, technical competence and other factors are used in selecting a contractor for executing a construction project. Different tendering methods have been used in construction projects for inviting tenders. According to Ramus (1981), Manthosi and Thawala (2012) and Ganderton (2012) there are various methods such as open selective, negotiation, competitive, openselective, design and build tendering approaches that have been used in construction projects. In addition, serial and two-stage tendering methods have been significantly used also in construction projects. According to Mathonsi and Thawala (2012) the use of open tendering method involves placing an advertisement in a widely read newspaper to invite prospective contractors to tender and it is strongly criticized for its increased cost of processing. Selective tendering in the views of Ramus (1981) involves considering 5-8 competent contractors to be invited to tender for a project. Criteria used in drawing up these competent contractors can include standard of workmanship required, equipment base of the firm, previous business records and financial standing amongst other factors. Selection of contractor through this approach may overcome the deficiencies in open tendering but may lead to higher quotations. Negotiation approach is used when a firm or client has previous satisfaction association with a contractor and the client is prepared to give the contract to this contractor on bases of reasonable price for the project. Such an arrangement is also used if the project is of specialist nature. This approach is known to save time but may lead to higher prices for the quotation (Ramus, 1981; Ganderton, 2012). Competitive tendering approach is used where various contractors of all categories are welcomed to submit tenders. According to Chinyio (2011) competitive tendering must have three stages of pre-qualification, tender documentation and bidding.

As indicated by Public Procurement Act (2007) competitive tendering in Nigeria is to encourage due process, accountability and transparency but this involves high bidding cost, conflicts of interest as it is not guaranteed that the lowest tender wins the project. Open-selective tendering approach is used as a hybrid of open and selective methods. The Traditional procurement method utilizes open, selective and negotiated tendering approaches to obtain its tenders (Mathonsi and Thawala, 2012). Design and build procurement method utilizes selective tendering method for obtaining tenders from Design-build contractors. According to Chinyio (2011) selective tendering method can be sub-divided into single stage and two-stage tendering methods. Single stage tendering is an approach where one stage of tendering is used while a two-stage tendering method involves a two-stage process of competitive selection of contractor on basis of price and negotiation of contract details and firm price with the contractor appointed at the first stage. On the first stage contractors will be assessed on basis of construction programmes, method statements, pricing of preliminaries, overheads and profits. In the second stage negotiation between the client and the contractor on price is undertaken. If agreed it becomes the contract price (Chinyio, 2011). This approach is advantageous in that it facilitates early appointment of a contractor and it combines strengths of competition and negotiation while its disadvantage is that the preferred contractor may fail to negotiate for the competitive price and negotiation may drag-on and compound the complexity of the process. All these discussed tendering approaches in this section are exploited for this study. Tendering approaches that are used for selecting a contractor for a project can affect project performance. If the tendering procedure used is such that focuses on low tender price, this may result in increased risk of cost overrun on the project due to high cost of variation orders (Assaf and Al-Heiji, 2006). As stretched by Iyer and Jha (2005) as cited in Soyombo and Ogunsanmi (2011) there is a need to be careful of contractor selection on projects as to reduce cost growths.

Project Management Actions

Project management action is a key for project success (Hubbard 1990). Jaselskis and Ashley (1991) suggested that by using the management tools, the project managers would be able to plan and execute their construction projects to maximize the project's chances of success. Then, the variables in project management include adequate communication, control mechanisms, feedback capabilities, troubleshooting, coordination effectiveness, decision making effectiveness, monitoring, project organization structure, plan and schedule followed, and related previous management experience (Walker and Vines 2000)

A project can be characterized by a few elements such as objectivity as it is definable with result, output or product, complexity with normally interrelated activities and large number of different tasks, unique where it is usually a "one-off" assignment, uncertainty as it has element of risk, temporary with its well defined beginning and end and lastly operate in a life cycle as emphasis and resource needs change during the life of the project. In contrary, project management is defined as the process of controlling the achievement of the project objectives, using the existing organizational structures and resources and manage the project by applying a collection of tools and techniques without interrupting the routine operation of a company (Munns & Bjeirmi, 1996). Some of the functions of project management are defining the work requirement, allocating resource needs, planning the execution of work required, monitoring the progress of the work and taking action to unexpected events that took place (Munns & Bjerimi, 1996).
According to Kerzner (2009), most individuals recognize the quantitative tools for planning, scheduling, and controlling work. It is essential that project managers comprehend completely the operations of each department. The only way to minimize risk is for organizations to plan better. Since organizations now exist in turbulent environment where competition, uncertainty and unprecedented complexity of new task has become the order of the day, One will unarguable recommend project management as one of the best methodology to foster better planning. These have become one of the reasons why more organizations are integrating project management as a way of life in their endeavor.

Nevertheless, Jeffrey K. Pinto (2010) in his publication motivated that, Project management is one of most prevalent tools for attaining competitive advantage over rivals in public and private business, use to improve internal operations, react quickly to external opportunities, achieve technological innovations, and more significantly robustly cope with the challenges arising from various business acumen. Project management serves as a brilliant technical tool to train future executives in most entities such as budget selection, resource allocation, planning, scheduling and fast tracking their project.
A number of attributes will affect this factor, including the communication system, control mechanism, feedback capabilities, planning effort, organization structure, safety and quality assurance program, control of subcontractors' works, and finally the overall managerial actions.

Problem of Performance in Construction Industry

The failure of any construction project is mainly related to the problems and failure in performance. Moreover, there are many reasons and factors which attribute to such problem. Ogunlana et al, (1996) stated that the construction industry performance problems in developing economies can be classified in three layers: problems of shortages or inadequacies in industry infrastructure (mainly supply of resources), problems caused by clients and consultants and problems caused by contractor incompetence/inadequacies. Okuwoga (1998) identified that the performance problem is related to poor budgetary and time control. Long et al (2004) remarked that performance problems arise in large construction projects due to many reasons such as: incompetent designers/contractors, poor estimation and change management, social and technological issues, site related issues and improper techniques and tools. Navon (2005) state that the main performance problem can be divided into two groups: (a) unrealistic target setting (i.e., planning) or (b) causes originating from the actual construction (in many cases the causes for deviation originate from both sources).

Samson and Lema (2002) found that the traditional performance measurement systems have problems because of large and complex amount of information with absence of approaches to assist decision maker understand, organize and use such information to manage organizational performance. Navon (2005) remarked that traditional project performance control is usually generic (e.g., cost control techniques). It relies on manual data collection, which means that it is done at low frequency (normally once a month) and quite some time after the controlled event occurred (i.e., not in real-time). Moreover, manual data collection normally gives low quality data.

Ling et al (2007) remarked that architectural, engineering and construction (AEC) firms may face difficulties managing construction projects performance in China because they are unfamiliar with this new operating environment. Kim et al (2008) stated that international construction projects performance is affected by more complex and dynamic factors than domestic projects; frequently being exposed to serious external uncertainties such as political, economical, social, and cultural risks, as well as internal risks from within the project.

Construction Management and Performance

There is a strong relation between project management and project performance. Management in construction industry is considered as one of the most important factors affecting performance of works. Brown and Adams (2000) studied a new approach to the measurement of the effect of Building Project Management (BPM) on time, cost and quality outputs using 15 `cases' derived from UK data. The evaluation undertaken demonstrates that BPM as it is presently implemented in the UK fails to perform as expected in relation to the three predominant performance evaluation criteria; time, cost and quality. Lehtonen (2001) obtained a model for performance measurement which assist both firms' top management and operational managers for continuous feedback on operational activities. Thomas (2002) stated that documenting and archiving performance data could be useful for future reference, such as for settling disputes on claims, and in maintenance and repair works. Kuprenas (2003) remarked that quantification of the impacts of the project management processes are identified through three steps of analysis: comparison of summary statistics of design performance, proof of statistical significance of any differences and calculation of a least squares regression line of a plot of design performance measurement versus amount/application of project management as a means to quantify management influence to design phase cost performance.

Cheung et al (2004) studied the project performance related to project managers. It is remarked that development of a Web-based construction Project Performance Monitoring System (PPMS) can assist project managers in exercising construction project performance indicators and can help senior project management, project directors, project managers, etc., in monitoring and assessing project performance. Pheng and Chuan

(2006) stated that while project management is only one of the many criteria upon which project performance is contingent, it is also arguably the most significant as people formulating the processes and systems who deliver the projects. Ugwu and Haupt (2007) stated that an adequate understanding and knowledge of performance are desirable for archiving managerial goals such as improvement of institutional transformations, and efficient decision making in design, specification and construction, at various project-level interfaces, using appropriate decision-support tools. Ling et al (2007) investigated project management (PM) practices adopted by Singaporean construction firms. It was determined the performance level of their projects in China; identifies PM practices that led to better performance; and recommended key PM practices that could be adopted by foreign construction firms in China to improve project performance.

Construction Projects and Performance

Success of construction projects depends mainly on success of performance. Many previous researches had been studied performance of construction projects. Dissanayaka and Kumaraswamy (1999) remarked that one of the principle reasons for the construction industry's poor performance has been attributed to the inappropriateness of the chosen procurement system. Reichelt and Lyneis (1999) remarked three important structures underlying the dynamic of a project performance which are: the work accomplishment structure, feedback effects on productivity and work quality and effects from upstream phases to downstream phases. Thomas (2002) identified the main performance criteria of construction projects as financial stability, progress of work, standard of quality, health and safety, resources, relationship with clients, relationship with consultants, management capabilities, claim and contractual disputes, relationship with subcontractors, reputation and amount of subcontracting. Chan and Kumaraswamy (2002) stated that construction time is increasingly important because it often serves as a crucial benchmarking for assessing the performance of a project and the efficiency of the project organization.

Cheung et al (2004) identified project performance categories such as people, cost, time, quality, safety and health, environment, client satisfaction, and communication. It is obtained by Navon (2005) that a control system is an important element to identify factors affecting construction project effort. For each of the project goals, one or more Project Performance Indicators (PPI) is needed. Pheng and Chuan (2006) obtained that human factors played an important role in determining the performance of a project. Ugwu and Haupt (2007) remarked that both early contractor involvement (ECI) and early supplier involvement (ESI) would minimize constructability-related performance problems including costs associated with delays, claims, wastages and rework, etc. Ling et al (2007) obtained that the most important of practices relating to scope management are controlling the quality of the contract document, quality of response to perceived variations and extent of changes to the contract. It was recommended for foreign firms to adopt some of the project management practices highlighted to help them to achieve better project performance in China.

Factors Affecting Performance of Managers

Ogunlana et al, (1996) recommended the need for focused effort by economy managers and construction industry associations to provide the infrastructure needed for efficient project management and performance. Chan and Kumaraswamy (2002) remarked that effective communication and fast information transfer between managers and participants help to accelerate the building construction process and performance. Kuprenas (2003) studied the impact of the use of a project management based organizational structure, project manager training, frequency of design meetings, and frequency of design reports on design phase cost performance. The process of a design team meeting frequency and the process of written reporting of design phase progress were found to be statistically significant in reducing design phase costs.

Navon (2005) stated that data are collected and used for construction managers as a basis to evaluate the project performance indicator's (PPI) actual value to compare it with the planned value and forecast its future value based on past performance. Pheng and Chuan (2006) identified the importance of the working environment variables for the performance of a project manager in the private and public sectors according to three main groups which are job condition, project characteristic and organizational related categories. The result revealed that working hours, physical condition of project site, complexity of project, material and supplies, project size, duration of project and time availability were viewed differently in terms of importance by the contractors and consultants groups. Team relationship was ranked as the most important variable affecting the performance of a project manager. It is obtained that project managers experiences do not have much effect on how they perceive their working environment.

Measurement of Project Performance

Brown and Adams (2000) obtained an evaluation framework to measure the efficiency of building project management (BPM) by using conventional economic analysis tools such as time, cost and quality. Lehtonen (2001) stated that performance measurement systems are imminent in the construction firms. Samson and Lema (2002) stated that effective and efficient management of contractors' organizational performance requires commitment to effective performance measurement in order to evaluate, control, and improve performance today and in the future.

Tangen (2004) obtained that performance measurement is a complex issue that normally incorporates at least three different disciplines: economics, management and accounting. Measurement of performance has garnered significant interest recently among both academics and practitioners. Tangen (2004) remarked the choice of a suitable measurement technique depends on a number of factors, including the purpose of the measurement; the level of detail required; the time available for the measurement; the existence of available predetermined data; and the cost of measurement.

Navon (2005) defined performance measurement as a comparison between the desired and the actual performances. For example, when a deviation is detected, the construction management analyzes the reasons for it. The reasons for deviation can be schematically divided into two groups:

(a) unrealistic target setting (i.e., planning) or

(b) causes originating from the actual construction (in many cases the causes for deviation originate from both sources).

Navon (2005) stated that performance measurement is needed not only to control current projects but also to update the historic database. Such updates enable better planning of future projects in terms of costs, schedules, labor allocation, etc. Pheng and Chuan (2006) stated that the measurement of project performance can no longer be restricted to the traditional criteria, which consist of time, cost and quality. There are other measurement criteria such as project management and products.

Cheung et al (2004) stated that New South Wales Public Works Department in Australia launched a Project Performance Evaluation (PPE) framework, which covers a wide range of performance parameters. PPE parameters are communication, time, cost, quality, safety, claims and issues resolution, environment, contract relations. The main purpose of PPE is to extend project performance measures to cover soft parameters also, such as communication and dispute resolution. In the UK, a project performance measurement tool referred to as the Key Performance Indicators (KPIs) was developed by the KPI working group under the UK Construction Industry Best Practice Programme to include time, cost, quality, client satisfaction, change orders, business performance, health and safety. The three major steps in implementing KPIs are as follows: Decide what to measure, Collect data and Calculate the KPIs. However, both the PPE and KPIs are valuable tools for measuring project performance over a period of time. Anyway, it is obtained from previous study that both methods PPE and KPIs can be used for measuring of performance as the indicators are similar in two methods. In this study KPIs method will be used to measure performance.

Iyer and Jha (2005) stated that measuring the performance of any construction project is a very complex process because modern construction projects are generally multidisciplinary in nature and they involve participation of designers, contractors, subcontractors, specialists, construction managers, and consultants. With the increasing size of the project, number of participants in the project also increases. The objectives or goals of all participants need not be same even in a given project. Hence to measure performance of a project without specifying the participant and without specifying the criteria for judging the performance holds no meaning. Past researchers have employed different criteria such as compliance to schedule, cost and quality to judge the project performance.

Lehtonen (2001) proposed new framework for measuring construction logistics by using two-dimensions in order to improve productivity. The first dimension (use of measures) contains two kinds of measures. One of these kinds is called improvement measures which help construction industry to find out the problems with current practices. These measures are mainly used during development projects. Another kind is called monitoring measures which are used for continuous monitoring of operations. The second dimension of the framework is the focus of measures. It clarifies at which organizational level measures can be used. There should be information available at the company and project level, as well as at the specific supplier or subcontractor level.

Samson and Lema (2002) proposed performance measurement system. The system comprises of construction business perspective including innovation and learning, processes, project, stakeholders, and financial perspective. The indicators developed from perspectives are categorized into three main groups which are drivers' indicators, process indicators and results indicators. The key to the success or failure of the measurement system are leadership commitment; employees' involvement and empowerment; and information coordination and management. Shen et al (2005) presented a method for measuring the environmental performance of construction activities committed by a contractor through calculating the contractor.s environmental performance score (EPS). The level of EPS serves as a simple indicator for measuring and communicating the level of a contractor environmental performance.

Cost performance can be measured through a cost performance index (CPI) computed
as (Kuprenas, 2003):

CPI=BCWP/ACWP
Where:
BCWP = budgeted cost of the work performed
ACWP = actual cost of the work performed.

From previous equation:
If CPI value of one means, the cost was as planned (at the budget Value)
If CPI value above one means, the project was below its budget
If CPI of less than one means, the project exceeded its budget.
Based on previous equation, time performance is measured through a schedule
performance index (SPI) computed as:
SPI=BCWP/BCWS
Where:
BCWP = budgeted cost of the work performed
BCWS = budgeted cost of the work scheduled.

From previous equation:
If SPI value of one means, the time was as planned (at the time Value)
If SPI value above one means, the project was ahead of schedule
If SPI of less than one means, the project was behind schedule

Key Performance Indicators

Samson and Lema (2002) remarked that characteristics of emerging performance measurement indicators need analysis of both the organization and environment such as: nature of work, global competition, quality awards, organizational role, external demands and power of IT. The indicators should be able to identify causes of problems, address all possible performance drivers, and identify potential opportunities for improvement. Stewart and Mohamed (2003) emphasized the importance of a structured evaluation framework to evaluate the value IT adds to the process of project information management. The framework is in the form of a Construct IT. with IT performance perspectives and indicators developed specifically for managing information on construction projects. Therefore, construction

organizations should lay the foundations for an IT performance measurement and management culture, by actively seeking to quantify the value IT generates.

Cheung et al (2004) remarked seven main key indicators for performance which are: time, cost, quality, client satisfaction, client changes, business performance, and safety and health. Navon (2005) stated that a number of research efforts to fully automate project performance control of various project performance indicators have been carried out in recent years. These are also briefly described together with the concept of measuring indirect parameters and converting them into the sought indicators. These are (1) labor and earthmoving productivity based on measuring the location of workers or earthmoving equipment at regular time intervals; (2) progress based on the above data; (3) a comprehensive control of construction materials starting by monitoring orders and purchasing up to the movement of the materials on site.

Pheng and Chuan (2006) stated that project performance can be determined by two common sets of indicators. The first set is related to the owner, users, stakeholders and the general public which are the groups of people who will look at project performance from the macro viewpoint. The second are the developer, a non-operator, and the contractor which are the groups of people who will look at project performance from the micro viewpoint. Jin et al (2006) studied the relationship-based factors that affect performance of general building projects in China. Thirteen performance metrics was used to measure the success level of construction projects. These factors were categorized into four groups namely cost, schedule, quality and relationship performance. It was recommended that foreign firms that have entered or are going to enter the Chinese construction industry should learn how to build cooperative and harmonious relationships with Chinese partners and finally achieve satisfactory project performance by paying sufficient attention to the aforementioned factors.

Ugwu and Haupt (2007) developed and validated key performance indicators (KPI) for sustainability appraisal using South Africa as a case study. It is used four main levels in a questionnaire to identify the relative importance of KPI. The main indicators were: economy, environment, society, resource utilization, health and safety and project management and administration. Luu et al (2007) provided nine key performance indicators (KPIs) which can be applied to measure project management performance PMP and evaluate potential contractors as well as their capacity by requesting these indices.

Project Success and Project Performance

Al-Momani (2000) stated that the success of any project is related to two important features, which are service quality in construction delivered by contractors and the project owner's expectations. Managing the construction so that all the participants perceive equity of benefits can be crucial to project success. It is obtained that the complete lack of attention devoted to owner's satisfaction contributes to poor performance. Declining market shares, low efficiency and productivity, and the rapid construction cost escalation also lead to poor performance. Nitithamyong et al (2004) remarked that the success of construction projects depends up on technology, process, people, procurement, legal issues, and knowledge management which must be considered equally.

Pheng and Chuan (2006) defined project success as the completion of a project within acceptable time, cost and quality and achieving client's satisfaction. Project success can be achieved through the good performance of indicators of the project. So, success refers to project success and performance refers to performance of indicators such as project managers. Wang and Huang (2006) stated that Project success has been widely discussed in the project management (PM) literature. The focus of most studies of project success is on dimensions of project success (how to measure it) and factors influencing project success. Wang and Huang (2006) studied that how the engineers evaluate project success and to what extent key project stakeholders' performance correlates with project success. It is obtained that project owners play the most important role in determining project success, and project management organizations' performance as the single point of project responsibility

III. METHODOLOGY

Iyer and Jha (2005) studied that the factors affecting cost performance by considering a questionnaire survey approach. Love et al (2005) examined project time-cost performance relationships by using project scope factors for 161 construction projects that were completed in various Australian States and using multiple regression technique of weighted lest squares. Ugwu and Haupt (2007) studied the key performance indicators and proposed an analytical decision model and a structured methodology for sustainability appraisal in infrastructure projects in a developing country like South Africa. The research was conducted using a combination of structured interviews with industry professionals, case study project data, existing government guidelines on environmental impact assessments and sustainable construction environment, literature on sustainability research, and questionnairebased survey for indicator validation. It is used the weighted sum model. Technique in multi-criteria decision analysis (MCDA) and the .additive utility model. In analytical hierarchical process (AHP) for multi- criteria decision.

Samson and Lema (2002) proposed performance measurement system as a model based on literature review. The system comprises of construction business perspective including innovation and learning, processes, project, stakeholders, and financial perspective. It was proposed a questionnaire including set of indicators affecting project performance. Cheung et al (2004) obtained framework software to monitor and measure project performance based on project performance measurement system (PPMS). Project performance factors were identified as a questionnaire for inclusion in the PPMS. The monitoring process is automated through the use of the World Wide Web (WWW) and database technology. Data collection and dissemination are similarly automated. The system contains four stages which are data entry, database, reporting and action. This system had eight indicators to measure performance which are people, cost, time, quality, safety and health, environment, client Satisfaction, and communication. Navon (2005) presented automated project performance control system (APPC) for measurement of the project performance indicators (PPI). The approach used for

automated PPI measurement is that the values of some indirect parameters are measured automatically and converted into the sought value of the PPI by special algorithms.

Research Design

According to Ghauri and Grønhaug (2005), a research design is the overall plan for relating the conceptual research problem to relevant and practicable empirical research. In order words, the research design provided a plan or framework for data collection and its analysis. The aim for a researcher was give as a correct picture of reality as possible by combining and analysing empirical data in relation to theory. Different approaches exist and the approach most suitable for the research depends on the desired starting point of the researcher in relation to present theories.

For this study it adopted a cross sectional survey design questionnaire survey, interviewing, case studies and modeling. Since the research study is meant to test rather than generate theory, it adopted a quantitative approach which focused on describing and drawing inferences from the findings on the relationships between construction project performance, local factors affecting performance, Project related factors, external environmental factors, project procedure factors and project management actions Correlation and Regression approaches was used to investigate the relationships between the variables and the extent to which the independent variables explained effects of project performance.

Study Population

The targeted population for the study were Consultants, Contractors and Owners of construction projects within the Coastal region members from the construction industry sector in Coastal Kenya. The sample was project leaders and members from construction firms in Coast, Kenya. This is due to the readily availability of construction firms in Coastal region of Kenya and due to the element of time constraints, about a total population of 4230 with the breakdown of its composition as shown in table 3.1 below.

Sampling Procedure and Target Sample Size

A sample the representative part of the total population chosen for analysis during a research (Bryman and Bell, 2007). The importance of the sampling process was crucial. The characteristic of the interest sample of the population were Consultants, Contractors and Owners of construction projects. Hence the sample size was purposively and conveniently distributed among the sample frame as shown in table 3.1, based upon those who are directly or directly involved in projects and have expertise in that field.

The unit of analysis will comprise of the Construction projects. Simple random sampling method was used. The study used an interview guide of cross sectional survey, questionnaire survey, interviewing, case studies and modeling as the data collection tool to collect views on the factors affecting Construction Projects performance at the Coastal region of Kenya.

This research study collected a sample size of about 180 using purposive sampling as the targeted sample needed to have an exposure to project management. A questionnaire was used to collect feedback from the potential respondents. The questionnaire was divided into 3 sections. The first section is aimed to collect personal details and organization information, followed by second section which aimed to assess in the respondents' experience in project management. The third section aimed to investigate the criteria used in measuring the project success and followed by the most important section which aims to find out what the factors that influence the success implementation of a project, which has been adopted from Pinto's Project management Profile (PIP). The last section was to identify if project life cycle act as a moderating variable to project success.

Sample size of 180 will be taken from the total list of workers made up of Executive directors/managers, Senior Staff, owners as shown in table 3.1 and conforms to the advice for statistical analyses, stating that the number 30 is useful rule of thumb when deciding on a suitable sample size (Stutely, 2003). Also this sample size was chosen due the sampling technique chosen which was mainly purposive and by convenient and targeted workers who are directly or indirectly involved in projects and have knowledge and expertise in the area of the study.

Sample Frame	Population size	Sample Frame
Executive Directors Managers	30	9
Senior Staff	600	78
Owners	3000	93
Total	4230	180

Source: Author's Field Work.

Data Processing, Analysis and Presentation

After collecting the data using a pre-coded questionnaire, it was edited for inconsistencies.

Statistical package for social scientists (SPSS) version 21.0 was used for data entry and analysis. Correlation analysis tools i.e. the Pearson' correlation coefficient was used to establish the relationship between project performance in relation to project related factors, external environment, project related procedures and project management related actions. Multiple regression analysis was conducted to determine variance in the dependent variable that was explained by the independent variables because

there was more than one study variable affecting perceived project performance. The study findings have been presented in a report.

The multiple regression analysis was used to help estimate a linear equation of the form:

$$\mathbf{Y = a + b_1*X_1 + b_2*X_2 + ... + b_p*X_p}$$

In this equation, the regression coefficients (or *B* coefficients) represented the *independent* contributions of each independent variable to the prediction of the dependent variable. Another i.e variable X_1 will be correlated with the *Y* variable, after controlling for all other independent variables.

IV. RESULTS AND ANALYSIS

Factors Affecting the Performance of Construction Projects

The results of this part of study provide an indication of the relative importance index and rank of factors affecting the performance of construction projects in the Coastal Region of Kenya.

Table (4.6) The relative importance index (RII) and rank of factors affecting the performance of construction projects in the Coastal Region of Kenya according to each category.

Factors	Owner		Consultant		Contractor	
	RII	Rank	RII	Rank	RII	Rank
(1) Cost factors						
Profit rate of project	0.709	24	0.791	13	0.754	23
Overhead percentage of project	0.662	26	0.702	30	0.677	29
Project design cost	0.515	40	0.703	29	0.597	40
Material and equipment cost	0.827	9	0.791	13	0..828	9
Project labor cost	0.756	19	0.759	15	0.754	22
Project overtime cost	0.603	37	0.615	36	0.622	36
Motivation cost	0.615	34	0.599	39	0.614	38
Cost of rework	0.603	36	0.687	38	0.602	39
Cost of variation orders	0.580	39	0.703	28	0.677	28
Regular project budget update and cost control systems	0.653	29	0.757	16	0.758	21
Escalation of material prices	0.862	5	0.847	6	0.904	20
Differentiation of coins prices	0.803	12	0.823	8	0.889	19
(2) Time factors						18
Planned time for project	0.768	18	0.775	14	0.780	16
Time needed to implement variation orders and Time needed to rectify defects	0.659	28	0.672	32	0.639	33
Average delay in claim approval and payment approval owner to contractor	0.956	1	0.911	1	0.958	1
Availability of resources as planned through project duration	0.886	3	0.873	2	0.919	2
(3) Quality factors						
Conformance to specification	0.897	2	0.823	7	0.837	8
Availability of personals with high experience and qualification	0.874	4	0.863	4	0.880	6
Quality of equipments and raw materials in project	0.850	7	0.855	5	0.876	7
Participation of managerial levels with decision making	0.827	9	0.799	11	0.815	13
Quality assessment system in Organization and Quality training/meeting	0.721	23	0.727		0.758	18
(4) Productivity factors						
Project complexity	0.744	22	0.727	21	0.776	17
Number of new projects / year	0.615	33	0.703	27	0.645	30
Management-labor relationship	0.791	14	0.703	26	0.758	19
Absenteeism rate through project	0.791	13	0.703	25	0.758	18

Sequencing of work according to Schedule	0.815	10	0.821	9	0.819	12
(5) Client Satisfaction factors						
Information coordination between owner and project parties	0.744	21	0.807	10	0.824	12
Leadership skills for project Manager /Owner	0.850	6	0.863	4	0.919	3
Number of disputes between owner and project parties	0.768	17	0.743	18	0.735	24
(6) Regular and community satisfaction factors						
Cost of compliance to regulators owner and project parties owner and project parties	0.615	33	0.663	34	0.619	37
Number of non compliance to regulation	0.650	30	0.639	35	0.629	34
Quality and availability of regulator documentation	0.662	27	0.751	17	0.668	30
Neighbors and site conditions Problems	0.803	11	0.727	20	0.725	25
(7) People factors						
Employee attitudes in project	0.697	25	0.743	18	0.810	14
Recruitment and competence development between employees	0.768	17	0.703	24	0.824	10
Employees motivation Belonging to work	0.780	15	0.711	23	0.806	15
(8) Environment factors						
Air quality	0.603	36	0.607	37	0.686	27
Noise level	0.580	38	0.527	40	0.628	35
Wastes around the site	0.650	30	0.599	39	0.664	31
Climate condition in the site	0.744	19	0.671	33	0.722	26

Source: primary data

The most important factors agreed by the owners, consultants and contractors as the main factors affecting the performance of construction projects in the Coastal Region of Kenya were: escalation of material prices; availability of resources as planned through project duration; average delay because of closures and materials shortage; availability of personals with high experience and qualification; quality of equipments and raw materials in project; and leadership skills for project manager.

Table (4.7) the following factors are among the top significant factors affecting the performance of construction projects in the Coastal Region of Kenya for all parties

Factors	**Owner**		**Consultant**		**Contractor**	
	RII	**Rank**	**RII**	**Rank**	**RII**	**Rank**
Escalation of material prices	0.862	5	0.847	6	0.904	4
Availability of resources as planned through project duration	0.886	3	0.873	2	0.919	2
Availability of personals with high experience and qualification	0.874	4	0.863	3	0.880	5
Average delay in claim approval and payment approval owner to contractor	0.956	1	0.911	1	0.958	1
Quality of equipments and raw materials in project	0.850	7	0.855	5	0.876	6
Leadership skills for project Manager /Owner	0.850	6	0.863	4	0.919	3

Source: primary data

According to owners, consultants and contractors; it was obtained that the Average delay in claim approval and payment approval owner to contractor results to closures and materials shortage was the most important performance factor as it has the

first rank among all factors with relative index (RII) = 0.956 for owners, 0.911 for consultants and 0.958 for contractors. This agreement between all target groups is traced to the cultural and political situation from which affects the Coastal Region of Kenya.

Construction projects in the Coastal Region of Kenya is suffering from a number of problems because of closures and materials shortage. These problems can be considered as an obstacle for time performance of projects as this impact on the rate at which projects are executed. All owners, consultants and contractors feel with such this sensitive problem in their projects.

Availability of resources as planned through project duration has been ranked by the owners' respondents in the third position with RII equal 0.886. It has been ranked by the consultants respondents in the second position with RII equal 0.873and has been ranked by the contractors respondents in the third position with RII equal 0.919. This factor can be considered as an important for three parties and it has a similar rank for all parties as it affects directly on project performance such as time. Availability of resources is related to closures. If resources are not available as planned through project duration, the project will suffers from problem of time and cost performance. Hence the schedule is not adhered to.This result is in line with Iyer and Jha (2005) as availability of resources as planned through project duration is an important factor for owners and contractors in Indian construction projects. This is because resource availability as planned schedule can improve time performance of projects.

Availability of personals with high experience and qualification has been ranked by the owners respondents in the fourth position with RII equal 0.874 It has been ranked by the consultants respondents in the third position with RII equal 0.863 and has been ranked by the contractors respondents in the sixth position with RII equal 0.876. This factor is more important for consultants than for others. Availability of personals with high experience and qualification lead to better performance of quality, time, cost, productivity and safety of projects. In the Coastal region of Kenya projects are awarded to the lowest bidder. Some of the lowest bidders may lack management skills and less attention is paid to contractor's plan, cost control, overall site management and resource allocation. Samson and Lema (2002), Cheung et al (2004) and Iyer and Jha (2005) are in agreement with our result as this factor is very important because it affects strongly on quality performance of construction projects.

Leadership skills for project manager has been ranked by the owners respondents in the seventh position with RII equal 0.850. It has been ranked by the consultants respondents in the third position with RII equal 0.863 and has been ranked by the contractors respondents in the second position with RII equal 0.919. This factor is considered as more important for contractors than for others. This is mainly because that if project manager has strong leadership skills, then the project performance can be monitored, controlled and managed with high quality. This result is in line with Iyer and Jha (2005) as this factor is more important for contractors than for owners because skills and quality of leadership affects strongly and directly on contractors performance through project. Escalation of material prices has been ranked by the owners respondents in the fifth position with RII equal 0.862. It has been ranked by the consultants respondents in the seventh position with RII equal 0.847 and has been ranked by the contractors respondents in the fourth position with RII equal 0.904. This factor is considered as more important for contractors than for others because escalation of material prices affects the cost performance of contractors.

It should be mentioned that there were many projects in the Coastal Region of Kenya finished with poor cost performance because of escalation of material prices. This is because of weakening of Kenyan shilling against the US dollar.

Quality of equipments and raw materials in project has been ranked by the owners respondents in the ninth position with RII equal 0.850. It has been ranked by the consultants respondents in the sixth position with RII equal 0.855 and has been ranked by the contractors respondents in the seventh position with RII equal 0.876. It is not surprising to obtain that this factor is more important for consultants than for others because that quality control is one of the most important duties for the consultant in the site of construction project. This will lead to owner satisfaction and implementation of project according to specifications. In the Coastal Region of Kenya, most of available materials are with little variation in quality and produced by a limited number of producers. Cheung et al (2004) and Iyer and Jha (2005) are in agreement with the result as this factor affects the project performance and the degree of owners satisfaction. Constant breakdowns of machines and equipments due to the aging factors affects the performance of work since most man hours are spent majorly in repairs of the same.

However, there are some factors which can be considered as more important for one party than for others as shown in the Table 4.6. This is because contractors are interested with operational and managerial factors such as productivity and material availability. Unlike contractors, however, the owners and consultants considered the client and technical factors to be more important than operational ones.

Table 4.8 shows summary of factors ranking according to all categories: performance of construction projects in the Coastal Region of Kenya according to all categories

Factors	All Response	
	RII	Rank
Average delay in claim approval and payment approval owner to contractor	0.942	1
Availability of resources as planned through project duration	0.893	2
Leadership skills for project Manager /Owner	0.877	3
Availability of personals with high experience and qualification	0.872	4
Escalation of material prices	0.871	5
Quality of equipments and raw materials in project	0.860	6

Conformance to specification	0.852	7
Differentiation of coins prices	0.838	8
Sequencing of work according to Schedule	0.818	9
Material and equipment cost	0.815	10
Participation of managerial levels with decision making	0.814	11
Information coordination between owner and project parties	0.792	12
Planned time for project	0.774	13
Employees motivation Belonging to work	0.766	14
Recruitment and competence development between employees	0.765	15
Project labor cost	0.756	16
Neighbors and site conditions Problems	0.752	17
Management-labor relationship	0.751	18
Absenteeism rate through project	0.751	19
Profit rate of project	0.751	20
Employee attitudes in project	0.750	21
Project complexity	0.749	22
Number of disputes between owner and project parties	0.749	23
Quality assessment system in Organization and Quality training/meeting	0.735	24
Regular project budget update and cost control systems	0.723	25
Climate condition in the site	0.712	26
Quality and availability of regulator documentation	0.694	27
Overhead percentage of project	0.680	28
Time needed to implement variation orders and Time needed to rectify defects	0.657	29
Number of new projects / year	0.654	30
Cost of variation orders	0.653	31
Number of non compliance to regulation	0.639	32
Wastes around the site	0.638	33
Cost of compliance to regulators owner and project parties owner and project parties	0.632	34
Air quality	0.632	35
Cost of rework	0.631	36
Project overtime cost	0.613	37
Motivation cost	0.609	38
Project design cost	0.605	39
Noise level	0.578	40

Source: primary data

Table (4.9) the following factors are among the top ten significant factors affecting the Performance of construction projects in the Coastal Region of Kenya according to all categories

Factors	**All Response**	
	RII	**Rank**
Average delay in claim approval and payment approval owner to contractor	0.942	1
Availability of resources as planned through project duration	0.893	2
Leadership skills for project Manager /Owner	0.877	3
Availability of personals with high experience and qualification	0.872	4
Escalation of material prices	0.871	5
Quality of equipments and raw materials in project	0.860	6
Conformance to specification	0.852	7
Differentiation of coins prices	0.838	8
Sequencing of work according to Schedule	0.818	9
Material and equipment cost	0.815	10

Source: primary data

According to all response, average delay because of closures and materials shortage was the most important performance factor as it has the first rank among all factors with RII = 0.942. This importance is traced to the difficult political situation from which the Coastal Region of Kenya suffers. Construction projects in the Coastal Region of Kenya is suffering from complex problems because of closures and materials shortage. These problems can be considered as an obstacle for time

performance of projects. All owners, consultants and contractors feel with such this sensitive problem in their projects. Availability of resources as planned through project duration has been ranked by all response in the second position with RII equal 0.893. This factor is considered as an important for all parties as it affects directly on project performance such as time. If resources are not available as planned through project duration, the project will suffers from problem of time and cost performance. This result is in line with Iyer and Jha (2005) as availability of resources as planned through project duration is an important factor for all response in Indian construction projects. This is because resource availability as planned schedule can improve time performance of projects.

Leadership skills for project manager has been ranked by all response in the third position with RII equal 0.877. If project manager has strong leadership skills, the project performance can be monitored, controlled and managed with high quality. This result is in line with Iyer and Jha (2005) as skills and quality of leadership affects strongly and directly on performance of construction project. Availability of personals with high experience and qualification has been ranked by all response in the fourth position with RII equal 0.872. Escalation of material prices affects the cost performance of project. It was mentioned that there were many projects in the Coastal Region of Kenya

Escalation of material prices has been ranked by all response in the fifth position with RII equal 0.871. Availability of personals with high experience and qualification lead to better performance of quality, time, cost, productivity and safety of projects. In Coastal region, projects are awarded to the lowest bidder. Some of the lowest bidders may lack management skills and less attention is paid to contractor's plan, cost control, overall site management and resource allocation. Samson and Lema (2002), Cheung et al (2004) and Iyer and Jha (2005) are in agreement with the result findings as this factor is very important because it affects strongly on quality performance of construction projects.

Quality of equipments and raw materials in project has been ranked by all response in the sixth position with RII equal 0.860. Quality control is one of the most important duties for the consultant in the site of construction project. This will lead to owner satisfaction and implementation of project according to specifications. In the Coastal Region of Kenya, most of available materials are with little variation in quality and produced by a limited number of producers. Cheung et al (2004) and Iyer and Jha (2005) are in agreement with the result findings as this factor affects the project performance and the degree of owners satisfaction.

Weakening of the Kenyan Shilling against the US dollar has been ranked by all response in the eighth position with RII equal 0.838. This factor affects the liquidity, project budget and cost performance. Construction projects in the Coastal Region of Kenya have suffered from differentiation of coins prices because of difficult political and economical situation experienced in the country. Conformance to specification has been ranked by all response in the seventh position with RII equal 0.852. This factor is an important for owner's satisfaction. The owner usually seeks to implement project according to specification. Iyer and Jha (2005) are in agreement with the result as this factor is significant for owners because this factor is strongly related to client satisfaction.

Sequencing work according to schedule has also been ranked by all response in the ninth position with RII equal 0.818. This is mainly because cash flow affects the project budget and project cost performance. This result is in agreement with Samson and Lema (2002) because cash flow can give an important evaluation for the cost performance at any stage of project.

Material and equipment cost has been ranked by all response in the tenth position with RII equal 0.818. Cost performance of any project depends mainly on liquidity of organization. This result is in line with Samson and Lema (2002) as liquidity of organization is very important for evaluation of project budget and cost performance.

Performance Categories

Table 4.10 shows the ten categories which affect the performance of construction projects. Cost group has been ranked by the owners respondents in the seventh position with RII equal 0.682. It has been ranked by the consultants respondents in the fifth position with RII equal 0.731 and has been ranked by the contractors respondents in the sixth position with RII equal 0.723. This group is more important for consultant than for others because liquidity of organization and project design cost affect the project cost performance and this is related to owner satisfaction. Cheung et al (2004) are in line with our result as cost group affects strongly the performance of construction projects and it can be one of the most important indicators to measure performance. Iyer and Jha (2005) are in agreement with our result as cost is considered as an important criteria for judgment of construction projects performance.

Table (4.10) the relative importance index (RII) and rank of major groups affecting the performance of construction projects in the Coastal Region of Kenya.

Factors	Owner		Consultant		Contractor	
	RII	Rank	RII	Rank	RII	Rank
(1) Cost factors	0.682	7	0.731	5	0.723	6
(2) Time factors	0.817	2	0.808	2	0.824	3
(3) Quality factors	0.834	1	0.813	1	0.833	1
(4) Productivity factors	0751	5	0.731	4	0.751	5
(5) Client Satisfaction factors	0.787	3	0.804	3	0.826	2
(6) Regular and community satisfaction factors	0.683	6	0.695	7	0.660	8
(7) People factors	0.748	4	0.719	6	0.813	4

(8) Environment factors	0.644	8	0.601	8	0.675	7

Source: primary data

Quality group has been ranked by the owners respondents in the first position with RII equal 0.8834. It has been ranked by the consultants respondents in the first position with RII equal 0.813 and has been ranked by the contractors respondents in the first position with RII equal 0.833. This group is the most important one for consultants because consultants are interested with clients and technical factors. Consultants observed that quality of equipments and raw materials in project and availability of personals with high qualification affect strongly the quality performance of project. Samson and Lema (2002) remarked that number of disputes and rework tasks through project affects the quality performance. Cheung et al (2004) remarked that quality group affects moderately on the performance of construction projects. Iyer and Jha (2005) observed that quality performance affects the cost performance of construction projects.

Time group has been ranked by the owners respondents in the second position with RII equal 0.817. It has been ranked by the consultants respondents in the second position with RII equal 0.808 and has been ranked by the contractors respondents in the third position with RII equal 0.824. This group is also more important for consultant than for others because the consultant is concerned with planned time for project completion. Samson and Lema (2002) remarked that time performance is affected by schedule stability of construction projects. Cheung et al (2004) remarked that time group affects strongly the performance of construction projects and it can be one of the most important indicators to measure performance.

Client satisfaction group has been ranked by the owners respondents in the third position with RII equal 0.787. It has been ranked by the consultants respondents in the third position with RII equal 0.804 and has been ranked by the contractors respondents in the third position with RII equal 0.826. It is interesting to observe that client satisfaction group is more important for consultants than for contractors because consultants are usually interested with client factors. This is mainly due to financing issues and owner interference which are considered very important by consultants. Samson and Lema (2002); Iyer and Jha (2005) obtained that client satisfaction is affected by information coordination between owner and project parties. Cheung et al (2004) remarked that client satisfaction group affects moderately the performance of construction projects.

People group has been ranked by the owners respondents in the fouth position with RII equal 0.748. It has been ranked by the consultants respondents in the sixth position with RII equal 0.719 and has been ranked by the contractors respondents in the fourth position with RII equal 0.813. It is not surprising to observe that people group is the most important one for contractors because contractors remarked competence development between employees and belonging to work affect strongly on productivity, cost and time performance of contractors. Iyer and Jha (2005) obtained that people group affects the projects performance by participants' attitudes, Commitment to the project, employees motivation and competence development.

Productivity group has been ranked by the owners respondents in the fifth position with RII equal 0.751. It has been ranked by the consultants respondents in the fourth position with RII equal 0.731 and has been ranked by the contractors respondents in the fifth position with RII equal 0.751. It is obtained that this factor has a similar importance for three parties as productivity affects the cost, time and quality performance of projects. Samson and Lema (2002) remarked that productivity is an important indicator affecting the performance of construction projects.

Regular and community satisfaction group has been ranked by the owners respondents in the sixth position with RII equal 0.683. It has been ranked by the consultants respondents in the seventh position with RII equal 0.695 and has been ranked by the contractors respondents in the eighth position with RII equal 0.660. This group is not important for three parties because it rarely affect the project performance because of political situation in the Coastal Region of Kenya. Samson and Lema (2002) obtained that regular and community satisfaction group is one of set of projects performance indicators.

Environment group has been ranked by the owners respondents in the eighth position with RII equal 0.644. It has been ranked by the consultants respondents in the eighth position with RII equal 0.601 and has been ranked by the contractors respondents in the seventh position with RII equal 0.675. It is obtained that this group is not important for three parties because environmental factors such as air quality and noise level do not affect practically on the performance of projects in the Coastal Region of Kenya. Cheung et al (2004) remarked that environment group affects strongly the performance of construction projects. Iyer and Jha (2005) and Ugwu and Haupt (2007) observed that environment group affects moderately the performance of construction projects. This might be because of different location and environmental condition. The following is a brief discussion of the ranking of factors for each group:

Group one: Cost factors:

The relative importance index (RII) and rank of cost factors are summarized in Table 4.11.

Factors	**Owner**		**Consultant**		**Contractor**	
	RII	**Rank**	**RII**	**Rank**	**RII**	**Rank**
(1) Cost factors						
Profit rate of project	0.709	4	0.791	4	0.754	4
Material and equipment cost	0.827	2	0.791	3	0.828	3
Escalation of material prices	0.862	1	0.847	1	0.904	1

Differentiation of coins prices	0.803	3	0.823	2	0.889	2

Source: primary data

Owners view:

As expected, escalation of material prices has been ranked by the owners respondents in the first position with RII equal 0.862. It is worth noticing that this factor is the most important one for owners because continuous closures in the Coastal Region of Kenya lead to rapid shortage of construction materials and escalation of construction material prices. This escalation of material prices affect the liquidity of owners' projects and cost performance of their projects.

Material and equipment cost has been ranked by the owners respondents in the second position with RII equal 0.827. This factor affects the owner's liquidity and project cost performance. This result is in line with Okuwoga (1998) as material and equipment cost in Nigeria construction projects is practically significant for owners because of poor cost control. However, the result of Iyer and Jha (2005) and Ugwu and Haupt (2007) are not in agreement with our result as this factor is not important to owners because cost of materials and equipments rarely affect the cost performance of construction projects. This might be due to different location, economical and
political situation.

Differentiation of coins prices has also been ranked by the owners respondents in the third position with RII equal 0.803. This mainly because cash flow affects the project budget and project cost performance. This result is in agreement with Samson and Lema (2002) because cash flow can give an important evaluation for the cost performance at any stage of project.

Profit of the project has been ranked by the owners respondents in the fourth position with RII equal 0.709. This factor affects the owners' liquidity, project budget and cost performance. Components of project cost. The result of Ugwu and Haupt (2007) is not in line with our result because cost of labors in South Africa rarely affect the project budget and cost performance. This can be attributed to different location, regulations and laws.

Consultants view:

Escalation of material prices has been ranked by the consultants respondents in the first position RII equal 0.862. Continuous closures in the Coastal Region of Kenya due to political tensions lead to rapid shortage of construction materials and escalation of construction material prices. This escalation of material prices affect the cost performance of projects which is related to client's representative.

Differentiation of coins prices has been ranked by the consultants respondents in the third position with RII equal 0.803. This factor is related to clients' representative factors such as owners' liquidity and project budget. Construction projects in the Coastal Region of Kenya suffered from differentiation of coins prices because of difficult political and economical situation (World Bank, 2004).

Profit rate of project has been ranked by the consultants respondents in the fourth position with RII equal 0.709. Cash flow can give an important evaluation for the cost performance at any stage of project. This result is in agreement with Samson and Lema (2002) as cash flow is a significant factor for cost performance evaluation. Profit rate of project has been ranked by the consultants respondents in the fourth position with RII equal 0.791. Profit rate is an important indicator to evaluate cost performance of construction projects. Material and equipment cost has also been ranked by the consultant respondents in the third position with RII equal 0.791. Material and equipment cost is one of the main components of project budget affecting the performance of cost.

Contractors view:

Escalation of material prices has been ranked by the contractors respondents in the first position with RII equal 0.904. This factor is the most important one for contractors because continuous closures of roads in the Coastal region of Kenya lead to rapid shortage of construction materials and escalation of construction material prices. This escalation of material prices affect the liquidity of contractors and profit rate of their projects.

Differentiation of coins prices has been ranked by the contractors respondents in the second position with RII equal 0.874. Differentiation of coins prices affects the project's profit rate for contractors and the contractors' cost performance.

Material and equipment cost has been ranked by the contractors respondents in the third position with RII equal 0.828. This factor is considered as one of project cost components. Therefore, material and equipment cost affects the contractors' profit rate and hence their cost performance. Iyer and Jha (2005) and Ugwu and Haupt (2007) are not in agreement with these result as cost of materials and equipments is not important to contractors and it rarely affect the cost performance. This can be attributed to different economical and political situation.

Comparison between owners, consultants and contractors:

Comparison between owners, consultants and contractors for cost factors are summarized in Table 4.12:

Factors	**Owner**		**Consultant**		**Contractor**	
	RII	**Rank**	**RII**	**Rank**	**RII**	**Rank**
(1) Cost factors						
Profit rate of project	0.709	4	0.791	4	0.754	4
Material and equipment cost	0.827	2	0.791	3	0.828	3
Escalation of material prices	0.862	1	0.847	1	0.904	1
Differentiation of coins prices	0.803	3	0.823	2	0.889	2

Source: primary data

Escalation of material prices has been ranked by the owners and contractors respondents in the first position. This factor has been also been ranked by the consultants respondents in the first position. It is observed that this factor is more important for owners and contractors because escalation of material prices affects the liquidity of owners and the profit rate of contractors. Continuous closures of shops in the Coastal Region of Kenya lead to rapid shortage of construction materials and escalation of construction material prices. This has been necessitated by the political tensions that have been experienced in the region.

Differentiation of coins prices has been ranked by the owners respondents in the third position. It has been ranked by the consultants respondents in the second position and has been ranked by the contractors respondents in the second position. It is not surprising to find out differentiation of coins prices is more important for contractors than for others because this factor affects the contractors' profit rate and cost performance.

Material and equipment cost has been ranked by the owners respondents in the second position but it has been ranked by the consultants and the contractors respondents in the third position. It is remarked that this factor is more important for owners than for others. Material and equipment cost is one of project cost components which affect the owners' liquidity and project budget. Iyer and Jha (2005) and Ugwu and Haupt (2007) are not in line with the result finding as materials and equipments cost rarely affect the cost performance of Indians' and South Africans' construction projects. This can be attributed to different economical and political situation.

Profit rate of project has been ranked by the owners respondents in the fourth position. It has been ranked by the consultants respondents in the fourth position and has been ranked by the contractors respondents in the fourth position. Cash flow is more important for owners and contractors than for consultants because it can give an important evaluation for the owners' and the contractors' cost performance at any stage of project. Samson and Lema (2002) remarked that cash flow is a significant factor for evaluation and measurement of construction projects' cost performance.

Group two: Time factors:

The relative importance index (RII) and rank of time factors are summarized in Table 4.13:

Factors	Owner		Consultant		Contractor	
	RII	Rank	RII	Rank	RII	Rank
Time factors						
Planned time for project	0.768	3	0.775	3	0.780	3
Time needed to implement variation orders and Time needed to rectify defects	0.659	4	0.672	4	0.639	4
Average delay in claim approval and payment approval owner to contractor	0.956	1	0.911	1	0.958	1
Availability of resources as planned through project duration	0.886	2	0.873	2	0.919	2

Source: primary data

Owners view:

Average delay in claim approval and payment approval owner to contractor resulting to materials shortage due to cash flow has been ranked by the owner respondents in the first position with RII equal 0.956. This factor is the most important one for owners because construction projects in the Coastal Region of Kenya is suffering from time performance problems such as delay due to closures and materials shortage. Owners usually feel with this sensitive problem in their projects. Delay in payment from owner to contractor lead to delay of contractors' performance and cause problem in time performance. This may also lead to disputes and claims between owner and contractor of project. All of that will affect the overall performance of project which has been implemented. Karim and Marosszeky (1999) are in line with our result because that average delay in payment from owner to contractor affects the time performance and causes delay of project.

Availability of resources as planned through project duration has been ranked by the owner respondents in the second position with RII equal 0.886. This factor affects directly and practically on project performance such as time. If resources are not available as planned through project duration, the project will suffer from problem of time and cost performance. This result is in line with Samson and Lema (2002) as it is remarked that resource availability affects on processes performance of construction projects. In addition, Iyer and Jha (2005) and Ugwu and Haupt (2007) are in agreement with our result because availability of resources as planned through project duration is an important factor for owners in Indian and South African

Planned time for project construction has been ranked by the owner respondents in the third position with RII equal 0.768. Planned time for project construction may not be suitable practically. If planned time is not suitable for implementation, the performance of project will suffers from delay and disputes between the owner and other parties of project. Owners usually want their projects to finish as early as possible. Cheung et al (2004) and Iyer and Jha (2005) are in agreement with the result as planned time for project construction is an important for owners because this factor affects strongly the time performance.

Time needed to implement variation orders has been ranked by the owner respondents in the fourth position with RII equal 0.768. Time needed to implement variation orders, will affect the performance of basic schedule. Therefore, this will affect the time performance. This result is in line with Samson and Lema (2002) and Cheung et al (2004) as this factor affects strongly the

time performance. For example, estimated schedule will be changed and modified.

Consultants view:

Average delay in claim approval and payment approval from owner to contractor has been ranked by the consultants respondents in the first position with RII equal 0.776. Delay in payment from owner to contractor lead to delay of project performance. This may also lead to disputes and claims between consultant and contractor of project. All of that will affect the overall performance of project which has been implemented. Karim and Marosszeky (1999) are in line with our result as the average delay in payment from owner to contractor affects the time performance because it causes delay of project. Percentage of orders delivered late has been ranked by the consultants respondents in the first position with RII equal 0.911. When orders from consultant to contractor are delivered late, time performance of project will also be delayed. Then the schedule of project will be affected. This result is in agreement with Karim and Marosszeky (1999) because this factor affects strongly on time performance. Consultants usually feel with this sensitive problem in their projects.

Availability of resources as planned through project duration has been ranked by the consultants respondents in the second position with RII equal 0.873. This factor affects directly and practically on project performance such as time. If resources are not available as planned through project duration, the project will suffer from problem of time performance. This result is in agreement with Samson and Lema (2002) and Ugwu and Haupt (2007) as resource availability is an important factor for consultants because it affects the processes performance of construction projects.

Planned time for project construction has been ranked by the consultants respondents in the third position with RII equal 0.768. Planned time for project construction may not be suitable practically. Therefore, the performance of project will suffer from delay and disputes between consultant and contractor. Cheung et al (2004) is in line with the result as this factor affects strongly on time performance.

Contractors view:

Average delay in payment from owner to contractor has been ranked by the contractors respondents in the first position with RII equal 0.958. Delay in payment from owner to contractor lead to delay of contractors' performance and cause problem in time performance. This may also lead to disputes and claims between contractor and consultant of project. All of that will affect the overall performance of project that has been implemented. Karim and Marosszeky (1999) are in line with our result as the average delay in payment from owner to contractor affects the time performance because it causes project delay.

Availability of resources as planned through project duration has been ranked by the contractors respondents in the second position with RII equal 0.919. This factor affects directly and practically on contractors' performance through projects. If resources are not available for contractors as planned through project duration, the project will suffer from problem of time and cost performance. This result is in line with Samson and Lema (2002) because resource availability affects on processes performance of contractors. However, Iyer and Jha (2005) and Ugwu and Haupt (2007) are not in agreement with the result findings as availability of resources as planned through project duration is not important for contractors and it is rarely affects the contractors' time performance. This might be due to different location, political and economical situation.

Planned time for project construction has been ranked by the contractors respondents in the third position with RII equal 0.780. Planned time for project construction may not be suitable practically. Therefore, the performance of project will suffer from delay and disputes between contractor and consultant. Cheung et al (2004) and Iyer and Jha (2005) are in line with our result as planned time for project construction is an important for contractors because this factor affects strongly on contractors performance for project time.

Comparison between owners, consultants and contractors:

Comparison between owners, consultants and contractors for time factors are summarized in Table 4.14:

Factors	Owner		Consultant		Contractor	
	RII	Rank	RII	Rank	RII	Rank
Time factors						
Planned time for project	0.768	3	0.775	3	0.780	3
Time needed to implement variation orders and Time needed to rectify defects	0.659	4	0.672	4	0.639	4
Average delay in claim approval and payment approval owner to contractor	0.956	1	0.911	1	0.958	1
Availability of resources as planned through project duration	0.886	2	0.873	2	0.919	2

Source: primary data

According to owners, consultants and contractors; average delay in claim approval and payment approval owner to contractor According to owners, consultants and contractors; the delay normally causes closures and materials shortage was the most important performance factor as it has the first rank among all factors with RII = 0.956 for owners, 0.911 for consultants and 0.958 for contractors. This agreement between all target groups is traced to the recent difficult economic situation and government procedures in the country. Construction projects in the Coastal Region of Kenya is not an exception from this kind of situation suffering from complex problems because of closures and materials shortage. These problems can be considered as an obstacle for time performance of projects. All owners,

consultants and contractors feel with this sensitive problem in their projects. This agreement between parties is traced to disputes which will happen between project's parties when the payment from owner is delayed. This will affect the performance of project specially time criteria. Karim and Marosszeky (1999) are in agreement with the result findings as the average delay in payment from owner to contractor affects the time performance.

Availability of resources as planned through project duration has been ranked by the owners respondents in the second position. It has been ranked by the consultants respondents in the second position and has been ranked by the contractors respondents in the second position. This factor can be considered as an important for three parties and has a similar rank for all of them. This factor is related to closures and it affects directly on project performance such as time. If resources are not available as planned through project duration, the project will suffer from problem of time performance. This result is in line with Iyer and Jha (2005) because availability of resources as planned through project duration has a similar RII for owners, client representatives and contractors.

Time needed to implement variation order**s** and Time needed to rectify defects has been ranked by the owners respondents in the fourth position and has been ranked by the consultants and contractors respondents in the fourth position. This factor has the same rank for contractors and consultants and it is more important for them because it is related to contractual relationships between them. The contractor cannot implement any stage through project without having orders from project's consultant. Karim and Marosszeky (1999) is in line with these results because this factor affects strongly on time performance Planned time for project construction has been ranked by the owners respondents in the fourth position and has been ranked by the consultants and contractors respondents in the fifth position. This factor is more important for owners as they usually want their projects to finish as early as possible. Cheung et al (2004) and Iyer and Jha (2005) are in agreement with the result findings because this factor affects strongly on time performance and it is considered as an important for owners.

Group three: Quality factors:

Table 4.15 the relative importance index (RII) and rank of quality factors are summarized in the table below.

Factors	Owner		Consultant		Contractor	
	RII	**Rank**	**RII**	**Rank**	**RII**	**Rank**
Quality factors						
Conformance to specification	0.897	1	0.823	3	0.837	3
Availability of personals with high experience and qualification	0.874	2	0.863	1	0.880	1
Quality of equipments and raw materials in project	0.850	3	0.855	2	0.876	2
Participation of managerial levels with decision making	0.827	4	0.799	4	0.815	4
Quality assessment system in Organization and Quality training/meeting	0.721	5	0.727	5	0.758	5

Source: primary data

Owners view

Conformance to specification has been ranked by the owner's respondents in the first position with RII equal 0.897 though it is ranked third position by consultants 0.823 and 0.837 with contractors respectively. This factor is the most important one for owners because this factor is an important to owner's satisfaction in term of performance and meeting of the desired end product that meets the owners specifications and standards. The owner usually seeks to implement project according to specification. Iyer and Jha (2005) are in agreement with the result as this factor is significant for owners because this factor is strongly related to client satisfaction.

Availability of personals with high experience and qualification has been ranked by the owners respondents in the second position with RII equal 0.874 and in the first position by both the consultants and contractors with RII equal 0.863 and 0.880 respectively. Availability of personals with high experience and qualification in project lead to implementation of project with suitable cost, time and with professional quality which satisfy the owner. This result is related to Cheung et al (2004) and Iyer and Jha (2005) results as this factor affects strongly on project performance because it affects strongly the degree of owners satisfaction.

Quality of equipments and raw materials in project has been ranked by the owners respondents in the third position with RII equal 0.850 while it has been ranked second by both the consultants and contractors with RII equal 0.855 and 0.876 respectively. The owners usually want materials used in their project with a good quality and according to specification. In the Coastal Region of Kenya, most of available materials are with little variation in quality and produced by a limited number of producers. Based on Cheung et al (2004) and Iyer and Jha (2005), this factor affects the project performance and the degree of owners satisfaction.

Participation of managerial levels with decision-making has been ranked by the owners, consultants and contractors

respondents in the fourth position with RII equal 0.827, 0.799 and 0.815 respectively. If managerial levels share with decision making, this will lead to better implementation of project and this will satisfy the owner with more degree. Iyer and Jha (2005) are in agreement with the result as this factor is practically significant for owners because decision-making depends mainly on work group and participation of working levels.

Quality assessment system in organization has been ranked by the owners consultants and contractors respondents in the fifth position with RII equal 0.827, 0.799 and 0.815 respectively. Quality assessment system in organization is rarely achieved or implemented through construction projects in the Coastal Region of Kenya. This result is in line with Iyer and Jha (2005) and Ugwu and Haupt (2007) as this factor is not significant to owners because of absence of practical quality assessment system in Indian and South African construction projects. However, Samson and Lema (2002) are not in line with the result as this factor affects on contractors performance.

Consultants view

Availability of personals with high experience and qualification has been ranked by the consultants respondents in the first position with RII equal 0.863. This factor is the most important one for consultants because availability of personals with high experience and qualification assist consultants to supervise the project with a good professionalism and also this assist them to satisfy the owner with a successful performance of project. This result is in agreement with Cheung et al (2004) and Iyer and Jha (2005) as this factor affects strongly on project performance because it affects strongly the degree of owners satisfaction which is one of the main responsibilities of consultants.

Quality of equipments and raw materials in project has been ranked by the consultants respondents in the second position with RII equal 0.855. Consultants usually want materials used in supervised project with a good quality and according to specification. Based on Cheung et al (2004) and Iyer and Jha (2005), this factor affects the project performance and the degree of owners satisfaction which is one of the main responsibilities of consultants.

Conformance to specification has been ranked by the consultants respondents in the third position with RII equal 0.823. This factor is an important to client representative satisfaction because it is mainly related to owner satisfaction. Iyer and Jha (2005) are in agreement with the result as this factor is significant for client representative because this factor is strongly related to client satisfaction.

Participation of managerial levels with decision-making has been ranked by the consultants respondents in the fourth position with RII equal 0.799. If managerial levels share with decision making, this will lead to better performance of project and this will satisfy the client representative with more degree. Iyer and Jha (2005) are in agreement with our result as this factor is practically significant for client representative because decision-making depends mainly on participation of working levels.

Quality assessment system in organization and quality training/meeting has been ranked by the consultants respondents in the fifth position with RII equal 0.727. Quality training/meeting is rarely achieved or implemented in construction projects in the Coastal Region of Kenya. However, this result is not in agreement with Samson and Lema (2002) as this factor affects strongly on quality performance of construction projects.

Contractors view

Availability of personals with high experience and qualification has been ranked by the contractors respondents in the first position with RII equal 0.880. This factor is the most important one for contractors because availability of personals with high experience and qualification assist contractors to implement their projects with a successful and suitable performance. In the Coastal Region of Kenya, the majority of site managers are civil engineers with good work experience but little training or education in management. Samson and Lema (2002), Cheung et al (2004) and Iyer and Jha (2005) are in line with the result as this factor is very important to contractors because it affects strongly on quality performance of construction projects.

Quality of equipments and raw materials in project has been ranked by the contractors respondents in the second position with RII equal 0.876. Contractors must implement their projects according to required and agreed quality because owners and consultants usually want materials used in supervised project according to specification and agreement. Based on Cheung et al (2004) and Iyer and Jha (2005), this factor affects the quality performance and the degree of owners and consultants satisfaction.

Conformance to specification has been ranked by the contractors respondents in the third position with RII equal 0.837. This factor is significant for contractors as it is related to consultants and owners satisfaction. Iyer and Jha (2005) are in agreement with the result as this factor is significant for contractors because this factor is related to consultants and clients satisfaction.

Participation of managerial levels with decision-making has been ranked by the contractors respondents in the fourth position with RII equal 0.815. If managerial levels share with decision making, this will lead to better performance of project and this will satisfy both of consultant and owner with more degree. Iyer and Jha (2005) are in agreement with the result as this factor is practically significant for contractors because decision-making depends mainly on participation of working levels.

Quality assessment system in organization and quality training/meeting been ranked by the contractors respondents in the fifth position with RII equal 0.758. Quality assessment system in organization is rarely achieved or implemented for contractors in the Coastal region of Kenya. Ugwu and Haupt (2007) are in agreement with our result as this factor is not important to contractors because of absence of quality assessment systems in South African construction projects. However, Samson and Lema (2002) and Iyer and Jha (2005) are not in line with the result findings as this factor is significant for contractors performance in Tanzania and India construction projects. This might be due to different location and different managerial properties.

Group four: Productivity factors:

The relative importance index (RII) and rank of productivity factors are summarized in Table 4.16:

Factors	Owner		Consultant		Contractor	
	RII	Rank	RII	Rank	RII	Rank
Productivity factors						
Project complexity	0.744	4	0.727	2	0.776	2
Management-labor relationship	0.791	3	0.703	3	0.758	3
Absenteeism rate through project	0.791	2	0.703	4	0.758	4
Sequencing of work according to Schedule	0.815	1	0.821	1	0.819	1

Source: primary data

Owners view:

Sequencing of work according to schedule has been ranked by the owner's respondents in the first position with RII equal 0.815. This factor is the most important one for owners because sequencing of work according to schedule assists the owner to deliver project according to scheduled time for project completion. Samson and Lema (2002) are in agreement with the result as sequencing of work affects the productivity performance of construction projects.

Absenteeism rate through project has been ranked by the owners respondents in the second position with RII equal 0.791. Absenteeism through project will affect the productivity performance of project. Therefore, the owner will suffer from delay of project. This result is in agreement with Samson and Lema (2002) and Iyer and Jha (2005) as it is remarked that absenteeism through project implementation is very important for owners because it affects on productivity performance of construction projects.

Management-labor relationship has also been ranked by the owners respondents in the third position with RII equal 0.791. Management-labor relationship can assist for strong coordination and motivation between labor level and managerial level. This will assist for implementation of project with success productivity and good performance. All of that will satisfy the owner of project. This result is in line with Samson and Lema (2002) as management-labor relationship is significant for productivity performance of construction projects. However, Iyer and Jha (2005) are not in agreement with the result as this factor is moderately important for owners in Indian construction projects. This might be due to different location and culture.

Project complexity has been ranked by the owners respondents in the fourth position with RII equal 0.776. Project complexity affect the degree of overall performance through project. Iyer and Jha (2005) are not in line with our result as this factor is moderately important for owners. In addition, Ugwu and Haupt (2007) are not in agreement with our result as this factor is not important for owners. This might be due to different locations and projects types.

Consultants view:

Sequencing of work according to schedule has been ranked by the consultants respondents in the first position with RII equal 0.821. This factor is the most important one for consultant because sequencing of work according to schedule assists consultant to deliver project to the owner according to scheduled time for project completion. Samson and Lema (2002) are in agreement with our result as sequencing of work affects the productivity performance of construction projects. Project complexity has been ranked by the consultants respondents in the second position with RII equal 0.727. Degree of project complexity is correlated with experiences required for supervision and skills needed to monitor and supervise performance of project. Iyer and Jha (2005) are not in line with our result as this factor is moderately important for client representatives in Indian construction projects. In addition, Ugwu and Haupt (2007) are not in agreement with the result as this factor is not important for consultants. This might be because of different locations and projects types. Absenteeism rate through project has been ranked by the consultants respondents in the third position with RII equal 0.703. Absenteeism through project will affect the productivity and time performance of project. Samson and Lema (2002) are in agreement with our result as absenteeism affects the productivity performance of construction projects.

Management-labor relationship has also been ranked by the consultants respondents in the third position with RII equal 0.703. Management-labor relationship can assist for strong coordination and motivation between contractor level and consultant level. This will lead to implement project with success supervision and so good performance of consultant. This result is in agreement with Samson and Lema (2002) as management-labor relationship is significant for productivity performance of construction projects.

Contractors view:

Sequencing of work according to schedule has been ranked by the contractors respondents in the first position with RII equal 0.819. This factor is the most important one for contractors because sequencing of work according to schedule assists contractors to implement project according to scheduled time for project completion. Therefore, the contractors will not suffer from time and cost performance problems. Samson and Lema (2002) are in line with our result as sequencing of work affects the productivity performance of contractors.

Management-labor relationship has been ranked by the contractors respondents in the third position with RII equal 0.758. Management-labor relationship can assist for strong coordination and motivation between labor level and managerial level. This will lead to implement project with success productivity and suitable time performance of project. Samson and Lema (2002) are in agreement with our result as management-labor relationship is significant for productivity performance of construction projects. However, Iyer and Jha (2005) are not in agreement with our result as this factor is

moderately important for contractors. This might be due to different location, culture and management coordination.

Project complexity has been ranked by the contractors respondents in the second position with RII equal 0.776. Degree of project complexity is related with experiences required for implementation and skills needed to construct project. All of that affect on the degree of contractors performance. Ugwu and Haupt (2007) are in line with our result as this factor is an important for contractors because performance of construction projects mainly depends up on project complexity. However, Iyer and Jha (2005) are not in agreement with the result as this factor is moderately important for contractors in India. This might be because of different location and construction projects nature.

Absenteeism rate through project has been ranked by the contractors respondents in the fourth position with RII equal 0.758. Absenteeism through project will affect the productivity. The contractor will suffer from time performance problem. This result is in agreement with Samson and Lema (2002) and Iyer and Jha (2005) as absenteeism through project implementation is very important for contractors because it affects the productivity performance of contractors.

Comparison between owners, consultants and contractors:
Comparison between owners, consultants and contractors for productivity factors are summarized in Table 4.17:

Factors	Owner		Consultant		Contractor	
	RII	Rank	RII	Rank	RII	Rank
Productivity factors						
Project complexity	0.744	4	0.727	2	0.776	2
Management-labor relationship	0.791	3	0.703	3	0.758	3
Absenteeism rate through project	0.791	2	0.703	4	0.758	4
Sequencing of work according to Schedule	0.815	1	0.821	1	0.819	1

Source: primary data

Sequencing of work according to schedule has been ranked by owners, consultants and contractors in the first position. This factor is the most important one for three parties because sequencing of work according to schedule assists them to perform project according to scheduled time for project completion. Therefore, there is no delay or cost overruns. Samson and Lema (2002) are in line with our result as sequencing of work affects the productivity performance of contractors.

Management-labor relationship has been ranked by owners and contractors respondents in the second position and has been ranked by consultants respondents in the third position. However, this factor is considered as an important for three parties as management-labor relationship can assist them for strong coordination and motivation between labor level and managerial level. This will lead to implement project with success productivity and so good performance of project. This result is in line with Samson and Lema (2002) as management-labor relationship is significant for productivity performance of construction projects. However, Iyer and Jha (2005) are not in agreement with our result as this factor is moderately important for owners and contractors. This might be due to different location and culture.

Group five: Client Satisfaction factors:

The relative importance index (RII) and rank of client satisfaction factors are summarized in Table 4.18:

Factors	Owner		Consultant		Contractor	
	RII	Rank	RII	Rank	RII	Rank
Client Satisfaction factors						
Information coordination between owner and project parties	0.744	3	0.807	2	0.824	2
Leadership skills for project Manager /Owner	0.850	1	0.863	1	0.919	1
Number of disputes between owner and project parties	0.768	2	0.743	3	0.735	3

Source: Primary data

Owners view:

Leadership skills for project manager have been ranked by the owners respondents in the first position with RII equal 0.850. This factor is the most important one for owners because leadership skills for project manager affect the degree of project performance and client satisfaction. This result is in line with Cheung et al (2004) as this factor is an important for effectiveness on project performance. Otherwise, Iyer and Jha (2005) are not in agreement with our result as this factor is moderately important for owners. This might be due to different location and management style.

Number of disputes between owner and project parties have been ranked by the owners respondents in the second position with RII equal 0.753. Disputes between owner and project parties will affect on relationship between them and also the degree of client satisfaction will be decreased. All of that can affect the performance of project. Samson and Lema (2002) and Iyer and Jha (2005) are in agreement with our result as this factor is high

important for owners because number of disputes affects strongly on client satisfaction and project performance.

Information coordination between owner and project parties has been ranked by the owners respondents in the third position with RII equal 0.744. Information coordination between owner and project parties will lead to strong relationship between them and the client will be more satisfied. Samson and Lema (2002) and Cheung et al (2004) are in line with the result as this factor is an important for effectiveness on construction project performance because information coordination affects on client satisfaction. On the other hand, Iyer and Jha (2005) are not in agreement with our result as this factor is moderately important for owners. This might be because of different location and culture. Speed and reliability of service to owner has been ranked by the owners respondents in the fourth position with RII equal 0.718. This factor increases the degree of satisfaction with respect to client. This result is in line with Cheung et al (2004) and Iyer and Jha (2005) as this factor this factor is very important for owners because it affects strongly on client satisfaction.

Consultants view:

Leadership skills for project manager have been ranked by the consultants respondents in the first position with RII equal 0.848. This factor is the most important one for consultants because leadership skills for project manager assist consultants to supervise the project with strong and suitable performance. This will convenient and satisfy the client of project. Cheung et al (2004) is in line with the result as this factor is an important for effectiveness on project performance because client satisfaction depends up on it. Information coordination between owner and project parties has been ranked by the consultants respondents in the second position with RII equal 0.807. Information coordination between owner and project parties will lead to strong relationship between owner and consultant. Therefore, the client will be more satisfied. Samson and Lema (2002) and Cheung et al (2004) are in agreement with our result as this factor is an important for effectiveness on construction project performance because it affects the client satisfaction.

Number of disputes between owner and project parties have been ranked by the consultants respondents in the third position with RII equal 0.743. Disputes between owner and consultant will affect on relationship between them and the degree of client satisfaction will be affected. Al of that can affects the performance of project. Samson and Lema (2002) are in agreement with our result as this factor is an important for construction project performance because it affects strongly on client satisfaction.

Number of reworks has been ranked by the consultants respondents in the third position with RII equal 0.743. This factor has an effect on client satisfaction and project performance. Samson and Lema (2002) are in line with our result as number of reworks affects the project performance because it affects the client satisfaction.

Contractors view:

Leadership skills for project manager have been ranked by the contractors respondents in the first position with RII equal 0.919 for contractors. This factor is the most important one for contractors because leadership skills for project manager affect the construction contractors performance. Cheung et al (2004) and Iyer and Jha(2005) are in line with our result as this factor is an important for contractors because it is significant for effectiveness on project performance.

Information coordination between owner and project parties will lead to success construction contractors performance and strong relationship between project parties. Samson and Lema (2002) Cheung et al (2004) are in agreement with our result as this factor is an important for contractors because information coordination affects the client satisfaction and project performance. However, Iyer and Jha (2005) are not in line with our result as this factor is moderately important for contractors. This might be due to different location and management style.

Number of disputes between owner and project parties have been ranked by the contractors respondents in the third position with RII equal 0.735. Disputes between owner and contractor will affect the relationship between them and the degree of client satisfaction will be affected. Al of that affects on performance of contractors. Samson and Lema (2002) and Iyer and Jha (2005) are in agreement with our result as this factor is high important for contractors because number of disputes affects strongly on client satisfaction and construction contractors performance.

Comparison between owners, consultants and contractors:

Comparison between owners, consultants and contractors for client satisfaction factors are summarized in Table 4.19:

Factors	Owner		Consultant		Contractor	
	RII	Rank	RII	Rank	RII	Rank
Client Satisfaction factors						
Information coordination between owner and project parties	0.744	3	0.807	2	0.824	2
Leadership skills for project Manager /Owner	0.850	1	0.863	1	0.919	1
Number of disputes between owner and project parties	0.768	2	0.743	3	0.735	3

Source: primary data

Leadership skills for project manager have been ranked by owners, consultants and contractors respondents in the first position. This factor is the most important one for three parties because leadership skills for project manager affect the degree of project performance and client satisfaction. Cheung et al (2004) observed that this factor is an important for effectiveness on project performance. Cheung et al (2004) are in line with our result as this factor is an important for three parties because it is significant for effectiveness on project performance. Number of

reworks has been ranked by owners, consultants and contractors respondents in the fifth position. This factor has the same rank for three parties because number of reworks affect the relationship between them. This result is in line with Samson and Lema (2002) as number of reworks affects the client satisfaction and overall project performance.

Number of disputes between owner and project parties have been ranked by owners respondents in the second position and have been ranked by consultants and contractors respondents in the third position. This factor is more important for owners because disputes between owner and project parties will affect on relationship between them and the degree of client satisfaction will be affected. All of that affects the performance of project. Samson and Lema (2002) and Iyer and Jha (2005) are in agreement with our result as this factor is high important for owners and contractors because number of disputes affects strongly on client satisfaction and construction performance.

Information coordination between owner and project parties has been ranked by the owners and contractors respondents in the third position and has been ranked by the consultant respondents in the second position. This factor is more important for consultants because in formation coordination affects the client satisfaction. Consultants usually are related to client factors. Samson and Lema (2002) and Cheung et al (2004) are in line with our result as this factor is an important for effectiveness on construction project performance because it affects the client satisfaction.

Group six: Regular and Community Satisfaction factors:

The relative importance index (RII) and rank of regular and community satisfaction factors are summarized in Table 4.20:

Factors	Owner		Consultant		Contractor	
	RII	**Rank**	**RII**	**Rank**	**RII**	**Rank**
Regular and community satisfaction factors						
Cost of compliance to regulators owner and project parties owner and project parties	0.615	4	0.663	3	0.619	4
Number of non compliance to regulation	0.650	3	0.639	4	0.629	3
Quality and availability of regulator documentation	0.662	2	0.751	1	0.668	2
Neighbors and site conditions Problems	0.803	1	0.727	2	0.725	1

Source: primary data

Owners view

Neighbors and site conditions problems have been ranked by the owners respondents in the first position with RII equal 0.803. This factor is the most important one for owners because construction projects in the Coastal Region of Kenya usually suffer from this problem due to effects caused to the environment by construction works. This problem affects the time performance of project and causes disputes and delays. Iyer and Jha (2005) are not in agreement with our result as this factor is not important for owners. This might be because of different location, environment and culture. Quality and availability of regulator documentation has been ranked by the owners respondents in the second position with RII equal 0.662. Quality and availability of regulator documentation affects the regular and community satisfaction. Project performance will also be affected. This result is in line with Samson and Lema (2002) as this factor affects the project performance because it affects the regular and community satisfaction.

Number of non-compliance to regulation has been ranked by the owners respondents in the third position with RII equal 0.650. The more increase of non compliance to regulation, the more dissatisfaction of regular and community for project. This will affect the project performance. This result is in agreement with Samson and Lema (2002) as this factor affects the project performance because it affects the regular and community satisfaction.

Cost of compliance to regulators requirements has been ranked by the owners respondents in the fourth position with RII equal 0.615. Cost of compliance to regulators requirements affects the cost performance of project. Samson and Lema (2002) is in line with our result as this factor affects the regular and community satisfaction.

Consultants view

Quality and availability of regulator documentation has been ranked by the consultants respondents in the first position with RII equal 0.751. This factor is the most important one for consultants as quality and availability of regulator documentation affects the regular and community satisfaction. Project performance will also be affected. This result is in line with Samson and Lema (2002) as this factor affects the project performance because it affects the regular and community satisfaction.

Neighbors and site conditions problems has been ranked by the consultants respondents in the second position with RII equal 0.727. Construction projects in the Coastal Region of Kenya usually suffer from this problem. This problem affects the consultant performance of project and causes disputes and delays. Iyer and Jha (2005) are not in line with our result as this factor is not important for client representative. This might be because of different location and culture. Cost of compliance to regulators requirements has been ranked by the consultants respondents in the third position with RII equal 0.663. Cost of

compliance to regulators requirements affects the cost performance of project. Samson and Lema (2002) is in line with our result as this factor affects the regular and community satisfaction.

Number of non-compliance to regulation has been ranked by the consultants respondents in the fourth position with RII equal 0.639. The more increase of noncompliance to regulation, the more dissatisfaction of regular and community for project. This will affect the project performance. This result is in agreement with Samson and Lema (2002) as this factor affects the project performance because it affects the regular and community satisfaction.

Consultant view

Neighbors and site conditions problems has been ranked by the contractors respondents in the first position with RII equal 0.725. Contractors considered this factor as the most important one because construction projects in the Coastal Region of Kenya usually suffer from this problem. This problem affects the performance of contractors and causes disputes and delay of project. Iyer and Jha (2005) are not in agreement with our result as this factor is not important for contractors. This might be because of different location, environment and culture affects the project performance because it affects the regular and community satisfaction.

Neighbors and site conditions problems has been ranked by the consultants respondents in the second position with RII equal 0.725. Construction projects in the Coastal Region of Kenya usually suffer from this problem. This problem affects the consultant performance of project and causes disputes and delays. Iyer and Jha (2005) are not in line with our result as this factor is not important for client representative. This might be because of different location and culture.

Cost of compliance to regulators requirements has been ranked by the consultants respondents in the fourth position with RII equal 0.663. Cost of compliance to regulators requirements affects the cost performance of project. Samson and Lema (2002) is in line with our result as this factor affects the regular and community satisfaction.

Number of non-compliance to regulation has been ranked by the consultants respondents in the fourth position with RII equal 0.639. The more increase of noncompliance to regulation, the more dissatisfaction of regular and community for project. This will affect the project performance. This result is in agreement with Samson and Lema (2002) as this factor affects the project performance because it affects the regular and community satisfaction.

Contractors view

Neighbors and site conditions problems has been ranked by the contractors respondents in the first position with RII equal 0.725. Contractors considered this factor as the most important one because construction projects in the Coastal Region of Kenya usually suffer from this problem. This problem affects the performance of contractors and causes disputes and delay of project. Iyer and Jha (2005) are not in agreement with our result as this factor is not important for contractors. This might be because of different location, environment and culture.

The relative importance index (RII) and rank of regular and community satisfaction factors are shown below in table 4.21

Factors	Owner		Consultant		Contractor	
	RII	Rank	RII	Rank	RII	Rank
Regular and community satisfaction factors						
Cost of compliance to regulators owner and project parties owner and project parties	0.615	4	0.663	3	0.619	4
Number of non compliance to regulation	0.650	3	0.639	4	0.629	3
Quality and availability of regulator documentation	0.662	2	0.751	1	0.668	2
Neighbors and site conditions Problems	0.803	1	0.727	2	0.725	1

Source: primary data

Neighbors and site conditions problems has been ranked by the owners and contractors respondents in the first position and has been ranked by the consultants respondents in the second position. This factor is more important for owners and contractors because it is strongly related to client satisfaction and contractors performance. However, Iyer and Jha (2005) are not in line with our result as this factor is not important for owners and contractors. This might be because of different location, environment and culture.

Quality and availability of regulator documentation has been ranked by the consultants respondents in the first position and has been ranked by the owners and contractors respondents in the second position. Quality and availability of regulator documentation is more important for consultants because if affects the performance of consultants and community satisfaction. This result is in line with Samson and Lema (2002) as this factor affects the contractors' performance because it affects the regular and community satisfaction.

It is obtained that there is a strong agreement between owners and contractors for ranking of all regular and community satisfaction factors because these factors are more related to contractors' performance and client satisfaction. Generally, it can be said that three parties have similar agreement for ranking of these factors.

Group seven: People factors:

The relative importance index (RII) and rank of people factors are summarized in Table 4.22.

Factors	Owner		Consultant		Contractor	
	RII	Rank	RII	Rank	RII	Rank
People factors						
Employee attitudes in project	0.697	3	0.743	1	0.810	2
Recruitment and competence development between employees	0.768	2	0.703	3	0.824	1
Employees motivation Belonging to work	0.780	1	0.711	2	0.806	3

Source: primary data

Owners view

Employees' motivation Belonging to work has been ranked by the owners respondents in the first position with RII equal 0.780. Employees' motivation leads to belonging to work and productivity will be improved. However, this result is not in agreement with Iyer and Jha (2005) as this factor is moderately important for owners. This might be due to different culture and management style.

Recruitment and competence development between employees has been ranked by the owners respondents in the second position with RII equal 0.768. Recruitment and competence development between employees improve performance of project and the client will be more satisfied. Samson and Lema (2002) are in line with our result as this factor enhance quality and productivity performance of construction projects. Employee attitudes in project have been ranked by the owners respondents in the third position with RII equal 0.697. Employee attitudes affects the project performance and owner satisfaction. This result is in agreement with Iyer and Jha (2005) as this factor is considered as an important for owners because attitudes of employees is related to client satisfaction and project performance.

Consultants view

Employee attitudes in project have been ranked by the consultant respondents in the third position with RII equal 0.743. Employee attitudes affects the project performance and owner satisfaction. This result is in agreement with Iyer and Jha (2005) as this factor is considered as an important for owners because attitudes of employees is related to client satisfaction and project performance.

Employees' motivation has been ranked by the consultants respondents in the second position with RII equal 0.711 Employees' motivation leads to more belonging to work and performance of project will be improved. Recruitment and competence development between employees has been ranked by the consultants respondents in the fourth position with RII equal 0.688. Recruitment and competence development between employees improve performance of consultants through projects and the client will be more satisfied. Samson and Lema (2002) are in line with our result as this factor enhances quality and productivity performance of construction projects.

Recruitment and competence development between employees has been ranked by the owners respondents in the third position with RII equal 0.703. Recruitment and competence development between employees improve performance of project and the client will be more satisfied. Samson and Lema (2002) are in line with our result as this factor enhance quality and productivity performance of construction projects.

Contractors view

Recruitment and competence development between employees has been ranked by the consultant respondents in the first position with RII equal 0.824. Recruitment and competence development between employees improve performance of project and the client will be more satisfied. Samson and Lema (2002) are in line with our result as this factor enhances quality and productivity performance of construction projects.

Employee attitudes in project have been ranked by the consultant respondents in the second position with RII equal 0.810. Employee attitudes affects the project performance and owner satisfaction. This result is in agreement with Iyer and Jha (2005) as this factor is considered as an important for owners because attitudes of employees is related to client satisfaction and project performance.

Employees' motivation has been ranked by the consultants respondents in the third position with RII equal 0.806 Employees' motivation leads to more belonging to work and performance of project will be improved. Recruitment and competence development between employees has been ranked by the consultants respondents in the fourth position with RII equal 0.688. Recruitment and competence development between employees improve performance of consultants through projects and the client will be more satisfied. Samson and Lema (2002) are in line with our result as this factor enhances quality and productivity performance of construction projects.

Comparison between owners, consultants and contractors:

Comparison between owners, consultants and contractors for people factors are summarized in Table 4.23:

Factors	Owner		Consultant		Contractor	
	RII	Rank	RII	Rank	RII	Rank
People factors						
Employee attitudes in project	0.697	3	0.743	1	0.810	2
Recruitment and competence development between employees	0.768	2	0.703	3	0.824	1
Employees motivation Belonging to	0.780	1	0.711	2	0.806	3

work

Source: primary data

Employees motivation Belonging to work has been ranked by the owners respondents in the first position while it has been ranked by consultants and contractors in the second and third. This factor is the most important one for three parties because belonging to work usually improves productivity and performance of project. Iyer and Jha (2005) are in agreement with this result as this factor is an important for three parties because belonging to works improve productivity and performance of project.

Recruitment and competence development between employees has been ranked by the owners respondents in the second position. It has been ranked by the consultants respondents in the third position and has been ranked by the contractors respondents in the first position. It is remarked that this factor is important for contractors because contractors require competent employees in the Coastal Region of Kenya. Iyer and Jha (2005) remarked that this factor is moderately important for contractors because of absence of recruitment and competence development between employees system in construction projects. However, other factors are obtained that more important for one party than others as shown previously.

Group ten: Environment factors:

The relative importance index (RII) and rank of environment factors are summarized in Table 4.24:

Factors	Owner		Consultant		Contractor	
	RII	Rank	RII	Rank	RII	Rank
(8) Environment factors						
Air quality	0.603	3	0.607	2	0.686	2
Noise level	0.580	4	0.527	4	0.628	4
Wastes around the site	0.650	2	0.599	3	0.664	3
Climate condition in the site	0.744	1	0.671	1	0.722	1

Source: primary data

Owners view

Climate condition in the site has been ranked by the owners respondents in the first position with RII equal 0.744. This factor is the most important one for owners because climate condition in the site affects the productivity and time performance of project. This result is not in line with Iyer and Jha (2005) as climate condition is not important for owners because of different location, weather and environment.

Wastes around the site have been ranked by the owners respondents in the second position with RII equal 0.650. Wastes around the site affect the health and safety of employees. This result is in agreement with Cheung et al (2004) as wastes around the site affect strongly the performance of project. However, Ugwu and Haupt (2007) are not in agreement with our result as this factor is not important to owners. This might be because of different location and environment.

Air quality has been ranked by the owners respondents in the third position with RII equal 0.603 Air quality affects the health, safety and productivity performance. Cheung et al (2004) observed that air quality affects strongly the performance of project. However, Ugwu and Haupt (2007) obtained that this factor is not important to owners. This might be because of different location and environment.

Noise level has been ranked by the owners respondents in the fourth position with RII equal 0.580. Noise level affects the productivity performance of project. Ugwu and Haupt (2007) obtained that this factor is not important for owners. This might be because of different location and environment.

Consultants view

Climate condition in the site has been ranked by the consultants respondents in the first position with RII equal 0.671. Consultants considered this factor as the most important one because climate condition in the site affects the productivity and time performance of project. Iyer and Jha (2005) are not in agreement with our result as climate condition is not important for consultants. This might be due to different location, whether and environment.

Air quality has been ranked by the consultants respondents in the second position with RII equal 0.592. Air quality affects the health, safety and productivity performance. Cheung et al (2004) observed that air quality affects strongly the performance of project. However, Ugwu and Haupt (2007) obtained that this factor is not important to consultants. This might be because of different location and environment.

Wastes around the site have been ranked by the consultants respondents in the third position with RII equal 0.599. Wastes around the site affects the health and safety of employees. Cheung et al (2004) remarked that wastes around the site affect strongly the performance of project. However, Ugwu and Haupt (2007) obtained that this factor is not important to consultants. This might be because of different location and environment. Noise level has been ranked by the consultants respondents in the fourth position with RII equal 0.527. Noise level affects the productivity performance of project. Ugwu and Haupt (2007) obtained that this factor is not important for consultants. This might be because of different location and environment.

Contactors view

Climate condition in the site has been ranked by the contractors respondents in the first position with RII equal 0.722. Contractors considered this factor as the most important one because climate condition in the site affects the productivity and time performance of project. This result is not in agreement with Iyer and Jha (2005) as climate condition is not important for contractors. This might be because of different location, weather and environment.

Air quality has been ranked by the contractors respondents in the second position with RII equal 0.686. Air quality affects the

health, safety and productivity performance of contractors. Cheung et al (2004) and Ugwu and Haupt (2007) are in line with our result as this factor is very important for contractors because it affects strongly the performance of contractors.

Wastes around the site have been ranked by the contractors respondents in the third position with RII equal 0.664. Wastes around the site affects the health and safety of employees. Cheung et al (2004) observed that wastes around the site affect strongly the performance of project. However, Ugwu and Haupt (2007) obtained that this factor is not important to contractors. This might be because of different location and environment.

Noise level has been ranked by the contractors respondents in the fourth position with RII equal 0.628. Noise level affects the productivity performance of contractors. Ugwu and Haupt (2007) obtained that this factor is moderately important for contractors. This might be because of different location and environment.

Comparison between owners, consultants and contractors:

Comparison between owners, consultants and contractors for environment factors are summarized in Table 4.25:

Factors	Owner		Consultant		Contractor	
	RII	Rank	RII	Rank	RII	Rank
(8) Environment factors						
Air quality	0.603	3	0.607	2	0.686	2
Noise level	0.580	4	0.527	4	0.628	4
Wastes around the site	0.650	2	0.599	3	0.664	3
Climate condition in the site	0.744	1	0.671	1	0.722	1

Source: primary data

Climate condition in the site has been ranked by the owners, consultants and contractors respondents in the first position. This factor is the most important one for them because it affects the productivity and time performance of project. This result is not in agreement with Iyer and Jha (2005) as climate condition is not important for three parties. This might be because of different location, weather and environment.

Noise level has been ranked by the owners, consultants and contractors respondents in the fourth position. However, for all parties, noise level is less important than other environmental factors because it is rarely obtained in the coastal region of Kenya Ugwu and Haupt (2007) remarked that this factor is not important for owners and consultants but it is moderately important for contractors. Generally, noise level affects the productivity performance of construction projects.

Degree of Agreement among the Owners, Contractors and Consultants Regarding Factors Affecting the Performance of Construction Projects.

To determine whether there is a significant degree of agreement among the three groups (Owners, Contractors and Consultants) Kendall's Coefficient of Concordance is used as a measure of agreement among raters. Each case is a judge or rater and each variable is an item or person being judged. For each variable, the sum of ranks is computed. Kendall's W, ranges between zero (no agreement) and one (complete agreement).

To determine whether there is degree of agreement among the levels of each of the factors affecting the performance of construction projects for each owner, contractors and consultants, Kendall's Coefficient of Concordance says that the degree of agreement on a zero to one scale is (Moore et al, 2003; Frimpong et al, 2003):

$$W = \frac{12U - 3m^2 n (n-1)^2}{M^2 n (n-1)} \quad (1)$$

$$U = \sum_{i=1}^{n} R$$

□ n = number of factors;
□ m = number of groups;
□ j = the factors 1,2,.,N.
□ Null Hypothesis: H0 : There is insignificant degree of agreement among the
Owners , Contractors and Consultants.
□ Alternative Hypothesis: H1 : There is significant degree of agreement among the
Owners , Contractors and Consultants.

Table 4.26 shows the results of Kendall's Coefficient of Concordance for each group:

Field	W	Chi-square	P-Value	Decision
Cost factors	0.586	152.946	0.000	Reject H0
Time Factors	0.457	119.277	0.012	Reject H0
Quality Factors	0.586	152.946	0.000	Reject H0
Client satisfaction factors	0.537	140.157	0.000	Reject H0
People Factors	0.484	126.324	0.004	Reject H0
Environmental factors	0.217	56.637	0.995	Don't Reject H0
All factors	0.507	132.327	0.001	Reject H0

Source: primary data

The agreement is significant at level of significant á = 0.05

For Cost, Time, Quality, Productivity, Client Satisfaction, People and environmental factors, and all groups together, the p-values (Sig.) are less than á = 0.05 (á is the level of significance) the null hypothesis, H0, is rejected and the alternative hypothesis, H1, is accepted. Therefore, it can be said that there is a significant degree of agreement among the owners, contractors and consultants regarding factors affecting the performance of construction projects in the Coastal Region of Kenya.

On the other hand, for regular and community satisfaction, Health and Safety, and Environment factors, the p-values (Sig.) are greater than á = 0.05 (á is the level of significance) then we don't reject the null hypothesis, H0. Therefore, it can be said that there is insufficient evidence to support the alternative hypothesis, H1. Hence, there is insignificant degree of agreement among the owners, contractors and consultants regarding factors affecting the performance of construction projects in the Coastal Region of Kenya.

Means Differences of the Respondents Agreements Regarding the Factors Affecting the Performance of Construction Projects

The Kruskal-Wallis. (KW) test is a statistical test that is used to compare the ranks means between two or more samples. This test is used in order to check out if there are any significant differences in the point of view of the respondents (Owners, Contractors and Consultants) regarding the levels of each of the factors affecting the performance of construction projects. The KW results are shown in the following.

Table (4.27) Kruskal- Wallis test for factors affecting the performance of construction Projects

Field	KW value	DF	P-Value (Sig)
Cost factors	2.141	2	0.343
Time Factors	0.097	2	0.953
Quality Factors	0.004	2	0.998
Client satisfaction factors	2.634	2	0.268
People Factors	4.456	2	0.108
Environmental factors	2.949	2	0.753

DF : Degrees of Freedom

Source: primary data

As shown in previous table, all p-value (sig.) for each group is greater than á = 0.05(á is the level of significance), then there are no significant differences between the organization types (Owners, Contractors and Consultants) regarding their respondent degree to all fields.

Part Three: The Practices Concerning the Performance of Construction Projects:

The target groups in this study are owners, consultants and contractors. 120 questionnaires were distributed as follows: 25 to owners, 35 to consultants and 60 to contractors. 88 questionnaires were received (73%) as follows: 17 (70%) from owners, 25 (72%) from consultants and 46 (77%) from contractors as respondents. This part of study discusses the practices concerning the performance of construction projects.

Time management practice

What kind of method do you use to represent the project planning and scheduling? Table (4.28) Usage of planning method.

Item	Percentage % (Frequency)		
	Owner	Consultant	Contractor
Bar Chart	56.25	41.67	53.49
Critical Path Method	43.75	54.77	32.56
S-Curve	-	4.17	11.63
Others	-	-	2.33
Total	100	100	100

Source: primary data

Table 4.26 shows that Bar Chart method is the most important planning and scheduling method for owners and contractors because Bar Chart method can facilitate time performance control for each scheduled activity through project implementation. However, Critical Path Method (CPM) is the most important one for consultants because CPM can be used to determine critical activities of project. This will assist consultants to evaluate overall time performance and to identify the effectiveness of critical path on completion date of project. S-Curve method is never used by owners and it is rarely used by consultants and contractors. This is because S Curve method can compare only between actual time and estimated time at any stage through project implementation. It is difficult to control time performance for each scheduled activity and it is difficult to obtain critical path affecting overall time performance of project.

Chen (2007) remarked that in many situations, time of projects can be complicated and challenging to be managed. When the activity times in the project are deterministic and known, critical path method (CPM) has been demonstrated to be useful tool in managing projects in an efficient manner to meet this challenge. Koo et al (2007) stated that construction planners face many scheduling challenges during the course of a project. Planners today rely on CPM-based scheduling tools to evaluate different sequencing alternatives for their feasibility and whether they will meet project deadlines

2. How often your project team does formally meet for discussion of monitoring, updating and controlling the progress?

Table (4.29) Frequency of meeting type of project team

Item	Percentage % (Frequency)		
	Owner	Consultant	Contractor
Daily	11.76	4.17	10.87
Weekly	70.59	87.50	80.43
Monthly	17.65	4.17	8.70
No	-	4.17	-
Total	100	100	100

Source: primary data

Table 4.27 shows that owners, consultants and contractors often meet weekly for discussion. Weekly meeting assist them for monitoring, updating and controlling the progress through project implementation. In addition, they can solve problems, evaluate current performance, and improve future works. Respondents are rarely meets daily or monthly. Daily meeting are required in the case of sensitive and very important works. Monthly meeting is not effective for monitoring or updating processes. Navon (2005) stated that a controlling and updating is an important element to identify factors affecting construction project performance. Marica (2007) obtained that the controlling and monitoring works affect the quality, production and management system.

3. How often do you coordinate your schedule with master schedule of the project owner?

Table (4.30) Coordination frequency of current schedule with master schedule

Item	Percentage % (Frequency)		
	Owner	Consultant	Contractor
Increase salary	58.82	59.09	52.17
Bonus in position	-	9.09	15.22
Training	26.67	13.64	19.57
Others	20.00	18.18	13.04
Total	100	100	100

Source: primary data

Table 4.28 shows that most of owners, consultants and contractors use increase salary system in order to stimulate the construction time. This system will motivate employees and assist them to improve productivity and performance. This system is more important for employees than bonus in position or training systems because these systems are rarely affect on employees performance or their productivity. This is traced to cultural situation in the the Coastal Region of Kenya. Training is required according to nature of project and its duration. In addition, training is an important for improvement and development overall performance of organization. Chan and Kumaraswamy (2002) proposed specific strategies to increase speed of construction and so to upgrade the construction time performance. It is remarked the better training and motivation system can help to accelerate the performance.

6. Which software do you apply for planning and scheduling the progress the project?

Table (4.31) Usage of each software for planning and scheduling

Item	Percentage % (Frequency)		
	Owner	Consultant	Contractor
Primavera	-	12.00	19.57
Microsoft project	88.24	88.00	50.00
Excel sheet	11.76	-	26.09
Others	-	-	4.35
Total	100	100	100

Source: primary data

Table 4.29 shows that Microsoft project is the most important, famous and easy program used by owners, consultants and contractors for planning and scheduling. This program enables them to schedule, monitor, update and control many criteria of project such as time, cost and resources. In addition, most organizations in the Coastal Region of Kenya are familiar with this program to be used for planning and scheduling processes. It is observed that Primavera program is an advanced and a complex program compared with Microsoft project. Construction organizations in the Coastal Region of Kenya are not familiar with Primavera to be used or applied. However, Excel program has a limitation in usage for planning and scheduling.

Chan and Kumaraswamy (2002) remarked that construction programs with advanced available software can help to accelerate the performance. Goh (2005) remarked that information technology management leads to performance improvement in the construction industries. For instance, in Singapore 2003, general administration, design, project management, planning, scheduling, site management were enhanced by using of IT. In addition, there were more advantages as quick working, good quality of work and fast access of information.

7. Did your company formally participate in the pre-project planning effort? Table (4.32) Company formally participation in the pre-project planning effort.

Item	Percentage % (Frequency)		
	Owner	Consultant	Contractor
Yes, as the pre-project planner	75.00	12.00	23.91
Yes, as the consultant	12.50	80.00	8.70
No	12.50	8.00	67.39
Total	100	100	100

Source: primary data

Table 4.30 shows that most owners participate in the pre-project planning effort as the pre-project planner. Most

consultants participate in the pre-project planning effort as the consultant. However, Most contractors do not participate in the pre-project planning effort. Planning of construction projects is one of the main duties and responsibilities of consultants. Owners mainly need planning for budget and time estimation of projects. Some contractors participate in the planning for complex and large projects. This depend up on the nature and type of implemented works. Wang (2004) remarked that construction planning and efficient site utilization are of importance in the site management of building construction. Today.s complex projects, coupled with an increasing number of project participants, require more effective planning and communication.

8. Did projects be delay because of the Coastal Region of Kenya political conditions?

Table (4.33) Delay of projects because of the Coastal region of Kenya political conditions

Item	Percentage % (Frequency)		
	Owner	Consultant	Contractor
Yes	88.24	88.00	76.09
No	-	-	2.17
Sometimes	11.76	12.00	21.74
Total	100	100	100

Source: primary data

Table 4.31 shows that most owners, consultants and contractors agree that projects were delay because of the Coastal Region of Kenya political conditions. Continuous closures in the Coastal Region of Kenya lead to rapid shortage of construction materials and delay of projects. This problems can be considered as an obstacle for time performance of construction projects. All owners, consultants and contractors feel with such this sensitive problem in their projects

Cost management practice:

1. Do you have the cost schedule associated with the estimated time schedule? Table (4.34) Presence of cost schedule associated with the estimated time schedule.

Item	Percentage % (Frequency)		
	Owner	Consultant	Contractor
Yes	68.75	64.00	58.70
No	6.25	4.00	17.39
Sometimes	25.00	32.00	23.91
Total	100	100	100

Source: primary data

Table 4.32 shows that construction organizations often use cost schedule associated with the estimated time schedule. This association assist organizations to evaluate performance of cost and time together at any stage through project implementation. That will assist construction organizations to know if project is ahead or behind of schedule and if it is over or under estimated cost. Reichelt and Lyneis (1999) obtained that time schedule and budget performance are controlled by the dynamic feedback process. Those processes include the rework cycle, feedback loops creating changes in productivity and quality, and effects between work phases.

2. Do you apply the actual value and earned value concept in controlling cost for the project?

Table 4.33 shows that most of owners, consultants and contractors apply the actual value and earned value concept in controlling cost for the project. Earned value concept provides a system for evaluating the performance of the project through integrating cost, schedule, and work. This will assist for evaluation cost and time performance of projects. For example, at any stage of project, if earned value is more than actual value, the cost performance will be good. Vandevoorde (2006) stated that Earned value project management is a well-known management system that integrates cost, schedule and technical performance. It allows the calculation of cost and schedule variances and performance indices and forecasts of project cost and schedule duration. The earned value method provides early indications of project performance to highlight the need for eventual corrective action.

3. Do you have a cost engineer who is only responsible for dealing with cost control? Table (4.35) Having a cost engineer who is only responsible for dealing with cost Control.

Item	Percentage % (Frequency)		
	Owner	Consultant	Contractor
Yes	11.76	28.00	30.43
No	76.47	60.00	43.48
Sometimes	11.76	12.00	26.09
Total	100	100	100

Source: primary data

Table 4.35 shows that most of owners, consultants and contractors do not have a cost engineer who is only responsible for dealing with cost control. This is because most construction firms in the Coastal Region of Kenya are small size nature. Hence, their needs to cost engineer is much lower than large companies. Chan and Kumaraswamy (1996) stated that poor site management and low speed of decision making involving all project teams affecting cost performance control of project. Reichelt and Lyneis (1999) obtained that project cost performance can be controlled by the dynamic feedback process. Those processes include the rework cycle, feedback loops creating changes in productivity and quality, and effects between work phases.

4. Do you give right and authority for line managers to manage the actual expenses?

Table (4.36) Giving right and authority for line managers to manage the actual Expenses.

Item	Percentage % (Frequency)		
	Owner	Consultant	Contractor
Yes	41.18	29.17	43.48
No	23.53	41.67	32.61
Sometimes	35.29	29.17	23.91

Total	100	100	100

Source: primary data

Table 4.36 shows that most owners and contractors give right and authority for line managers to manage the actual expenses. However, most of consultants do not give right and authority for line managers to manage the actual expenses. Giving right and authority for line managers to manage the actual expenses depends mainly on the nature and size of works. Chan and Kumaraswamy (2002) remarked that effective communication and fast information transfer between managers and participants help to accelerate the building construction process and performance.

5. Do you apply any software to plan, monitor, and control cost?

Table (4.37) Applying any software to plan, monitor, and control cost

Item	Percentage % (Frequency)		
	Owner	Consultant	Contractor
Yes	47.06	50.00	45.65
No	23.53	33.33	28.26
Sometimes	29.41	16.67	26.09
Total	100	100	100

Source: primary data

Table 4.37 shows that most owners, consultants and contractors use software program in order to facilitate planning, monitoring and controlling cost. The most programs used in construction organization in order to control and monitor cost are: Excel and Ms Project programs. Most organizations are familiar with these software programs because they are easy to be used and have different facilities and functions to control the cost. Goh (2005) remarked that information technology management leads to performance improvement in the construction industries. For instance, in Singapore 2003, general administration, design, project management, cost control, site management was enhanced by using of IT. In addition, there were more advantages as quick working and good quality of work.

6. Do you apply the following records to estimate the construction cost for the
project?

Table (4.38) Applying the following records to estimate the construction cost for the Project.

Item	Percentage % (Frequency)		
	Owner	Consultant	Contractor
Historical cost data	45.8	40.5	37.1
Current quotation for labor material and equipment cost	54.2	56.8	59.7
Others	-	2.7	3.2
Total	100	100	100

Source: primary data

Table 4.38 shows that most owners, consultants and contractors use current quotation for labor, material and equipment cost to estimate the construction cost for the project. This method is more accurate for cost estimation than others because it depend on current situation. However, historical data is interested to be used for owners, consultants and contractors as an experience can assist for quick evaluation and estimation. Dissanayaka and Kumaraswamy (1999) stated that the current knowledge for construction industry that would influence performance enables project managers to pay special attention to control performance more effectively. Thomas (2002) stated that documenting and archiving performance data could be useful for future reference and projects.

7. Did the project be delay by late payment from the owner?

Table (4.39) Delay of project by late payment from the owner

Item	Percentage % (Frequency)		
	Owner	Consultant	Contractor
Yes	35.29	32.00	28.26
No	29.41	12.00	15.22
Sometimes	35.29	56.00	56.52
Total	100	100	100

Source: primary data

Table 4.39 shows that most consultants and contractors stated that the project was sometimes delay by late payment from the owner. In the Coastal Region of Kenya, contractors usually suffer from this problem. Delay in payment from owner to contractor lead to delay of contractors' performance and cause problem in time performance. This may also lead to disputes and claims between owner and contractor of project. All of that will affect the overall performance of project which has been implemented. Karim and Marosszeky (1999) remarked that average delay in payment from owner to contractor affects the time performance and causes delay of project.

8. Did the actual cost of projects be more than the estimated cost because of the Coastal Region of Kenya political conditions?

Table (4.40) The percent if actual cost of projects was more than the estimated cost because of the Coastal region of Kenya political conditions

Item	Percentage % (Frequency)		
	Owner	Consultant	Contractor
Yes	76.47	80.00	82.61
No	-	4.00	2.17
Sometimes	23.53	16.00	15.22
Total	100	100	100

Source: primary data

Table 4.41 shows that most owners, consultants and contractors agree that actual cost of projects was more than the estimated cost because of the Coastal Region of Kenya political conditions. Continuous closures in the Coastal Region of Kenya lead to rapid shortage of construct the Coastal Region of Kenya ion materials and escalation of construction material prices. This escalation of material prices affect the liquidity and cost performance of projects.

V. CONCLUSION AND RECOMMENDATIONS

Conclusion

Construction industry is considered as an important sector in the world as it develops and achieves the goals of society. The performance of the construction industry is affected by clients, contractors, consultants, stakeholders, regulators, national economies and others. The main aim of this thesis is to identify the factors affecting the performance of construction projects in the Coastal Region of Kenya. The aim of this research was broken down into the following objectives:

To determine the factors affecting the performance of construction projects in the Coastal region of Kenya.

A structured questionnaire survey approach was considered to study the impact of various attributes and factors affecting construction projects performance. The questionnaire assists to study the attitude of owners, consultants and contractors towards key performance indicators in the construction industry. These questionnaires were distributed to expert engineers such as projects managers, site engineers/office engineers and organizations managers. They have a strong practical experience in construction industries field. Their sufficient experiences are a suitable indication for pilot study.

Forty factors were considered in this study and were listed under eight groups based on literature review. These groups gave a comprehensive summary of the main performance indicators. The indicators were summarized and collected according to previous studies and others are added as recommended by local experts. The main groups considered in this thesis are time, quality, productivity, client satisfaction, regular and community satisfaction, people, and environment.

The target groups in this research were owners, consultants and contractors. 180 questionnaires were distributed as follows: 45 to owners, 55 to consultants and 80 to contractors. 132 questionnaires (73%) were received as follows: 32 (70%) from owners, 40 (72%) from consultants and 61 (77%) from contractors as respondents. The respondents were classified as projects managers, site engineers/office engineers and organizations managers, as they have a practical experience in construction industries field. Their sufficient experiences were a suitable indication to find out the perceptive of the relative importance of project performance indicators of the owner, consultant and contractor parties. Their experiences included many construction fields such as buildings, roads and transportations, and water and sewage projects.

To identify the most significant project procedures that affect performance of construction projects in the coast.

According to owners, consultants and contractors the Average delay in claim approval and payment approval owner to contractor resulting to closures and materials shortage was the most important performance factor as it has the first rank among all factors with RII = 0.956 for owners, 0.911 for consultants and 0.958 for contractors. This agreement between all target groups is traced to the payment procedure and economical situations from which the Coastal region of Kenya suffers. Construction projects the Coastal region of Kenya is suffering from these complex problems because of closures and materials shortage. These problems can be considered as an obstacle for performance of projects.

Availability of resources as planned through project duration has been ranked by the owners' respondents in the third position with RII equal 0.886. It has been ranked by the consultants respondents in the second position with RII equal 0.873and has been ranked by the contractors respondents in the third position with RII equal 0.919. This factor can be considered as an important for three parties and it has a similar rank for all parties as it affects directly on project performance such as time. Availability of resources is related to closures. If resources are not available as planned through project duration, the project will suffers from problem of time and cost performance. Hence the schedule is not adhered to.

The most important factors agreed by the owners, consultants and contractors as the main factors affecting the performance of construction projects the Coastal region of Kenya were: escalation of material prices; availability of resources as planned through project duration; average delay because of closures and materials shortage; availability of personals with high experience and qualification; quality of equipments and raw materials in project; and leadership skills for project manager. However, there are some factors which can be considered as more important for one party than for others. This is because contractors are interested with operational and managerial factors. However, the owners and consultants considered the client and technical factors to be more important than operational ones.

Quality group has been ranked by the owners respondents in the first position with RII equal 0.834. It has been ranked by the consultants respondents in the first position with RII equal 0.813 and has been ranked by the contractors respondents in the first position with RII equal 0.833. This group is the most important one for owners, contractor's and consultants because consultants since both are interested with clients and technical factors. Both observed that quality of equipments and raw materials in project and availability of personals with high qualification affect strongly the quality performance of project.

Time group has been ranked by the owners respondents in the second position with RII equal 0.817. It has been ranked by the consultants respondents in the second position with RII equal 0.808 and has been ranked by the contractors respondents in the third position with RII equal 0.824. This group is also more important for consultant and owners than contractors because the consultant is concerned with planned time for project completion.

Client satisfaction group has been ranked by the owners respondents in the third position with RII equal 0.787. It has been ranked by the consultants respondents in the third position with

RII equal 0.804 and has been ranked by the contractors respondents in the third position with RII equal 0.826. It is interesting to observe that client satisfaction group is more important for consultants than for contractors because consultants are usually interested with client factors. This is mainly due to financing issues and owner interference which are considered very important by consultants.

People group has been ranked by the owners respondents in the fouth position with RII equal 0.748. It has been ranked by the consultants respondents in the sixth position with RII equal 0.719 and has been ranked by the contractors respondents in the fourth position with RII equal 0.813. It is not surprising to observe that people group is the most important one for contractors because contractors remarked competence development between employees and belonging to work affect strongly on productivity, cost and time performance of contractors.

To evaluate Project management actions that affect project performance in the coastal region.

Kendall's Coefficient of Concordance is used to determine whether there is degree of agreement among performance factors for owners, consultants and contractors. For Cost, Time, Quality, Productivity, Client Satisfaction, People, Innovation and learning factors, and all groups together, there is a significant degree of agreement among the owners, consultants and contractors. This is because all of owners, consultants and contractors are interested with these groups. On the other hand, for Regular and community satisfaction, and Environment factors, there is insignificant degree of agreement among the owners, consultants and contractors. This is because contractors are interested with these factors more or less than owners and consultants. This is because contractors are interested with operational and managerial factors. The owners and consultants considered the client and technical factors to be more important than operational ones.

The Kruskal-Wallis. (KW) test is used in order to check out if there are any significant differences in the point of view of the respondents (owners, consultants and contractors) regarding the levels of each of the factors affecting the performance of construction projects. It was found that there are no significant differences between the organization types (owners, consultants and contractors) regarding their respondent degree to all fields.

To determine the influence to which the project related factors affects the performance of construction projects in the coastal region.

The practices concerning with the project performance such as time, cost, project and owner satisfaction were analyzed in order to know the main practical problems in projects performance in the Coastal region of Kenya and then to formulate recommendations to improve performance of construction projects in. The following is a summary and conclusion for the main practices concerning with the project performance indicators in the Coastal region of Kenya.

Time management practice:

Bar Chart method is the most important planning and scheduling method for owners and contractors because Bar Chart method can facilitate time performance control for each scheduled activity through project implementation. However, Critical Path Method (CPM) is the most important one for consultants because CPM can be used to determine critical activities of project. This will assist consultants to evaluate overall time performance and to identify the effectiveness of critical path on completion date of project. Owners, consultants and contractors often meet weekly for discussion. Weekly meeting assist them for monitoring, updating and controlling the progress through project implementation. In addition, they can solve problems, evaluate current performance, and improve future work.

Most of owners, consultants and contractors use increase salary system in order to stimulate the construction time. This system will motivate employees and assist them to improve productivity and performance. This system is more important for employees than bonus in position or training systems because these systems are rarely affect on employees performance or their productivity. This is traced to cultural situation in the coastal region of Kenya. Training is required according to nature of project and its duration. In addition, training is an important for improvement and development overall performance of organization.

Microsoft project is the most important, famous and easy program used by owners, consultants and contractors for planning and scheduling. This program enables them to schedule, monitor, update and control many criteria of project such as time, cost and resources. In addition, most organizations in the Coastal region of Kenya are familiar with this program to be used for planning and scheduling processes. It is observed that Primavera program is an advanced and a complex program compared with Microsoft project. Construction organizations in the Coastal region of Kenya are not familiar with Primavera to be used or applied. However, Excel program has a limitation in usage for planning and scheduling.

Most owners, consultants and contractors agree that projects were delay because of the Coastal region of Kenya current political conditions. Continuous political tensions in the Coastal region of Kenya lead to rapid shortage of construction materials and delay of projects. This problems can be considered as an obstacle for time performance of construction projects. All owners consultants and contractors feel with such this sensitive problem in their projects.

Cost management practice:

Most owners and contractors give right and authority for line managers to manage the actual expenses. However, most of consultants do not give right and authority for line managers to manage the actual expenses. However, giving right and authority for line managers to manage the actual expenses depends mainly on the nature and size of works.

Most owners, consultants and contractors use software program in order to facilitate planning, monitoring and controlling project cost. The most programs used in construction organization in order to control and monitor cost are: Excel and Ms project. Most organizations are familiar with these software programs because they are easy to be used and have different facilities and functions to control the cost. Most owners, consultants and contractors use current quotation for labor, material and equipment cost to estimate the construction cost for

the project. This method is more accurate for cost estimation than others because it depends on current situation. However, historical data sometimes is interested to be used for owners, consultants and contractors because an experience can assist for quick evaluation and estimation.

Most consultants and contractors stated that the project was sometimes delay by late payment from the owner. In the Coastal region of Kenya, contractors usually suffer from this problem. Delay in payment from owner to contractor lead to delay of contractors' performance and cause problem in time performance. This may also lead to disputes and claims between owner and contractor of project. All of that will affect the overall performance of project which has been implemented.

Most owners, consultants and contractors agree that actual cost of executed projects was more than the estimated cost because of the Coastal region of Kenya political conditions. Continuous political tensions in the Coastal region of Kenya lead to rapid shortage of construction materials and escalation of construction material prices. This escalation of material prices affect the liquidity and cost performance of projects.

Owner satisfaction management practice:

Generally, it is obtained that most of consultants and contractors projects are high satisfied by the owners in the Coastal region of Kenya. In addition, some contractors and consultants projects are medium satisfied by the owner because of many reasons such as: poor quality, non conformance to specification, problems in cost and time performance, weak coordination or relationship between projects participants, occurrence of accidents through implementation stage, claims and disputes. In addition, consultants and contractors projects usually have few defects with low impact on the owner satisfaction.

Recommendation

Training programs

It is recommended to develop human resources in the construction industry through proper and continuous training programs about construction projects performance.

These programs can update their knowledge and can assist them to be more familiar with project management techniques and processes. In addition, it is preferred to develop and improve the managerial skills of engineers in order to improve on performance of construction projects. All of that can be implemented by offering effective and efficient training courses in scheduling, time, cost, quality, safety, productivity, information systems and management of human resources. These continuous training courses will lead to success performance through construction projects such as availability of resources as planned through project duration, availability of personals with high experience and qualification, proper quality of equipments and raw materials used in project. In addition, training system will assists for improvement of construction time performance.

Recommendations for construction organizations

It is necessary for construction organizations in the Coastal region of Kenya to evaluate both of market share and liquidity before implementation of any construction project based on the economic situation in region. This will assist organizations to perform projects successfully and strongly. In addition, it is recommended that a new approach to contract award procedure by giving less weight to prices and more weight to the capabilities and past performance of contractors. It is necessary to establish proper industry regulations and appropriate mechanism for contractors' enforcement. A structured methodology and technique should be identified to overcome the effect of local political and economic situations on the performance of construction projects in the Coastal region of Kenya.

In addition, construction organizations are recommended to evaluate project overtime through project construction in order to enhance and improve time and cost performance of projects. Planned time for project implementation should be more suitable for practice. Time needed to implement variation orders and to rectify defects should be estimated and scheduled without affecting project time completion. Having regular meeting among project participants can also enhance performance. Construction organizations should have different incentive systems in order to improve overall performance. In addition, they should have continuous safety training and meeting in order to apply safety factors and achieve better performance.

Recommendations for owners

Owners are recommended to facilitate payment to contractors in order to overcome delay, disputes and claims. All managerial levels should be participated with sensitive and important decision-making. Continuous coordination and relationship between project participants are required through project life cycle in order to solve problems and develop project performance. It is recommended to minimize disputes between owner and project parties. Employees in construction industries should be more interested with belonging to work to productivity and time performance of project.

Recommendations for consultants

Consultants should be more interested with design cost by using multi criteria analysis and choosing the most economic criteria in order to improve their performance and to increase owners satisfaction. In addition, consultants are recommended to facilitate and quicken orders delivered to contractors to obtain better time performance and to minimize disputes and claims.

Recommendations for contractors

Contractors should not increase the number of projects that cannot be performed successfully. In addition, contractors should consider political and business environment risk in their cost estimation in order to overcome delay because of closures and materials shortage. There should be adequate contingency allowance in order to cover increase in material cost. A proper motivation and safety systems should the Coastal region of Kenya. More applications of health and safety factors are necessary to overcome problems of safety performance.

Contractors are recommended to minimize waste rate through project implementation in order to improve cost performance. They should be more interested with conformance to project specification to overcome disputes, time and cost performance problems. Quality materials should be more interested with contractors to improve cost, time and quality performance. This can be done by applying quality trainings and

meetings which are necessary for performance improvement. Contractors are recommended to be more interested with sequencing of work according to schedule. In addition, contractors should have a cost engineer in their projects to control cost successfully.

Recommendations for future research

It is recommended to develop performance measurement framework and modeling system in order to measure performance of construction organizations and projects. In addition, it is recommended to study and evaluate the most important factors as a case study of construction projects in the Coastal region of Kenya.

REFERENCES

[1] Al-Momani, A. H., (2000), Examining service quality within construction processes, Technovation, Vol. 20, PP. 643-651

[2] Augusto, M. L., J. Yasin, M. and Figueira, J. R., (2006), Benchmarking in a multiple criteria performance context: An application and a conceptual framework, European Journal of Operational Research, Vol. 184, PP. 244 -254

[3] Becerik, B. (2004), A review on past, present and future of web based project management and collaboration tools and their adoption by the US AEC industry, International Journal of IT in Architecture, Engineering and Construction, Vol. 2, No.3, PP. 233 . 248

[4] Belassi, W. and Tukel, O. I., (1996). A new framework for determining critical success/failure factors in projects. International Journal of Project Management, 14(3), 141-151

[5] Chua, D. K. H., Kog, Y. C., and Loh, P. K.(1999). ‘‘Critical success factors for different project objectives.’’ J. Constr. Eng. Manage.,125(3), 142–150.

[6] Chan D. W. M. and Kumaraswamy, M. M., (1996), An evaluation of construction time performance in the building industry, Building and Environment, Vol. 31, No. 6, PP. 569- 578

[7] Chan, A. P.C. and Chan, D. W.M., (2004), Developing a benchmark model for project construction time performance in Hong Kong, Building and Environment, Vol. 39, PP. 339 .349

[8] Chan, A. P.C., (2001), Time cost relationship of public sector projects in Malaysia, International Journal of Project Management, Vol.19, PP. 223-229

[9] Chan, D. W. M. and Kumaraswamy, M. M., (2002), Compressing construction durations: lessons learned from Hong Kong building projects, International Journal of Project Management, Vol.20, PP. 23.35

[10] Chritamara, S. & Ogunlana, S. O. (2002), “System dynamics modeling of design and build construction projects" Construction Innovation, Arnold Press, vol. 2, pp 269 - 295.

[11] Cooke-Davis, T. (2001) The Real Success Factors on Projects, International Journal of Project Management, 14: pp. 185-190

[12] Freeman, M. and Beale, P. (1992) Measuring Project Success, Project Management Journal, 23: pp. 8 -17

[13] Frimpong Y. Jacob O. and Lynn C. (2003), Causes of delay and cost overruns in construction of groundwater projects in a developing countries; Ghana as a case study, International Journal of Project Management Vol. 21, PP. 321-326.

[14] Fryer, B. (1985) The Practice of Construction Management. London: Collins

[15] Gichuge, H. (2000) Risk Management in the Building Industry in Kenya: An Analysis of Time and Cost Risks Unpublished Ph.D. Thesis, University of Nairobi.

[16] Gido, J., Clement, and James P. (2003) Successful Project Management. United States: Thompson South Western

[17] Greenberg,J. and Baron, J. (2000), Behavior in Organization, New York: Prentice Hall.

[18] Hughes, M.W. (1986) Why Project Fails? The Effects of Ignoring the Obvious, Industry Engineering, 18: pp. 18-64

[19] Hubbard, D. G.(1990). ‘‘Successful utility project management from lessons learned. Project. Manage. Journal.,21(3), 19–23.

[20] Jaselskis, E. J., and Ashley, D. B (199). ‘‘Optimal allocation of project management resources for achieving success. Constr. Eng. Manage.,117(2), 321–340

[21] Kaming, P. F., Olomolaiye, P. O., Holt, G. D., and Harris, F. C. (1997).‘‘Factors influencing construction time and cost overruns on high-rise projects in Indonesia.’’ Constr. Manage. Economy.

[22] Karim, K. and Marosszeky, M., (1999), Process monitoring for process re-engineering - using key performance indicators, International conference on construction process reengineering, CPR 99, Sedney UNSW 12-13 July, Building Research center.

[23] Kometa, S.T., Olomolaiye, P.O. and Harris, F. C. (1996) A Review of Client Generated Risks to Project Consultants, International Journal of Project Management, 14: pp. 273-279

[24] Li H., Cheng E.W.L., Love, P.E.D. and Irani Z., (2001), Co-operative benchmarking a tool for partnering excellence in construction, International Journal of Project Management, Vol. 19, PP. 171-179

[25] Lim, C.S. and Mohamad, M.Z. (1999) Criteria of Project Success: An Exploratory Re examination. International Journal of Project Management, 17: pp. 243-248

[26] Ling, F. Yean, Y. Low S. P. Wang, S. Q. and Lim, H. H. (2007), Key project management practices affecting Singaporean firms.project performance in China, International Journal of Project Management

[27] Liu, A.N.N. and Walker, A. (1998) Evaluation of Project Outcomes. International Journal of Project Management, 16: pp 209-219

[28] Pheng L. S.,and Chuan, T. Q (2005) Environmental Factors and Work Performance of Project Managers in the Construction Industry, National University of Singapore Martin, C.C. (1976) Project Management. New York: Amaco Might,

[29] Morris, P.W.G. and Hough, G.H. (1987) The Anatomy of a Major Project: A Study of the Reality of Project Management. New York: Wiley & Sons

[30] Navon R. (2005), Automated project performance control of construction projects, Automation in Construction, Vol. 14, PP. 467. 476

[31] Okuwoga A. A., (1998), Cost . time performance of public sector housing projects in Nigeria, Habital Intl., Vol. 22, No. 4, PP. 389 . 395

[32] Pocock, J. B., Liu, L. Y., and Kim, M. K. (1997b). ‘‘Impact of management approach on project interaction and performance.’’ J. Constr. Eng. Manage.

[33] Republic of Kenya (2002), Economic Survey 2002, Nairobi, Central Bureau of Statistics, Ministry of Finance and Planning, Government Printer.

[34] Republic of Kenya (2003), Economic Recovery for Wealth and Employment Creation 2003 – 2007, Nairobi, Government Printer.

[35] Republic of Kenya (2005): Economic Survey 2005, Nairobi, Central Bureau of Statistics, Ministry of Finance and Planning, Government Printer. Republic of Kenya (2007), Kenya Vision 2030, Nairobi, Government Printer.

[36] Samson, M. and Lema, N. M, (2002), Development of construction contractors performance measurement framework, 1st International Conference of Creating a Sustainable

[37] Sayles, L.R. and Chandler, M.K. (1971) Managing Large Systems. New York: Harper & Row

[38] Thomas, S. N., Palaneeswaran, E. and Kumaraswamy, M. M., (2002), A dynamic e-Reporting system for contractor.s performance appraisal, Advances in Engineering Software, Vol. 33, PP. 339.349

[39] Tolosi, P. and Lajtha G.(2000), Toward improved benchmarking indicators, Telecommunications Policy, Vol. 24, PP. 347-357

[40] UNRWA, (2006), Projects completion reports, UNRWA, Gaza

[41] UNRWA, (2007), Projects completion reports, UNRWA, Gaza

[42] Walker, D. H. T.(1995). ‘‘An investigation into construction time performance. Constr. Manage. Econom.,13(3), 263–274

[43] Walker, D. H. T.(1995). ‘‘An investigation into construction time performance. Constr. Manage. Econom.,13(3), 263–274

[44] Walker, D. H. T., and Vines, M. W.(2000). ‘‘Australian multi-unit residential project construction time performance factors. Eng., Constr. Archit. Manage,7(3), 278 –284

[45] Wang, X. and Huang, J. (2006), The relationships between key stakeholders' project performance and project success: Perceptions of

Chinese construction supervising engineers, International Journal of Project Management, Vol. 24, PP. 253-260

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Correlation coefficient of each item of cost factors and the total of this part

No	Cost Factors	Correlation coefficient	P-Value (Sig.)
1	Profit rate of project	.543	0.000**
2	Overhead percentage of project	.687	0.000**
3	Project design cost	.563	0.000**
4	Material and equipment cost	.373	0.000**
5	Project labor cost	.446	0.000**
6	Project overtime cost	.639	0.000**
7	Motivation cost	.696	0.000**
8	Cost of rework	.689	0.000**
9	Cost of variation orders	.635	0.000**
10	Regular project budget update and cost control systems	.479	0.000**
11	Escalation of material prices	.440	0.000**
12	Differentiation of coins prices	.437	0.000**

**Correlation significance at 0.01 level

Correlation coefficient of each item of time factors and the total of this part

No.	Time factors	Correlation Coefficient	P-Value (Sig.)
1	Planned time for project	.539	0.000**
2	Time needed to implement variation orders and Time needed to rectify defects	.706	0.000**
3	Average delay in claim approval and payment approval owner to contractor	.577	0.000**
4	Availability of resources as planned through project duration	.543	0.000**

**Correlation significance at 0.01 level

Correlation coefficient of each item of quality factors and the total of this part

No.	Quality factors	Correlation Coefficient	P-Value (Sig.)
1	Conformance to specification	.755	0.000**
2	Availability of personals with high experience and qualification	.795	0.000**
3	Quality of equipments and raw materials in project	.755	0.000**
4	Participation of managerial levels with decision making	.565	0.000**
5	Quality assessment system in Organization and Quality training/meeting	.763	0.000**

**Correlation significance at 0.01 level

Correlation coefficient of each item of productivity factors and the total of this part

No.	Productivity factors	Correlation Coefficient	P-Value (Sig.)
1	Project complexity	.669	0.000**
2	Number of new projects / year	.609	0.000**
3	Management-labor relationship	.722	0.000**
4	Absenteeism rate through project	.778	0.000**
5	Sequencing of work according to Schedule	.731	0.000**

**Correlation significance at 0.01 level

Correlation coefficient of each item of client satisfaction factors and the total of this part

No	Client Satisfaction factors	Correlation Coefficient	P-Value (Sig.)
1	Information coordination between owner and project parties	.511	0.000**
2	Leadership skills for project Manager /Owner	.606	0.000**
3	Number of disputes between owner and project parties	.681	0.000**

**Correlation significance at 0.01 level

Correlation coefficient of each item of regular and community satisfaction factors and the total of this part

No	Regular and community satisfaction factors	Correlation Coefficient	P-Value (Sig.)
1	Cost of compliance to regulators owner and project parties owner and project parties	.869	0.000**
2	Number of non compliance to regulation	.837	0.000**
3	Quality and availability of regulator documentation	.890	0.000**
4	Neighbors and site conditions Problems	.678	0.000**

**Correlation significance at 0.01 level

Correlation coefficient of each item of people factors and the total of this part

No.	People factors	Correlation Coefficient	P-Value (Sig.)
1	Employee attitudes in project	.847	0.000**
2	Recruitment and competence development between employees	.829	0.000**
3	Employees motivation Belonging to work	.881	0.000**

**Correlation significance at 0.01 level

Correlation coefficient of each item of environment factors and the total of this part

No.	Environment factors	Correlation Coefficient	P-Value (Sig.)
1	Air quality	.874	0.000**
2	Noise level	.810	0.000**
3	Wastes around the site	.866	0.000**
4	Climate condition in the site	.777	0.000**

**Correlation significance at 0.01 level

An Assessment of the Effects of Inventory Management Procedures on Performance of Kengen

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Abstract- The scope of inventory management in the 21st Century concerns the fine lines between replenishment lead time, carrying costs of inventory, asset management, inventory forecasting, inventory valuation, inventory visibility, future inventory price forecasting, physical inventory, available physical space for Inventory, replenishment, returns and defective goods, and demand forecasting in East Africa firms are striving to manage this element of Inventory to the best of their knowledge due to the cost implication involved in improper management of Inventory (Lysons& Farrington, 2006). Many organizations have adopted the use of Inventory control procedure as its positive effects are more than the negative ones. Performance of an organization is proved to be increasing with the effectiveness and type of inventory control procedures used. This research therefore critically assessed inventory control procedures of KenGen with a view of other organizations. The purpose of the study was to assess the effects of Inventory Management Procedures on performance of KenGen based on the Inventory classification, storage methods, Material codification and Material inspection. The descriptive aspect of the research design was used in establishing the company performance and the analytical research design was used to establish relationship between inventory management procedures and performance of KenGen. The target population of this study was200 workers with a sample size of 133. This study used semi-structured questionnaires with both closed and open ended questions to collect primary and secondary data. The filled in and returned questionnaires were coded and entered into a statistical package for sciences Version 22.0. Descriptive statistics such as means, standard deviations as well as regressions analysis was done to establish relationships between the variables of the study and performance of KenGen. Many organizations have adopted the use of stock control procedure as its positive effects are more than the negative ones. Performance of an organization is proved to be increasing with the effectiveness and type of stock control used (Bailey, 2008).This research therefore critically examined stock control procedures of KenGen with a view of other organizations.

Index Terms- Inventory Management, Logistics, enterprise resource Planning system, Just in Time

I. INTRODUCTION

Inventory management is an ongoing and dynamic process. To keep out the inefficiencies in system, process and physical operations, calls for active management participation and continuous improvement in all processed and systems that are involved in inventory management. It is all about knowing what is on hand, where it is in use, and how much finished product results. Inventory can mean different things and depends on the industry the firm operates in. It includes; Raw materials and components from suppliers, Work in progress or part finished goods made within the business, Finished goods ready to dispatch to customers ,Consumables and materials used by service businesses.

Lysons (2006) says that, inventory management involves a process of efficiency overseeing the constant flow of units into and out of an existing inventory. This process usually involves controlling the transfer in of units in order to prevent the inventory from becoming too high, or dwindling to levels that could put operation of the company into jeopardy. Competent inventory management also seeks to control the costs associated with the inventory, both from the perspective of the total value of the goods included and the tax burden generated by the cumulative value of the inventory.

Inventory managers are concerned with cost, criticality and contribution of their holdings, ordering and maintaining inventory has several costs. These include capital costs, administrative cost, storage charges, shrinkage, taxes and insurance. Most of these vary directly with the average quantity of inventory held. Obvious strategies for cost avoidance would be reduce or eliminate inventories. That probably cannot be done in very many cases. Most Firms in the United States of America, west and Eastern Europe determine the level of inventory necessary to provide an acceptable level of customer service and manage that size of inventory as efficiently as possible. According to Ballou(2000) Firms like Nissan uses Just in Time method of Inventory management hence keep zero or very minimal inventory.

Inventory availability is the most important aspect of customer service. The goal of inventory management is therefore to increase financial returns on inventory while simultaneously increasing customer service levels (Frazelle, 2002).In this context, the primary goal of inventory is to provide the right item, at the right location and time, at the lowest cost. To meet this goal, inventory professionals work with two major (and sometimes conflicting) objectives in mind: Maximize customer service (that is, provide material when the customer needs it) and minimize inventory dollars (that is, control the number of dollars invested in parts and material). Transit agency executives are interested in meeting both of these objectives. Inventory management departments must work with purchasing departments and customers to reconcile the two conflicting objectives.

Sumil (2007) states that, inventory management requires demand forecasting that is having some record of what sold and what did not sell through the year. Analyze that data. Break the inventory down into categories and try to correlate the categories with customers. Trends or patterns will likely emerge. Depending on what business you are in, these might correspond to the rhythm of the seasons, or they could relate to the financial year ends of your biggest customers.

Organizations uses inventory control to minimize idle time caused by shortage of inventory and non-availability of inventories as per requirement to keep down capital investment in inventory. According to Sumil(2007), increasingly integrating financial data such as accounts receivable with sales information that includes customer histories is what most firms do. The goal is to control inventory quarter to quarter so it does not come back to bite the bottom line.

Key components of an integrated system are general ledger, electronic data Interchange, database connectivity and connections to a range of vertical business applications. According to Lyson (2006),accompany recognizes that customer is always the ''King'' thus the organization ensures the availability of materials in the store so as to prevent any disruption during production process. The company recognizes that customer satisfaction in a manner that the inventory control managers defines how often inventory levels are reviewed to determine when and how much to order. It is performed on either a perpetual or a periodic basis. Inventory manager's implements inventory on the basis of forecasted demand of product availability.

Automation can dramatically impact all phases of inventory management, including counting and monitoring of inventory and anticipating inventory needs, including inventory handling requirements. This is true even of stand – alone systems that are not integrated with other areas of the business, but many analysis indicate that productivity and hence profitability gains that are garnered through use of automated systems can be increased even more when a business integrates its inventory control procedures with other systems such as accounting, production to better control inventory levels. (Weelearjan,2007).

Inventory control can be done through introduction of different measures so as to prevent the company from incurring unnecessary losses made by different departments. There are measures which can be put in place to ensure that the stock is well controlled and the organization is performing well too. KenGen has existed for many years with the objectives of providing better consistent services to customers and maximizing profits .To date the company does not focus on how much of each stock items firm should hold in the store, how much should be ordered at a given time and what point more stock should be ordered, this has greatly affected performance especially the production, sales and reducing on its financial performance. Sumil (2007), concludes that, It is therefore important for an organization to have a sound, effective and well-coordinated inventory control management procedures to help it perform and to have a competitive advantage in the current competitive business environment.

Statement of the problem

Most Organizations have not yet adopted inventory control management tools and systems in purchasing and supply hence they are facing the challenge of stock out cost. According to Tersine (2008) this simply means the non-availability of the stock. This is serious in KenGen and may result in delaying the operation. This stock out is multisided in the loss of machine and man-hour, the loss of service to customers, the loss of goodwill, the loss of lagging behind in competition and loss of profit.

The scenario becomes even more damaging especially for a power production company which requires stock of a variety of items for the purpose of replacement whenever there is a break down. The challenge is that of identifying different spares or materials required. According to Skeet (2001) when there is no order and effective management of inventory procedures to retail outlets, they are bound to operate in a loss and facing possible liquidation due to heavy stock out cost, perforation, obsolescence and unnecessary locking capital in stock inventory.

Kenya Electricity generating company (KenGen) keeps different types of products ranging from chemicals, machine components, hardware materials, electrical materials, Fuels and lubricants forcing it to be much careful in storage hence increased performance. Over the past years, KenGen has experienced a lot of challenges while trying to carry out its inventory management and materials control processes. This could be partly attributed to challenging Inventory control management practices. Skeet (2001) assets that, an organization experiences frequent stock out cases, pilferages and theft, stock deterioration and damage, overstocking leading to tying up of capital in stock and over/under valuation of stock. Previous researchers have concentrated on carrying out research on effective Inventory control procedures, importance of Inventory control management on organization performance, leaving out an assessment of the effects of Inventory Management procedures on an organization performance. This problem has therefore led to the researcher to carry out the research on an assessment of effects of Inventory control procedure on performance of KenGen.

The researcher is keen to find out the relationship between Inventory Control Procedures and performance of KenGen and some of the problems hindering the smooth operation of KenGen. The study realizes that Inventory management involves determining the purchasing practice and techniques and strategy. The purpose of the study was to assess the relationship between Inventory Control procedures and its impact on the performance of KenGen.

Objectives of the study

General Objectives

The general objective of this study was to assess the effects of Inventory Control Procedures on performance of KenGen.

Specific Objectives

i. To determine how Inventory classification contributes to performance of KenGen.
ii. To determine how storage methods adopted by KenGen contribute to the control of stock.
iii. To find out how Material codification contributes to the performance of KenGen.

iv. To find out how Material inspection assists in the performance of KenGen

RELATED LITERATURE

Theoretical Framework

A theory is an organized system of accepted knowledge that applies in a variety of circumstances to explain a specific set of phenomenon. There are four theories of inventory management that include, Materials requirement planning (MRP).Just In Time (JIT), ABC Analysis and Economic Order Quantity (EOQ).

a. Materials Requirement Planning (MRP)

According to Biederman, (2004), one of the assumptions behind the lot sizing models is that demand for an item is independent of all other demands. This situation is true for most manufactures of finished goods. However sub-assemblies, raw materials and parts do not exhibit this independence. Demand for these items is dependent on the assembly schedule for finished goods. Similarly, many Maintenance, Repair Operations(MRO) items which are Supplies consumed in the production process but which do not either become part of the end product or are not central to the firm's output, MRO items include consumables (such as cleaning, laboratory, or office supplies), industrial equipment (such as compressors, pumps, valves) and plant upkeep supplies (such as gaskets, lubricants, repair tools), and computers, fixtures and furniture. The replenishment of these items depends on maintenance schedule. Recognition of the existence of demand dependence lies behind the techniques known as materials requirement planning (MRP).

MRP Systems attempt to support the activities of manufacturing, maintenance or use by meeting the needs of the master schedule. in order to determine needs, MRP systems need an accurate bill of materials for each final product or project. These bills can take many forms but it is conceptually advantageous to view them as structural trees. Seven general types of structural tree can be identified. Process industries such as oil refiners, drug and food manufacturers generally take a few raw materials and make a much larger number of end products.

Manufactures/assemblies such as the automobile companies make a number of components purchase others and assemble them into finished products. Each type of firm can use MRP profitably but the greatest complexity of its operations. The goals of MRP are to minimize inventor, to maintain a high service coverage and to co-ordinate delivery schedules for manufacturing and purchasing activities. These aims often conflict in other systems but under MRP are achievable simultaneously. The feature and ability of modern MRP systems to allow rapid re-planning, searching and in response to the changes of dynamic environment are responsible for attractiveness of MRP. (Chopra&Meidl,2001).

b. Just In Time

Although the history of Just In Time (JIT) traces back to Henry Ford who applied Just in Time principles to manage inventory in the Ford Automobile Company during the early part of the 20th Century, the origins of the JIT as a management strategy traces to Taiichi Onho of the Toyota Manufacturing Company. He developed Just in Time strategy as a means of competitive advantage during the post-World War II period in Japan.

The post-World War II Japanese automobile industry faced a crisis of existence, and companies such as Toyota looked to benchmark their thriving American counterparts. The productivity of an American car worker was nine times that of a Japanese car worker at that time, and Taiichi Onho sought ways to reach such levels.

Just in time (JIT) is a production strategy that strives to improve a business' return on investment by reducing in-process inventory and associated carrying costs. Just in time is a type of operations management approach which originated in Japan in the 1950s. It was adopted by Toyota and other Japanese manufacturing firms, with excellent results: Toyota and other companies that adopted the approach ended up raising productivity (through the elimination of waste) significantly. To meet JIT objectives, the process relies on signals or Kanban between different points, which are involved in the process, which tell production when to make the next part. Kanban are usually 'tickets' but can be simple visual signals, such as the presence or absence of a part on a shelf. Implemented correctly, JIT focuses on continuous improvement and can improve a manufacturing organization's return on investment, quality, and efficiency. To achieve continuous improvement key areas of focus could be flow, employee involvement and quality. (Bailey et al, 2005).

Just In time relies on other elements in the inventory chain as well. For instance, its effective application cannot be independent of other key components of a lean manufacturing system or it can "end up with the opposite of the desired result. In recent years manufacturers have continued to try to hone forecasting methods such as applying a trailing 13-week average as a better predictor for JIT planning; however, some research demonstrates that basing JIT on the presumption of stability is inherently flawed.

Christopher (2005) defines JIT as the uninterrupted flow of 100% acceptable materials delivered on due date as option cost 100% of time. the cited authors relate this definition for dozens of techniques including supplier certification materials, requirements planning, MRP Manufacturing resource Planning, (MRP 11), bar coding systems, contracting, electronic data interchange (EDI) Value analysis and work simplification. This type of purchasing production and inventory control has the great advantage of locating and fixing quality problems immediately. Christopher (2005) makes the point, 'It is like large rocks under the water in a lake". If the water level is too high one can see the necks and avoid the danger. Similarly if the inventory is small, the defects are spotted and corrected immediately. There is less scrap and remark, and quality improves dramatically. The supplier provides full time on site personnel who attend design-engineering meeting, investigates their products and use the company's purchase orders to affect delivery. (Christopher, 2005).

c. ABC Analysis

Lysons & Farrington (2006) defines ABC Analysis as a method for inventory categorization used in inventory management and/or materials management. In this approach normally 3 types of inventory items are separated: A Items: these require tight control and Just-in-time management, because even if they are present only in small numbers, they make up a large percentage of Inventory on a cost basis Items: these can be less tightly controlled because they are

less expensive than A-Items, C Items: these require only very limited or no control, because they are large in numbers and very cheap.

Smarus (2008) contents that; a big organization has a large number of items. All items cannot be given equal attention, it is therefore essential to determine the items or group of items that deserve the maximum control. One of the most important considerations for control is the value of the annual consumption of inventory items. It has been observed that a small number of inventory items consume a very large share of inventory consumption during the year. Further a little larger number of inventory items covers a moderate share of annual inventory consumption. This brought out the concept of ABC analysis.

In his study, Christopher (2005) found out that,ABC analysis is an important tool to control inventory investment in an organization. It provides good guidelines for adopting appropriate purchasing policy for different categories of items and also for amount of attention, which is required from different levels of management, to be given to various items. Any stock is segregated into different sections. These items are classified into 3 sections, A, B and C. The logic of segregating these items into sections is that section A consists of limited number of items that are very expensive. Section B has items that are not expensive and the number of units that is to be ordered is also not very large. The section C consists of numerous items, which have a low monetary value. The logic behind such segregation is that every section is viewed differently by the cost accountant, due the difference in order time, reorder time and delivery period. For example, though the unites in section A are less, their monetary value is also high and so is their delivery period. The ABC analysis is a simple and probably the most effective of all stock control methods.

Bierderman (2004) stressed that, maintaining inventory through counting, placing orders, receiving stock, takes personnel time and costs money, ABC analysis helps in placing the orders, deciding the quantity of purchase, safety stock thus saving the organization from unnecessary stock outs hence enhancing effecting inventory management.

d. Economic Order Quantity Model

Chopra &Meidl(2001) defines EOQ as an inventory-related equation that determines the optimum order quantity that a company should hold in its inventory given a set cost of production, demand rate and other variables. This is done to minimize variable inventory costs. The equation is as provided below.

$$EOQ = \sqrt{\frac{2SD}{PI}}$$

Where:

S	=	Setup	costs
D	=	Demand	rate
P	=	Production	cost

I = Interest rate (considered an opportunity cost, so the risk-free rate can be used)

The EOQ formula can be modified to determine production levels or order interval lengths, and is used by large corporations around the world, especially those with large supply chains and high variable costs per unit of production.Despite the equation's relative simplicity by today's standards, it is still a core algorithm in the software packages that are sold to the largest companies in the world.

The purpose of using the EOQ Model in this research is to assess the effect of Economic Order Quantity in enhancing the effect of Inventory Management Controls. Schroeder (2000) asserts that the ordering quantities which minimizes the balance of cost between inventory holding costs and re-order costs is what is known as economic Order Quantity . To be able to calculate a basic EOQ, certain assumptions are necessary that states that there is a known constant, stock holdings and ordering cost. Interestingly the rates of demand are known of which price are constant per unit. In addition replenishment is made instantaneously that is, the whole batch is delivered at once hence no stock-out allowed.

In his study, Dave (2001) found out that the addition number of units of inventories enables the company to minimize the total costs of inventory such as holding costs, order cost and shortage cost. Schaider (2001) echoed his sentiments by stating that EOQ attempts to estimate the best order quantity by balancing the conflicting cost of holding stock and of placing (Ordering) the replenishment orders.

Schaieder (2001) States that, EOQ Contributes to strategic inventory management since it is used as part of a continuous review inventory system, in which the level of inventory is monitored at all times, and a fixed quantity is ordered each time the inventory level reaches a specific re order point. He stressed that factors such as new product lines, promotional lines, outstanding orders and minimum order quantities are to be considered when ordering for the Inventory. According to Schaider (2001), ordering a large amount at one time will increase holding costs, while making more frequent orders of fewer items will reduce holding costs but increase order costs, the EOQ model finds the quantity that minimizes the sum of these costs and interestingly Lyson& Farrington (2006) asserts that EOQ is a model for making such kind of decisions.

Conceptual Framework

Conceptual framework is an analytical tool with several variations and contexts. It is used to make conceptual distinctions and organize ideas. Strong conceptual frameworks capture something real in a way that is easy to remember and apply. The conceptual framework in this study will give an overview of the independent variables and dependent variables that defined the objective of the research. The independent variable included; Inventory classification, Storage Methods, Material Codification and Material Inspection.

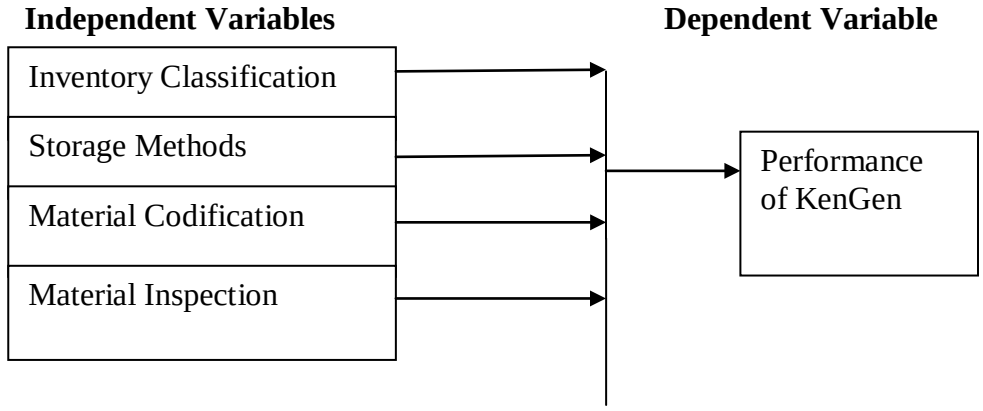

Figure 2.1 Relationships between Variables in the Study

Inventory Classification

There are a number of techniques which play an important role in the inventory control Programme. The techniques are very helpful in rationalization of inventory control approach and assist in formulation of inventory control policies. Stocks classification is done for strategic review, some of these techniques used by organizations are; Vital Essential and Desirable (V-E-D), in their Study.Ballou(2000) found out that Inventories also need to be classified according to Vital, Essential and Desirable (V -E-D), which in essence means that stress is more on importance rather than on *v*alue. The VED analysis is done to determine the criticality of an item and its effect on production and other services

Again, inventories may also be classified according to Fast-moving, Slow-moving and Non-moving items in order to see the rapidity of their use and towed out the unnecessary ones. This is aimed at keeping the total inventory size down and reduces investment. Thus; selective control may be exerted under different types of classification according to necessity. A single-type approach may not prove fruitful under all circumstances. Another technique is Fast, Slow &Nonmoving Analysis (FSN). According to Kumar (2007), in fast moving slow moving and non-moving of inventory classification. Here, classification is based on the pattern of issues from stores and is useful in controlling obsolescence. To carry out an FSN analysis, the date of receipt or the last date of issue, whichever is later, is taken to determine the number of months, which have lapsed since the last transaction. The items are usually grouped in periods of 12 months.FSN analysis is helpful in identifying active items which need to be reviewed regularly and surplus items which have to be examined further. Non-moving items may be examined further and their disposal can be considered.

Storage Methods

Ballou (2000) concurs that, Storage methods are vital aspects to be considered when an organization is setting up a warehouse, in line with that it will enable an organization to store its materials safely and securely for operational efficiency. Stock Control involves acquisition of Storage systems, storage systems refer to the techniques used to keep inventory safely and free from deterioration through conservation in the organization, eliminate cases of damages of materials, theft, pilferage, overstocking and obsolescence. Cases of stock outs of materials are as a result of poor documentation, poor monitoring of inventory levels and lack of control of stock movement within the stores.

Schaider (2000) states that, materials are equivalent to money and proper storage and great attention have to be paid to the proper storage, so that they are free from damage and possibilities of pilferage. Stores record such as bin card should give accurate balances as verified form time to time by the auditors. There are various storage methods -inventory control model that a company adopts in the control of its inventory. They include; Periodic Stocks Review and two Bin systems

Periodic stock review ascertains that this method involves fixing for each commodity, stock levels which are recorded in the stock control system and used as a means of indication on when some action is necessary. There are various kinds of stock levels, but the fundamental controls are minimum, ordering, hastening and maximum levels. (Saleemi,2007).

The minimum stock level is the amount expressed in unit of issue below which the stock of any given commodity should not be allowed to fall. When the level is reached it triggers off urgent action to bring forward delivery of the next order. Itis also called the danger level. In fixing the minimum level the main factor to be to be taken into Account is the effect which a run-out of stock would have upon the flow of work or operations.

The maximum stock level is the amount expressed in units of issue above which the stock should not be allowed to rise. The purpose of this level is to curb excess investment. In fixing a maximum the main consideration is usually financial and the figure is arranged so that the value of the stock will not become excessive at any time.

The reorder level is the amount expressed in unit of issue at which ordering action is indicated in time for the material to be delivered before the stock fall below the minimum. Two main factors are involved in deciding the ordering level ;first the anticipated rate of consumption and the estimated time which will elapse between the raising of a provision demand and the actual availability of goods in store after receipt and inspection. The hastening stock levels is the amount expressed in unit of issue at which it is estimated that hastening action is necessary to

request suppliers to make early deliveries. It is fixed between the minimum and the ordering levels. (Saleemi, 2007).

Two bin systems is used to establish a connection between the order and reorder procedures. As mentioned above, from the point of view of a producer, uneven supply of stock and odd consumption is not very healthy. Such unevenness is sorted by two-bin system. In such a system, the stock is sorted into two bins, or piles. The first stock (bin 1), is the larger of the two and is used up between the times periods that lasts from purchase of stock till the reorder. The second stock (bin 2), can be used from the time when the reorder is placed till the order is actually received. The second stock has a considerable amount of standby that can be used for emergencies.(Smarus, 2008).

Material Codification

Sree Rama Rao (2008) asserts that, Codification of materials can also be termed as the identification of materials. This deals with uniquely identifying each item in the inventory. It is useful in requisitioning items or the operational departments, in placing of orders by the purchase department, in receiving and expediting the items on receipt from the supplier, in having a unique record of each of the items in stores and in work-in-process or in warehouse so as to facilitate the control over the inventory levels, and also in having a good control over the loss, deterioration, obsolescence, non-movement, or pilferage of the items in the inventory. Unique identification of the materials – whether they are raw materials, work-in-process or finished goods – is the first step towards a good materials management system. Without it, the control over inventory by rigorous exercises such as inventory techniques is not very effective. Without it, confusion might prevail in the operational departments. Moreover for a good quality control system a unique identification is a pre-requisite. There are many other advantages such as variety reduction and standardization.

Weelearjan (2000) concurs that, Codification is another important element of inventory control activities. It helps in avoiding duplication of items in the inventory and enables correct entries in the bin cards, Inventory control cards and account codes.Codes, including barcodes, can make the whole process of stock control much easier. It includes allocating codes to all groups of items in the store for ease of control and tracking. Sree Rama Rao (2008) further confirms that, For the purpose of identification and convenience in storage and issue of materials, each item of material is given a distinct name. Such a process of giving distinct names and symbols to different items of materials is called codification of materials. Good store-keeping requires proper classification and codification of various items of stores on stock. Stores are generally classified either by their nature or by their usage. The former method of classification or classification by the nature of materials is most commonly used. Under this method of classification, the various items of stores are divided into specific groups like construction materials, belting materials, consumable stores, and spare parts and so on. All the items are grouped, so that each item of stores will be conveniently codified on alphabetical, numerical or alpha-numerical basis and given a distinctive store code number. Numerical codification system is each item is allotted a number, the numbering may be straight or in groups or blocks. This method is very suitable for those companies where the number of items is very large.In alphabetical codification, each item is denoted by a combination of the alphabets, for example, A for nut, B for screw and so on. This system is not suitable if there is large number of store items. In alpha-numeric codification, alphabets along with numbers are used for coding. The decimal codification system is more commonly used. The number of digits in the code will depend upon the extent of classification required. The greater the number of details to be covered, the greater will be the number of digits. This system of inventory control makes it quick and easy in identifying of materials; it helps to ensure a proper material control, saving of time in material handling and eliminates the chances of wrong issue.

Material Inspection

In their study, Patric&Bruce (2000) found out that, quality is important all along the supply chain, whether its checking quality at the supplier, monitoring quality along the production line, or checking final quality of the finished items before it is delivered to the customer. However, one area that is very important in the monitoring of quality is the inspection of items that arrive at the facility from your suppliers. Ensuring that the parts and raw materials are of the correct quality or specifications before the item even enters the plant are a key aspect of ensuring total quality of the finished goods. Inspection, in this context, means the examination of incoming consignments for quantity and quality. Very often there is a separate inspection department which does this work, but otherwise goods are inspected by stores personnel. Whatever the system of inspection in force, it is the duty of the stores function to see that the inspection is done before items are accepted into stock. Quality assurance activities, and 'co-maker' relationships between buyers and suppliers, have reduced the extent to which the inspection of incoming goods is undertaken, but it remains an important activity. There are various methods of inspection which can be adopted by the inspection committee they include Visual Inspection and sampling.

Visual Inspection is an inspection method where items that arrive at the receiving dock are first visually checked for defects or obvious issues. Items that are in packaging may also be rejected if the packaging is damaged. The quality department may have specific instructions for the warehouse depending on the item that is being received.

Sampling method is when an inbound delivery arrives for a large number of a particular part; the warehouse may not be required to inspect each and every item. In these cases the quality department may suggest a sample of the delivery be inspected. The sample size may be determined by the quality department and may depend on the required level of inspection, the quantity of the items received, and the past performance of the vendor to produce items meeting the necessary specifications. When the sample has been selected the items can then undergo visual inspection at the receiving dock or detailed inspection by the quality department. Samples of chemical materials may require through testing in the lab to determine whether the inbound delivery meets the required specifications.(Lysons& Farrington, 2008).

METHODOLOGY

Research Design

According to Kothari (2008), a research design is a systematic plan to study a scientific problem. The design of a study defines the study type, research question, hypothesis, independent and dependents variables, experimental design, and, if applicable, data collection methods and statistical analysis plan.Research design is the framework that has been created to seek answers to research questions (Muaz &Mohammed, 2013).

This study was descriptive in nature. Mugenda & Mugenda (2003) explain that descriptive design attempts to provide further insight into the research problem by describing the variables of interest. Descriptive survey was most appropriate for this study as it's a method of collecting information by interviewing or administering a questionnaire to a sample of individuals (Orodho, 2003). Inventory management affects organization performance and the aim of this research is to find out the effects of the various variables identified earlier on the inventory management procedures and their contribution on organization performance and this is the reason a descriptive design is best suited in this research. This reseach involves collecting information from only a portion of the population of interest, thus a sample survey was carried out. This is because the design produces higher response rate and the better data quality can be provided (Cooper, 2003).

Target Population

Mugenda(2003) defines target population as the specific population about which information is desired. The population for this study were staff members of Kenya Electricity Generating Company comprising of different departments that include Supply Chain, Mechanical, Finance, technical and operations all based at Kipevu Diesel Plant Mombasa.

Table 3.1 Target Population

Department	Target population	Total percentage (%)
1. Supply Chain	9	5
2. Mechanical	65	32
3. Finance	6	3
4. Technical Services	40	20
5. Operations	80	40
Total	**200**	**100**

Sample and Sampling Techniques

Mugenda & Mugenda (2003) define a sampling frame as a list, directory or index of cases from which a sample can be selected. A sample is defined as a smaller group obtained from the accessible population (Mugemda & Mugenda, 2003). Mugenda further explains that the sample should be carefully selected so as to be representative of the whole population with the relevant characteristics. Cramer & Howitt (2004) define it as a set of entities drawn from a population with the aim of estimating the characteristics of a population.

According to Kothari (2008), stratified random sample increases a sample statistical efficiency and provides data for analyzing various populations. Stratified sampling involves the division of a population into smaller groups known as strata. The study will employ stratified and simple random sampling techniques to develop the sample components.

Kothari (2008) discussed that, if a population from which a sample is to be drawn does not constitute a homogenous group, stratified sampling technique is generally applied in order to obtain a representative sample of the target group.

Determining sample size is a very important issue because samples that are too large may waste time, resources and money, while samples that are too small may lead to inaccurate results. Stratified random sampling technique was used to select a sample for the study. Mugenda & Mugenda (2003) explain that, the goal of stratified random sampling is to achieve desires representation from various sub groups in the population. In this study, Five sub groups were identified from which the sampling will be done; Supply chain, Mechanical, finance, technical services and operations.

The researcher determined the minimum sample size needed to estimate a process parameter through population mean μ. The study population is made up of 200 members with 5 stratum hence the population mean is 40. To come up with a precise sample size, the researcher used Yamane (1967) simplified formula to calculate the size at 95% confidence level and p=0.05. The formula produces an effecve method of determining sample size as shown below:-

$$n = \frac{N}{1 + N(e)^2}$$

Where n is the sample size, N is the population size, and e is the level of precision. When this formula is applied to the above sample, we get Equation as:-

$$n = \frac{200}{1 + 200\ (0.05)^2}$$

$$= 133$$

$n_h = (N_h / N) * n$

where n_h is the sample size for stratum *h*, N_h is the population size for stratum *h*, N is total population size, and n is total sample size.Ccategorizations of employees' respondents is as per table 3.2.

Table 3.2 Sampling and sample size

[17] Department	[18] No. of Staff	[19] Sample Size [20] $n_h = (N_h / N) * n$
[21] Supply Chain	[22] 9	[23] 6.0
[24] Mechanical	[25] 65	[26] 43.0
[27] Finance	[28] 6	[29] 4.0
[30] Technical Services	[31] 40	[32] 27.0
[33] Operations	[34] 80	[35] 53.0
[36] **Total**	[37] **200**	[38] **133**

Data Collection Instruments

Research instruments are measurements tools which were designed to obtain data on the research topic. Questionnaires were administered on the targeted population within the various departments. This was necessary so as to find out their views at different departments. Kothari (2004) defined a questionnaire as consisting of a number of questions printed or typed in a definite order on a form or set of forms. The researcher preferred to use this instrument as is free from bias from the interviewer, respondents have adequate time to give well thought out feedback large samples can be reached as well.

Data processing and Analysis

Kothari (2008) defines analysis as the computation of certain indices or measures along with searching for patterns of relations that exist among data groups. It is made up of qualitative statistics; analyzing information in a systematic manner in order to come to a useful conclusion and recommendation. The statistical method for this study was descriptive and inferential statistics. After the fieldwork, the data was coded and tabulated by use of tables. Data analysis was done using Statistical Package for Social Sciences computer software (SPSS version 20.0) for windows. Descriptive statistics such as mean, percentage and standard deviation will be used to present the various characteristics for the data sets. For this kind of study, descriptive analysis is the best and has been supported by such scholars as (Schaieder & Qing2001). According to Kothari (2008), correlation analysis studies the joint variations of two or more variables Correlation of positive one means a strong relationship between the independent variables and the dependent variable. A positive coefficient ranges from 0 to 1.0. Tables and charts will be used to present the results of the study.

A multivariate regression model was used to link the independent variables to the dependent variable as follows;

$$\mathbf{Y= \alpha +\beta_1 X_1 +\beta_2 X_2+\beta_3 X_3 +\beta_4 X_4 + \varepsilon}$$

Where:

Y = Performance of KenGen
$\mathbf{X_1}$ = Inventory Classification
$\mathbf{X_2}$ = Storage Methods
$\mathbf{X_3}$ = Material Codification
$\mathbf{X_4}$ = Material Inspection

In the model , α= the constant term while the coefficient $\beta_i i = 1…5$ was used to measure the sensitivity of the dependent variable (Y) to unit change in the predictor variables X_1 ,X_2 ,X_3 ,X_4. ε is the error term which captures the unexplained variation in the model.

RESEARCH FINDINGS AND DISCUSSION

Response Rate

Response rates are calculated by dividing the number of usable responses returned by the total number eligible in the sample chosen. (Mitchell 2009) argues, with documentation from others, that the survey response rate should be calculated as the number of returned questionnaires divided by the total sample which were sent for the survey initially out of 133 questionnaires distributed for data collection, 120 of them were returned and used for data analysis. Therefore the response rate for this study was 120/133*100= 90% and the remaining 10.0% (N=13) was non respondents. The 90.0% is considered adequate response rate (Mugenda & Mugenda 2010). The reliability of the data correction questionnaire is discussed in the next sections under reliability.

Reliability of the Questionnaire

Cronbach's test of reliability was performed purposely to determine reliability of the test instrument. On running the reliability procedure some items had to be removed as they had quite unusually low inter-item correlation. Consequently the number of remaining items in each variable and their corresponding reliability score are as shown in table 4.1. For each variable, the number of items retained for further analysis is shown in the last column.

Table 4.1: reliability of variables based on Cronbach's alpha level

Variable	Cronbach's alpha	No. of items
Material Classification	.763	4
Storage Methods	.829	4

Material codification	.911	4
Material inspection	.738	4
Organizational performance	.756	5

Note: An alpha level> .7000 threshold is acceptable.

Demographic profile of respondents

Gender, age, highest education attained and position held by the respondent were the demographic variables considered for this study. All these variables were measured as categorical variables under nominal level scale of measurement. These variables give an insight about the sample characteristics that took part in this study. Frequency distribution of findings in table 4.2 shows that the female respondents were 29% and 71 % were male. The huge difference could be attributed to the fact that most of the non-respondents were of ages of 18- 25 years. On the respondents' education level,(men=32, female=8).

A majority of respondents, 35.8%, were in 36-45 years age bracket and 31.7 were over 45 years age. However only 15.8% was between ages 18-25 years. Those with degree and postgraduate holders were the majority, 57.5%, followed by diploma, 32.5% and certificate were only 10.0 %. These respondents were from different job levels; top level, 83%, middle level, 60.0% subordinate, 21.7% and general worker, 10.0%. So the foregoing distribution of demographic characteristic describes the sample from which data was collected for analyzing the relationship between the staff's level of education and performance of KenGen.

Table 4.2: demographic profile of respondents

		N	Percentage
Gender of respondent	Female	35	29%
	Male	85	71%
Age in Years	18-25yrs	19	15.8
	26-35 Yrs	20	16.7
	36-45 Yrs	43	35.8
	Over 45 Yrs	38	31.7
Highest education attained	Certificate	12	10.0%
	Diploma	39	32.5%
	Degree & Postgraduate	69	57.5%
Job Level	Top Level	10	8.3
	Middle Level	72	60.0
	Subordinate	26	21.7
	General Worker	12	10.0

Descriptive statistics of study variables

The term descriptive statistics deals with collecting, summarizing, and simplifying data. It seeks to achieve this in a manner that meaningful conclusions can be readily drawn from the data. In this study, the descriptive statistics specifically sought to gauge the level of the independent variables (classification, storage method, codification and material inspection) and independent variable, organizational performance. The responses were captured on a 5-point Likert scale ranging from 1-Strongly disagrees to 5-strongly agree. The mean and standard deviations of these responses were calculated to gauge the mean level of the variable and its variability (standard deviation, SD).

Inventory classification

Material classification system used in KenGen was assessed using four sub-variables. The analysis result in table 4.3 below shows that materials are clearly classified, mean=4.52. The classification system is based on rate of usage (that is, Fast-moving, Slow-moving and Non-moving items), mean= 4.33, the materials are classified based on usage, mean=4.21, and always all the inventory is classified on the basis of its importance and not its value, mean=3.90.This has been supported by Ballou (2000) who found out that, Inventories need to be classified according to Vital, Essential and Desirable (V -E-D), which in essence means that stress is more on importance rather than on value. The VED analysis is done to determine the criticality of an item and its effect on production and other services

According to Kumar (2007), in fast moving slow moving and non-moving of inventory classification. Here, classification is based on the pattern of issues from stores and is useful in controlling obsolescence. To carry out an FSN analysis, the date of receipt or the last date of issue, whichever is later, is taken to determine the number of months, which have lapsed since the

last transaction. The items are usually grouped in periods of 12 months.FSN analysis is helpful in identifying active items which need to be reviewed regularly and surplus items which have to be examined further. Non-moving items may be examined further and their disposal can be considered.

Therefore at KenGen the respondents agreed that, items are assessed in terms of the rapidity of their use and importance in production process, materials are well and clearly classified purposely to keep total inventory size and cost down.

Table 4.3: Inventory classification in KenGen

	N	Mean	Std. Deviation
1. Material are well and clearly classified	120	4.52	.608
2. System of classification is based on rate of usage	120	4.33	.473
3. Classification is according to usage	120	4.21	.408
4. Inventory is classified based on its importance rather than its value (VED)	120	3.90	1.048

Material storage method

Material storage at KenGen Company was measured using four variables and the findings presented in table 4.4. The findings indicated that there is enhanced inventory management, mean=4.70, the materials are stored according to their respective groups mean=4.46, First-in-first-out system used and the stock levels are well monitored mean=4.03. Ballou (2000) concurs that, Storage methods are vital aspects to be considered when an organization is setting up a warehouse, in line with that it will enable an organization to store its materials safely and securely for operational efficiency. Stock Control involves acquisition of Storage systems, storage systems refer to the techniques used to keep inventory safely and free from deterioration through conservation in the organization, eliminate cases of damages of materials, theft, pilferage, overstocking and obsolescence. Cases of stock outs of materials are as a result of poor documentation, poor monitoring of inventory levels and lack of control of stock movement within the stores.

This is confirmed by scholars such as Schaider (2000) who asserts that, materials are equivalent to money and proper storage and great attention have to be paid to the proper storage, so that they are free from damage and possibilities of pilferage. Stores record such as bin card should give accurate balances as verified form time to time by the auditors. There are various storage methods -inventory control model that a company adopts in the control of its inventory. They include; Periodic Stocks Review and two Bin systems

According to the employees who took part in this study, storage procedures of material at KenGen was proper and orderly. That is to say, there are proper documentation and dating of materials to minimize obscelence; the stock levels are well monitored and there is likely to have minimum pilferage and expired material as First-in-first-out basis is used.

Table 4.4: Material storage at KenGen

	N	Mean	Std. Deviation
1. There are proper material documentation	120	4.70	.603
2. Stored according to material groups	120	4.46	.634
3. First in first out system used (FIFO)	120	4.39	.626
4. Material stock level are monitored effectively	120	4.03	.869

Material coding at KenGen

Material coding at KenGen was measured using four variables and findings tabulated in table 4.5. The findings indicated that, at KenGen the material coding is strategic mean=4.54, incoming materials are well classified for coding mean=4.48, the material coding system is effective mean=4.12, and also the electronic devices adopted by KenGen for material coding has somehow enhanced inventory management mean=3.62,

Scholars such as Weelearjan (2000) concurs that, Codification is an important element of inventory control activities. It helps in avoiding duplication of items in the

inventory and enables correct entries in the bin cards, Inventory control cards and account codes.Codes, including barcodes, can make the whole process of stock control much easier. It includes allocating codes to all groups of items in the store for ease of control and tracking this increases efficiency and effectiveness in inventory management.

These findings therefore indicate that at KenGen, materials are strategically coded, all the incoming materials are grouped for coding for ease of control and monitoring, the devices used enhances inventory management hence material coding in KenGen is effective.

Table 4.5: Material coding

	N	Mean	Std. Deviation
1. Strategic material coding system	120	4.54	.660
2. Incoming material classified for coding	120	4.48	.502
3. Material coding is effective	120	4.12	.918
4. Electronic devices enhance inventory management	120	3.62	1.589

Material inspection at KenGen Company

Material inspection at KenGen was the fourth independent variable considered. It was measured using four sub variables. Based on the findings in table 4.6, it was clear that materials received are thoroughly inspected mean=4.98. The procured materials are inspected against set standards mean=4.73, the KenGen tender committee is well composed mean=4.33, and sub-standard materials are not accepted mean=3.80. According to the respondents it is evident that, it is important to comprehensively inspect materials upon receipt, materials should be inspected against some set standards, and Tender processing committees should be well composed this will ensure that substandard goods or materials get rejected at the receiving point enhancing quality of goods, works and services as supported by Patric & Bruce (2000) who found out that, Quality is important all along the supply chain, whether its checking quality at the supplier, monitoring quality along the production line, or checking final quality of the finished items before it is delivered to the customer. However, one area that is very important in the monitoring of quality is the inspection of items that arrive at the facility from your suppliers.

Table 4.6: Material inspection at KenGen Company

	N	Mean	Std. Deviation
1. Material received are comprehensively inspected	120	4.98	.129
2. Material inspected against set standards	120	4.73	.444
3. Tender Committee well composed	120	4.33	.873
4. Substandard materials are totally not accepted	120	3.80	1.728

Inferential statistics

This section covers the findings of regression and correlation analysis. It includes direction and magnitude of relationship, Goodness of fit Model and Test of significant of model.

Correlation analysis

Correlation coefficient is a single number that describes the degree of the relationship between two or more variables. A Pearson correlation indicates the direction, strength and significance of the bivariate relationships of two variables. According to William (2003) theoretically there could be a perfect positive correlation between two variables which is by 1.0 or a perfect negative correlation between two variables which is represented by -1.0.

Table 4.7: Pearson Correlation coefficient matrix

	Classification	Storage	coding	Inspection
classification	1	.513**(.000)	.707**(.000)	.763**(.000)
Storage	.513**(.000)	1	.730**(.000)	.607**(.000)
Coding	.707**(.000)	.730**(.000)	1	.668**(.000)
Inspection	.763**(.000)	.607**(.000)	.668**(.000)	1
Performance	.680**	.424**	.707**	.814**

Note: (1) **. Correlation is significant at the 0.01 level (2-tailed). (2) P-values are in parentheses. (3) all p-value<0.001)

Correlation analysis was performed between all the IV independent variables. The resultant correlation matrix is presented in table 4.7 above. From the tabulated result, it was deduced that the correlation of one variable to its own self equals to 1. There was moderate positive correlation between material classification at KenGen and storage methods with the value being 0.513, this indicates that when the materials are well classified either according to their usage or type the storage method will be efficient. Storage method was found to be positively and significantly correlated with material coding, significant value of 0.730, this is because it is through the coding of materials that determines how the materials are stored for instances the codes that relate to machine spares will be stored differently this enhances retrieval of stock and ease of stock take. Similarly material inspection was found to be strongly and positively correlated with material coding with the significant value of 0.607.

In conclusion, an increase in efficiency and effective classification of material, material storage, inspection and coding will be accompanied by increased performance and vice versa. Therefore these four variables' level of efficiency can predict the level of performance at KenGen.

Regression analysis

Regression analysis was undertaken with respect to performance of KenGen as the dependent variable and the four independent variables; Storage methods, inventory classification, material coding and material inspection. Multiple linear regression analysis is a general statistical technique used to analyze the relationship between a single dependent variable and several independent variables (William 2009). It is one of the most extensively used multivariate statistical techniques for testing hypotheses and predicting values for dependent variables. Data was input into the SPSS software and the results obtained shown in table 4.7.1 below.

Table 4.7.1: Model Summary

Model Summary				
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.881[a]	.775	.768	.38815

The model summary shows the ratio of variation in the response variable, in this case performance that can be attributed to the predictor variables in the model; it is called the coefficient of determination. Therefore from the model summary table 4.8; the four IV independent variables correctively accounted for about 77.5% of the variations in performance (R square=.775) and the remaining, 22.5% can be attributed to other factors not captured in the model.

Table 4.7.2: ANOVA

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	59.848	4	14.962	99.309	.000[b]
	Residual	17.326	115	.151		
	Total	77.174	119			

A. Dependent Variable: Performance

B. Predictors: (Constant), Inspection, Storage, Material Classification, Coding

This study used ANOVA to establish the significance of the regression model with a significant error level of .05. The model was statistically significant in predicting youth participation in given that the regression model had a probability of less than 0.05% of giving a wrong prediction hence high reliability of the result.

Estimated Model of Coefficient

From the established linear equation model below;

$\mathbf{Y= \alpha +\beta_1 X_1 +\beta_2 X_2+\beta_3 X_3 +\beta_4 X_4 + \varepsilon}$

Where Y = Performance of KenGen
α = Constant
X_1 = Inventory Classification
X_2 = Storage Methods
X_3 = Material Codification
X_4 = Material Inspection
E = stochastic term or error term
$\beta_1, \beta_2, \beta_3, \& \beta_4$ = Regression coefficient
As depicted by Table 4.7.3 below,

Table 4.7.3 Coefficients 1

Coefficients Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.968	.481		2.013	.046
	Material classification	.144	.153	.072	.944	.347
	Storage	.701	.122	.386	5.726	.000
	Coding	.820	.118	.546	6.953	.000
	Inspection	.790	.080	.739	9.932	.000
a. Dependent Variable: PERFORMANCE						

From chapter 3, the estimated regression model was $Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \varepsilon$. Therefore using the multiple regression coefficients in table 4.10 above, the fitted regression model would be: $-Y = .968 + .144X_1 + .701X_2 + .820X_3 + .790X_4$.

From the standardized Beta;

$\beta_{1=}$ .144; Shows that a unit increase in material classification results in 0.144 increase in performance of KenGen other factors held constant.

$\beta_{2=}$ .701; Shows that an increase in storage methods results in 0.701 increase in performance of KenGen other factors held constant.

$\beta_{3=}$ .820; Shows that an increase in Material Coding results in 0.820 increase in Performance of KenGen other factors held constant

$\beta_{4=}$ .790; Shows that an increase in material inspection results in 0.790 increase in Performance of KenGen other factors held constant

From the regression analysis, the higher the absolute value of the beta coefficient of the four variables, the higher the contribution that the independent variables have on the dependent variable (performance). Therefore, coding of material had highest contribution (β=.820, p<.001) on performance of KenGen, then followed by inspection procedures (β =.709, p<.001), storage methods (β=.701, p<.001), and material classification was least and insignificant contribution to performance (β=.144, p=.347).

The main objective of the study was to assess the effects of inventory management procedures on performance of KenGen. Based on these findings, coding has the highest effect; inspection and storage had significant positive effect on the performance of KenGen. Therefore, efficient and effective coding, inspection and storage procedures of materials would be key to reduced spoilage, pilferage, loses stock-out costs and material theft at KenGen. Consequently there is therefore increase chance of meeting customer expectation through timely delivery of customer quality service or products.

II. SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Summary of the Findings.

The study was undertaken at KenGen Company in Mombasa Kipevu power station to assess the effect of inventory control procedures on the performance of KenGen. To achieve this objective, four specific objectives were formulated and studied. Summary of the major findings has been designed according to each individual independent variable.

The first objective was 'To determine how Inventory classification contributes to performance of KenGen' analysis of data produced descriptive indicating that materials were well classified according to importance or grouping. It was found that material classification procedures positively correlated with performance. The regression result revealed that classification procedures had a significant positive effect on performance at KenGen. These finding are in line with what other studies found that material classification is essential in inventory management.

The second objective sought to determine the effect of storage methods on performance of KenGen. It was established that, at KenGen, storage procedures are effective, that is to say, they use first-in-first out procedures, materials well documented, and stock levels are well monitored. The storage procedures were found to correlate positively and significantly with performance. The effectiveness of storage methods and procedures had a significant effect on performance of KenGen. Therefore with proper storage records at KenGen, the company is able to determine the optimum order quantity that it should hold in its

inventory given a set cost of production, demand rate and other variables. For that reason variable inventory costs are likely to be minimal at KenGen. Consequently if this benefit is transferred to the customer by pricing its product/services competitively, then the company becomes more competitive in terms of production cost.

The third objective was material Coding. It was found that the coding of materials at KenGen help in properly identifying materials and it is effective. Example there is clearly coded materials. Proper material codification procedures was found to be positively and significantly related to performance. From the regression analysis, these procedures had a significant positive effect on performance at KenGen. So at KenGen, material duplication is minimal due to proper coding systems and procedures, materials are well trucked and only essential and necessary materials for production or any other use are acquired at the right time. The implication is that reduced loses through theft, expiry, obsolesce are minimal. Therefore production costs are consequently lowered to the advantage of the company.

Finally the fourth and last specific objective sought to determine the effect of material inspection procedures on performance of KenGen. It was established that the inspection procedures put in place were quite effective in ensuring only quality materials are allowed into the store which are comprehensively inspected against set standards. The inspection level of materials and thoroughness positively and significantly related with performance. The inspection level had positive effect on performance, the effect was significant. The findings are in agreement to other studies that quality is a key objective of procurement and essential to organization performance. Therefore the materials used for production at KenGen were of quality and therefore quality production was obtained. Quality being one of the critical factors customers' value, then KenGen customers are satisfied in terms of quality.

In summary the inventory procedures adopted at KenGen were found to be effective. They result to proper inventory management. Inspection ensured quality materials are procured, proper records ensured that there are the right materials at the right time and right place. Consequently there was minimum production cost due to minimal losses.

III. Conclusions

Based on the findings above, the study found that classification of materials was important in improving performance of KenGen. An improved classification system (example, classifying items as either fast-moving, or slow-moving or non-moving goods) would have a positive effect on inventory management and consequently the organizational performance. Also the study concludes that effective and efficient storage procedures have positive effect on inventory management. The organizations which do monitoring stock levels would minimize stock costs, idle stock, theft and pilferage.

The study further concluded that effective coding of all materials acquired would result to effective inventory management. That is to say, the materials which are strategically coded according to the class the material belongs would enhance inventory management at KenGen. This would not only reduce material loses; it would also improve material trucking and monitoring stock.

Recommendations

The study revealed that, the business world is becoming more and more competitive. Companies compete to produce products and services that retain customers. Customers can be retained through quality and competitively priced products. To achieve these, companies have to procure quality materials through inventory classification, storage methods, material codification and material inspection.

The study therefore recommends that:-KenGen should invest and ensure proper inspection of all materials as one of its source of competitive advantage.

Good store-keeping requires proper classification and codification of various items of stores on stock. Therefore KenGen should consider classifying materials either by their nature or by their usage and also classify other materials in terms of their criticality in the production process.

The study also recommends that Procuring entities like KenGen to invest in modern state of the art inspection equipments to enhance the quality and conformity of the materials procured. By so doing the company would produce quality products and therefore remain competitive in the market.

The study further recommends that, there is need for the procuring entities to adopt E-procurement and processes such as strategic Supplier Relationship Management (SRM), this will enhance quality of products, reduce non-conformity, reduce lead time, assist in stock level monitoring and reduce storage cost as the suppliers will be able to supply as and when required.

Limitations of the Study

Various challenges were faced during the study, key among them being limited financial resources to cover all expenses that would have been necessary for the study. Some respondents were outright hostile and felt that some information may lead to too much exposure on the institution and were therefore not willing to disclose all that was necessary. Majority of the senior and middle level management did not have time to respond to questionnaires and therefore delegated to junior staff members who did not have all the requested information and were not willing/ able to go back for clarification or more information since they view the exercise as of a purely academic nature rather than a basis for future research and which may result in mutual benefit. Also the study was carried out in one of the KenGen's power station this may not depict the true picture of inventory management in relation to KenGen as an organization.

Suggestions for further study

This study confined itself to determine the effect of inventory procedures on performance of KenGen, therefore this study recommends that further research be undertaken to simultaneously consider other factors which might influence organization performance like employee motivation, training, government policies and emerging issues in public procurement. To this end the study recommend those stakeholders and other organizations, to relook into their inventory management procedures seriously as their source of better performance.

REFERENCES

[1] Baily, P. J. H. (2008). Procurement principles and management. Harlow, 9th edition, England: Prentice Hall.

[2] Ballou H. (2000).Evaluation inventory Management performance using turnover Curve. International Journal of physical Distribution & Logistics management: London: McMuster Publishing

[3] Biederman, D. (2004). Reversing Inventory Management. Mc Graw – Hill, New York

[4] Chan& Chan; (2005) Questionnaire Interpretation

[5] Chandra C, (2001). Taxonomy of Inventory policies for supply chain effectiveness.International Journal of Retail Distribution Management. 15:15-27

[6] Chopra, S and Meidl.P (2001).Supply chain Management, New York: prentice Hall.

[7] Christopher M, (2005).Logistics and supply chain Management, 3rd Edition; Britain; Cengage

[8] Cooper, R., Schindler, P. (2003).Business research methods. New Delhi, Tata McGraw Hill

[9] Dave, P (2001). Optimizing Economic Order Quantity.6th edition. McGraw -Hill: New York.

[10] Durrheim and Wassenaar; (2002) Validity and reliability of data

[11] Kothari, C.R (2008). Research Methodology: Methods and techniques(2nd edition)

[12] Kumar R, (2005). Research Methodology: A Step-by-Step Guide for Beginners, (3RDEdn)

[13] Lyson K, Farrington B (2006). Purchasing and supply chain Management, (7thEdn). London: Prentice Hall.

[14] Lysons, K. (2006). Purchasing and Supply Chain Management, (3rd edition). London Prentice Hall.

[15] Mitchell (Mitchell RC. Washington, DC: Resources for the Future; 2009. Using surveys to Value Public Goods: The Contingent Valuation Method.)

[16] Muaz, Jalil Mohammad (2013).Practical Guidelines for conducting research.Summarizing good research practice in line with the DCED StandardNew Delhi, New Age international Publishers Limited

[17] Mugenda, O.M, & Mugenda, A.G. (2003).Research Methods: Quantitative and Qualitative Approaches.Acts Press, Nairobi.

[18] PatricJ.Muntane and Bruce H.Charnov (2000), Management, 3rd edition. Publishing Ltd.

[19] Razi A. & Tam, M,J (2003). An applied model for improving Management in ERP Systems, Journal of Logistics Information Management 18:43-67

[20] Saleemi N.A (2007). Store Keeping and stock control simplified, Saleemi Publication Ltd. Nairobi.

[21] Schaieder M & Qing J. (2001). An alternative analysis of inventory cost of JIT and EOQ Purchasing, international journal of physical distribution & Logistics 13:24-31.

[22] Skeet J. (2001).Maximizing Profitability through inventory Management. Prentice Hall, Englewood Cliffs, N.J

[23] Smarus J. (2008). The impact of increasing demand visibility on production and Inventory Control Efficiency. Mc Graw – Hill, New York.

[24] Sree Rama Rao, (2008): "Storage and Control of Stock "; 2nd Edition; London; Pitman

[25] Sumil B. & Sameer.P (2007).International Purchasing, Inventory Management and Logistics London: Prentice Hall.

[26] Tersine R. (2008). Principles of Inventory and Material Management 2nd Edition. North Holland.

[27] WeeleArjan J. V. (2000).Purchasing and Supply Chain Management; Analysis, Planning and Practice, (2ndEdn), Thomson Learning, Bangalore, India.

[28] William Stevenson (2009): Operations Management, 10th Edition.

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Near Miss Incident Management, the Root for an Effective Workplace Safety is determined by the Management Commitment

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Abstract- Near miss incidences are often ignored by most stakeholders in the workplace and yet every major or fatal accident or incident originates from a near miss that was not prevented or controlled. Management of near miss incidences is directly proportional to the prevention of major incidences and accidents and therefore goes a long way to eliminate or minimize work place hazards and guarantee the safety of the workers with a direct bearing on the overall performance of the organization. Although the near-miss concept has long been understood in the oil industry, what has been largely missing is the integration of near-miss management into the safety culture and day to day operations in a manner that underlines the critical connections between near-misses and behavior. In the oil industry, incident assessment is key to its very survival and profitability. But among other incidences, there were challenges in the management of the near miss incidences in the organization, hence the necessity of the study to determine the role of near miss incidents management on the safety performance of the organization. Near Miss incident Management System theorems were also part of this study. In this study the target population was the workers in an Oil and Gas organization . This involved those engaged in storage of white (refined) oil products, pipeline transportation and dispensing of petroleum products within the study area. For this descriptive study, a random sampling was used to select a representative sample of the target population. Data collection in the research was through the use of structured questionnaires designed by the researcher. Questionnaires were distributed in cluster and randomly among the workers. After data collection, analysis of the same was done using appropriate statistics software such as SPSS. The study found that Management commitment in the organization may be improved by the availing of resources for the establishment, implementation and maintenance of a Near Miss Incident Management System (NMIMS) for an effective work place safety performance

Index Terms- Near miss, Incident, Hazard

I. INTRODUCTION

At the root of every accident or incident fatal or otherwise is a near miss that was ignored and not prevented. Near miss incidents often precede loss producing events but are largely ignored because nothing (no injury, damage or loss) happened. Employees may not be enlightened to report these close calls as there has been no disruption or loss in the form of injuries or property damage (Vassiliou et.al, 2009). Thus, many opportunities to prevent the accidents that the organizations have not yet had are lost. Near misses are often less obvious than accidents and are defined as having little if any immediate impact on individuals or processes. Despite their limited impact, near misses provide insight into potential accidents that could happen. Safety activities in most organizations are reactive and not proactive. Many organizations wait for losses to occur before taking steps to prevent an occurrence.

Overview of Near Miss

A near miss is an unplanned event that did not result in injury, illness, or damage but had the potential to do so. Only a fortunate break in the chain of events prevented an injury, fatality or damage; in other words, a miss that was nonetheless very near. A near miss is also any unplanned event or chain of events in which personal injury or damage to property, plant or equipment has only been avoided by choice or chance.

A broader definition which focuses not only on the negative side of near misses but also on their positive contribution to a system's operation describes a near miss as an event, a sequence of events, or an observation of unusual occurrence that possess the potential of improving a system's operability by reducing the risk of upsets some of which could eventually cause serious damage. A near miss is an opportunity to improve environmental, health and safety practice based on a condition, or an incident with potential for more serious consequence. Near miss is viewed as "improvement opportunities" which positive experiences are encouraging employees to report rather than to hide. It also includes all operational disturbances, some of which have the potential to cause serious damage while others are inconveniences that mainly cause inefficiencies. It not only captures events but also includes observation.

Although the label of 'human error' is commonly applied to an initiating event, a faulty process or system invariably permits or compounds the harm, and should be the focus of improvement. Other familiar terms for these events are a "close call", or in the case of moving objects, "near collision" or a near hit. According to (Lauver et al 2009) a near miss is defined as "anytime an employee felt that they were in an unsafe situation due to circumstances, equipment, or their own actions which had a high probability of resulting in an injury, and only by good fortune did the employee remain uninjured". Near miss definitions vary and may even include incidents that result in damage or injuries but not death.

Statement of the problem

As numerous catastrophes illustrate, management failure to capture and remedy near-misses may foreshadow disaster. Notable examples where near-miss precursors have been observed but not effectively managed with dire consequences include:-

The 1997 Hindustan refinery explosion in India. Sixty people died and over 10,000 metric tons of petroleum-based products were released to the atmosphere or burned. Written complaints of corroded and leaking transfer lines where the explosion originated went unheeded (Khan and Abbasi, 1999).the 1998 morton explosion and fire resulting from a reactor temperature excursion (khan et al, 1999).nine people were injured, two seriously In an accident investigation, the Chemical Safety Board concluded, "Management did not investigate evidence in numerous completed batch sheets and temperature charts of high temperature. As these examples illustrate, failure to utilize precursor data to identify and remedy systemic flaws can have catastrophic results. To reduce the likelihood of future catastrophe and further improve employee safety and process reliability, management systems that recognize operational weaknesses need to be developed to seek and utilize accident precursors (March et al., 1991). These programs operate under the umbrella of Near Miss Management Systems. Near miss management systems have been developed and are implemented across a range of industries including the chemical/process, airline and rail, nuclear and medical disciplines.

II. RELATED LITERATURE

The Safety Pyramid

"Unsafe act or mechanical or physical hazard" lines up with Heinrich's third, and arguably most controversial, axiom: "The unsafe acts of persons are responsible for the majority of accidents." According to Heinrich, 88 percent of accidents are caused by unsafe acts of persons and 10 percent by unsafe machines (with 2 percent being unavoidable or acts of God).From the "safety pyramid", and was further developed by Frank E. Bird based on his 1969 study of industrial accidents (Bird and Germain, 1996). He concluded that out of 300 near misses, there shall be 29 minor incidences causing minor injuries which require first aid for intervention and 1 major incident which may be fatal or cause major injury such as impairment. Therefore, if the near misses can be reduced, chances of the major incident shall also be remote or drastically reduced.(Phimister et.al,2000)

Fig.1 The Safety Pyramid

Essentially, injury data capture the unfortunate individuals. To illustrate this, Lauver et al. cited Heinrich's (1931) finding that for every 300 unsafe acts, 29 minor injuries occur and one major injury occurs (Lauver et al., 2009).

The Ice Berg Theory

According to this theory, workplace incidents and accidents cost an organization in terms of compensation payments but more costs are the indirect costs of the same. It is a calculation method developed to estimate the indirect costs of an incident or accident in the workplace. Assuming the cost of an accident is shillings 10,000.Associated costs which include but not limited to investigations, loss in productivity, equipment downtime is five times the accident cost which will be shillings 50,000 . The replacement costs such as overtime, new employee, re-training will be shillings 10,000. The real cost of this accident shall be shillings 70,000 which is seven times the cost of the accident. Therefore in the Iceberg Theory, the initial cost of an accident is only the tip of what it really costs an organization.

Near Miss Management System

For every accident that takes place, there are a large number of near miss incidents. Incidents that involve no injury or property damage but could have done it should still be reported and investigated to find the root cause and prevent a close call becoming a reality. The investigation may well highlight weaknesses that are likely to be of interest to other companies and services and it will be important to ensure that the details are circulated as widely as possible. General safety warnings are circulated within the company and other service circulars, thus strengthening procedures across the industry. It should be noted that, if a serious incident occurred and it was subsequently discovered that there had been an earlier similar near miss incident that had not been reported, the consequences could be more severe. It is, therefore, important for near misses to be reported. Although it takes sometime to fully develop a system, a well designed near-miss management structure should have the following components: A near miss Management Oversight Team at the corporate or headquarters level, a near miss Management Team at site level, a well-defined near miss process with principles defined at the corporate level, an electronic near miss management system to report, analyze and track near misses. An audit system to check the effectiveness of the near-miss practices, identifying weaknesses and strengths of all steps

and training programs for all workers (Phimister etal 2000).According to the Wharton Risk Center's near miss study, conducted in 2000, an effective NMMS must cover the entire range of operations and must contain the essential components of eight steps, as in the near miss management process.

Near miss management Process

This is a seven step process aimed at implementing the NMMS. These steps include Identification, Disclosure (Reporting), Prioritization, Distribution Identification of Causes (Causal analysis), Solution Identification, Dissemination and Resolution (Tracking) (Phimister et al.,2000).

a. Identification

Identification is the first step of the process where an individual recognizes an incident or a condition as a "near miss". To execute this step successfully there must be a clear definition of a near miss, and the means to ensure that every employee in the organization knows this definition at all times. This calls for sensitization of all employees in the organization which should be facilitated and driven by the Management or their representative and the workers' representatives. These sensitization campaigns should be done by the HSE committees using such tools as group discussions, tool box talks, brochures and films. As the employees become aware on how to identify near miss incidents, they shall be equipped to own and be part and parcel of this worthy course. Establishing a culture sensitive to the Near Miss concept is critical for successful implementation of a Near miss management system and takes time and effort to develop. Identification of current and potential problems can be encouraged by recognizing and rewarding observant workers and by publicizing identified problems as well as the actions taken to address them. (Phimister et al.,2000)

b. Reporting or Disclosure

A recognized near miss has only limited value even to the one who identified it, unless it is reported for appropriate measures to be taken to prevent its recurrence. Once a near-miss is identified it must be disclosed, preferably in a written form. This can be done either by the worker who identified the near miss or by a supervisor to whom a near-miss is reported verbally who may resolve this worker's problem or bring it to the attention of others.

Having a clear and simple procedure for reporting would encourage this process and would increase the probability of reporting most near miss observations. Reporting should be made very simple to encourage every employee who observes or experiences a near miss to fill-out a report without spending much time and effort. It is important to capture as many Near Misses as possible even though not all of them may have the same importance. The objective of near miss disclosure is to ensure that all identified near misses are reported.(Bridges,2000)

The reporting system must be accessible or "user friendly", as well. Reporting systems should be empowering for all. There are instances where workers suspected a hazard or problem but stayed silent because they did not have access to data that could provide objective support or justify their feelings (Maher & Casamayou, 2009). And, in some cases, low-level workers who know of problems may not have enough clearance to submit a report; thus, serious information may not be recorded or communicated to decision makers.

An organization's intent, or motivation, for requiring injury and near-miss reporting influences worker participation. Workers that fear punishment, retribution, or criticism are likely to remain silent (Maher & Casamayou, 2009; Rose, 2004). Fortunately, research suggests that there are ways to encourage employee participation. A shift towards an organizational culture that allows workers to feel like reporting is an opportunity rather than a self sacrificing event can increase reporting organizational safety (Hofmann & Stetzer, 1998; Morris & Moore, 2000). Other ways to effect positive change toward injury and near miss reporting is to ensure anonymity or re-direct accountability to an outside agency.

c. Prioritization and Distribution

This is the ranking of near misses according to the severity of the consequence they may cause in case they occurred to allocate appropriate time, expertise and resources to follow up on the incident. Prioritization is a very critical step in establishing an effective Near Miss Management system since this step determines, out of the large number of Near-Miss reports, which ones will require and to what extent the attention of the limited resources of the organization. Prioritization is important for a near miss program with a high number of reports in which case most near misses shall be investigated by the reporter and/or the supervisor. High priority near misses should have a separate distribution channel from the low priority ones to ensure appropriate trafficking of the report for prompt attention. The characteristics for high priority near misses include but not limited to:-Expertise beyond the worker's capabilities is required to investigate the incident, Similarity of the incident to previous incidences or trends hence requiring the same attention, Incident with significant potential for major loss, cost to mitigate and environmental damage (Phimister et al., 2000).

d. Evaluation (Causal Analysis)

Once a near miss is reported based on the given priority the reporter, a supervisor or a group of experts related to the subject matter should identify the root cause(s) or the underlying factors that enable the incident or unsafe condition and come-up with actions(s) to eliminate the recurrence of this or similar incidents (Peace,1992).

Clearly priority given to a particular near miss plays an important role in these follow up activities (Eckes,2000). If the reported incident is labeled as "high priority", it may require a rather thorough causal analysis such as identification of root-causes to help tackle the problem at the basic level. This is accomplished through a HSE committee in an organization. Recurrence of similar incidents indicates that implemented solutions have not been satisfactory. Over time, due to repeating events of similar nature, the priority of new near misses will become higher with each report.

e. Elimination and Control

According to (Soukas et al, 1993),once near misses are identified, they should be controlled from recurrence by elimination or minimizing them. This is the determination of the corrective actions that remedy the causes of potential accident. The corrective action may be to eliminate or minimize near misses, manage the near miss incidence and deter it from recurrence and to alert all stakeholders in the organization of the hazard such as through signs or alarm. The existing standard

operating procedures in the organization should be changed to account for the hazard.

The employees should be sensitized on the control measures for the specific near miss corrective action. This acts as a learning point. The identified corrective action should not be a source of new incidents. The hierarchy of control should be adopted with the last option for appropriate and adequate personal protective equipment for all the workers (Dowell,1997).

f. Dissemination

This is the channeling of the identified corrective actions to the respective implementers. It also involves informing the targeted audience on the decision made. This involves the use of all the necessary resources (human and financial) to implement the corrective actions.

g. Resolution and Review

This is the step where all actions are completed including follow up with the proper departments and personnel. It is at this step that one needs to identify and track all open actions and pursue with the right people for their closure. These activities may involve:-Reviewing or auditing the corrective actions upon completion to ensure that they were objective, Updating the near miss report if deviations from the indeed action were implemented and Feedback to the reporter and others on the completion and closure of the incident (Phimister et al., 2000).

Near miss management policy and reinforcement

To ensure that safety is consistently given priority in decision making, the responsibilities of each member of the organization from top management to individual must be spelled out in the safety and health program. But merely assigning responsibility does not suffice: each person must be held accountable for his/her safety performance, and each individual assigned such responsibilities must be given adequate authority and resources to meet them.

Control systems to ensure that responsibilities are being met must therefore be in place. There are different ways of achieving this objective: some companies require that the recordable injury rate for each supervisor be factored into annual review and promotion decisions, while others use a formal tracking system that allows supervisors with good safety records to earn bonuses (DeJoy, 1985).

Employees must also be held accountable for complying with safety policies and procedures. The company's overall program should contain a disciplinary component that is clearly expressed, and employees who violate safety procedures should be subject to disciplinary action. The program should establish a hierarchy of disciplinary measures, beginning with verbal and written warnings, proceeding to formal meetings.

Management Commitment to Safety

The success of any workplace safety is determined by the organizational management. The top management formulates the Near Miss management system policy and objectives which are pivotal to implement and maintain the system with periodic reviews and updates. The top management provides resources (financial, human, technical and infrastructural) which are key to facilitate the implementation and maintenance of the system.

A top management representative is appointed and authorised amongst other duties to ensure that the system is established, implemented, maintained and to report on the performance of the system. An effective and efficient implementation of a near miss management system requires the full support of all levels of management. This goes beyond just management approval. There must be active involvement. It is important to continuously follow-up on system progress, encourage reporting, reward participation, and most importantly lead by example.

Management engages all employees who are intimately familiar with daily operations; therefore, it can easily detect potential problems on a timely basis. But, there are several important issues that have to be recognized and addressed to effectively integrate near-miss management into corporate governance. These are: Management support and encouragement, ensuring a uniform and seamless operation across all businesses and having a seamless and efficient system for handling near misses as well as accidents.

This means that management must consider worker protection the company's top priority and be willing to spend time and money on programme development, safety equipment, and employee training. One of the best ways management can demonstrate its commitment to safety is the development of a comprehensive, written safety and health programme that is performance oriented and general enough to cover the complete range of projects conducted by the organization.

The written program should also outline procedures for formally evaluating or auditing the occupational safety and health program's success at least once a year. A written, site-specific safety plan should also be kept at each work site. At a minimum, this plan should include information on safety responsibilities, emergency procedures, and provisions for hazard communication, accident prevention, inspections, grounded electrical systems, record keeping, personal protective equipment, and housekeeping (Boden, 1984).

Workers' adequate knowledge, skill and ability to their works, especially toward risks and dangers in their work and near miss management, may minimize accidents. These competences can be enhanced through training and appropriate workers selection which is a management responsibility. Workers competence was enhanced through training in Malaysia and it was noted to have reduced the rate of accidents from twenty five persons per week to about five persons per week (Dedobbeler et.al, 1991).

How Near Miss Management affects the Organizational Safety Performance

Near misses are often pre-cursors and valuable warning signs of existing safety problems (Maher & Casamayou, 2009). “A near miss by luck is no different to a midair collision from an organizational failure view point and hence the reaction to the two should be identical” (Rose, 2004,).

Documenting near-misses can provide a more true picture of workplace hazards (Krause et al., 2010). Injury reports alone are often unreliable because of the many barriers that complicate employee reporting (Azaroff et al., 2002). Krause et al. (2010) found that an organization’s number of near-miss events was positively correlated with its injury rate. Likewise, (Lauver et al. 2009) emphasized that the reporting of near-misses is a critical concern for organizations because they account for such a large portion of unsafe acts.

At the 2010 Engineering and Operations Conference Line Workers Roundtable, those present recommended capturing near-miss data as a way to improve their existing safety programs (Morris & Moore, 2000). Consequently, the American Public Power Association (APPA) collected a selection of near-miss forms and policies to help members start programs of their own. The APPA recognized that near-miss reporting can help focus safety training and provide a foundation for worker "tailgate talks" (American Public Power Association, 2010.). Furthermore, the collection authors noted that using a near-miss form is an excellent way to reinforce the group's safety culture and promote organizational learning.

A safety program that includes clear accident and incident reporting requirements, incorporates trend analysis, and encourages open discussion enhances the overall safety of an organization (Rogers Commission, 1986). A strong organizational safety culture is correlated with safer working environments (Columbia Accident Investigation Board, 2003). Reason (1997) noted that a healthy safety culture should focus on reporting and learning, rather than assigning blame. And, the goal of any organization's incident reporting and investigation system should be to support corporate safety measures that come from lessons learned (Rose, 2004). Accurate accident and incident reporting can help organizations decide where to focus resources to make cultural changes for safety (Krause & Russell, 1994). When employees believe their supervisors value safety they are more likely to report occupational injuries and illnesses and participate in investigations (Lauver et al., 2009). Supervisor support for safety behavior and a safety culture often results in a positive change in employee attitude towards safety (Littlejohn, Margaryan, & Lukic, 2010).Injury and near-miss analyses allow organizations to assemble key information related to employee safety. This is a prerequisite for the process that allows organizational and individual learning to occur; workers must have access to data and acknowledge that results or outcomes are unsatisfactory (Maher & Casamayou, 2009). Once employees or managers acknowledge this, change can begin through informal processes like casual communication and adjustments in expectations and norms.

Incident and near miss data is used in the decision making process by organizations when they make formal policy, equipment, and training changes. Often, data analyses indicate problem areas and identify systems that need improvement (Columbia Accident Investigation Board, 2003; Krause & Russell, 1994). Monitoring minor accidents and near-misses allows organizations to adjust safety policies and procedures and possibly prevent future incidents (Lauver et al., 2009). Actually, making policy, rule and standard operating procedure changes based on injury and accident data is recognized as one of the first steps towards organizational learning (Maher & Casamayou, 2009).

Injury and near-miss reporting can help organizations evaluate the current state of operations and changes in policy, training and equipment, as well as individual and team performance. Measuring performance can help organizations determine whether safety efforts are having the desired outcome (Petersen, 1998). Certain programs can be used to assess an organization's present safety environment and even provide insight to trends through past or historical event analysis. (Earnest, 2000) emphasized the value of measuring before the face and after the fact performances; a system like this provides a means to hold managers or workers accountable for injury and loss experienced after a policy or procedure change. It also gives organizations a way to measure the effectiveness of the change.

Injury and near miss reporting is an essential part of an organization's risk management plan. Past accident and injury statistics help identify high risk processes or behaviors and the frequency and severity of these events helps managers set priorities for action. After new safety measures and policies are developed and put in place, the final step is monitoring the results. Importantly, the changes that stem from injury and near miss data analysis should result in better safety and financial security for employees, as well as improved productivity and cost savings for employers (FIRST, Drexel School of Public Health).

Often, when organizations recognize unsatisfactory results, they strive to produce more favorable outcomes. Frequently, these types of changes carry a financial impact; organizations can use injury and near-miss data to aid in budgeting and resource allocation. Organizations can use injury and near-miss data to bolster support for changes in staffing and equipment, and to promote investments in training, incident prevention, technology, physical fitness, and recruiting (Loflin & Kipp, 1997: TriData Corporation, 2004).Injury and near-miss data can also be used to educate researchers, industry, and the public. Feedback from analyses contributes to equipment modifications by manufacturers and changes in professional standards. For instance, changes in fire fighter protective ensembles, self-contained breathing apparatus design and standards of use, closed cab apparatus, and advanced restraint systems have all been improved as a result of injury information sharing (TriData Corporation, 2004).

Occupational health researchers can benefit from organizational injury and near-miss data collection. NIOSH recognizes that all federal agencies can benefit from increasing coordination and information exchange (Surveillance Strategic Plan, 2011). Madsen (2009) found that fatal accident experiences in mines had a significant and measureable impact on worker safety because they prompted changes in government mine safety laws and regulations. Public officials and stakeholders can be persuaded to modify their expectations, change municipal requirements, and support budget items when they are educated about the nature of an organization's safety or health problem, possible solutions, and resources needed (Levy, 1996). Alternatively, if statistics are not available to describe a safety problem and its consequences, stakeholders and officials are likely to invest in solving other, more immediate problems (Maher & Casamayou, 2009).

III. METHODOLOGY

Research Design

The research design that was used in this study was descriptive and empirical research with largely qualitative findings. The research design generally entailed describing a unit in details. It is intensive, descriptive and holistic analysis of an entity (Oso & Onen, 2005).

The choice of the research was due to the fact that a near miss in the work place in the oil industry is the next major or

fatal accident if it is not properly and promptly managed and may affect the overall performance of the organization.

Target Population of the study

In this study the target population consisted of most of workers at all levels the organization with 883 workers.

Sample size of the study

Since the target population was 883 workers in the organization through random sampling method, These were workers, supervisors and management levels. According to (Kothari , 2011), the size of the target population was determined by the following formula

$$n=\frac{Z^2pqN}{Z^2p.q+(N-1)\ e^2}$$

Where: n = the desired sample size (in case of finite population)

Z = Confidence level at 95% at 1.96

p=acceptance error of 0.5

q=1-p

e=Statistical significance set=0.05

N=the target population size of workers in KPC Depots as at September 2013.

Therefore; the sample size (n)

$$n=\frac{(1.96)^2(.5)\ (.5)(883)}{(1.96)^2\ (.5)\ (.5)+\ (883-1)(0.05)^2}$$

$$=\frac{848}{3.1654}$$

= 267.9

= 268

Allowing 5% for any loss =13

= 281

Data Collection

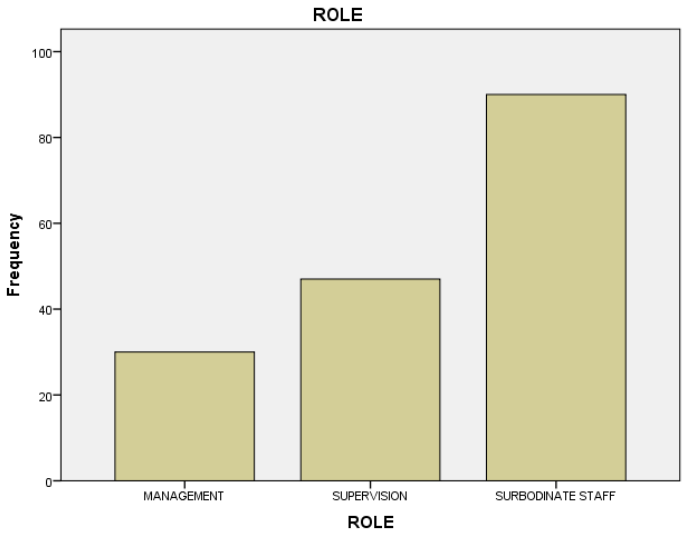
The researcher used questionnaires and interviews as the main tools for collecting data. The selection of these tools was guided by the nature of data to be collected, the time available as well as by the objective of the study. The overall aim of this study is to assess how the near miss management system affects the workplace safety performance in the organization in the oil and gas industry. The researcher was mainly concerned with opinions, skills, knowledge and attitude of workers of oil industry on near miss management system, such information could only be best collected through the use of questionnaires and interviews (Touliatos & Compton, 1988; Bell, 1993).

IV. DATA ANALYSIS, FINDINGS AND DISCUSSION

Response Rate

A total of 281 questionnaires were administered but only 167 were fully filled and returned while 114were not returned. This represented a response rate of 60% the respondents included the management, supervisors and workers in the organization.

Graph 4.2 Response rate in the organization



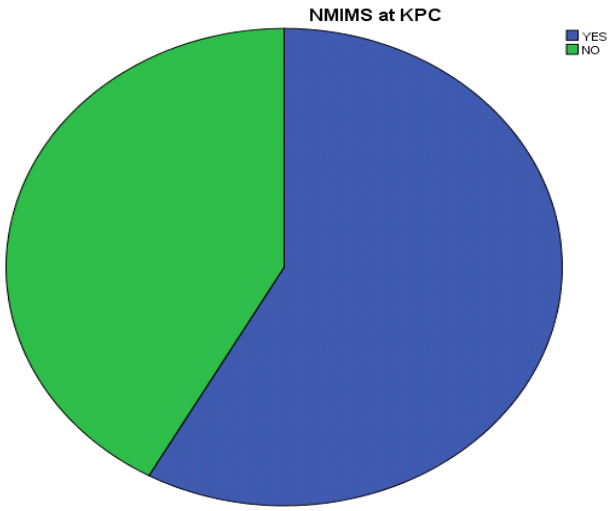
Source: Research Data (2015)

From the above data the analysis focused on the workers with a response rate of 82% followed by the supervisors at 45% and lastly the management at 30% rate.

Near Miss incidents Management system

Near miss incidents management systems are systems that report incidents that could lead to injury or property damage, to prevent consequences that could be severe therefore it is important for near miss to be identified, reported and mitigated against in the system, the item covers the entire range of operations in the organization.

Figure 4.3: Near miss management system

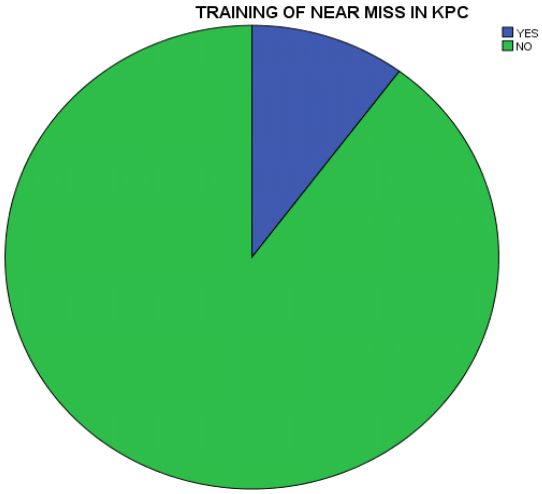


From the above figure it is clearly evident that the firm has an informal near miss management system with a high respondents clearly indicating that the firm adopts the system.

Training of Near Miss

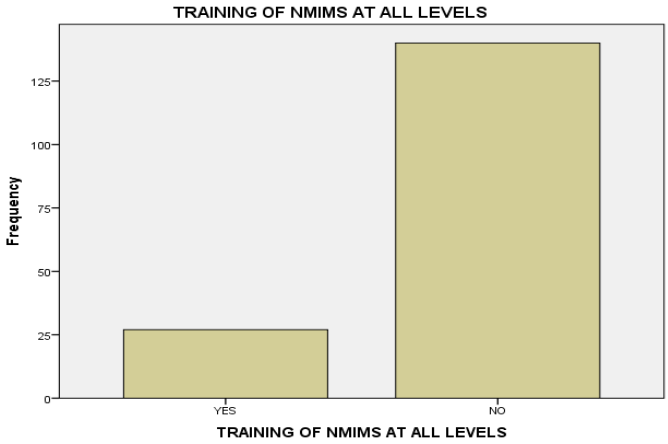
The researcher sought to find out whether the organization carries out training on near miss to all its employees across the board, a scale of No and Yes was used with yes indicating that the training takes place and no indication that the training does not take place. The findings are as shown below.

Figure 4.4.1:Training of Near Miss



From the above data it is clearly evident that no near miss training takes place with a high respond rate saying that the training does not take place followed by a few of the employees agreeing that it takes place.

Figure 4.4.2: Training of NMIMS at all levels in the organisation



From the above data most workers are in unison that no training takes place at all levels in the organisation at a frequency of 140 (83.8%) no and the rest at 27 (16.2%) frequency.

Safety Briefs

The researcher sought to find out whether the organisation employees understand safety briefs which should be offered by supervisors in terms of near miss in the organisation, this as illustrated in the table below

Table 4.5: Safety briefs

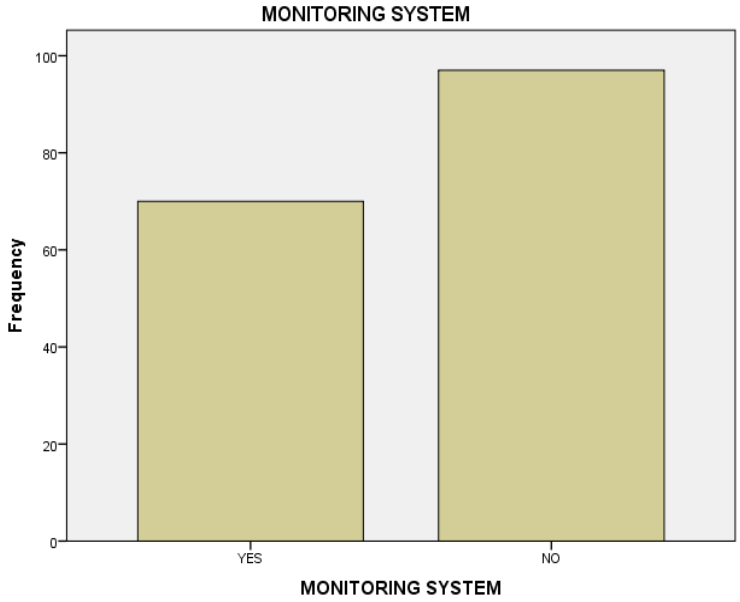
Frequency	Percent		Cumulative Percent
Yes	47	28.1	28.1
No	120	71.9	100
Total	167	100	

From the above it is clearly evident that majority of the employees do not understand safety briefs in the organisation with a high percent saying no with a frequency of 120 which also forms the highest percent at 71.9% and yes at a frequency of 47 and 28.1%.

Near miss incident monitoring system

Whether the organization workers are aware of a near miss monitoring system in the organization. The findings were as outlined below.

Figure 4. 6 Near miss incident monitoring system



From the above data most employees were in unison that there is no monitoring system of near miss management n the firm with a frequency of 97 yes and 60 frequency yes.

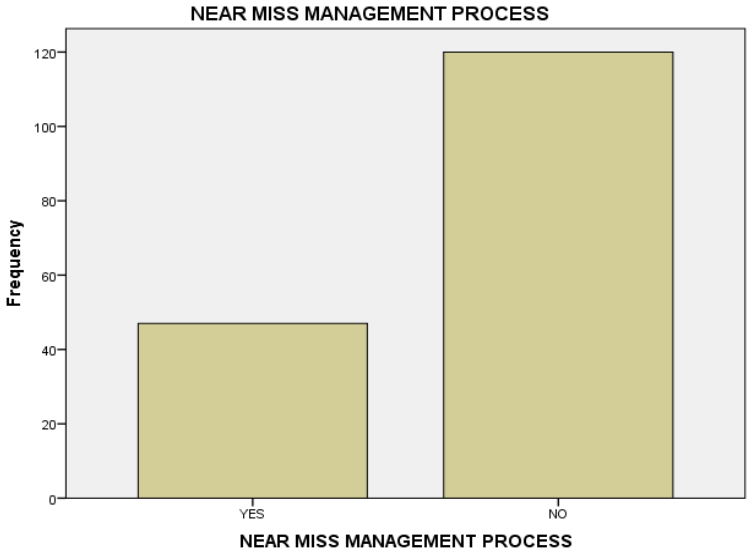
Table 4.6 Near Miss Monitoring system

	Frequency	Percent	Cumulative percent
Yes	**20**	**41. 9**	**41.9**
No	**97**	**58.1**	**100**
Total	**167**	**100**	

Near miss management process

For near miss management process in the firm the data is as outlined in the process below.

Figure 4. 7: Near miss management process



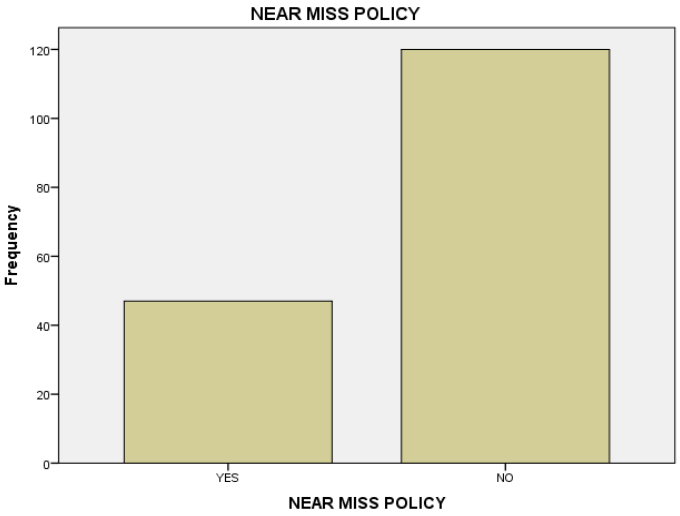
From the above data it is clear that most employees are in agreement that the firm does not have a near miss management

process with majority no at 118 (70.65%) frequency and no at a frequency of 45.

Near miss management policy

For the near miss policy in the organisations. The findings were as shown in the figure below

figure 4. 8 Near Miss Management Policy

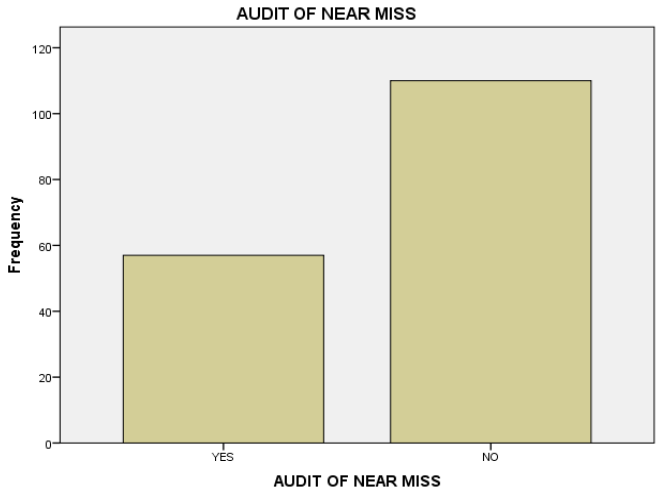


From the findings above most employees do not understand a near miss policy in the organization with a majority frequency of 118(70.65%) saying no and frequency 45 (29.35%) saying yes. Therefore they could not be effective in implementing the system they do not understand

Audit of the near miss management process

For audit of the near miss management process in the firm and whether the employees in the organisation understand the audit process, the findings were as shown in the figure below

Figure 4. 9: Audit of the Near Miss Management process

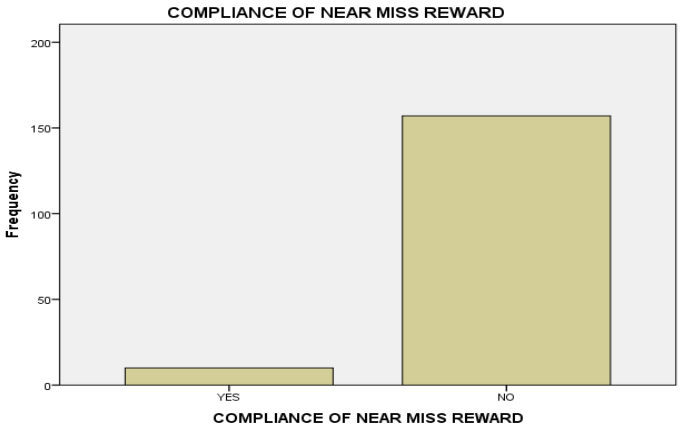


From the above data it is clear that most employees do not understand that there is an audit of near miss in the firm with a frequency of 110 (68.75%) no and yes at a frequency of 50. (31.25%)

Reward System for near miss reporting

The management should establish, implement and maintain reward procedure and ensure that the employees understand it. The findings were as shown in the figure below.

Figure 4.10: Reward system for Near Miss reporting

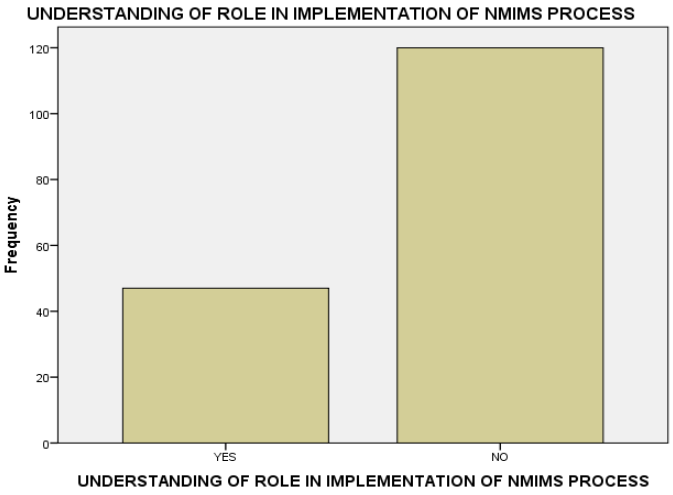


From the above data it is clearly evident that most employees registered the absence of reward system with a majority at 150 (93.8%) frequency saying no and the rest yes at a frequency of 10 (6.2%).

Understanding of role in implementation of near miss management process

Whether the workers understand the role they play in the implementation of NMIMS process in the system, the findings were as outlined in the diagram below.

Figure 4.11: Understanding of role in implementation of NMIMS process.



From the above data most workers do not understand the role they play in the implementation of the NMIMS process in the organization with a frequency of 120 (71.9%) and yes 47 (28.1%) in the organization.

Regression Analysis

Table 4.12.1 Regression Model

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.226[a]	.051	.028	.439

a. Predictors: (Constant), NEAR MISS POLICY FORMULATED BY MGT, HEALTHY BRIEFS BEFORE COMMENCING WORK, HEALTH, SAFETY AND ENVIRONMENT (HSE) POLICY IN KPC, NEAR MISS MANAGEMENT

From the table above the study used correlation coefficient r to check on the magnitude and the direction of the relationship between the variables, coefficient of determination (the percentage variation in the dependent variable being explained by the changes in the independent variables) and p- value were used to check on the overall significance of the model. Correlation coefficient of 0.226 indicates a strong positive correlation between the dependent and independent variables. On the other hand coefficient determination (R2) of 0.051 shows that 0.5% of the variation in the near miss policy is explained by the changes in the healthy briefs before commencing work, health safety and environment policy and near miss management . The adjusted R square of 2.8% also shows that the model is a good estimate of the relationship between the variables.

Table 4.12.2 Role of Intergration of near miss management system on safety performance

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	1.685	4	.421	2.188	.073[b]
	Residual	31.189	162	.193		
	Total	32.874	166			

a. Dependent Variable: INTERGRATION OF NEAR MIS

b. Predictors: (Constant), NEAR MISS POLICY FORMULATED BY MGT, HEALTHY BRIEFS BEFORE COMMENCING WORK, HEALTH, SAFETY AND ENVIRONMENT (HSE) POLICY IN KPC, NEAR MISS MANAGEMENT

The significance value is .073[b] which is less than 0.05 thus the model is statistically significance in predicting the role of intergration of near miss management systems, healthy safety and environmental policy, healthy briefs on the organization safety performance. The F critical at 5% level of significance was 2.188 Since F calculated is greater than the F critical value (value=0) this shows that the overall model was significant.

Table 4.12.3 Coefficient of determination

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	.977	.206		4.735	.000
	HEALTH, SAFETY AND ENVIRONMENT (HSE) POLICY IN KPC	.143	.082	.134	1.736	.084
	HEALTHY BRIEFS BEFORE COMMENCING WORK	.016	.071	.018	.230	.818
	NEAR MISS MANAGEMENT	.148	.076	.152	1.942	.054
	NEAR MISS POLICY FORMULATED BY MGT	-.071	.071	-.079	-1.006	.316

a. Dependent Variable: INTERGRATION OF NEAR MISS MIS

The regression above has established that taking all factors into account (Healthy, safety and environment policy, healthy briefs before commencing work, near miss management ad near miss policy formulated by management) constant at zero, organization safety performance will be 0.977 The findings presented also shows that taking all other independent variables at 0.001, a unit increase in health, safety and environment policy will lead to an increase in 0.143 on organization safety performance, a unit increase in health briefs before commencing work at 0.016, a unit increase in near miss management at 0.148 and a unit decrease in near miss policy formulated by management at -0.071.This infers that near miss management policy, followed by health, safety and environment policy, health briefs before commencing work and lastly by near miss policy formulated by management influencing organizational safety performance reduction least.

The cross tabulation table of near miss management and near miss implementation roles

NEAR MISS MANAGEMENT * NEAR MISS IMPLEMENTATION ROLES

Cross tabulation

Count

		NEAR MISS IMPLEMENTATION ROLES		Total
		YES	NO	
NEAR MISS MANAGEMENT	YES	92	26	118
	NO	30	19	49
Total		122	45	167

From the above analysis most respondents in terms of near miss management there is a near miss implementation roles at 92 to organizational safety performance.

Chi Square tests

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	4.930[a]	1	.026		
Continuity Correction[b]	4.116	1	.042		
Likelihood Ratio	4.740	1	.029		
Fisher's Exact Test				.035	.023
Linear-by-Linear Association	4.900	1	.027		
N of Valid Cases	167				

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 13.20.

b. Computed only for a 2x2 table

From the above analysis Pearson chi square analysis at X(1) = 4.93 and p = 0.026 this shows that there is no statistically significant association between the near miss management and near miss implementation roles formulated by management.

V. SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

Summary

Despite their limited impact near misses provide insight into potential major adverse conditions and business disruptions therefore addressing near misses timely and properly discourages major problems from flourishing (Jones et al 1999). It is important to note that even though investigations have shown that almost all major incidents had precursors with minor or no consequences not all minor incidents have the potential to cause a major incident.

Every major or fatal accident or incident originates from a near miss that was not prevented or controlled. Management of near miss incidences is directly proportional to the prevention of major incidences and accidents and therefore goes a long way to eliminate or minimize work place hazards and guarantee the safety of the workers with a direct bearing on the overall performance of the organization. Establishing a culture sensitive to the near miss concept is critical for successful implementation of a near miss system and takes time and effort to develop. Identification of current and potential problems can be encouraged by recognizing and rewarding observant people and by publishing identified problems as well as the actions taken to address them. It is important to capture as many near misses as possible even though not all of them will have the same impact.

Conclusions

There was no well-established and implemented near miss incident management system which should have a near miss incident policy, procedures and relevant records. This is evident with 70.65% of the responders on the affirmative. Although majority of workers are in a position to identify a near miss, reporting and mitigation of the same is lacking (with 71.9%) due to the fear of victimization.

Near miss incident system reward through incentives and other recognition mechanisms was not evident from the

research.(with 93.8% of responders confirming). This causes the workers have low morale in reporting of the near miss incidences and this has a direct outcome of major incidences. Training and awareness creation on near miss incidences among workers was also lacking (with 83.8%on the affirmative) and this has led to many of them being unable to identify, report, control and review of the incidences as per the research.

Recommendations

Top Management commitment may be improved by the availing of resources for the establishment, implementation and maintenance of a Near Miss Incident Management System (NMIMS)

Resources also should be availed by the top management to ensure training and awareness creation of all workers at all levels on Near Miss Incident Management System (NMIMS).This will give all the workers a leverage to identify, report and mitigate the incidences and this shall reduce the major incidences which could impact negatively on the organization by denting its image globally, reducing customer confidence and exposure to litigations leading to colossal financial losses due to compensation of injured and also high premiums for insurance.

Report of near miss incident should be encouraged by acknowledgement and recognition. There should be a formal reward system for the worker(s) who identifies and reports most near miss incidences through an incentive. It is important to note that the worker who identifies a near miss and the one who reports it does not have to be the same for example if someone complains to his or her supervisor about a problematic situation the supervisor who may resolve this persons problem or bring it to the attention of others can also report it as a near miss.

Establishing a system that captures all near misses regardless of their impact is important. Equally important is establishing effective prioritizing systems. Employees need clear guidelines on near miss management process to be able to recognize all the near misses that are likely to cause major problems.

With a well established near miss management system, with all observing and identifying every incident and reporting all potential issues as well as incidents, most near miss reports will not be indicators of major problems, however, paying attention not only to the high priority items but also to the other reported issues would help improving the systems productivity and operability.

Each near miss observation or incident may serve as a risk indicator or an event data point. These points individually and collectively should be investigated, analyzed for root causes and corrective and preventive actions taken to prevent recurrence. The system changes must be implemented and review practices observed to not only reduce the potential for catastrophic events but also to improve the system operations

REFERENCES

[1] Bird, F.E. Jr. and Germain, G.L(1996). Practical Loss Control Leadership. Loganville, Georgia. Det Norske Veritas Inc.

[2] Deniz S. Ones, Susan E. Jackson.(1999).Managing Human Resources for Environmental Sustainability, Jossey. SanFrancisco.

[3] Drucker, P.F. (1986). The practice of management. New York, New York: Harper Collins.

[4] Earnest, R.E. (2000). Making safety a basic value. Professional Safety.

[5] Frank, Alison Fleig (2005). Oil Empire: Visions of Prosperity in Austrian Galicia (Harvard Historical Studies). Harvard University Press.

[6] HOBBSA, . 1997, Human Factors in Airline Maintenance: A Study of Incident Reports (Canberra: Bureauof Air Safety Investigation).

[7] HOFSTEDGE., (1994). Cultures and Organisational: Intercultural Co-operation and its Importance for Survival London : Harper Collins.

[8] Hofmann, D.A., & Stetzer, A. (1998, December). The role of safety climate and communication in accident interpretation: Implications for learning from negative events. Academy of Management Journal, 41, 644-657.

[9] HSE Guidance on Regulations, L73, 'A guide to the Reporting of Injuries, Diseases and Dangerous Occurrences Regulations 1995', 4th Edition 2012, ISBN 978 0 7176 6459 7

[10] HSE Guidance Booklet HSG48, 'Reducing error and influencing behaviour', 2nd Edition, Reprinted 2007, ISBN 978 0 7176 2452 2,

[11] Jeremy Stranks (2006) The A-Z of Health and Safety. Thorogood Publishing Ltd

[12] Kothari C.R. (2011) Research Methodology, Methods and Techniques. 2nd Edition, New Age International Publishers Limited.

[13] Krause, T., & Russell, L. (1994). The behavior-based approach to proactive accident investigation. Professional safety.

[14] KrauseT., Groover, D. & Martin, D. (2010). Preventing incidents and fatalities. Professional Safety.

[15] Lauver, K. Lester, S. & Le, H. (2009). Supervisor support and risk perception. Their relationship with unreported injuries and near misses. Journal of Managerial Issues.

[16] Loflin, M.E. & Kipp. J.D. (1997). Incorporating risk management into emergency incident operations. Professional Safety.

[17] National Institute for Occupational Safety and Health (NIOSH). (2011, October 18). About NORA. Partnerships research and practice (Fact Sheet). Retrieved from Centers for Disease Control and Prevention Website: http://www.cdc.gov/niosh/nora/about.html.

[18] Phimister, J.R., U. Oktem, P. Kleindorfer, and H. Kunreuther. "Near-Miss ManagementSystems in the Chemical Process Industry." Working paper, Wharton Risk Managementand Decision Processes Center, University of Pennsylvania.

[19] REASONJ., (1990). Human Error, New York: Cambridge University Press.

[20] Scott, C.W. & Tretheway, A. (2008, August). Occupational discourse and the appraisal of occupational hazards: Interpretive repertoires, heedful interrelating, and identity at work. Journal of Applied Communication Research.

[21] Taylor, J. (2011, June 27). A call to collect industry and occupation codes in healthcare data (Policy Brief). Retrieved from Drexel University. Firefighter Injury Research & Safety Trends:

[22] Tolf, Robert W. (1976). "4: The World's First Oil Tankers". The Russian Rockefellers: The Saga of the Nobel Family and the Russian Oil Industry. Hoover Press.

[23] United States Fire Administration (2011, June). Executive Development .Student Manual 4th Edition, 1st Printing. Emmitsburg, MD: Authro.

[24] Van der Schaaf T.W,Deborah Luicer. (1991) Near-Miss Reporting as a Safety Tool'Butterworth

[25] Van der Schaaf T.W,Deborah Luicer. (1992) Near-Miss Reporting in chemical process IndustryButterworth.

[26] Vassiliou, Marius (2009). Historical Dictionary of the Petroleum Industry. Lanham, MD: Scarecrow Press ,Rowman and Littlefield.

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Effects of Internet Marketing Strategies on Sale of Communication Services. A Case Study of Telkom Kenya-Eldoret Branch

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Abstract- Internet marketing, or online marketing, is evolving into a broader mix of components a company can use as a means of increasing sales - even if your business is done completely online, partly online, or completely offline. The objectives of the study included identifying the effects ofinternet marketing on sales at TELKOM Kenya in Eldoret; identifying Challenges of internet marketing, establishing the Internet Marketing Environment at TELKOM Kenya in Eldoret and identifying the Product Characteristics of TELKOM Kenya in Eldoret. They used the findings to evaluate the effects internet marketing has on sales and how to apply new marketing strategies also to find out suggested areas to be researched on or make a comparative study. The study used a descriptive study design which was considered ideal due to its indebt and holistic approach of effects of internet marketing. It targeted a population of 171 It used stratified sampling technique to sample a sample size of 57 which is 30% of the targeted population. Questionnaires and interview schedule were used to collect data from the respondents. The research had a response rate of 100% with the demographic information of the respondent being stable in administration workforce. The research also focused on the gender of the employees, level of education, marital status, job position, work experience and the impact of internet marketing which were all analyzed. The study also focused on analyzing the challenges faced by marketing strategies. Data collection was done using questionnaires which was then captured on excel worksheet for tabulation and presentation. Descriptive statistics approach was adopted in analyzing and presentation of the data collected. The findings were then presented using charts, percentage and frequency tables. Frequency tables and percentage were used in presenting open ended questionnaires as it conveyed meaning to the data. The data analysis was also done by descriptive and statistical approach such as percentage and frequency tables. The key findings were that both managers and employees of the various departments sampled were aware of the implications of internet marketing strategies on sales. There were more male than female, there were no employee of age below20 years or above 40 years.

The level of education varied across board, some were primary school leavers while others had not attended school at all. The majority had between11 and 15 years job experience. The major recommendations from the study were that product customization, site design and usability on customer satisfaction and loyalty was very important on internet marketing and strategies. There was also correlation between product value, service quality, effective service, site design and usability, product customization, customer service and customer satisfaction. Age and Education showed the difference and effect on internet Marketing strategies. Gender and marital status were not included into this demographic factors analysis because there was no much significance difference between gender and marital status in Internet Marketing Strategies in computer related products purchaser.

Index Terms- Online Marketing, Search Engine Marketing , Search Engine, Optimization, Return on Investment

I. Introduction

According to Lewis, Internet marketing, also known as web marketing, web advertising, or e-marketing, is referred to as the marketing (generally promotion) of products or services over the Internet Marketing. IM is used as an abbreviated form for Internet Marketing. Internet offers numerous features (capacity, speed, precision and convenience) that help firms attract a large number of potential customers (Khanh and Kandampully, 2002). Consumers use the Internet for different reasons ranging from only gathering information to purchasing products internet. Buying over the Internet was more fun, safer, and quicker and they were more confident about their ability to buy internet (Goldsmith, 2002). The dramatic increase in internet and the detonation of its usage had facilitated the development of electronic commerce, which was described as the movement of buying and selling, or the trading of products, service and information between and among the organizations and individuals all the way through computer networks including the internet (Laudon and Traver, 2001). When investing in internet/internet marketing, strategic thinking would bring to the best rewards (David Scanlon, 2009).

Establishing and maintaining made to order communication with customers during the transaction could be expensive. Such as this kind of communication channels could be used to gather important customer feedback and to measure customer satisfaction, either they are satisfied or not. However, most consumers gather information on products, make cost comparisons and then go or visit a local store to make a purchase. Internet marketing is becoming a more and more significant strategy for the company to promote, advertise and interact with more customers over the internet. This is especially true in the environment where internet shopping or internet purchasing was still new and consumers are less familiar and

often more skeptical towards internet shopping, but slight is known about them. Therefore, in order to know and understand consumers' needs and wants, it is very important for us to have a survey and study to find out the impact of the internet marketing in computer industry towards customer satisfaction (Ahasanul and Ali Khatibi, 2007).Connectivity has increased quickly in both developed and developing countries; with one of the greatest growing regions being Asia. Malaysia is currently spending $5 billion on building a Multimedia Super/great Corridor. In Malaysia, the development of Multimedia Super Corridor (MSC) has concerned much attention on the development and accomplishment of Multimedia. In this regard, the use of multimedia in marketing products and services had improved in the local business activities. It is highly assumed that internet marketing services can support retailers in expanding new markets as well offering real time dealings and processing feedback. Despite this though, internet sales or internet marketing continue to develop as internet-based businesses become more complicated; indeed many users stay involved in internet shopping. Understanding possible markets is thus important for businesses investing in electronic commerce. Amichai-Hamburger (2002) indicated that the behavior of internet users plays a significant role in their internet behavior.
Although, purchasing over the internet is still a small portion of Internet usages, most analysts expect it to increase dramatically once consumer feel satisfied and safe about their purchases and protection of their privacy. Establishing and maintaining personalized communication with customers throughout the transaction can be expensive. Such communication channels can be used to gather important customer feedback and to measure customer satisfaction (Khanh and Kandampully, 2002).

The advent and development of Internet has created new opportunities for marketing professional to make better current marketing practices (Kalakota et al., 2001; Pires and Aisbett, 2001). Internet for marketing to consumers depends to a large extent on the characteristics of the products and services being marketed (Peterson, *et al*.,). Moreover, Internet marketing can be a time and cost-saving supplement to marketer overall marketing strategy. Since, Internet marketing is the component of marketing that deals with the planning, pricing, promotion, and distribution of products and services over the internet (Pan-Western E-Business Team, 2005). A good Internet marketing strategy clearly communicates a firm's unique selling proposition, or the unique collection of benefits that creates value for its customers.
Products that are being marketed over the Internet can be classified into two groups (Legard, 1998).The first group of products contain items that consumers do not need to see personally before purchasing. These products include computer to compact disc to scanned goods, and can be evaluated using just text, pictures and other digitally communicable information. This group of products is ideally suited to Internet shopping whereby the Internet could serve significant transaction and communication functions

In a fast-paced society, everything has to be done in an instant. Everything costs more. Everything moves faster. The good thing is that we can have anything we want in just one click. We have the different technological advances right within our reach – time efficient and cost effective- which make our way of life more convenient. All of these realities of modern society have been in the name of progress. One of the most popular, most obvious technological advances at present is the Internet, which provides the users convenience from entertainment to education and from personal concerns to business matters. Indeed, the Internet introduces many unique benefits to marketing including low costs in distributing information and media to a global audience. Internet marketing, as of 2007, is growing faster than other types of media. Since exposure, response and overall efficiency of Internet media is easier to track than traditional "off-line" media, through the use of web analytics for instance, Internet marketing can offer a greater sense of accountability for advertisers. Increasingly, however, marketers and their clients are becoming aware of the need to measure the collaborative effects of marketing, that is, how the Internet affects in-store sales.

Statement of the Problem

Today, Internet marketing, or online marketing, is evolving into a broader mix of components a company can use as a means of increasing sales - even if your business is done completely online, partly online, or completely offline. The decision to use Internet marketing as part of a company's overall marketing strategy is strictly up to the company of course, but as a rule, Internet marketing is becoming an increasingly important part of nearly every company's marketing mix. For some online businesses, it is the only form of marketing being practiced

Internet marketing is a business imperative because the Internet is an irrevocable and unstoppable trend. Viruses can pose a very serious threat to the privacy of internet businesses and their customers. They can enter the computer through various sources, such as downloading or even just clicking emails that contain viruses. This can lead to a loss of business information or any number of virus-related issues. Hackers and other illicit folk accessing private information of a business, both personal and private, can create numerous problems for businesses and its customers, along with identity theft. There are many legal issues an internet business needs to consider. For examples, electronic copyright, e-commerce cash and credit policies, international trade rules, tariffs, privacy policies, and security issues. Internet marketers must be prepared to deal with the issues related to copyright, intellectual property and other legal matters. Even if you have a traditional "brick-and-mortar" business, you'll lose valuable customers without an internet presence. People routinely search for goods and services with their computers in lieu of the yellow pages. If your business isn't on the Web, customers will likely choose another company with whom to do business. Most of the business organizations have not very much aware with the fact that internet marketing strategies play a significant role to acquire customers from globally

The main purpose of this study is to explore the importance of web shopping programs for retail industry that allows the companies to offer products and services 24 hours as per the needs and requirements of the customers. In addition, this study also provides evidences to the retail companies that how internet marketing strategies promote the firms at international level to acquire customers. The intended problem was to find out effects of internet marketing on sales. Therefore the researcher

considered to come up with the ways internet business can be protected.

Objective

The main objective of the study is to establish the effects of Internet marketing strategies on sales of communication services at TELKOM Kenya Eldoret. The specific objectives include:

i. To establish the effects of Website Marketing Strategies at TELKOM Kenya in Eldoret.
ii. To establish the effects of Mobile Marketing strategies on sales at TELKOM Kenya in Eldoret.
iii. To establish the effects of Social media Marketing Strategies on sales at TELKOM Kenya inEldoret.

II. RELATED LITERATURE

Online advertisement of any service, product, business etc. is all about internet marketing and that marketing is a necessity of any business which is online. Every online business is in the form of website. Having a website about a particular business is not a big thing. The main work starts after this that how to make a website well known among the people who are using internet and have interest in that you have. Online web site promotion is called internet marketing. Well there are many factors involves in promotion of any website.

One way is mouth to mouth marketing. In this you advertise your business's website by telling everyone that is around you. That community of people is very short. If a person is not in that community and he is fully interested in your service at that time you are helpless.

Second is email marketing that you send "Electronic mail" to people around internet. But that method is good but not very useful. For example many people block that kind of mails as a spam. So the emails got deleted by their spam filter. Third is that you enter your website into the online directories or search engines. Well there is not much difference between search engines and online directories. Directory is about the collection of many websites. People come to the directories in searching of their desired service. On the other hand search engine is also about a huge collection of websites. Now a day's search engines are more familiar than directories. Experts say that 85% to 90% websites are visited though search engines. Internet Marketing, however, requires customers to use newer technologies than traditional media, the reason why not all people may get the message. Low speed Internet connections were one barrier. If companies build overly large or complicated web pages, some Internet users struggle to download the information on dial up connections or mobile devices. From the buyer's perspective, another limitation is the inability of shoppers to touch, smell, and taste or try-on tangible goods before making an internet purchase. However, it is industry standards for e-commerce vendors to have liberal return policies and in store pick up services to reassure customers.

Also, internet advertising is cheap. Advertising in the phone book or a newspaper is expensive, especially if you want an ad that has a presence on the page (Godes and Mayzlin 2004). An advert in an Internet directory is generally free, and you can include links directing customers to your Web site for more information. And because you can provide customers with a wealth of information, they no longer have to pick up the phone to have their questions answered.

Although you don't need a Web site to register your site in an internet directory, your marketing efforts was much more effective if you have your own site. The first thing to do is to register a domain name. The name of your business is usually a good place to start, because it can help to build your brand and was easy for customers to remember. If that's not available, you may have to settle for another name. Before you commit, give your domain name serious consideration; the name you choose was your company's internet identity for years to come. Once you choose your domain name, you'll need to build a professional Web site. You can use templates provided by your Web host, hire a Web designer to develop your site, or use software to design it yourself.

The difficult part is to rise above the crowd and differentiate yourself from your competition. This is where a well thought out Internet marketing plan can help. Here are the main components of any good Internet marketing plan: Registering your site with search engines and directories; Optimizing your site for search engines; Sponsoring search engine keywords; Building a database of customer email addresses; Sending email newsletters and Buying internet advertisements.

In a fast-paced society, everything has to be done in an instant. Everything costs more. Everything moves faster. The good thing is that we can have anything we want in just one click. We have the different technological advances right within our reach – time efficient and cost effective- which make our way of life more convenient. All of these realities of modern society have been in the name of progress. One of the most popular, most obvious technological advances at present is the Internet, which provides the users convenience from entertainment to education and from personal concerns to business matters (Godes and Mayzlin 2004). Indeed, the Internet introduces many unique benefits to marketing including low costs in distributing information and media to a global audience. Internet marketing, as of 2007, is growing faster than other types of media. Since exposure, response and overall efficiency of Internet media is easier to track than traditional "off-line" media, through the use of web analytics for instance, Internet marketing can offer a greater sense of accountability for advertisers. Increasingly, however, marketers and their clients are becoming aware of the need to measure the collaborative effects of marketing, that is, how the Internet affects in-store sales.

One of the benefits associated with Internet marketing is the availability of great amounts of information. Compared to traditional media, such as print, radio and TV, Internet marketing can have a relatively low cost of entry. Consumers can access the Internet and research products, as well as purchase them at any hour of any day. Companies that use Internet marketing can also save money because of a reduced need for a sales force. Overall, Internet marketing can help a business' expansion from a local market to a national or international one faster (Peterson et al., 1997). It continues to grow in its importance as most companies have been making substantial commitments to add Internet marketing to their marketing mix. Other benefits are measurability, flexibility, and affordability. Internet marketing has over other traditional marketing outlets, and these benefits

are especially attractive to home based businesses. An Internet Marketing strategy should express your aims in terms of ROI

Internet Marketing Business Model

When it comes to becoming financially free through Internet marketing, there are actually many different channels you can choose from.

Below is an Internet Marketing model (Tjostheim, I. &Aanonsen K.) adopted by the Norwegian Tourist Industry that outlines how a good strategy can translate into bottom line ROI.

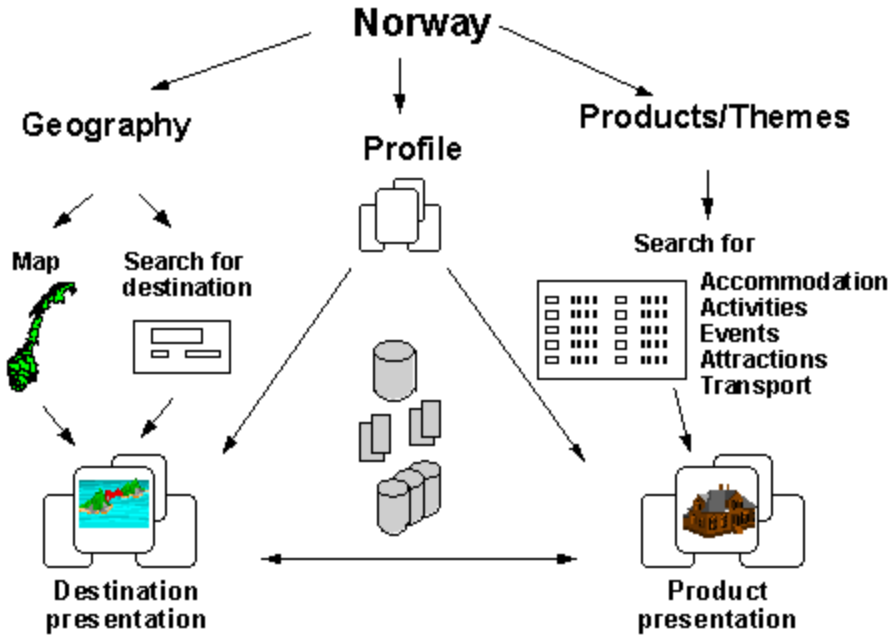

Figure2.1Internet Marketing Model

Internet marketing Theories

I. Affiliate Marketing Theory

Affiliate marketing is basically where you are a 'commission only' sales person and it is the best place to begin online. Most websites will have a link at the bottom of their website where you can sign up and begin to sell their products for them. They give you your own special link and all you do is build a website (don't worry it's very simple) and when somebody visits your website and clicks your link it will take them to the vendor's website. If that person then makes a purchase, you get a commission. There are many Internet marketers making over a million dollars per year from this business model.

II. Selling Your Own Product Theory

This is where you already have your own product or website established. This is the next step up from affiliate marketing; it's not as easy as just selling somebody else's product. You have to do the market research and create the product, you will need to sort out how you are going to deliver the product, and also be responsible for customer service. There is a lot more work involved in selling your own products, however this is ultimately where you want to get to.

III. Local Business Consulting Theory

Local business consulting is one of the fastest ways to build a 6-Figure business, however it's not for the complete beginner. Local business marketing or local business consulting is where you take over a local business' online marketing for a monthly fee. It is a great way to quickly build up a strong passive income but you will need to have a solid understanding of business, marketing and Internet marketing strategies first. Once you have another business model up and running it is a fantastic way to double your current business income in a very short space of time.

Conceptual Framework

This paper proposes to identify the relationships between consumer shopping behavior about Internet marketing and the relevant affective factors. Based on the discussion presented in literature review, it was identified that Internet marketing environment, product characteristics, familiarity and confidence, and promotional offer are the main factors that are affecting consumer shopping intention about Internet marketing. Therefore, based on these factors, the study framework is constructed and presented below.

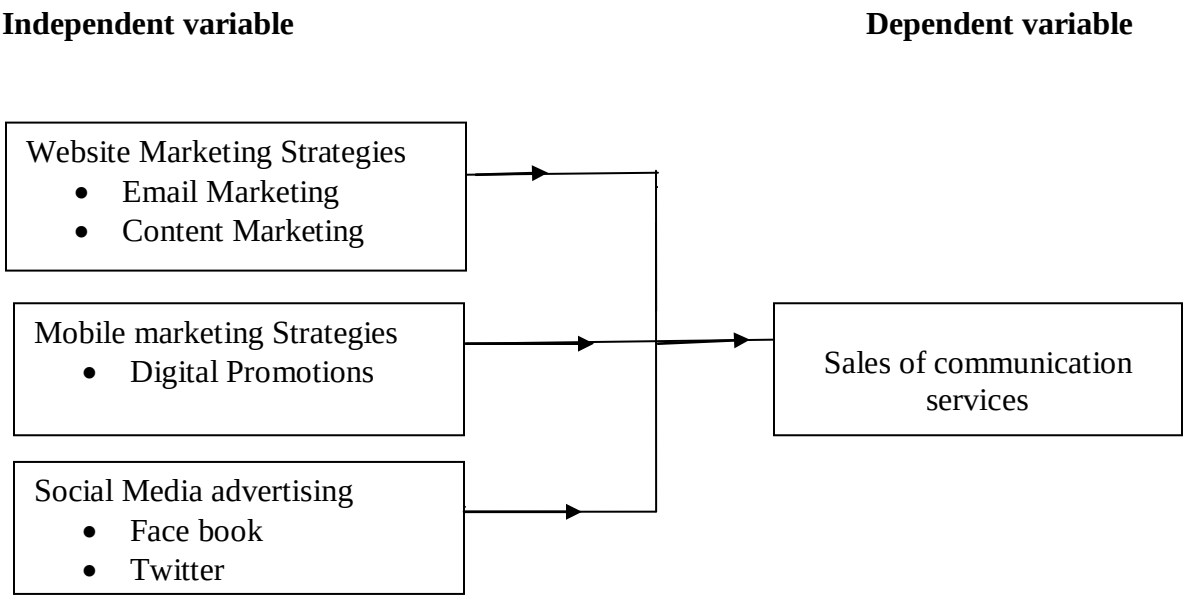

Figure2.2 Conceptual Framework

Review of Variables

It is important for the Internet marketer to attract the existing consumers in the highly competitive internet marketplace and evaluate the size of the target market (Haqueet al., 2006). Since, generally, in traditional market environment is tangible and permanent form of communication is needed for a transaction process between a buyer and seller (Kaur, 2005). Then again, Internet marketing is an electronic form where a computer is able to recognize, reproduce and store means that business could now be conducted in a paperless environment (Haqueet al., 2006). That means electronic marketing is an application of business-to-consumer electronic commerce which can be further broken down into internet shopping and internet purchasing or buying. Internet marketing environments allow vendors to create retail interfaces with highly interactive features. According to Haubl and Trifts (2000) interactivity from a consumer perspective is the implementation of sophisticated tools to assist shoppers in their purchase decisions by customizing Internet shopping environment to their individual preferences. That means in Internet marketing environment consumers are able to tailor the web content according to their need and liking. This gives consumer the same power as the content provider.

Internet buyers have fewer security worries, appreciate the quickness and flexibility of internet buying and see the web as making buying easier (Ronald Goldsmith, 2002). To satisfy all levels of competence among consumers, and their different requirements, tastes, and preferences a site must offer a vast array of features and functions that will inevitably make it slower to load and more complicated to use (Reichheld and Schefter, 2000). Speed to access Internet appears to be a major concern to many Internet users (Karakaya, 2001), therefore firms must create websites which are fast to load and culminate too much graphics or interactivity on their web site. Information such as discounted product and compiling special offers from several different companies selling the same product and displaying them to the public could increase customer satisfaction. Potential customers have an opportunity to make a detailed comparison of the offering before making an informed choice (Khanh and Kandampully, 2002).

Hence, from above discussion we can say that in Internet marketing environment a distinction has been made between person interactivity and machine interactivity (Habul and Trifts, 2000). Environmental factors can influence the use of technology, including Internet shopping (Pratibha, 2003). According to Man etal. (2005) some technology adoption concerns are more psychological than technical. Moreover, a better

Understanding of the Internet marketing environment and its operating process will definitely alleviate concerns and lead to higher usage of internet shopping. Some situations must be needed to do shopping internet. Indeed initially, according to MORI (2001) the level of Internet shopping is strongly related to the level of the Internet access. Moreover, poorly designed interfaces, cluttered page layouts, inadequate and ineffective search engines, dead links, outdated information, tedious navigational structures and complex checkout procedures may all contribute to consumer frustration with internet shopping (Leo, 2002).

Website Marketing Strategy:

Website marketing is directly marketing a commercial message to a group of people using web. In its broadest sense, every email sent to a potential or current customer could be considered email marketing. It usually involves using email to send ads, request business, or solicit sales or donations, and is meant to build loyalty, trust, or brand awareness. Email marketing can be done to either cold lists or current customer database. (Wakolbinger, Lea.2009) This form marketing is crucial to a small business online or offline. Essentially email marketing is about building a list of customers and prospective

customers. This list of names and emails are people who are interested in your business, and you know this to be true because they have opted into this list themselves. Perhaps they were offered future updates on products as well as coupons to sign up. As this list grows, it becomes more valuable. In fact, many marketing professionals consider this to be, in the long run, the most important small business marketing strategy in the long run. From whitepapers, to videos and webinars, content marketing encompasses all marketing formats that involve the creation and sharing of content in order to engage current and potential customers.

Content marketing subscribes to the notion that delivering high-quality; relevant and valuable information to prospects and customers drives profitable consumer action and improves brand loyalty.

Content marketers either share proprietary information with selected audiences, or they create new information and share it via different types of media, such as online newsletters, digital content, websites or micro sites, white papers, webcasts/webinars, podcasts, video portals or series, interactive online and email

Transactional emails are usually triggered based on a customer's action with a company. Triggered transactional messages include dropped basket messages, purchase or order confirmation emails and email receipts.

Direct email involves sending an email solely to communicate a promotional message (for example, an announcement of a special offer or a catalog of products). Companies usually collect a list of customer or prospect email addresses to send direct promotional messages to, or they can also rent a list of email addresses from service companies.

Opt-in email advertising, or permission marketing, is a method of advertising via email whereby the recipient of the advertisement has consented to receive it. This method is one of several developed by marketers to eliminate the disadvantages of email marketing. (Wakolbinger, Lea; Michaela, DenkOberecker, Kluas September 2009)

Opt-in email marketing may evolve into a technology that uses a handshake protocol between the sender and receiver. This system is intended to eventually result in a high degree of satisfaction between consumers and marketers. If opt-in email advertising is used, the material that is emailed to consumers will be "anticipated". It is assumed that the consumer wants to receive it, which makes it unlike unsolicited advertisements sent to the consumer. Ideally, opt-in email advertisements will be more personal and relevant to the consumer than untargeted advertisements.

A common example of permission marketing is a newsletter sent to an advertising firm's customers. Such newsletters inform customers of upcoming events or promotions, or new products. In this type of advertising, a company that wants to send a newsletter to their customers may ask them at the point of purchase if they would like to receive the newsletter.

Mobile Marketing Strategy:

The internet has become an ongoing emerging source that tends to expand more and more. The growth of this particular medium attracts the attention of advertisers as a more productive source to bring in consumers.

A clear advantage consumers have with internet advertisement is the control they have over the product, choosing whether to check it out or not.

Online advertisements may also offer various forms of animation. In its most common use, the term "internet advertising Web-related advertising has a variety of ways to publicize and reach a niche audience to focus its attention to a specific group. Research has proven that internet advertising has given results and is growing business revenue for the year 2012; Jupiter Research predicted $34.5 billion in US internet advertising spending.

Online advertisement can also be classified as Digital Promotions. Digital promotion in connection to the television industry is when networks use authentic digital resources to promote their new shows in a growing vast range of venues. Television networks development of digital off air promotional strategies allowed digital promotion to remain significant to the advertisement advancement in the television.(Fritz, Ben August 13, 2006).

An example of Online Advertising is television online digital promotions: The Sci Fi network for loaded a special recap episode of BattlestarGalactica onto Microsoft's Xbox internet gaming service; this gave the audience additional opportunities to sample content if they may or may not be familiar with the show. Another example of digital promotion in television is when network CBS incorporated new digital technologies of Bluetooth-enabled mobile devices that were able to download a thirty-second clip of a new show on their devices; consumers standing in range of a billboard don't need an internet link to download the show's content. These non-linear viewing opportunities provided as a valuable tool for gaining audiences; and to encourage them to intersect with the linear audience. Then again, intangible products are more suitable for Internet marketing. (Interactive Advertising Bureau January 2008),

So, from the above discussion it can be said that unique characteristics of the Internet marketing is intangibility (Cho and Park. 2003). However, products and services without those characteristics or with low importance will have electronic appeal (Michael, 1998; Simpson and Matthew, 2001). Products with a high sight/sound primal product appeal have the greater electronic shopping potential (Brian et al., 2003).

Social media marketing strategy:

Things move quickly in the world of Facebook advertising. It's no longer enough to buy a few Facebook ads, get users to "Like" your page and hope it strengthens your brand. You need an integrated marketing approach that considers both your paid media (Facebook ads) and earned media (word of mouth, shares, and recommendations).

Buying ads on Facebook is one of the most effective ways to get your message to the right people. You can target your content toward those most likely to be interested in your brand and thus more likely to engage with it.

Paid media offers some great benefits. Your brand or agency crafts the message and the ads, giving you complete control over what goes out (with the exception of sponsored stories). You also control schedule of delivery and the number of ads that you'll be serving. Paid media is easily measured, so you can see the impact

it has on the growth of your Facebook page. (Flatley, Joseph May 10, 2012)

When you buy a Facebook ad, you're buying more than just a targeted fan: you're buying the opportunity to access that fan's social graph. With the proper incentives, fans will share and recommend your brand to their connections. If you target the right person with your Facebook ad, she's more likely to recommend your page to her friend or her colleague who shares her interests. And that person in turn might share your content with a friend, and so on.

No matter what your budget, you can display your ads on Google and its advertising network. You pay only if people click your ads. You create ads and choose keywords, which are words or phrases related to your business.

When people search on Google using one of your keywords, your ad may appear next to the search results. That means you're advertising to an audience that's already interested in you.

People can simply click on your ad to make a purchase or learn more about you. Google AdWords offers targeted reach, greater control over your ads as you can edit them and adjust your budget, and measurable value.

Pay-Per-Click (PPC) advertising using Google Ad words can be a smart strategy when implemented in the right way at the right times for the right reasons.

The more recommendations and shares you get, the more trust your brand will earn and the more engagement you'll have on your page. This could become a snowball effect, where many users are sharing your brand -- a lot more than you paid for with your original Facebook ad. In fact, you can see more long-term benefits from earned media than paid, as sharing can continue to expand long after your initial ad campaign has ended. (Edited Harris, Dan 2002)

If your Facebook ads reach fans within your desired demographic, you can encourage many to go beyond the initial "Like" with calls-to-action to drive comments, shares and other interactions. In addition, if you're active on your brand page, encouraging people to comment on and "Like" your posts, you can leverage a high degree of activity to buy effective "Page Post like Sponsored Stories," which uses your fans' comments in ads. This will get your brand prominently displayed in front of friends of fans.

Empirical review

The Internet represents a phenomenal opportunity to stay in regular contact with both your company's prospect and customer base. Internet Marketing is a tool that allows you to stay "top of mind" with them and remind them of why doing business with you is such a rewarding experience. Regular contact through e-mail alerts, newsletters and announcements of the latest innovations pave the way to lasting commercial relationships and are essential elements in any Internet Marketing strategy

Sales promotions can offer many consumer benefits, among these the most obvious benefit is monetary savings, although consumers also may be motivated by the desire for quality, convenience, value expression, exploration and entertainment (Babinet al.,)Kwok and Uncles,(2005). These benefits enable consumers to maximize their shopping utility, efficiency and economy. Consumer sales promotions were directly tested Chandonet al., (2000), who showed that: monetary promotions are more effective for utilitarian products as they provide more utilitarian benefits, which are compatible to those sought from utilitarian products; and non-monetary promotions are more effective for hedonic products as they provide more hedonic benefits, which are compatible to those sought from hedonic products (Kwok and Uncles, 2005).

Competition in retail industry has also increased and all the leaders of the industry are expanding their business beyond boundaries, thus implementations of internet marketing strategies is essential for the development of these companies and acquire customers by creating awareness about company s products and‟ services. This requires adoption of several of the marketing strategies to increase the awareness of the consumers about the available products and services online provided by the company (Levenburg, 2005). In the global era, numerous well-known and major empirical studies have explored the Assisting retailers to expand their target markets¬ Broaden product lines¬ Drive down business costs¬ Assessing the trends and demands of market

The company can also tap several of the untouched market easily and cover large area without expanding their distribution channel. Incontestably, perceive value of a service or good has a significant impact on customer satisfaction. This value can be increased through internet marketing strategies by saving time and cost and offering quality services to attract and retain consumers for long term. By adopting these strategies, the consumers will find it more convenient to make shopping by simple sitting at home and finding goods and services of their choice.

There are also several of the alternative options for each category of goods which were not available in the traditional marketing and buying system (Doole and Lowe, 2008). Apart from this, online shopping programs also support an enterprise to identify and target their best customers and manage marketing campaigns with high quality sales for the organization (Grigoroudis and Siskos, 2009). Undeniably, the growing potentials and the loaded array of prospective rewards which the internet provides for both consumers and businesses have supported the increasing interest in e-commerce and online shopping. The fastest developing facet of “web usage” and customer acquisition strategy for businesses can be effectively use through E-commerce (Forsythe and Shi, 2003). Apart from this, web shopping also saves time of both customers as well as salesperson, which also enhances productivity of the employees and allows them to manage company and customers database in an effective way. This information is also utilized by salespersons to understand the customers’ decision making ability, and the type of products and services demanded by the segment of consumers. The time saving feature of the online shopping system is the biggest advantage for the consumers, as in this busy life people find it difficult to spare time from their busy schedule for shopping, so this serves as the best advantage for the consumers.

Internet marketing strategies in Grocery market is linked with both business-to-business marketing (B2B) and business-to-consumer marketing (B2C). Instead of this impressive growth and potential rewards of internet marketing strategies, the status quo of e-marketing service is significantly poor and unutilized by business firms. For instance more than 75% shares of online

market in UK retail industry are captured by the major players (Levenburg, 2005)

As more evidence suggests, the World Wide Web is a platform that presents tremendous possibilities for businesses to acquire customers and triumph in this highly dynamic and competitive business era that is dominated by traditional brick and mortar players. Various references and study material is available about the knowledge to improve definite processes and practices for retailers to enhance their sales (Chong and Shafaghi, 2010).

By utilizing this information and understanding consumer behavior, retailers can handle changing demands of the consumers in the technological and innovative society Since the main aim of this research study is to evaluate the role of internet marketing strategies in customer acquisition, this study also emphasize some other essential aspects associated with the significance of internet marketing strategies and other driving forces that influences the buying behavior of the consumers. This study is beneficial for both firms and consumers to manage fast pace of life, improving traditional marketing process, strengthen social and economic environment, effective utilization of IT requirements and wireless technology such as internet, telephone, Bluetooth, etc.

It has been also evaluated that internet marketing strategy and online shopping programs are not only the complete solution to attract the consumers for long time and enhance the profitability but also a part of the solution to acquire consumers and enhance profitability. Online marketing process also impact on satisfaction level of customers, as it provides the consumers with a variety of products and also those products, which are not in their reach through the normal marketing or direct selling techniques (Aungst and Wilson, 2005). Additionally, this study also captures driving forces that motivate the consumers to buy some particular product or prefer some particular company or brand. Additionally,this study has a scope for the B2C and B2B e-commerce models that impact both traditional marketing concepts and internet marketing strategies. Besides this, this dissertation also focuses on the marketing approach and strategies used to become successful in global retail industry such as web shopping programs, e-CRM process, club card membership and other issues associated with the traditional and online marketing process.

III. RESEARCH METHODOLOGY

Research Design

The study applied a descriptive study method. Descriptive research is a study designed to depict the participants in an accurate way. More simply put, descriptive research is all about describing people who take part in the study.

Sekaram (2006) observes that the goal of descriptive research is to offer the researcher a profile or describe relevant aspects of the phenomena of interest from the individual, organization, industry or other perspective.

The design allows for a holistic in depth study of the organizations which are similar in many aspects and the findings are hoped generalized to other areas. The design was chosen because it will involve investigation of the effects of internet marketing on sales which has the ability to answer as to how internet marketing affects sales. It was able to provide a detailed analysis of internet marketing.

Target Population

The population is the set of entities under study.Mugenda (2003) recommends a sample size of ten percent. However, Kothari (2004) recommends that a sample size be as large as possible in order to reproduce salient characteristics of the accessible population to an acceptable level as well as to avoid sampling errors. The target population included the employees responsible for internet marketing at TELKOM Kenya (Marketing Department). It will target a population of 171 employees consisting of 3branch managers, 6 sales and marketing managers, 18 Supervisors and 144 employees from marketing department. The branch manager is targeted because this is the person responsible for designing policies of the organization. Sales and Marketing manager is targeted because he is responsible for supervising and directing marketing activities in the sales and marketing department.

Sampling and sampling technique

A sample is a scientifically drawn group that actually possesses the same characteristics as the population.Stratified random sampling is where a given number of cases are randomly selected from each population sub-groupMugenda and Mugenda (2003). A subset of this population called a sample. The researcher adopted stratified sampling to sample 30% of the population from the Branch Manager, Sales and Marketing Manager, supervisors and Sales and Marketing employees researcher wrote their names and fold the papers and insert them in a basket. He there after picks 3 names from departmental heads, 3 from section heads, 6 from supervisors, 19 from senior employees and purposively go to the branch manager. According to Carmines and Zeller, a sample size of at least 25% for a target population of between 100 and 500 is appropriate and representative. It is important to remember that the sample we draw from the population is only one from a large number of potential samples. This is shown in table 3.2 below:

Table 3.1 Sample size

Strata	Target population	Sample size
Branch manager	**3 x 0.3**	**1**
Sales and marketing manager	**6 x 0.3**	**2**
Supervisors	**18 x0.3**	**6**
Sales and Marketing employees	**144x0.3**	**48**
Total	**171**	**57**

Data Collection Procedures

Data collection was done using questionnaires as the main data collection tools.A questionnaire with high reliability would receive similar answers if it is done again and again or by other researchers (Bryman& Bell, 2007; Saunders et al., 2007). The researcher collected data from the selected respondents after obtaining permission from Jomo Kenyatta University of Agriculture and Technology to carry out research in the identified area of study. The researcher visited TELKOM

KENYA - Eldoret to seek permission and explain the purpose of the research. The researcher sought the assistance of the heads of departments to distribute questionnaires to employees of TELKOM KENYA and other related respondents who distributed the data collection instruments/tools. After familiarization, data was collected from the respondents using questionnaires and interview. Questionnaires were administered personally by researcher to the respondents whose reactions was written down. A follow up was made to ensure that all questionnaires were returned. The researcher carried out structural interviews to secure information from the sales and marketing manager, Supervisors and employees in the sales and marketing department. The completed instruments was verified and collected from the respondents within a period of ten days from the day of distribution.

RESEARCH FINDINGS AND DISCUSSIONS

Response to Research Instruments

The study achieved a response rate of 100% all the questionnaires used by the respondents were returned hence promoted high response rate (All the 57 Questionnaires were filled and returned). A sample of 30% of the whole population of 171 employees was used in the study. According to Carmines and Zeller, a sample size of at least 25% for a target population of between 100 and 500 is appropriate and representative.The questionnaires are convenient for the task in that they can be easily and conveniently administered with the study sample.(Bryman& Bell, 2007; Saunders et al., 2007).A questionnaire with high reliability would receive similar answers if it is done again and again.Data collected through the use of well-structured questionnaire is easy to analyze.

4.2.1 Demographic Information of the Respondents

Strata	Target population
Branch manager	**3**
Supervisors	**6**
Sales and marketing manager	**3**
Sales and Marketing employees	**144**
Total	**171**

The above table implies that the department is stable in its administration workforce, though there is need to employ more as it grows

Gender of the Respondents

The study aimed at establishing the distribution of male and female within the department. The study findings indicated that there were more male to female employees in the department. This implies that most of the employees in the service are male with 72% (41) and female 28% (16).

Table 4.1 Gender of the Respondents

	Frequency	Percent	Valid percent	Cumulative percent
Male	41	71.9	71.9	71.9
Female	16	28.1	28.1	100
Total	**57**	**100**	**100**	

The above table implies that the department has tried in terms of gender balance; however there is need to employ more females. Men and women have different purchasing approaches. Whereas men tend to make purchase based on prices and availability of products, women are more holistic in their approach. Online purchasing is becoming very popular among the customers and a very important channel of distribution for the marketers. Generally, we associate technology with men but today even women are becoming increasingly techno savvy. They prefer a plasma TV over designer set and a high featured

mobile over designer shoes. Women go online to save time and simplifying their lives whereas men are more into news, stocks and other entertainment sites.One more important thing to note here is women have more demands for variety as compared to men. It is also seen that women always want somebody to accompany and make advices while they make their purchases of clothing. Advantage service provider! While serving to women you should keep in mind to appeal not only the purchaser but also her companion.If you target the right person with your Facebook ad, she's more likely to recommend your page to her friend or her colleague who shares her interests. Paid media is easily measured, so you can see the impact it has on the growth of your Facebook page. (Flatley, Joseph May 10, 2012)

Level of Education

The researcher sought to establish the level of education of respondent in the department. The researcher focused on the education level of the respondents since the level of education plays a major role in determining employees understanding effect of Internet Marketing Strategies on sales of communication services. Theprimary level 18% (10) Secondary institution 42% (24) Tertiary level 28 %(16) and No education 12% (7).

Table 4.2 Level of education

	Frequency	percent	valid percent	cumulative percent
Primary level	10	17.5	17.5	17.5
Secondary level	24	42.1	42.1	59.6
Tertiary level	16	28.1	28.1	87.7
No education	7	12.3	12.3	100
Total	**57**	**100**	**100**	

The research found that majority of the employees had secondary level education and only a few who didn't have any education.Professional marketers must be able to analyze international and national markets; aspiring marketers should be able to follow economic trends and developments through the Internet. Many marketing professionals work in a team, so it helps to have skills as both a leader and a team player. As professionals who interact with consumers and brand managers, marketers also needsstrong written and verbal communication skills.When people search on Google using one of your keywords, your ad may appear next to the search results. That means you're advertising to an audience that's already interested in you.Understanding possible markets is thus important for businesses investing in electronic commerce. Amichai-Hamburger (2002)

Marital status

The researcher sought to establish the marital status of the respondents in the department. The study showed single 19% (11), Married status 53 %(30) and married once 28 % (16).

Table 4.3 Marital status

	Frequency	percent	valid percent	cumulative percent
Single	11	19.3	19.3	19.3
Married	30	52.6	52.6	71.9
Married once	16	28.1	28.1	100
Total	**57**	**100**	**100**	

The researcher sought to establish the marital status of the respondents in the department as the majority categorized. Research shows relationship status for women can impact their decision-making and brand choices.

According to a study from Mindshare Hong Kong, females in relationships rely less conscious of brands compared to single females.Consequently, when it comes to media channels that influence skincare purchases, single females are more likely to rely on advertising and marketing. The result shows almost 20% of single females are more likely to be influenced by TV celebrities and have a higher tendency to be influenced by Facebook brand pages.

In terms of mobile usage, the study shows that females in relationships spend more time on mobile internet when lying in bed before sleeping. To the contrary, males in relationships are less likely to do so.

Job position

The position was categorized as Manager19%(11), General supervisor 23% (13) and Department 58 %(33).

Table 4.4 Job position

	Frequency	percent	valid percent	cumulative percent
Manager	11	19.3	19.3	19.3
General supervisor	13	22.8	22.8	42.1
Departmental heads	33	57.9	57.9	100
Total	**57**	**100**	**100**	

The research sought that, Departments was the most used in the TELKOM, Eldoret Kenya since it had the highest frequency than the others like General supervisor and Manager. Singles in 30s or above may have high disposable income, when they don't have kids, and they have more time and freedom to enjoy life. So this segment would be core customers for marketers to consider more in future, argued by Marc Fong, head of business planning at Mindshare Hong Kong.

Experience

The researcher sought to know the experience of the respondents in the organization. The study showed that1-5(11) 19% 6-10 (13) 23% and 11-15(31) 54 % over 16years (2) 4%. These are shown in the table below. The findings were summarized and presented in the form of a table below.

Table 4.5 Experience

	Frequency	percent	valid percent	cumulative percent
1-5	11	19.3	19.3	19.3
6-10	13	22.8	22.8	42.1
11-15	31	54.4	54.4	96.5
Over 16 years	2	3.5	3.5	100
Total	**57**	**100**	**100**	

The above table implies that the department favors 11-15 experience.

Effects of internet marketing strategies on sales

The researcher sought to establish the effects of Challenges facing internet marketing strategies has put in place. The study showed 30% (17) Market Share 25% (14) Operation Costs 17% (10), Competitive Advantage 21% (12) Quality of service delivery 7% (4) Employee Workforce Internet buyers have fewer security worries, appreciate the quickness and flexibility of internet buying and see the web as making buying easier (Ronald Goldsmith, 2002).A good Internet marketing strategy clearly communicates a firm's unique selling proposition, or the unique collection of benefits that creates value for its customers.(Pan-Western E-Business Team, 2005).Computer scientist Ramesh Sitaraman has asserted that Internet users are impatient and are likely to get more impatient with time. In a large-scale research study that completed in 2012 involving millions of users watching videos on the Internet, Krishnan and Sitaraman show that users start to abandon online videos if they do not start playing within two seconds.

Table 4.6 Effects of internet marketing

	Frequency	percent	valid percent	cumulative percent
Technology services	15	26.3	26.3	26.3
Customer oriented service	16	28.1	28.1	54.4
Knowledge process service	26	45.6	45.6	100
Total	**57**	**100**	**100**	

From the table above, there were three major online/internet factors that affected internet marketing strategies on sale of communication services namely

Knowledge of process service was the greatest followed by customer oriented service and the least being technology service.

Table 4.7 Effect of internet marketing strategies on sales

	Frequency	percent	valid percent	cumulative percent	
Enhance competitive Advantage	10	17.5	17.5	17.5	
Increase market share	17	29.8	29.8	47.4	
Reduces operation Costs	14	24.6	24.6		71.9
Enhances quality of service delivery.	12	21.1	21.1	93.0	
Increases employee Workforce at the Marketing department	4	7.0	7.0	100	
Total	**57**	**100**	**100**		

The above table implies that the Increases market share is the majority 17(30%) while the minority is Increases employee workforce at the marketing department 4(7%). This means that increase in market share has the greatest impact on internet marketing strategies on sale of communication services, whereas increase in employee workforce at the department least affect internet marketing strategies on sale of communication services.Amichai-Hamburger (2002) argues that the behavior of internet users plays a significant role in their internet behavior.

Product Characteristics

The researcher aimed at identifying the Product Characteristics The study showed that 80%Improved competitive strategies in the market.

Table 4.8 Product Characteristics at TELKOM,Eldoret, Kenya

Product Characteristics	Frequently	Rarely	Not applicable
Improved competitive strategies		√	
Increases the skill of employees in purchasing and supply of goods		√	
Improves procurement techniques in procuring of goods and services	√		
Improves outsourcing of goods and services	√		

From the above findings, the researcher noted that product characteristics affect the internet marketing strategies it the following ways. Improved competitive strategies rarely affect internet marketing strategies on sale of communication services. Increase in the skills of employees in purchasing and supply of goods also rarely has an impact on internet marketing strategies on sale of communication services.Internet for marketing to consumers depends to a large extent on the characteristics of the products and services being marketed (Peterson, *et al*.,).

Internet marketing strategies on sale of communication services is frequently affected by improved procurement techniques in procuring of goods and services. Improved outsourcing of goods and services frequently had impact on internet marketing strategies on sale of communication services. Conventional wisdom indicates that companies offering digital and information based products that can easily be delivered online, are likely to benefit from Internet commerce. We classified products into search and experience, tangible and intangible goods and examined their effects on Internet commerce benefit. The key finding is that product characteristics alone might not have significant influence on Internet commerce benefit and further research into market scope, characteristics of

business sector and value chain is needed to understand more precisely what contributes to Internet commerce benefit

Challenges facing Internet Marketing Strategies at TELKOM Kenya in Eldoret

The researcher sought to establish the **c**hallenges facing internet marketing strategies at TELKOM Kenya in Eldoretthat the department has put in place. The study showed 9% (5) Increase market share 6% (3) Enhance competitive advantage and 4% (2)Operations costs, 46% (27) Enhance quality of service delivery and 35% (20) Increase employee Workforce at the purchasing department. Establishing and maintaininginformation made to order communication with customers during the transaction could be expensive.(David Scanlon, 2009). Amichai-Hamburger (2002) indicated that the behavior of internet users plays a significant role in their internet behavior.

IV. SUMMARY RECOMMENDATIONS

Summary of the findings

From the research it was clear that both managers and employees of the department were aware of the implications of internet marketing strategies. The objectives of the research study and the stated research questions were tested against the findings and this was demonstrated by 100% response to questionnaire in chapter four. The data was then analyzed and presented in form of tables.

The researcher concluded that from the analysis results done at the earlier part of this chapter, demographic factors were examined and their effects on e-commerce or internet marketing in computer industry in TELKOM Kenya were analyzed critically. Gender and marital status were not included into this demographic factors analysis because there is no much significant difference between gender and marital status in internet marketing in computer related products purchaser. Age, and education showed the difference and effect on internet marketing strategies and showed that they are more satisfied and find the internet business with good security and good IT services with computer industry and their behavior is good and will increase in future by adding some good effective resources in internet business in computer industry. Young people have been seen to be the major users of internet and e-commerce services and internet computer related products purchasers, individual aged 40 years and bellows accounts for 76.3% of all internet computer related products purchaser and older individuals' accounts for 23.7% only. Education as well makes a distinct difference on internet marketing level in computer industry, diploma, bachelor degree and masters' degree holders' accounts for 78% of the internetcomputer related products purchaser in TELKOM Kenya, and only 22% is accounted by other education level groups.

Customer expertise and familiarity

Expertise or product knowledge and expert in processing of the product is the understanding of the attributes in a product or service class and knowledge about how various alternatives stack up on these alternatives. Customers' expertise facilitates their learning of new and more complex types of information (AhasanulHaque and Ali Khatibi, 2007). The customers who are more innovative and knowledgeable with regard to the internet and its uses are more likely to buy internet from the computer industry than less innovative and knowledgeable customers (AhasanulHaque and Ali Khatibi, 2007).

Customer services

Commentary, that it is often repeated in terms of gaining benefits from the internet is in terms of marketing logistic, whereby internet buyers gain temporal advantage by ordering internet and delivered over internet (Adam Stewart, 2002). Electronic marketing broaden the marketing scope of internet users and allow buyers to make transaction online. Some researchers specify that, specific knowledge of the impact of attribute performance on satisfaction is, therefore, a basic requirement (Adam Stewart, 2002).

Recommendations

Internet Marketing requires customers to use newer technologies than traditional media, the reason why not all people may get the message. Low speed Internet connections are one barrier. If companies build overly large or complicated web pages, some Internet users struggle to download the information on dial up connections or mobile devices. From the buyer's perspective, another limitation is the inability of shoppers to touch, smell, and taste or try-on tangible goods before making an internet purchase. However, it is an industry standard for e-commerce vendors to have liberal return policies and in store picks up services to reassure customers. Consumers commonly seek quality information when purchasing new products. With the Internet usage growing popularity, internet consumer reviews have become an important resource for consumers that are seeking to discover product quality. Studies show that firms not only regularly post their product information and sponsor promotional chats on internet forums such as USENET (Mayzlin 2006), but also proactively induce their consumers to spread the word about their products internet (Godes and Mayzlin 2004). Some firms even strategically manipulate internet reviews in an effort to influence consumers' purchase decisions (Dellarocas 2006).

The efficacy of internet reviews could nonetheless be limited. First, internet reviews may merely represent consumers' preferences. These reviews may predict product sales but have little influence on consumers' decisions. In the terms of Eliashberg and Shugan (1997), internet reviews in this case serve as predictors rather than influencers of product sales. Second, reviewers are not a randomly drawn sample of the user population. Anderson (1998) finds that extremely satisfied and extremely dissatisfied customers are more likely to initiation transfers. Li and Hit (forthcoming) find potential bias in consumer reviews during early product-introduction periods. Finally, interested parties can easily manipulate internet forums. Dellarocas (2006) and Mayzlin (2006) theoretically analyze the scenarios in which firms can anonymously post internet reviews to praise their products or to increase awareness about them. As a result, potential buyers may heavily discount internet reviews. (Peterson et al., 1997). The second group of products is termed as 'experience products', which include items that consumers prefer to see and touch before purchasing, such as clothes and groceries. This group of products is not suitable for Internet shopping since

information about the product's features may not be sufficient for consumers to engage in Internet-based transactions.
However, most consumers gather information on products, make price comparisons and then visit a local store to make purchase. Internet marketing is becoming a more and more important strategy for the company to promote, advertise and interact with more customers over the internet. This is especially true in the context of Malaysia where Internet shopping is still new and consumers are less familiar, and often more skeptical towards internet shopping, but little is known about them. Therefore, in order to understand consumers' needs and wants, it is very important for us to have a survey to find out the factors of the Internet marketing towards consumer buying behavior, in terms of two different ways; a) factors that affect buying decision of the customer and b) how does Internet marketing affect the behavior of the customer.

Internet usage has grown exponentially over the last decade from its humble beginnings to its present incarnation as apparently present everywhere, it has revolutionized a lot of business and consumer behavior (Harter, 1999; Wilson and Laskey, 2003). Since, it is used to build and maintain customer relationships through internet activities to facilitate the exchange of ideas, products, and services that satisfy the goals of both buyers and sellers (Imber and Besty-Ann, 2000). However, despite its popularity and importance in the digital economy, no comprehensive literature review has been conducted in the field of Internet marketing (Ngai, 2003).

The researcher recommended that product customization, usability and site design on customer satisfaction and loyalty in internet marketing. Data were gathered from 80 respondents who are in TELKOM Kenya that are able to read and write and hence capable of using internet and its facilities. The results showed that there is a significant correlation between product value, E-service quality, effective cost, customer service, product customization, usability and site design and customer satisfaction. The results also revealed that there is a significant correlation between loyalty in internet marketing and customer satisfaction Demographic and psychographics profile, media habits, and level of awareness.

Suggestions for further study

The researcher suggested that a further research should be done to find new ways in which organizations can improve internet marketing at TELKOM, EldoretKenya. Incontestably, perceive value of a service or good has a significant impact on customer satisfaction. This value can be increased through internet marketing strategies by saving time and cost and offering quality services to attract and retain consumers for long term. By adopting these strategies, the consumers will find it more convenient to make shopping by simple sitting at home and finding goods and services of their choice. There are also several of the alternative options for each category of goods which were not available in the traditional marketing and buying system

REFERENCES

[1] Adam, S., R. Mulye, K.R. Deans and D. Palihawadana. (2002). E-marketing in perspective: Three country comparison of business use of the Internet.Marketing intelligence and Planning.

[2] Adelaar, T., Bouwman, H. and Steinfield, C. 2004.Enhancing customer value through click-and Mortar e-commerce: implications for geographical market reach and customer type.Telematics and Informatics, 21(2) pp.167-182.

[3] AhasanulHaque and Ali Khatibi. (2006). Identifying Potentiality internet Sales in Malaysia:A Study on Customer Relationships internet Shopping.

[4] AhasanulHaque and Ali Khatibi. (2006). the study of the behavior of Malaysian Consumer Towards internet shopping.

[5] AhasanulHaque and Ali Khatibi (2007).The Impact of internet marketing on customer Satisfaction in Malaysia.International Islamic University.

[6] Ahuja, M., Gupta, B. and Raman, P. 2003. An Empirical Investigation of Online Consumer Purchasing Behavior.Communications of the ACM. 46(12) pp.145–151

[7] Alba, J., Lynch, J.W.B., Janiszewski, C., Lutz, R., Sawyer, A., and Wood, S. (1997). Interactive Home shopping:

[8] Allard C.R Van Riel, Jos Lemmink and Sandra Streukens. (2004). Boost customer loyalty with Internet support: the case of mobile TELKOMs providers.

[9] Anderson, E.W., and Mittal.V.(2000).Strengthening the satisfaction-profit chain.

[10] Anderson, E.W., and Sullivan.M.W. (1993).The antecedents and consequences of customer Satisfaction for firms.

[11] Annual Report 2010 of Tesco Plc. 2011.[Online].Available at:

[12] http://ar2010.tescoplc.com/~/media/Files/T/Tesco-Annual-Report-2009/Attachments/pdf/tesco-annualreport.pdf [Accessed on 27 September 2010].

[13] Apigian, C.H., Ragu-Nathan, B.S., Ragu-Nathan, T.S. and Kunnathur, A. 2005.Internet technology: the strategic imperative. Journal of Electronic Commerce Research.6(2) pp.123–145.Aungst, S.G. and Wilson, D.T. 2005.

[14] Apnizan Abdullah, YusnizaKamarulzaman& Abdul Ghani Farida. (2008). Legal Services and Marketing limitation: A Focus on SME in Malaysia.

[15] A primer for navigating the shoals of applying wireless technology to marketing problems. Journal of Business & Industrial Marketing. 20(2) pp. 59-69.

[16] Axinn, W.G. and Pearce, L.D. 2006. Mixed Method Data Collection Strategies: New Perspectives on Anthropological and Social Demography (1st Edition). New York: Cambridge University

[17] Bandyopadhyay, S. 2001.Competitive Strategies for internet marketers for emerging market. Journal of Global Competitiveness, 11(2) pp.16-24.Bei, L.T. and Shang, C.F. 2006.

[18] Bergh, D.D. and Ketchen, D.J. 2009.Research Methodology in Strategy and Management.Emerald Group Publishing.

[19] Boone, L.E. and Kurtz, D.L. 2006.Contemporary Marketing (Eds). Thomson South-western Publishing Company. Brace, I. 2008. Questionnaire Design: How to Plan, Structure and Write Survey Material for Effective Market Research. UK: Kogan Page Publishers.

[20] Brink, D.D. et al. 2006.The effect of strategic and tactical cause-related marketing on consumers brand loyalty ."" Journal of Consumer Marketing. 23(1) pp.15–25. Craig, D.V. 2009. Action

[21] Building Marketing Strategies for State-Owned Enterprises against Private Ones Based on the Perspectives of Customer Satisfaction and Service Quality. Journal of Retailing and Consumer Services, 13pp. 1-13. Belk, R.W. 2006

[22] Chaffey, D., Mayer, R., Johnston, K. and Ellis-Chadwick, F., 2006, Internet Marketing, FT Prentice Hall, ISBN: 0273694057

[23] Crowther, D. and Lancaster, G. 2009. Research Methods: A Concise Introduction to Research in Management and Business Consultancy (2nd Edition).

[24] Dellarocas, (2003).Microfinance in Africa: Is It Either the Problem or the Solution? World

[25] Doole, I and Lowe, R. (2008).International marketing strategy: analysis, development and implementation. London: engage Learning EMEA

[26] Donnavieve and Siva Kumar, (2002).“Microfinance Evolution, Achievements and challenges” ITDG publishing, UK

[27] Drennan, J. and McColl-Kennedy, J. 2003.The relationship between Internet use and perceived performance in retail and professional service firms. Journal of Services Marketing.17(3) pp.295-311.

[28] Easterby-Smith, M. et al. 2006.Management Research: An introduction (2nd Edition). Sage Publications.

[29] Engel, R.J. and Schutt, R.K. (2005).The practice of research in social work (Eds). USA: SAGE.

[30] European Journal of Marketing.41(5-6) pp.512-536

[31] Ethridge, D.E. 2004.Research methodology in applied economics: organizing, planning, and conducting economic research (2nd Edition). USA: Wiley-Blackwell.

[32] Forsythe, S. and Shi, B. 2003.Consumer patronage and risk perceptions in Internet shopping. Journal of Business Research. 56(11), pp. 867

[33] Gefen, D., Karahanna, E. and Straub, D.W. 2003.Trust and TAM in Online Shopping: An Integrated Model, MIS Quarterly.27(1-51) pp.90.

[34] Godes and Mayzlin, (2006).Replicating Finance Programmes in Malawi and Malaysia. Small Enterprise Development. 4 (4)

[35] Godes and Mayzlin, (2004).Microenterprise Credit Programs: Déjà vu. World

[36] Goode, M. and Harris, L. 2007.Online behavioral intentions: an empirical investigation of antecedents and moderators.

[37] Gopalani, A. and Shick, K. 2011. The service-enabled customer experience: a jump-start to competitive advantage. Journal of Business Strategy.32(3) pp.4-12.

[38] Grigoroudis, E. and Siskos, Y. 2009. Customer Satisfaction Evaluation: Methods for Measuring and Implementing Service Quality International Series in Operations Research and Management Science Series. New York:

Groups activities in Kenya.Orange , 2013 08 -06.

[39] Handbook of Qualitative Research Methods in Marketing (Eds) Edward Elgar Publishing, UK.Research Essentials. San Francisco:

[40] Haqueet al., (2006).Fighting marketing with Microcredit: Experience in Bangladesh. Oxford University Press, Inc. New York.

[41] Harter, (1999); Microenterprise in International Perspective: An Overview of the Issues. Journal of Economic Development. 1 (1).

[42] Hee-Woong, K.and Gupta, M. 2005.The old, the new and the complicated: A trilogy of marketing relationships. European Journal of Marketing.35 (1-2) pp.182-193.

[43] Hoch et al. (1994)... A Cautionary Note for Microfinance Institutions and Donors Considering Developing Micro insurance Products.

[44] http://www.africog.org Cause ofpublicconcern on the privatization and Safaricom IPO

[45] http://www.isoc.org/inet97/proceedings/C6/C6_1.HTM,Norwegian Computing Center 10th November 2006

[46] Hulme, D. and P. Mosley. 1996. Finance against Poverty. Volumes 1 & 2.Routledge. London.

[47] International Herald Tribune report 16.11.2007

[48] Jahnget al., (2000).Microfinance and Marketing Reduction.Oxfam.

[49] John Wiley and Sons Creswell, J.W. 2003.Research Design: Qualitative, Quantitative and Mixed Methods Approaches (2nd Edition).

[50] Marcus, Rachel, Beth Porter and Caroline Harper. 1999. Money Matters: Understanding.

[51] Mayzlin (2006), Microfinance and Poverty: World Bank Economic Review

[52] Microfinance. Save the Children. London.

[53] Mugenda, O. M. &Mugenda, A. G. (2003). Research Methods: Quantitative and Qualitative Approaches. Nairobi: Acts Press.

[54] MutegiMugambi(2012-11-22)State turns its Telekom Kenya loan into Equity Business: Daily 2013-08-06

[55] Neslin, S. A. et al. 2006. Opportunities and Challenges in Multichannel Customer Management, Journal of Services Research.9(2) pp.95-112.

[56] Ngai, (2003).Reaching the Poor with Effective Microcredit: Evaluation of a Grameen Bank Replication in the Philippines. International Rice Research Institute. Philippines.

[57] Ngai, E.W.T., Xiu, L. and Chau, D.C.K. 2009.Application of data mining techniques in customer relationship management: A literature review and classification. Expert Systems with Applications.36 pp.2592–2602.83-103.

[58] Ng, S. David, M. E. and Dagger, T.S. 2011.Generating positive word-of-mouth in the service experience. Managing Service Quality. 21(2) pp. 133-151

[59] NyabiageJevans(2013-01-12)Government ownership grip in Telkom Kenya Standard Digital (2013-08-06)

[60] Omondi Michael (2012-11-27) Treasury stake in Telkom Kenya cut after debt swap Business Daily 2013-08-06

[61] Oxford Butterworth-Heinemann; Department for Environment, Food and Rural Affairs, Defra 2009.The share of supermarkets in the UK.[Online]. Available at: www.questia.com [Accessed on 30 September 2011].

[62] Peattie and Peattie, (1994).“Finance Against marketing -Volume 1”, Routledge, London, 1996. Sage.

[63] Creswell, J.W. 2003.Research Design: Qualitative, Quantitative, and Mixed Methods Approaches. UK: Publisher SAGE.

[64] Saunders, M. et al. 2007.Research methods for business students (4th Edition). London: Financial Times Prentice Hall

[65] Springer. Hamill, J. (1997). The Internet and International marketing. Journal of international marketing review, 14(5), 300-321

[66] Sweeney, S., MacLellan, A. and Dorey, E., 2006, 3GMarketing on the Internet: Third Generation Internet Marketing Strategies for Online Success, Maximum Press, ISBN: 1931644373

[67] Sweeney, S., 2006, 101 Ways to Promote Your Web Site, Maximum Press, ISBN: 1931644462

[68] Tjostheim, I. and Aanonsen K., Internet Marketing and the Norwegian Tourism Industry: A National Coordinated Marketing Effort on the Internet,

[69] Totten and Block, (1987).Finance againstPoverty.Volumes 1 & 2.Routledge. London. UK and Ireland.

[70] Wilson and Laskey, (2003).In Search of Sound Practices for Microfinance.

Journal of Microfinance.

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