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International Journal of Business and Public Management (ISSN: 2223-6244) Vol. 1(1): 75-84
Available online at: http//:www.journals.mku.ac.ke

Full Length Research Paper

Collective efficiency and its effects on infrastructure planning and development for small manufacturing enterprises in Kenya

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Recieved: February 28, 2011 Accepted: March 15, 2011

Abstract
This paper explores the extent of use of collective efficiency among the wood enterprises in Kenya and its effect on the infrastructure planning and development. Small manufacturing enterprises are known to contribute to economic dynamism, entrepreneurship and industrial development in less developed countries. However, they are handicapped by lack of capacity to accumulate capital, develop infrastructure and acquire technologies necessary for competing in a liberalized global market individually. Data was obtained from 284 wood enterprises owner/managers selected through multistage sampling in western Kenya and by use of questionnaires, observation checklists and documentary analysis. Data analysis by regression shows that infrastructure development is affected linearly by collective efforts. The paper recommends that industrial infrastructure planning in Kenya should be informed by the Collective efficiency, Networking, Systems approach and Constructivism paradigms so as to anchor the small manufacturing enterprises in the industrialization process. The paper also recommends that a Jua Kali development authority should be established to address the needs of the small manufacturing enterprises sector borrowing from the export processing zones authority model.

Keywords: Infrastructure planning, Collective efficiency, wood enterprises
JEL Classification: C30

1.0 Introduction

Small Manufacturing Enterprises (SMEs) (SMEs are used here to mean all enterprises engaged with the manufacture/production of artifacts for sale as a business venture employing less than 50 employees) have been noted to play a significant role in promoting economic growth in Less Developed Countries (LDCs), developing and developed countries (Liedholm and Mead, 1999). Small enterprises contribute to economic dynamism and entrepreneurship and this paper submits that for sustainable industrial development in LDCs, the SMEs will have to play a pivotal role. As United Nations Industrial Development Organization (UNIDO, 1998) puts it, sustainable industrial development is a process of developing Land, Cities, Businesses and communities to meet the needs of the people or nation, without compromising on the ability of future generations to meet their own needs. Consequently, in LDCs sustainable development has to target rural development with strategies that support the rural poor extending benefits of development to them.

Since the 1980s, African economies have endeavored to give micro interventions that have sought to create and promote the development of enterprises or ease their constraints through direct assistance in the field of finance, technology and skills upgrading. Yet, the envisaged growth and transition, graduation of SMEs from micro to small, small to medium and medium to large enterprises does not seem to be taking place (Lukac, 2005).

For SMEs to be drivers of industrialization, such transition becomes a necessity for SMEs in LDCs. Further, the SMEs must be self sustaining through technological innovations and building competitive advantages in a liberalized global market. Most SMEs are not able to do this on their own. It has been noted that SMEs in developing countries remain in traditional activities generally with low levels of productivity, poor quality products and serving small localized markets and therefore cannot accumulate capital for their growth, infrastructure development and acquisition of modern technologies. Since most SMEs in LDCs are not able to build competitive advantages on their own and benefit from economies of scale, they could achieve this by exploiting collective efficiency, working in clusters, forming associations and engaging in subcontracting with large firms thus gaining from flexible specialization.

In this subsector study, the wood industry is used to examine the extent to which collective efficiency paradigm (Collective efficiency refers to joint actions or collective efforts that are made by enterprises working together, accessing the needed

infrastructure jointly, to facilitate their individual enterprises improved performance) is used in supporting the growth of the wood enterprises and by extension SMEs. The use of the wood industry is appropriate since forests are important renewable assets of a country's wealth that even poor counties have all could posses. Forests provide renewable raw materials for a wide range of industries with wood industries providing a wide range of products for consumption and intermediate purposes thereby contributing to economic growth and development of a region or country.

In Kenya, the performance of the wood industry has continued to decline over the years. As at 2009, virtually all large sawmills had collapsed leading to the closure of Pan Africa Paper Mills that was producing 80% of the pulp and paper products in Kenya. Between 2001 and 2002, the wood and cork subsector performance dropped by 56% while import of timber increased from 78.2 m^3 to 606 m^3 in the same period (Kenya, 2003). While the poor performance in the wood industry has been attributed to the ban of logging which in itself is a manifestation of poor infrastructure planning, it is also indicative of the challenges faced in the growth of Small manufacturing enterprises within this sector. There is however, insufficient literature on the use of networking and collective efficiency as a paradigm that informs infrastructure and technology development that in turn support the growth of SMEs in LDCs.

2.0 Literature review

2.1 Small Manufacturing Enterprise

Small-scale firms are significant and frequently a dominant component of the Industrial sector in most African countries (Liendholm and Mead, 1987). The micro enterprises (for Kenya, small scale enterprises employing less than 10 employees) account for the bulk of industrial employment in these countries (Liendholm and Mead, 1987). However, there are relatively few firms that employ 10 to 50 workers (small enterprises) and even fewer firms that employ between 50 and 100 workers (Medium enterprises) in Kenya and hence they generate relatively little employment (Liendholm and Mead, 1987). Given the dispersed settlement patterns in Africa, the emergence of rural towns as a focal point enables policy makers to provide the needed infrastructure for productive small and medium enterprises at relatively lower costs. In addition to roads or railroads, electricity and water, one must not forget needed improvements in the institutional infrastructure such as developments of legal, information systems and technology. These infrastructure-type improvements are more important in low-income countries than elsewhere.

The contribution of small enterprises goes beyond employment generation. They also contribute to new innovation, and more importantly they engender entrepreneurial spirit. Indeed the promotion of small enterprises has become key element of government policy in many developing countries to stimulate economic growth and employment including self employment. As such many governments are actively supporting small enterprise growth (Lukács, 2005). According to the statistics, in industrialized countries, SMEs are major contributors to private sector employment. Empirical studies have shown that SMEs contribute to over 55% of GDP and over 65% of total employment in high income countries.

The role of SMEs is well acknowledged in other countries such as Japan, Korea, and all other industrialized economies in terms of creating employment, reducing poverty and increasing the welfare of the society (Lukács, 2005). Lukács (2005) reports that SMEs and informal enterprises, accounted for over 60% of GDP and over 70% of total employment in low income countries, like Kenya. In much of the developing world, the private economy is almost entirely comprised of SMEs and that they are the only realistic employment opportunity for millions of poor people throughout the world. Lukács (2005) observes that there is little or no technological dynamism in this group, and few 'graduate' into large size or modern technologies. There is need therefore to investigate the extent to which collective efficiency is employed in planning and developing infrastructure that in turn facilities the growth of SMEs.

2.2 Infrastructure Planning and Development for Small Manufacturing Enterprises

Infrastructure and technology are a challenge for SMEs who are hard put to accumulate capital hence can do little on their own to support infrastructure and technology development. This calls for the adoption of the collective efficiency paradigm in the planning and development of infrastructure in LDCs. Infrastructure offers supportive structure for the growth of other sectors, raises growth of enterprises and reduce income inequity (Lopez,2004).

Infrastructure planning and development, especially in rural areas should support technology adoption and innovation that in turn lead to enterprises growth and building of competitive advantage. This does not seem to happen in LDCs where SMEs remain generations behind in the kind of technology they employ. This is one area where policy pronouncements has not fully succeeded in creating a direct connection between infrastructure development, technology acquisition, adoption and development and thus the growth of individual SMEs. Research seems also to be treating this as separate and more so, not emphatically establishing empirically the significance of the differences between the inter-relationship from one region to the other, one country to the other and one society to the next.

2.3 Conceptual Models in Infrastructure Planning for Small Manufacturing Enterprises

Since SMEs in LDCs are unable to develop infrastructure and technology significantly on their own, then collective efficiency paradigm need inform the infrastructure planning and development so that SMEs engage in joint actions. The thesis here is that this joint actions needs to be engineered in the planning and developing of industrial infrastructure, targeting to support SMEs access better or improved technology and hence the growth of the individual enterprises and the sector as whole and its contribution to the industrialization process.

The joint actions, as noted by Nadvi *et al*, (1994) works better when small manufacturing enterprises work/operate close together in clusters. Nadvi *et al* (1994) and Schimitz (1995) notes that industrial clusters are concerned with local growth processes that arise from sectoral and regional concentration of small and medium sized firms that facilitates gain in efficiency and flexibility. As pointed out by Schimitz (1995), the concept of collective efficiency is facilitated by the clustering on a

number of subsequent development factors which include Labour division; Specialization by SMEs; Rapid production of specialized products; Emergency of suppliers to handle raw materials, component parts and machinery; Emergency of service providers such as technical, legal, communication among others; Emergency of marketing agents; Emergency of a pool of skilled workers and Formation of consortia or associations for specific services and lobbying all of which need to be considered in infrastructure planning and development.

In infrastructure planning, Ombura (1997) points that infrastructure networks are useful instruments within network economies. Infrastructure and related services help to make things happen, it feeds and it is fed by trade, it fuels foreign direct investment, it backs up the creation and sustainability of industrial clusters, it cuts costs and raises competitiveness. Infrastructure includes both hard and soft: ports Airports, Railway systems, Road Networks Power, Communication, water, Waste management, IT, Legal, Financial and Technological infrastructure (Ishikawa 2002).

Infrastructure planning begins with industrial location choices which place spatial distribution of industry in reference to other social aspects. A spatial planning approach ensures the most efficient use of land by balancing competing demands within the context of sustainable development (Rozee, 2003). It becomes an ongoing, enduring process of managing change by a range of actors, in the interests of sustainable development (Tewdwr, 2004). This makes efforts to promote industrial development extremely urgent and rural focused.

A sustainable industrial policy and development strategies encompassing a variety of inter-related economic, social and environment objectives such as encouragement of an open and competitive economy, the creation of productive employment and protection of the natural resources through efficient use of renewable and non renewable resources required. Such a policy and strategy should create a self sustaining industrial sector having strong linkages with domestic economy. This, network analysis approach in infrastructure planning portends that co-operative mechanism should be established alongside the competitive rules of behaviour and take advantage of collective differentiation and learning (Ombura, 1997). It emphasizes pooling together to create infrastructure for use in network economies. This leads to the combined improvement in the fields of technology, marketing, transportation, communication, access to services and waste management with the benefit of reduced costs in overcoming difference. This should work together or in conjunction with the systems theory which requires that facility configuration be done in a distinctive but interrelated and inter dependent pattern (Catamase and Synder, 1988).

Small manufacturing enterprises represent such systems where interactions between infrastructure and technology determine enterprise development trends in a collective and networking environment. This brings to the fore the need for industrial infrastructure planning and development that seeks to promote access to acquisition and development of technologies that lead to improved efficiency, effectiveness and productivity of the small manufacturing enterprises. Thus, SMEs cannot attain growth unless they employ technologies that allow for competitiveness. The technology acquisition and development can only be facilitated by appropriate and relevant infrastructure to be determined in a networking and collective approach.

In technology development, Gushesh (2003) indicates that technology is accepted by society depending on the social context, the perceived ease of use and perceived usefulness in addressing society's immediate needs. This means that society should be involved in determining what technology it needs and the direction along which it should be developed (Constructivism).

Traditionally, theories of technology have been informed by the determinist ideology which holds that the path for development is dictated by technical necessities and that pursuit for efficiency controls the direction of this path without any reference to society (Feenberg, 1999). Critics to this ideology have argued that when choices are presented in the path of technological development, social influences play a vital role. Constructivism puts forth an alternative ideology of technology development. According to Gushesh (2003) technical design is influenced by society since human needs are seen to have cultural base. Thus cultures and societies would have different definitions of technology that would be appropriate to the context of that society. That would explain why modern technologies that have succeeded in developed countries fail in less developed countries and hence the need to engage local communities in participatory approaches when developing technologies appropriate to their context.

This study is informed by collective efficiency theory in SMEs growth, networking and systems approach in infrastructure planning and development and constructivism in technology development. All paradigms encouraging stakeholders to come and work together for the betterment of their operations, improved productivity and economic development of society and leads to the conceptual model for the study figure 1.

3.0 Research Methodology

The study was an Ex Post Facto Subsector survey in three categories of wood enterprises, sawmill; Panel production enterprises and furniture making enterprises in three districts, Uasin Gishu; Kericho and Nakuru all in the Rift Valley province of Kenya. The three study sites have the largest proportion of wood industries in Kenya and have climatic conditions favorable for both indigenous and exotic forest covers. The districts also have fairly well developed social economic infrastructure with agriculture being the predominant source of income for the majority of the residents. The target population was owner/managers of wood enterprises in the three districts. For sampling purposes the administrative divisions in the three districts were used as sampling unit and the main shopping centers in each division sampled for data collection. The sample size was determined to be 284 (3 panel production enterprises, 100 saw mills and 181 furniture producing enterprises) using the Krejcie et al, (1970) model. A multistage sampling strategy was adopted for the study.

Data was collected by use of a questionnaire containing both open and closed ended questions, an observation checklist and a secondary data survey guide. Error variance minimization was considered at the research design stage and sampling

employing the principle of triangulation where exclusive use of one method would bias or distort the picture of the particular slice of reality under investigation (Cohen et al, 2000). The content validity of data collection instruments were ascertained by peer examination of the instruments against stated study objectives and also by pre-testing the instrument. Consistency and replicability of the research instrument over time was established by the use of the test-retest method where ten (10) respondents were selected from the neighboring Trans Nzoia district and the instrument administered twice with a two (2) months intervening period. The test score were correlated against the retest scores and a coefficient of correlation(r) of 0.931 obtained and a coefficient of determination (R^2)=0.866 indicating strong instruments reliability.

It should be noted however, that reliability cannot be assessed on a purely statistical basis and measures obtained in such studies are not the ultimate explanatory factors but merely indicators of the presence of factors that cumulatively add up to and are interpreted to construct the explanatory factors in form of variable that are used in the analysis models (Cohen et al, 2000). Dependability of data in this study has therefore been achieved by respondents checks, debriefing by other scholars and peers, triangulation, prolonged engagement in the field, repeat visits, persistent observation and studying industry records and data so that the study findings are consistent with the reality of the wood industry on the ground.

In data analysis, codes were also used as scores. Care was taken to put into consideration the factors of theory (what is known about possible responses), mutual exclusivity and exhaustiveness and details that should be factored into the coding decisions. Some variables were measured and coded by aggregation of measures for various sub-variables and also aggregating scores for responses that are not mutually exclusive. Numeric data took the value of the numeral used as the code for the response but care was taken to ensure that they were in the same units. The study investigated and tested the hypothesis on the interrelationship between collective efficiency and the growth of wood enterprises. Each of these variables in turn depended on sub-variables as shown in the development of the collective efficiency index (CEI) and the infrastructure development index (IDI) under study findings.

The null Hypothesis; Collective Efficiency does not play a significant role in influencing infrastructure development in wood enterprises in western Kenya. H_0: *IDI = f(CEI) thus,* $IDI=\alpha+\beta\ (CEI)$ was tested in the study for linear, exponential and logarithmic relationships. The collective efficiency Index (CEI) variable was synthesized from the respondents involvement in collective efforts sub variables which included Backward and forward linkage; Subcontracting; Sharing of equipment; Networking and information sharing; Sector quality standards; Sector association; and Partnerships. A measure of infrastructure development (IDI) accessed by wood products manufacturing enterprises in western Kenya was developed from sub-variables which include physical infrastructure consisting of roads, information, transport, communication, water, energy, building and others like plant and access to other services such as banking, insurance and legal services that are important in facilitating industrial growth.

4.0 Study Findings

4.1 Background Information of the Respondents

A sample of 284 wood enterprises was taken from three (3) districts, Nakuru, Kericho, and Uasin Gishu, out of which 203 returned satisfactorily completed research instruments indicating a 71.5% return rate. The majority (74%) of the wood enterprises are sole proprietorship which are mainly furniture production enterprise followed by sawmills with very few panel production enterprises. There has been a steady increase in the number of wood enterprises with time with most started between 2000 and 2006. The majority (71%) of the wood enterprises are aged between 1 and 10 years. The trend is the same in other developing countries where the majority of SMEs are less than 10 years (Bowen et al, 2009; Namibia, 2009; Fernando, 2003; Williams, 1997; Bala Subrahmantra et al, 2003).

The owner/managers were fairly youthful with a mean age of 37.12 years with most (35.5%) aged between 31-40 years. This age statistics are similar to those observed elsewhere in developing countries (Bowen et al, 2009; Namibia, 2000; Kimuyu, 2001; Pogue, 2008; Bala Subrahmanya et al, 2003) across the micro, small and medium enterprises in all industrial sectors. On gender, women participation in the wood industries sector is low (6.4%). This is a common trend especially in the manufacturing sector although women tend to dominate in trade (Institute of Economic Affairs, 2008; Kimuyu, 2001; William, 1997).

Gender is said to affect enterprise performance in as far as their relative strength is concerned. Kimuyu (2001) observed that male owned enterprise are at least twice as much in average revenues compared to those in female owned enterprise. In the wood industries, however, the difference in performance is not significant at the 95% confidence level with the male owned enterprise having a mean $\bar{x}$ = 0.1771 and those female owned enterprise with a mean $\bar{x}$ = 0.1531 % of the wood enterprises growth index. On marital status, the majority (84.7%) of the owner/managers are married with the respondents hesitant to indicate the number of children and other dependants which would be a measure of their family responsibilities.

4.2 Collective Efficiency and the Infrastructure Development Accessed by Wood Enterprises

4.2.1 Collective efficiency

The broad objective of this study was to investigate the relationship between collective efficiency and the growth of Wood enterprises in Kenya. The study sought to answer the questions, to what extent is the collective efficiency employed in wood industries in Western Kenya? And test the null hypothesis that collective efficiency does not play a significant role in influencing the growth of the wood enterprises in Kenya. The collective efforts (joint action) enquired into included subcontracting, sharing of equipment, networking, quality standards assurance, sector associations, backward and forward linkages and partnerships.

On subtracting, the most commonly employed effort is specializing in production of some parts and using others bought in from neighbouring enterprises reported by 31% of the respondents followed by getting others to make some

components for an enterprise (24.1%). These proportions are low. However, they show a significant effort towards subcontracting but absence of a clear policy in support of subcontracting among SMEs is notable. On the sharing of tools among wood enterprises, the most common practice is doing work for neighbouring enterprise reported by 41% of the respondents followed by borrowing/lending tools from and to the neighbouring firms (15.8%); using neighbouring enterprises facilities to get some work done (11.3%); and getting neighbouring enterprises to provide services for the enterprise (7.9%). This shows a significant amount of equipment sharing. Osinachi (2004) indicates that firms in Nigeria build a learning network mainly to improve their performance through sharing of tools, cost of transporting raw materials and information.

The most frequently mentioned area of information sharing is on quality (51.2%) followed by market (21%) then Technology and production methods in that order. The other areas of networking and cooperation mentioned by the respondent include delivery and expediting supplies (48.3%), sharing industry bulletin and report (21.2%) market information (15.8%) and purchasing of materials (15.3%) among others. This suggests that deliberate efforts should be made to facilitate information sharing among SMEs, which again can be achieved through careful infrastructure planning and development with the aim of bolstering this type of collective efforts and gains. In Nigeria, the Chamber of Consumers and Industry provide business information for the firms and work with local manufacturers association to organize local trade fairs whose effect (Osinachi, 2004). Bravtigarn (1997) notes that sharing of technical knowhow and skilled workers are benefits gained by small firms clustering in developing countries since individual firms cannot alone afford the cost of high technical skilled workers or invest in Capital goods.

On the question of wood enterprises cooperation in ensuring product quality standards, it emerged that the most common collective effort is setting and adhering to certain quality standards in the sector reported (23.6%), collaborating in pricing (21.2%) and checking each other quality performance (19.2%). Yet, there are no structures on the ground to show that this takes place as a deliberate collective effort in Kenya. Producers turn to export markets when local markets are saturated (Cawthorne, 1995) and quality standards determine the export drive for clusters (Nadvi, 1999). What this portends for the wood industries in developing countries is that, not only is it threatened by failure to meet quality standards for the export market but even the local market will be lost to imports due to better quality and lower prices as a result of better technology that results in efficiencies and lower production costs. Consequently, SMEs have to shift focus to verifying the quality control process and the quality values installed in each enterprise at every stage of the production process as noted (Nadvi, 1999; Kaplinsky and Readman, 2001).

Participation in wood industries sector association is low with the highest frequently mentioned (9.9%) indicating they participate in industry annual parties, 3% join and contribute towards common market especially export market, 2.5% participate in common annual exhibition while only 2% of the respondents are members of sector/industry association. This low performance in a collective efficiency measure indicates an area that has to be pursued relentlessly if the SMEs sector is to be developed to make a significant contribution to sustainable industrial development.

In Kenya, the federation of Jua Kali Association is a national body with membership drawn from all districts Jua Kali Associations, yet the wood enterprises owner/managers have not shown to be members. On the benefits from backwards and forward linkages in wood industries, the owner/managers do not seem to be clear on them with the majority not responding to the item on what they gain by linking to Agriculture, Trade, other industries and the service industry. Among those who responded, most (28.1%) indicate they benefit from the Agriculture Industry since it buys their products, provide raw materials (21.7%) and provide food (15.8%) for the wood industry sector.

The majority (51.7%) of the wood enterprise owner/managers indicate that the trade sector provides market for the wood industry sector while other industries are seen to provide buildings and materials (3.9%), new technology (3.4%) and competition (3.4%) to the wood industry. The service industry is said to provide education and health services (13.8%) and security 1.5% to the wood industry sector. Although these proportions are low, they indicate a significant role played by other sectors in the survival and growth of the wood industry sector but more so, the lack of systematic efforts in support of backward and forward linkage between sectors and firms. Powers (2004) point out two ways an industry can be linked to manufacturing, through purchases of manufactured inputs and through sales of intermediaries to manufacturing firms. SMEs gain from forward and backward linkages and there is need to support backward and forward links.

A Collective Efficiency Index (CEI) was synthesized from the joint actions discussed here. The Collective Efficiency Index ranges from 0 to 1 in a continuum and the higher an enterprise ranks on the index the more the joint actions it engages in and the more it benefits from collective efficiency. It was observed that the wood enterprises have a very low extent of use of joint actions with an index that ranges from 0.02 to 0.31 with a mean of 0.1029. The majority (99.5%) of the wood enterprises were grouped into very low (0-0.25 CEI) collective efficiency quartile as shown in figure 2. This shows that the wood enterprises participate in minimal collective efforts.

The absence of systematic structures and infrastructure that facilitate collective efforts could possibly explain this and is a pointer to a direction for intervention in infrastructure planning and development. This raises the question, is there sufficient evidence that the collective efforts undertaken, however minimal, benefit wood enterprises? Does the collective efficiency have any influence what so ever in the growth and development of the wood industry? An analysis of Variance indicate that there is no significant difference in the level of collective efforts across the various sub sectors of the wood industry, ($F=0.168$, $P=0.820$, $\alpha=0.05$) but the difference between the means is significant ($F=3.583$, $P=0.030$, $\alpha=0.168$, $x=0.05$) when examined by location (study districts) with Kericho significantly worse off. The lessons here are that collective efficiency woul play a significant role in buttressing SMEs growth and needs to be considered when planning infrastructure for industrial development.

4.2.2 Infrastructure Development Accessed by Wood Enterprises in Kenya

Infrastructure is expected to influence the industrial sector. Physical infrastructure-roads, information, transport, communication, water, energy and buildings were examined in wood industries. In addition, the plant and other services accessed were examined. The location of wood enterprises from rural and urban point of view was noted to be mainly urban centers (77.3%) with an indication that they are on average 12.4 km from a major town centre and 1.5 km from the nearest similar industry. The finding is similar to those of Kimuyu (2001) and Pogue (2003) who noted that more than half of businesses are located in urban centers. Locating small enterprises in town centers influence its performance in that it accesses better infrastructure, is closer to its potential customers and accesses a pool of better skilled labour from youths who migrate to town in search of better wage jobs. According to Kimuyu (2001), location mops up performance effects of spatial differences in the business environment such as marginal differences in the state of the infrastructure and their imperatives.

On the site/ plot ownership, it emerged that the majority (79.3%) of the respondent do not own the premises where they operate from. This indicates that the majority of wood enterprises owners have no ability to accumulate capital to enable them buy their business premises. Other studies have similar findings (William, 1997 and Kimuyu, 2001) suggesting unstable business environment and negative effect on growth potential. The problem is more or less the same across the study sites and type of wood industry. The enterprises are also handicapped in that they cannot use their insecure business premises as collateral to obtain credit for enterprise growth. On the source of industrial energy, the majority (42.9%) use electricity with a significant 16.7% and 3.9% using generator and fuel wood respectively. Electricity is also the main source of lighting with the lamps and generators used by a significant proportion 18.7% and 11.5% respectively. UNIDO (2007) observes that local availability of energy resources determine their use. Incidentally, solar energy has not been exploited with only (2.0%) of the respondents indicating they use it, yet Kenya has an abundance of sun most of the time and wind which is not reported to be used at all.

It has been recommended that there is need to design appropriate technology package linking local resources and creating awareness about the potential economic benefits of applications of renewable energy and taking an integrated and program approach that would enhance successful adoption of industrial application of renewable energy in SMEs in Africa (Monga, 2007). Water is a major challenge in less developed countries with only 31.5% of the wood enterprises in western Kenya accessing piped water while the others use rivers/dams, wells/boreholes, and rainwater. It was observed that in Vietnam most paper mills use river water (Rudolf, 2003), while in Kenya 75% of small manufacturing enterprises in general do not access water at all. This is a challenge that should be addressed in infrastructure planning and development for sustainable growth of SMEs leading to sustainable industrial development.

On means of transport, most (27.1%) of the respondents use public transport but the opposite is the most informative, that 72.9% do not access public transport, they rely on other means. It is also worth noting that while it would be desirable for SMEs to access a multiplicity of means of transport so that they choose on the basis of cost, no single means is accessed by more than 27.1% of the respondents. Poor transportation limits access to raw materials and markets and affects production cost. According to Brojonegor (2009), existence of reliable and sufficient electricity, energy, water supply, good and reliable information communication technology systems, enhancement of production capacity would bolster the performance of SMEs. The study revealed a poor road network with only 34.5% of the respondents accessing tar marked roads which are on average 1.34 km from the enterprise. Poor road networks for removal of forest products are noted in Romania (Cretu, 1996) among other less developed and developing countries, a challenge that has to be continually addressed in infrastructure planning. Alternatives to roads such as railway, ropeways combined with roads have been developed and used in Central Switzerland (Durhstein, 1996) indicating need to explore alternatives in Kenya.

The most common means of communication is mobile telephone used by 95.1% of the respondents. Internet and fax have low usage, 10.3% and 4.4%, respectively by wood enterprises. The majority 78% of the respondents do not access industrial information with only 1% obtaining information from the Ministry of Trade. The problem of inadequate communication infrastructure and skills has been noted in other sectors in Kenya (Bowen et al, 2003; Kashorda, 2007) and in Sri Lanka (Fernando, 2003). Yet, the importance of adequate and efficient communication cannot be overstated. Moodley (2002) notes that the structure of industry and market requires adoption of ICTs and the government policy and support in promoting internet-based communication are expected. The wood industry sector would benefit significantly from adoption of Information Communication Technology in order to facilitate its integration into the global furniture value chain (Moodley, 2002).

The productive assets employed by wood enterprises are an important aspect of industrial infrastructure. Most (46.3%) of the respondents use temporary structures, 21.7% use semi permanent while 16.7% use permanent structures. A comparison of the wood enterprise performance using a one way analysis of variance shows that the variance between means is significant (F=3.90, P= 0.004, α=0.005) indicating that the wood enterprises operating in semi permanent structures perform significantly better (n= 46, $\bar{x}$ =0.23) than those in permanent structures (n =33, $\bar{x}$=0.17) and the least performing being those in temporary structures (n=94, $\bar{x}$ =0.1365). This vindicates Kimuyu's (2001) observation that businesses that operate in temporary premises are subject to disruptions and distortions of productivity and continuity that affects their enterprise performance.

The wood enterprises use mainly manual cleaning (96%) with low stock holding averaging between Kshs. 1,000 and 5,000 of raw materials held by (25%) of the respondents, working in progress of between 1,000 and 5,000 held by 24.6% and finished goods of between Kshs. 1,000 and 5,000 held by

(20.2%) of the enterprise. This challenge of low investment has been noted elsewhere. Kenya (1999) noted that many of the wood industry firms in Kenya belong to the small or informal sector with the smallest sawmill handling 500 cubic meters of wood annually. AKE (2008) indicates that in Finland, 60% of the wood enterprises are small, owning only one machine. In Russia, Turpenen (2008) points out that sawn timber was produced primarily utilizing worn out and outdated equipment with Low Level Automation. In Romania, there are no proper material buffer in front and behind each machine with incorrect dust removal (Budeu et al, 2009) while in Nepal, the main equipment in the set include axe, saw, sharpener, and hammer (Acharya and Acharya, 2007). These findings suggest that SMEs should be facilitated to acquire better, secure, and larger workshops that facilitate operations of the modern equipment and the nature of wood working enterprises.

The other services accessed by wood enterprises is Banking (86.2%), legal (65%), credit (21.7%) and Insurance (2.0%). The banking services are accessed on average 16.34 Km from the wood enterprises while those who access legal services have to travel on average 5.2 km to access it. Williams (1997) sees difficulty in securing credit as the greatest problem for SME development while Fernando (2003) says SMEs do not borrow from banks because of bureaucratic procedures and burdensome collateral. In Namibia, 50 % of SME do not apply for loans (Namibia, 2000). Lewis et al (2004) asserts that lack of credit leads to SMEs continued use of outdated equipment that causes inefficiency. What this means is that left on their own, SMEs have no means or capability to extricate them from this vicious circle. On the whole, Infrastructure as it relates to provision of access roads, adequate power, water, sewerage and telecommunication has been a major constraint in the development of SMEs and should be critically evaluated when planning infrastructure for SMEs growth.

When all the above discussed measures of infrastructure development are pooled together in computing an Infrastructure Development Index (IDI), a continuum ranging from 0 to 1, it is noted that the IDI score for each wood enterprise ranges from 0.04 to 0.71 with a mean of 0.324 and 76.5% of the wood enterprises below 0.5 as shown in the scatter plot figure 3 and suggests a lot of efforts are needed in infrastructure planning and development to ensure wood enterprises access well developed infrastructure. Comparing infrastructure access in the three study districts, it was observed that there is a significant difference in the levels of infrastructure accessed but not significant across types of wood industry. On the whole, the type and level of access to infrastructure essential for a manufacturing enterprise is generally poor and low. FAO (1997) noted that infrastructure development remained low while demand and consumption for forest products increased with population growth.

4.2.3: The Relationship between Collective Efficiency index (CEI) and Infrastructure Development index (IDI)

Infrastructure plays a key role in the growth of the economy, the growth of the country and supports the growth of all sectors. Infrastructure provides vital links for easier dissemination of information that facilitates commercial exchange. Kristiansen (2003) argues that external relations are essential to innovations. Joint actions are examined here and the extent to which they are supported by the infrastructure accessed and used by wood enterprises. The question, is there a relationship between infrastructure and collective efficiency in wood industries? And what is the nature of the relationship?, are tackled under this section.

The variables Collective Efficiency Index (CEI) the dependent variable and the infrastructure development index (IDI) are examined for linear, exponential and logarithmic relationships. A Summary of Analysis of the parameter estimates of Relationship between Infrastructure Development Index (IDI) and Collective Efficiency (CEI) are shown in table 1. This shows that the relationship between Infrastructure Development and Collective efficiency is linear since r=0.305 and R^2 =0.093 for the linear function are higher than those of log linear; exponential and logarithmic functions. This implies that Infrastructure affects collective efforts in wood enterprises linearly and that there is need to deliberately develop infrastructure with a focus to supporting joint actions and collective efforts in wood enterprises in particular and the small manufacturing enterprises in general. This would in turn contribute significantly to sustainable industrial development.

5.0 Conclusion

Collective efficiency, the competitive advantage SMEs derives from external economies and joint actions in wood enterprises in Kenya is low. The majority of the wood enterprises are in the 1st quartile of the collective efficiency index and there is no significant difference across the subsectors of the wood industry. While the variances between the means of the CEI by the study districts are significant, all the parameters (indicators) of collective efficiency indicate low performance in the extent of use of joint actions. The infrastructure accessed by wood industries in western Kenya is poor.

The infrastructure development index is on average low with majority accessing infrastructure classified as low and very low (1st and 2nd quartiles of the Infrastructure Development Index. Uasin Gishu district has better infrastructure compared to Nakuru and Kericho while there is no difference in infrastructure accessed between different wood industry subsectors. The relationship between infrastructure and collective efficiency is essentially linear. This means that better Infrastructure will always lead to better and more efficient joint actions and benefits from them. For the Small Manufacturing Enterprises (SMEs) to play a significant role in the Industrialization process, infrastructure planning and development has to be informed by the SMEs potential in the industrialization process and the challenges they encounter that hinder the individual enterprises growth and that of the SME sector collectively.

Specifically, the study recommends that;

(i) Planning for sustainable industrial development should shift focus to the Local Small Manufacturing Enterprises (The Jua Kali Sector).

(ii) Collective efficiency, Networking, Systems approach and constructivism should be used as the basis for planning and developing infrastructure and technology for sustainable industrial development.

(iii) In order, to anchor SMEs as a vehicle towards sustainable industrial development, there should be established a Jua Kali Development Authority (JKDA) to address the needs of SMEs as discussed in

this study and to borrow the model of EPZ in its operation and infrastructure development and the model of CDF in its financing and structured so as to have representation from National, regional, district and location levels.

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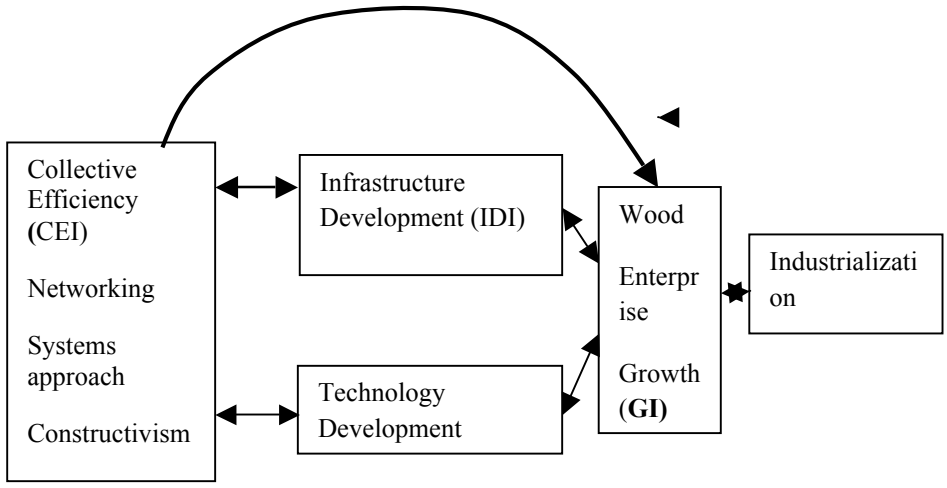
Appendices

Figure 1: Collective Efficiency as a Basis for Infrastructure, Technology and SME Growth



The relationship between collective efficiency (CEI) and infrastructure development (IDI) in wood enterprises is tested using the production function that relates outputs to its underlying factor inputs.

Figure 2: Collective Efficiency Index Arranged In Ascending Order

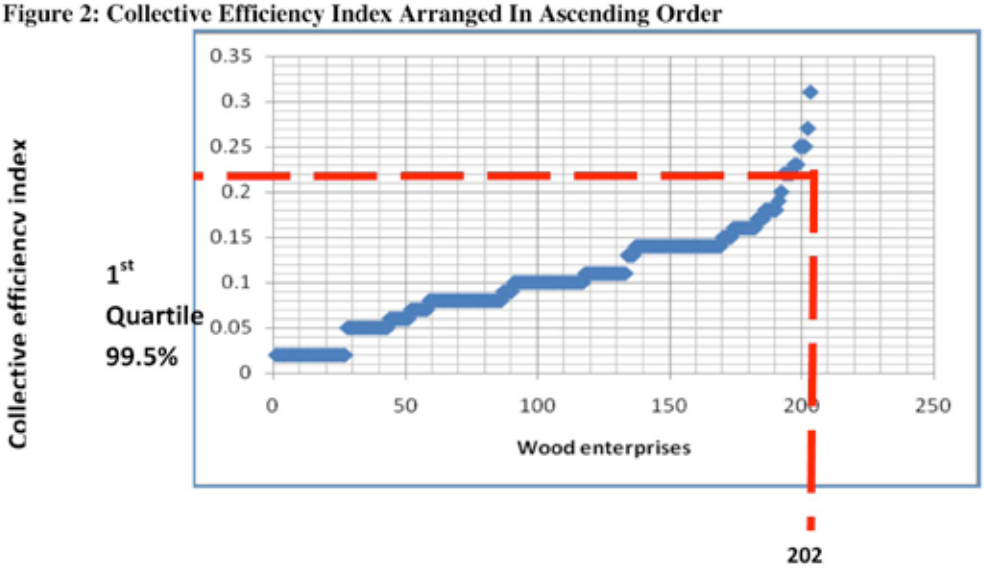
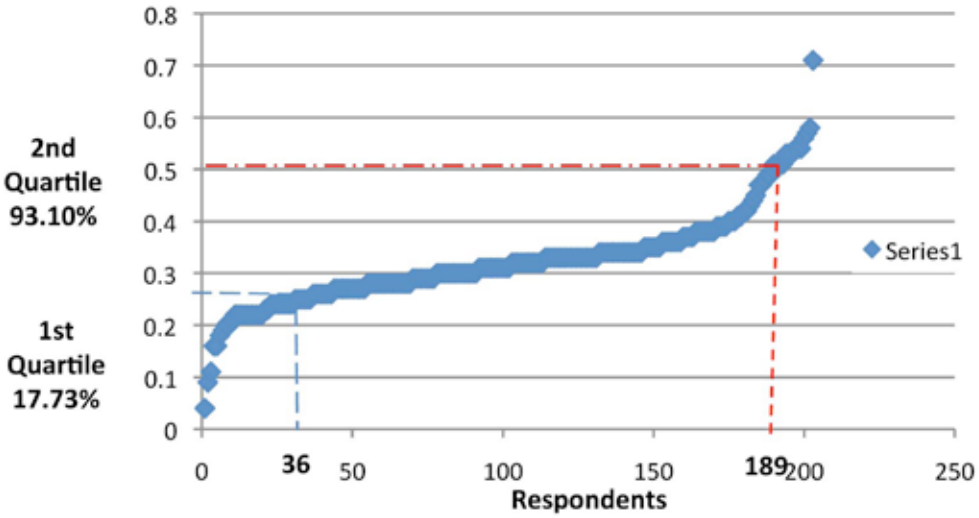


Figure 3: Infrastructure Development Index Arranged In Ascending Order



This shows that only a very small fraction of wood enterprise (6.9%) is able to access good infrastructure in the 3rd quartile.

Table1: Parameter Estimates of the Relationship between Collective Efficiency and Infrastructure Development

CEI Vs IDI	Linear	Exponential	Logarithmic
Estimates			
R	0.305	0.251	0.285
R^2	0.093	0.063	0.080
α	0.042	0.661	- 0.02
Model	CEI = 0.042 + 0.305IDI	Log CEI= 0.661 + 0.251 IDI	Log CEI= -0.02 + 0.283 log IDI