

**PROJECTION OF OPTIMAL ALLOCATION OF EDUCATIONAL
RESOURCES IN PRIMARY AND SECONDARY SCHOOLS IN KENYA
DURING THE PERIOD 2013-2030**

BY

OLOO FREDRICK ODUOL

**A THESIS SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
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DEPARTMENT OF EDUCATION MANAGEMENT AND FOUNDATIONS

MASENO UNIVERSITY

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DECLARATION

Declaration by Candidate:

This thesis is my original work and has not been presented in any other university.

Signature.....Date.....

OLOO FREDRICK ODUOL

PGD/MED/037/2010

Declaration by Supervisors:

Signature.....Date.....

Dr. M. Olel

Department of Educational Management and Foundations

Maseno University

Signature.....Date.....

Dr. C. Mbagaya

Department of Educational Psychology

Maseno University

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DEDICATION

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ABSTRACT

Rapid population growth and the commitment of Kenya government to offer free and compulsory basic education have greatly increased the demand for education in Kenya. Studies indicate that non-enrolment still persists in Kenya partly due to inadequate educational resources, poor school environment, overcrowded classrooms and overburdened teachers. The purpose of this study is to project an adequate allocation of education resources for the primary and secondary schools in Kenya during the period 2013-2030. The study objectives are: to project school age population (6-17 years) corresponding to primary and secondary levels for the period 2013-2030; to project enrolments in primary and secondary schools in Kenya in 2013-2030; to estimate the optimal number of teachers required for the enrolments by primary and secondary levels in 2013-2030; to estimate the free schooling funds required for the enrolments in primary and secondary schools in Kenya in 2013-2030 and to estimate the optimal number of classrooms required to accommodate the school enrolments in primary and secondary schools in Kenya in 2013-2030. The results of this study may be used by the education planners and managers to plan and allocate adequate education resources to schools. The study used conceptual framework with school age population as independent and education resources as dependent variables. The study design used was trend analysis of past time series data of demographic and enrolment indicators. The study population comprised of the school age population (6-17 years of age) who were 12,025,635 in 2009. The sample was selected through a saturated sampling technique. Data were collected by the use of proformas and interview schedules. Face validity and desk review reliability were used. Data was collated by the use of cohort projection model, after which the government official rates of resource allocation were used to estimate the required quantities of teachers, free schooling funds and classrooms. Triangulation data analysis was used. The results indicated that school age population would increase by 23.32 percent and enrolments by 23.0 percent which translated into teachers required increasing by 29.9 percent, free schooling funds by 109.77 percent and classrooms by 23.0 percent. The projected enrolments when segregated into primary and secondary levels of education indicated that the secondary level was increasing at a higher rate than the primary level. Recommendations based on this study indicate that the government should bridge the existing shortages and then annually recruit 5,800 teachers, boost the free schooling kitty with Kshs. 2.0 billion and construct 3,833 new classrooms to take care of increasing enrolments.

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ABBREVIATIONS

CBF	-	Constituency Bursary Fund
CDF	-	Constituency Development Fund
EPDC	-	Education Policy and Data Center
FPE	-	Free Primary Education
FDSE	-	Free Day Secondary Education
GDP	-	Gross Domestic Product
GER	-	Gross Enrolment Ratio
GNP	-	Gross National Product
KNBS	-	Kenya National Bureau of Statistics
MDG	-	Millennium Development Goals
MOE	-	Ministry of Education
NCPD	-	National Council for Population Development
NER	-	Net Enrolment Ratio
PTR	-	Pupils to Teacher Ratio
ROK	-	Republic of Kenya
TSC	-	Teachers Service Commission
UPE	-	Universal Primary Education
UN	-	United Nations

ACRONYMS

ASAL	-	Arid and Semi-Arid Lands
EFA	-	Education For All
KNEC	-	Kenya National Examinations Council
UNESCO	-	United Nations Education, Scientific and Cultural Organization

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CHAPTER ONE

INTRODUCTION

1 .1 Background to the Study

Basic education is the bedrock upon which all human resource development is founded. It must be available to everyone for growth and development to be inclusive without which no society can develop effectively (UNESCO, 2007). Kenya had a population of 38.6 million persons in 2009, out of which 31.15 percent were of basic education level of age bracket 6-17 years (ROK, 2010). The school age population constituted the potential seekers of learning and the government is determined to enroll all school age population.

Demography is important in the realm of education planning. This is because population statistics serves as the basis upon which to develop education plans (Bella & Belkachla, 2006). The age composition of the population determined the size of school going age; and the greater the number of school age population, the greater the need to create more classroom space and recruit teachers (Bella & Belkachla 2006).

Education planning therefore cannot be divorced from consideration of population change, as it deals with a targeted population which is constantly changing in number, age, sex composition and geographic distribution. The population of children aged 0-4 years age group gives an indication of the burden of child care, the group 5-15 years age group is an indication of investment needed for school enrolment and teaching staff, while the economically active population is reflected by the 15-64 years age group (Mohanty, 2010).

The Government of Kenya was determined to fulfill MDG of universal primary education and EFA goals by 2015 (ROK, 2008b) in addition to offering compulsory basic education as stipulated in the Constitution of Kenya 2010 and Basic Education Act 2013. To enable all the school age population to be enrolled in schools, the education system must be planned to

serve the major social-economic objectives of the society by efficiently allocating education resources to the sector.

Kenya Vision 2030 is Kenya's blue print for 2008-2030 development planning, which aims at making Kenya a newly industrializing "middle" income country, providing high quality life for all its citizens by the year 2030" (NESC, 2007). The education goals of Vision 2030 are to provide globally competitive quality education and training and research for development. This is to be done by reducing illiteracy by increasing access to education, improving the transition rate from primary to secondary schools and raising the quality and relevance of education (NESC, 2007). Access and transition rates can only be improved to unitary values by efficiently allocating resources to the schools so that they become attractive and offer quality education.

Beginning with the 1990 World Conference on Education For All (EFA), Governments, Civil Society, and International Agencies reaffirmed basic education's highest priority by increasing resource allocations and launching initiatives in pursuit of EFA goals. However, commitment to basic education leveled off in the second half of the 1990s (Somerset, 2006).

While the fundamental importance of basic education continued to be recognized and pursued, a renewal of the commitment to EFA was clearly called for and in the year 2000, the World Education Forum was held in Dakar, Senegal, which reaffirmed commitment to EFA by 2015 (UNESCO 2007). The Dakar Frame Work for Action of 2000 set the goal to ensure that by 2015, all children particularly girls, children in difficult circumstances and those belonging to ethnic minorities would have access to a completely free and compulsory primary education of good quality (Sawamura and Sifuna, 2008).

Kenya is among the few sub-Saharan Africa countries that is implementing Free Primary Education (FPE) in an attempt to resurrect and strengthen its educational system in order to universalize her primary education (Riddell, 2003), and also implementing Free Day Secondary Education (FDSE)- (ROK, 2008b).

That therefore called for a concerted effort to establish school age population and then give an estimate of resources which the government of Kenya would have to provide to sustain them in schools. This study therefore strove to fill that gap by providing projections of enrolments and estimates of resources that education planners might use in the allocation of education resources.

The Government of Kenya had previously attempted to offer free primary schooling for the first four grades in 1974, which resulted in unexpected upsurge in enrolment leading to overcrowded classrooms and insufficient teachers. The government responded by hiring untrained teachers (Sommerset, 2007). The government again in 1979 banned levying of building funds directly from parents and the result was an increased enrolment which forced the government to increase class sizes leading to high pupil to teacher ratios (Sommerset, 2007). The government finally implemented free primary education policy in 2003, which had a significant impact on enrolment in primary schools, making enrolment to increase by 20 percent from 6.0 million in 2002 to 7.2 million in 2003.

The FPE programme was to provide more opportunities to the disadvantaged school age population (Sifuna, 2005) as cited in Makori (2010) and (ROK, 2005b). The policy focused on the attainment of EFA by 2015 and in particular UPE by 2005 (Sifuna, 2005). The programme had been described as laudable because of its effect on gross enrolment rate (GER) which increased from 92% in 2002 to 104% in 2003 and net enrolment rate which increased from 77.3 percent in 2002 to 92.5 percent in 2008. That increased enrolment

resulted in overcrowded classrooms, teachers' shortage and inadequate learning resources (ROK, 2009). A capitation grant of Ksh 1,020.00 for every enrolled pupil in primary school was also introduced in the year 2003 to support free primary education by enabling schools to purchase tuition materials and manage general operations (ROK, 2003).

Although the government had good intention of offering free schooling to all school age population, it was equally important to note that either the estimated number of expected learners was not known or the provision of adequate learning resources was ignored. That was why the resources were overstretched in all the instances. This study therefore endeavored to project enrolments so that adequate allocation of resources could be planned for and provided in good time whenever any reform or policy was being implemented.

According to UNESCO, 2007; progress had indeed been significant but EFA had continued to be an unattainable goal in a number of countries. Asia and Pacific regions which had two thirds of the world's out- of school children 35 years ago, improved to less than one third and had 25 million children out of the world's 77 million children out of school. East and Southeast Asia, largely because of great strides made by the Republic of China, had registered the most dramatic progress towards UPE. Sub-Saharan Africa and South Asia continued to be two regions of the world where the MDG of universal primary education was not likely to be met by the target year 2015.

According to 2009 census, Kenya as a country still had 1.9 million primary and 2.7 million secondary school age populations out of school despite the fact that free schooling was being implemented. That could have been caused by inadequacy and insufficiency in allocation of education resources. It was noted that most of the enrolment and education resources projection studies were done by UNESCO for MDG and EFA goals' tracking and implementations. It was mainly Asian countries that had been making long term projections

of enrolments and resources hence making these countries able to estimate education resources required for their education system (Ahmed 2000 and Arun, 2004). It had been noted that limited enrolment projection studies were done in individual sub Sahara African countries, Kenya included. Enrolment and resources projection studies done in Kenya had been short term projections and were restricted in only one subsector of education (Mbutia, 2000 and Wambua & Nyaga, 2011). This study projected school enrolments for a period of 18 years spanning the vision 2030 period and then estimated education resources that would be needed to efficiently serve the enrolments.

EFA Global monitoring report 2010 (UNESCO and EPDC, 2010) noted that low achievement levels were often associated with poor school environment. Schools in low income areas frequently suffered from overcrowded classrooms. The report further indicated that the cost of achieving EFA by 2015 was estimated on the cost of building sufficient and good classrooms to accommodate all learners in classes of 35-40. A recent study established that 30 percent of classrooms in sub-Saharan Africa were either temporary constructions or in need of serious repairs (Theunyck, 2009). Kenya needed additional 15,000 new classrooms at primary level and 5,000 at secondary level as indicated in UNESCO 2008-2015 classroom projection so that each classroom could accommodate 45 pupils in high potential areas and 25 in ASAL areas (ROK, 2005).

Whereas the key plank of EFA and MDGs was realization of UPE, by then more than 40 percent of the worlds out of school children were in sub Saharan Africa, and despite the government of Kenya implementing FPE, the country had approximately 1.5 million primary school age children out of school in 2004 (King ,2005). It was therefore important that the government improved the schools' environment and decongested the overcrowded classrooms for high achievements to be realized in schools. That could only be realized when the government projected enrolments and corresponding education resources requirements.

This study filled that gap by estimating the optimal number of classrooms required to efficiently accommodate the enrolments in the schools, the results would then be used by the government to provide the estimated numbers of the classrooms to serve the enrolled learners in order to attain MDG and EFA 2015 goals and also Kenya Vision 2030.

Yieke (2006) and UNESCO (2005) noted that the FPE policy was rushed without consultation with various stakeholders and many issues were not addressed adequately. According to Sifuna (2005) the government did not do a situational analysis before implementing FPE. That resulted in confusion among the teachers, parents, school committees, sponsors and donors. The other challenges included unavailability of sufficient physical facilities, school furniture, equipment and teachers among others which resulted in overcrowded classrooms and overburdened teachers (Rob *et al*, 2004 and ROK, 2008).

Makori (2009) says that the introduction of FPE in 2003 created a positive outcome because it increased enrolment in many schools. However, in terms of challenges it emerged that in some schools the ratio of pupils to teachers was as high as 70:1 which was well beyond the recommended ratio of 40:1. There was an issue of inadequate physical facilities where most schools did not have adequate classrooms to accommodate the large number of pupils enrolled under FPE. Building the necessary classrooms to improve access and at the same time ensure that class sizes accommodate 35-40 learners for effective learning presented enormous challenges for many countries. UNESCO (2010) noted that achieving EFA goals would require an additional 4.3 million classrooms to improve access and at the same time ensuring class sizes of 35-40 learners for effective learning.

All the studies mentioned above lauded the implementation of FPE in 2003 in Kenya as it boosted enrolment figures in the schools. However, they had at the same time noted that the education resources available in schools then were overstretched. It was therefore important

that estimates of education resources like teachers, classrooms and free schooling funds among others were determined in advance so that they were efficiently allocated to the projected enrolments.

According to Organization for Economic Co-operation and Development (OECD, 2004), expenditure on education is an investment that can help foster growth, enhance productivity, contribute to personal and social development and reduce social inequality. In Kenya, the average government public spending on education and training rose from Ksh 72.3 billion in 2003/04 to Ksh 116.1 billion in 2008/09 and reduced as a percent of GDP from 6.36 in 2003/04 to 5.5 in 2008/09 (ROK 2009). ROK (2005a) noted that costing of education was done at various levels and for the unit cost, it is assumed that for a given level, the objectives, strategies and detailed activities are clearly defined and specified. The unit cost approach helps to inject realism into allocation and mobilization of resources. This was a necessary step if desired growth and quantitative improvements were to be achieved in the face of prevailing resource constraints (Nyawanda, 2008).

The government of Kenya was directly funding the education of learners under FPE and FDSE by disbursing funds to schools at a capitation rate of Ksh 1,020.00 for FPE and Ksh 10,265.00 for FDSE per learner per year. A necessary precondition for free schooling was that central budgets should be large enough to fund the influx of new learners. Official public expenditure from 2000/01 to 2003/04, spanning the period before and after the implementation of FPE in 2003 showed that the primary education budget rose roughly nine-fold over that period and increased roughly seven-fold as a share of public expenditure (ROK, 2009). That kind of huge increments in expenditure witnessed when free schooling was introduced needed to be maintained and improved as years progressed.

It had been indicated that the government's expenditure on education as a percentage of GDP reduced from 6.36 in 2003 to 5.5 by 2009. That should not have been the case because on the side of enrolments in schools, it significantly went up by the year 2009, and even the government had just introduced FDSE. That implied that the government had not used estimated school age population to fund the education sector. That could have led to insufficient education resources being allocated to the enrolled learners.

It was therefore important that a country projected on the likely future school enrolment as an essential component of educational planning. This study therefore strove to project school enrolments so that estimates of desired education resources like teachers and classrooms could be availed to the learners, in addition to the free schooling funds which should be budgeted for to be disbursed to primary and secondary schools to support the implementation of FPE and FDSE for the next 18 years.

The provision of education resources had been a major concern for many governments worldwide. Extensive studies had been done on the expansion of access to educational opportunities with a view of attaining EFA goals by 2015. Most studies done in sub-Saharan Africa had concentrated in the influence of resources on performance or on optimal usage of already available education resources but rarely estimated the education resources which should be efficiently allocated to the projected school enrolments.

Some of the education projection studies done in Kenya included the following; Mbuthia (2000), projected on the enrolment in Universities necessary to meet the demand of science and mathematics teachers in secondary schools while this study projected the teachers required for both the primary and secondary sub-sectors in the country; Wambua and Nyaga (2011), did a survey study on forecasting students' enrolment and teacher demand in

secondary schools in Nandi north and south districts, Kenya by 2012, while this study projected more resources for the next 18 years in the whole of Kenya.

Most of the studies on the projection of enrolment and resources were done by UNESCO for MDG and EFA 2015 goals. It was mainly Asian countries that had been doing long term projections of enrolments and resources while limited studies had been done in individual African countries, Kenya included. Some of the Asian based studies included; Ahmed (2000) who projected population, enrolment and the costs to the State of Primary, Secondary and Higher Education in Bangladesh for the period 2000-2020; Arun (2004) who studied projection of enrolment and teachers in India; and last but not least, BenDavid-Hdar and Adrian (2010) formulated a new model for equitable and efficient resource allocation to schools, the Israel case.

This study included components of the three aforementioned studies but focused on Kenya as a country. This study therefore projected enrolments first and then estimated resources required to efficiently serve the school age population enrolled in Kenya for the period under study. This study drew its importance from the fact that no meaningful fulfillment of MDG, EFA 2015 goals and Vision 2030 could be realized without planning for efficient allocation of educational resources to schools.

1.2 Statement of the Problem

Kenya's population census of 2009 indicated that there were 12,025,735 school age (6-17 years of age) children, out of whom 1.9 million primary school ages (6-13 age group) and 2.7 secondary school ages (14-17 age group) children were out of school. This large number of school age population was out of schools at a time when Kenya was implementing free primary education, free day secondary education and Kenya Vision 2030. Vision 2030's main education target was to reduce illiteracy by increasing access and transition from primary to secondary schools and raising the quality and relevance of education by the year 2030, hence the basis of this long projection study period of 2013-2030.

Studies have indicated that the FPE program was rushed without doing a situational analysis and educational planners and administrators had not been consulted. The expected school enrolments had not been projected so that necessary educational resources could have been procured and provided to the learners in good time. Studies revealed that low achievement in an education system was often associated with poor school environment. In 2010 Kenya still required additional 15,000 classrooms for primary schools and 5,000 classrooms for secondary schools to decongest the overcrowded classrooms. Some classrooms had as high as 70 pupils instead of the recommended 40 pupils per classroom. In addition there was a shortage of 45,180 and 8,400 primary and secondary school teachers respectively.

The main problem in Kenya is that either the educational resources available in schools are in most instances not adequately provided to schools leading to overcrowded classrooms and overburdened teachers, or are not efficiently allocated to schools to accommodate, serve and sustain the enrolments in schools. That inadequacy is mainly caused by lack of advance information and data of projected enrolments to be used during a programs' implementation, more so when the desired policy or program is being implemented in a hurry.

This is a worrying trend hence a concerted effort is needed to reverse it in order to attain UPE by 2015 and education goal of Kenya Vision 2030. This study therefore projected the expected enrolments and then determined the quantities of educational resources in particular teachers, classrooms and free schooling funds (FPE and FDSE funds) which will adequately serve all the projected enrolments in primary and secondary schools in Kenya for the period 2013-2030.

1.3 Purpose of the Study

The purpose of the study was to make projections of optimal educational resources to be allocated to primary and secondary schools in Kenya for the period 2013 -2030.

1.4 Objectives of the Study

- i. To project school age population (6-17 years of age) corresponding to primary and secondary levels of education in Kenya for the period 2013-2030.
- ii. To project enrolments for primary and secondary levels of education in Kenya for the period 2013-2030.
- iii. To estimate the optimum number of teachers required for the enrolments in primary and secondary levels of education in Kenya for the period 2013-2030.
- iv. To estimate the recurrent free schooling funds required for the enrolments in primary and secondary levels of education in Kenya for the period 2013-2030.
- v. To estimate the optimal number of classrooms required to accommodate enrolments in primary and secondary levels of education in Kenya for the period 2013-2030.

1.5 Research Questions of the Study

- i. What were the projected numbers of school age population in Kenya for the period 2013-2030?
- ii. What were the projected enrolments in primary and secondary schools in Kenya for the period 2013 -2030?
- iii. How many teachers were required for the projected enrollment?
- iv. How much were the free schooling funds for the enrolments in primary and secondary schools in Kenya for the period 2013-2030?
- v. How many classrooms were required to accommodate the primary and secondary schools enrolments in Kenya during the period 2013-2030?

1.6 Significance of the Study

The results of this study might be used by educational planners to plan for efficient provision of educational resources in primary and secondary schools. The educational resources which might be planned for included teachers' training and recruitment, identified sites for building of new schools, construction of new classrooms, budget preparation and disbursement of Free Primary Education and Free Day Secondary Education funds. The results might also be used to determine future policy changes in the education sector. Planners might also use the results to predict the effects of earlier events on later developments since once educational development has commenced, then it seems to grow relentlessly under its own momentum.

1.7 Assumptions of the Study

The study assumed that the gross intake rate, promotion and wastage rates as well as demographic factors would remain constant for the period provided for in the referenced documents. At the same time, it is assumed that the Pupil to Teacher Ratio (PTR) will remain constant at a ratio of 40:1 in both primary and secondary schools and that a classroom will

accommodate 40 pupils. The resource allocation would apply equally to the school age population whether enrolled in public or private schools.

1.8 Limitations of the Study

The study looked at general national figures without regional considerations. Social, economic and cultural factors were not taken into account although they might influence enrollment. Census data, demographic variables and internal efficiency rates might suffer from various sources of error. Last but not least, future policy pronouncements in relation to population control and education sector were not taken into account.

1.9 Conceptual Frame Work

This study was based on a conceptual frame work in which the independent variable determining the allocation of educational resources was the school age population. The population of school age was influenced by demographic factors such as fertility and mortality rates. The enrollment of school age population was influenced by the demographic life survival rates, and intervening internal efficiency parameters such as gross intake rate, promotion, repetition, graduation and transition rates. Optimal allocation of resources was in turn determined by existing government ratios, rates like pupils to teacher ratio (PTR), teacher's weekly load and capitation per learner. The dependent variables examined in this study were the education resources which were teachers, classrooms and free schooling funds (FPE and FDSE funds). This study determined the quantities of the dependent variables which could be optimally allocated to the projected enrollments in schools in Kenya for the next 18 years with an aim of attaining MDG No.2, EFA 2015 goals and realization of Vision 2030.

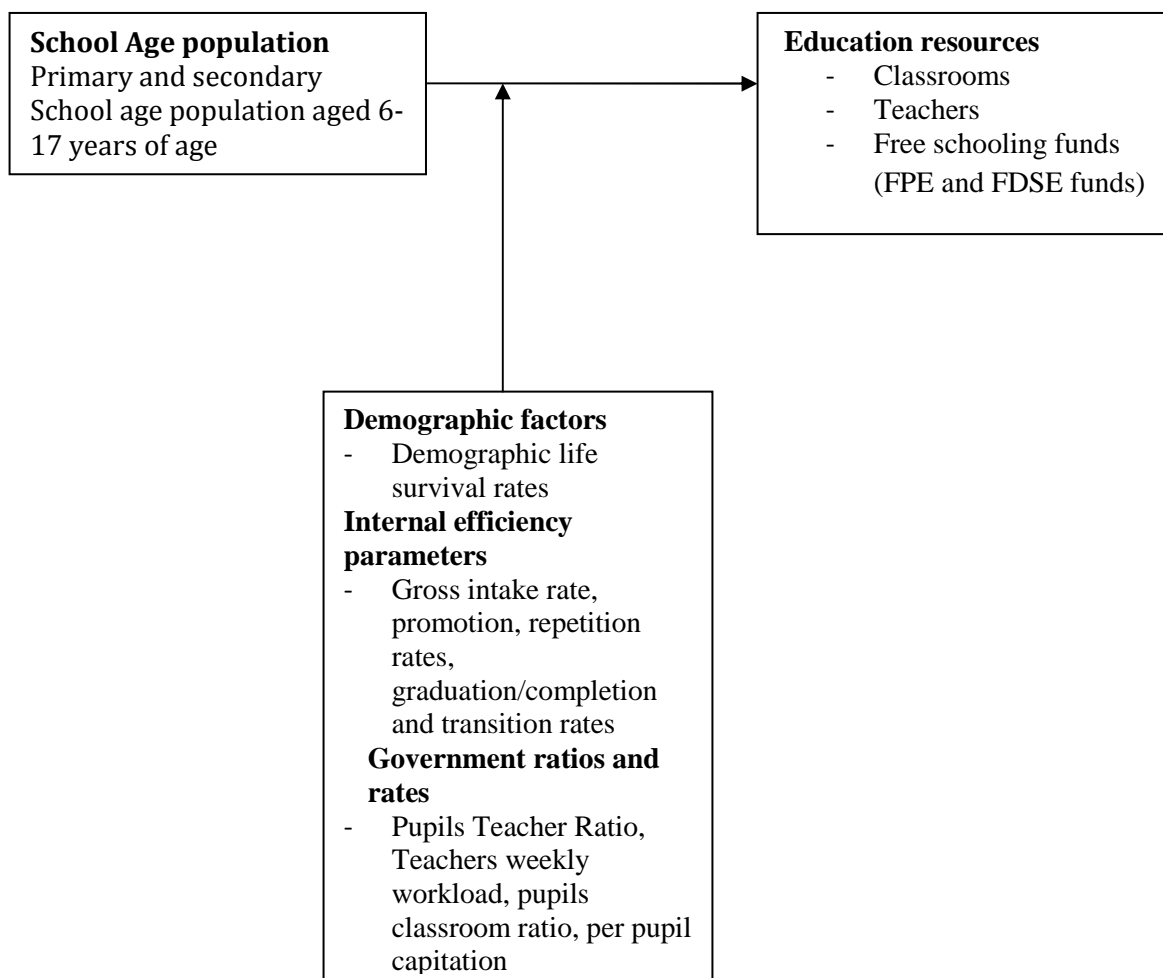


Fig.1.1: Conceptual Frame Work

Fig. 1.1 is a conceptual frame work showing how dependent and independent variables are interacting. The independent variable comprised of the school age children of 6-17 years old. The dependent variables are the teachers, free schooling funds (FPE and FDSE) and classrooms; they were being influenced by the enrolled learners who were determined by the prevailing demographic life survival rates, gross intake rate, class survival and repetition rates, graduation, and transition rates; and finally the government rates which were used to determine the quantities of the educational resources required to optimally serve the school age children enrolled.

1.10 Definition of Significant Terms

- Basic education** - will mean primary and secondary levels of education covering standard 1 up to form four
- Classroom** - will be a room which accommodates 40 learners per grade
- Education resources** - will mean education inputs mainly the teachers, classrooms and free schooling funds
- Efficient allocation** - will mean optimal and standard level of provision of education resources as per the official Kenya government rates
- Flow of students** - is simplified representation of movement of students from the entry point to the exit point
- Pupil: teacher ratio (PTR)** - is the total number of pupils in a school divided by the number of teachers in the school per academic year
- School age population** - will mean the basic education age bracket of 6-17 years of age; 6-13 years for primary level of education, and 14-17 years of age for secondary level of education
- Stream** - refers to a group of students in the classroom in a school
- Student cohort** - group of students in a particular grade in a particular year
- Survivors** - are the students who move into subsequent grade in the subsequent year
- Free schooling funds** - will mean the allocated FPE and FDSE funds to all enrolled in a year of study.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

Related literature was reviewed in this section to establish the link between the school age population and optimal allocation of educational resources as indicated in the objectives of this study. The purpose of this study was to project optimal allocation of education resources to primary and secondary schools in Kenya during the period 2013-2030. Literature on interaction between population and education, past enrolment trends, teachers' availability, and free schooling funds and classrooms availability was reviewed.

2.2 Interaction between Population and Education

High rates of population growth in the past still influenced the number of children being enrolled in schools all over the World in spite of the significant decrease in fertility from 5 in 1960s to an average of 2.7 children in 2000 (UN 2003). The World's total primary school age population for example, grew from 600 million in 1990 to 648 million in 2000, and looked set to reach an estimated 701 million in 2015 (UNESCO 2000). Those figures showed the scale of efforts that the World needed to make to meet the potential demand for education and ensure that all school age population were enrolled by 2015. In sub-Saharan Africa, the school age population was set to increase from 101 million in 2000 to 140 million in 2015. Kenya was one of the Sub-Saharan Africa countries where demand for education remained high against scarce resources. Access to education therefore must be planned for to adequately accommodate the growing demand (UNESCO 2005). It was hence important that enrolments were projected so that the scarce resources available could be efficiently allocated to the learners. This study provided the enrolment projections to be used by the education planners to efficiently allocate the scarce education resources to schools.

In Africa with the exception of Mauritius and South Africa, the ratio of children aged 5-14 years to the active population exceeded 50 percent. That meant that for purely demographic reasons, the goal of education for all was much larger to achieve in Africa than elsewhere (Mohanty 2010). In contrast, that percentage was lower in the countries that had long been industrialized. For instance in Japan and Germany, the ratio of 5-14 years old to the active population was about 16 per cent. Educational development therefore had two factors working in its favour in the wealthy countries, which were abundant resources and a proportionally smaller school-age population (Mohanty 2010). KDHS 2008-2009 report projected the population of Kenyans to reach 39.3 million people at the end of 2009 with a population growth rate of 2.9 percent per annum. The other basic demographic indicators were indicated in Table 2.1 on page 19

Table 2.1: Selected Demographic Indicators in Kenya for the years 1969, 1979, 1989, 1999, 2009 respectively

Indicator	1969	1979	1989	1999	2009
Population(millions)	10.9	16.2	23.2	28.7	39.4
Density(pop/km2)	19.0	27.0	37.0	49.0	67.0
%Urban	9.9	15.1	18.1	19.4	21.0
Crude birth rate	50.0	54.0	48.8	41.3	34.8
Crude death rate	17.0	14.0	11.0	17.7	
Total fertility rate	7.6	7.8	6.7	5.0	4.6
Infant mortality rate	119	88	66	77.3	52
Life expectancy at birth	50	54	60	56.9	58.9

Source: CBS, 1970, 1981, 1994, and 2002

The KDHS report indicated that fertility levels declined from 8.1 births per woman in the late 1970s to current level of 4.6 births per woman. The decline in fertility was expected to be manifested in the age distribution of the country's population. Mortality rates rose since 1980s presumable due to increased deaths from HIV and AIDS epidemic, deterioration of health services and widespread poverty (KNBS 2010). Although the birth rates had been decreasing over time, it was still higher than the death rates. That coupled with Kenya's high fertility rate; the population was bound to keep on increasing and would be characterized with a youthful population. A study done by the government indicated that about 43% of the population was younger than 15 years (KNBS 2010). Given that the country's population was characterized with a youthful population and the fertility rate was still high, the school age

population was bound to keep on increasing and if not planned for, the available education resources were likely to be overstretched. This study projected the school age population for the next 18 years and then estimated the education resources which could efficiently serve the enrolled learners.

UNESCO (2007) stated that age structure of the population determined the size of the school age population and that the greater the number of school age population, the greater the need to create more classroom space and recruit more teachers. The number of future births affected the number of children to be accommodated at every level of education system each year and equally on the rate of construction of new classrooms. A fall in the number of birth rates or migration was also important to planners as such patterns could lead to a policy shift in regard to closure of some schools and balancing of the under-utilized teachers. This study therefore endeavored to project the enrolments up to 2030 in Kenya. The main aim was to aid the education planners to plan for efficient allocation of education resources to meet the potential demand for education in order to fulfill MDGs, EFA 2015 goals and Kenya's Vision 2030 education goal.

The Kenya Vision 2030 is Kenya's blue print for 2008-2030 plan period which aims at making Kenya a newly industrializing, "middle income country providing high quality life for all its citizens by the year 2030" (NESC, 2007). The education goals of Vision 2030 are to provide globally competitive quality education and training and research for development. This is to be done by reducing illiteracy by increasing access to education, improving the transition rate from primary to secondary schools and raising the quality and relevance of education.

This study used age-sex component method to project the school age population. This method depended upon the assumptions on the dynamics of the population parameters such as fertility, mortality, life expectancy, survivorship ratio, and migration. These were summed up

in model life tables grouped in 5 years band and forecasted after every 5 years. In the computation process, projections were made for females and males combined in the 5 year age bands after the base year was obtained by multiplying the base population by age-specific survivorship ratios, which was algebraically expressed as

$$P_{x+5}^{t+5} = P_x^t * S_{x \text{ to } x+5}^{t+2..5} + NM_{x+5}^{tot+5}$$

Where P is the number of persons of a given sex at mid-year t in 5 year age group x, S represents the sex specific survivorship of a given sex and NM is the net number of in-migrants during the five year interval which was not applicable for the school age population (Ahmed 2000) due to the insignificant migratory pattern of school age population.

2.3 Past Enrolment Trends in Kenya

Ambitions to universalize primary enrolments, was not new in many sub-Saharan Africa countries. In many cases progress since independence had stalled and the gains made in 1960's and 1970's had been lost (Somerset 2007). In the policy climate of 1990's and into the 21st century, there was a primary concern for poverty alleviation in development strategies by seeking to provide funds to ensure that universal primary education formed integral component of national and sustainable poverty alleviation (Gould B. & Ulli H. 2002). EFA had added a new impetus to the push to improve access to education of Africa's children (UNESCO 2008a)

In Kenya primary school going age ranged between 6-13 years. This was the first phase of 8.4.4 education system. The main purpose of primary education was that it prepared learners to participate in the social, political and economic well being of the country and also made them to be global citizens (Education Info Center, 2006). In addition it catered for learners who wished and had the means to continue on with secondary education. Primary education was universal, and was offered free as per Kenya's constitution (ROK 2010). Kenya had

always placed education as a priority at all levels and promoted it as a key indicator for social and economic development. At independence there were fewer than 900,000 Kenyan children attending primary school but by 2007, the number had grown to 8.33 million (UNESCO, 2008c).

The government of Kenya had previously attempted to implement free primary schooling which resulted in an unexpected surge in the enrolments leading to overcrowded classrooms. For instance in 1973, the government announced a major initiative that beginning 1974 school year, formal school fees were abolished for the first four primary grades (Somerset 2006). The impact of this reform on the retention of the 1971, 1972 and 1973 already in schools and the 1974 intake improved. The government responded to the sudden jump in primary enrolment by hiring large numbers of untrained teachers (Somerset 2006).

In 1978, the government of Kenya again announced another reform that from the beginning of 1979, primary schools would no longer be permitted to collect building funds by direct levying from the families sending pupils to schools. Instead, funds were to be raised by Harambee (self help) activities involving the community as a whole (Somerset 2007). This resulted in an increase in Grade I intake and enrolment in general. The government in that case responded not by recruiting new teachers, but by increasing class sizes which resulted in an increased pupil to teacher ratio from 33:1 to 39:1 (Somerset 2007).

It was sad to note that in spite of the efforts made by the government in the two cited cases, some school age population still remained non-enrolled or the enrolled ones dropped out shortly afterwards. Studies indicated that the non-enrolment persisted due to the following reasons; Teachers, classrooms and other learning resources were inadequate and low income families remained too dependent on the labour force of their older children (Somerset 2007). That therefore made projection data which indicate future trends in enrolment and other

developments an important factor of planning in education because once an educational program had commenced, it seemed to grow relentlessly under its own momentum (Forojolla 1978). The results of this study filled the gap by projecting data for future enrolments and offered guidance by estimating the provision of teachers and classrooms so that the government could not be overwhelmed by upsurge of enrolment whenever a new reform was implemented.

The government of Kenya finally implemented free primary education policy in 2003 when NARC government was sworn in office after winning the 2002 general election. This had a significant impact on enrolment in primary schools as is shown in Table 2 .3 on page26

Table 2.2: Primary schools enrolment data from 2002 to 2008

Year	Boys	Girls	Total	GER	NER
2002	3,073,932	2,988,831	6,062,763	88.2	77.3
2003	3,674,398	3,485,124	7,159,522	102.8	80.4
2004	3,821,837	3,575,209	7,397,046	104.8	82.1
2005	3,912,399	3,690,112	7,602,511	107.2	83.2
2006	3,896,578	3,735,535	7,632,113	107.4	86.5
2007	4,258,616	4,071,532	8,330,148	107.6	91.6
2008	4,358,709	4,205,113	8,563,821	109.8	92.5

Source; MOE-EMIS 2009

Following the implementation of FPE, enrolment increased significantly by 20 percent from 6.0 million in 2002 to 7.2 million in 2003; the NER in Kenya grew by 15.2 percent between 2002 and 2008 hence indicating progress towards MDG and EFA target in 2015. GER of 109.8 in 2008 showed the improved level of access in primary education irrespective of age. The reported NER indicated that 7.5 percent of school age population was out of school.

Districts that registered 20% increase in enrolment in 2003 hardly recorded more than 5% in 2004 (Muthwi 2004; Own & Associates 2004).

Muthwi (2004) concluded that the FPE initiative of 2003, similar to interventions in the past, was pursued as a matter of political expediency and was not adequately planned and resourced within the consequences of drop out and falling educational quality (Muthwi (2004). In order for all school age population to be enrolled, there was a need to provide adequate education resources to attract and sustain them in schools. That implied that enrolments had to be projected and necessary education resources estimated to be allocated to schools. This study strove to project future enrolments and act as a guide to the government in the provision of resources to the schools.

Mukudi (2004) addressed the issues of sustainability in regard to UPE in Kenya including resource capacity and educational output. He concluded that without adequate investment, the synergies between educational access, economic growth and poverty reduction might not be capitalized on and a vicious cycle might be observed in which global competitiveness became elusive in the absence of investment in knowledge creation. Mukudi (2004) and Vos (2004) argued that given the financial constraints that Kenya faced, meeting the EFA target required a more efficient resource allocation within the education sector. The reasoning above formed the purpose of this study to project school age population and enrolments to be served so that estimated education resources were efficiently allocated to schools.

The EFA Global Monitoring Report (2011) indicated that the World was not on track to achieve MDG number 2. If the trend continued then there could be as many as 72 million children out of school by 2015, an increase over the then levels of 67 million children. Raja and Burnet (2004) noted that countries that had successfully increased enrolment faced two particular problems; enrolling the remaining 10 to 20 percent of the school age population at

primary level who tended to come from low income families and also ensuring that those in school benefited by learning.

The experiences in Kenya, Uganda and Tanzania showed that the elimination of fees at the primary level could have dramatic results. However, low enrolment among the poor households still presented a problem. That low enrolment could have reflected lack of supply, the opportunity cost of attending school, the perceived low returns from schooling in the labour market and long distances to schools (Raja & Burnet 2004).

The challenges mentioned above could be solved by efficiently allocating education resources to the learners so that distances to schools were reduced by having schools built closer to the learners and teachers adequately provided to guide the learning process. This study endeavored to provide projections of enrolments so that estimated resources could be efficiently allocated to schools and schools sited appropriately.

In Kenya, secondary education was the second level of formal education and was attended by learners aged 14-17 years. However, there were cases where underage or overage learners were enrolled. Secondary education strengthened the general knowledge acquired at primary level of education leading to further training and acquisition of skills that were required in different occupations in the industries, service sector and self employment. It was aimed at meeting the needs of students who terminated their education at that level and those who proceeded onto higher levels of education (Education Information Centre 2006).

Since Kenya's independence, the competition for secondary schooling entry had steadily intensified. In 1963, there were only 30,121 secondary school students and then later on the enrolment in secondary level of education improved from 881,328 in 2003 to 1,180,267 in 2007 (ROK 2008b). The GER increased from 28.5 percent in 2003 to 42.5 percent in 2008

while NER rose from 18.6 percent to 28.9 percent in 2008. The transition rate from primary to secondary education level rose from 42.7 percent in 2003 to 72 percent in 2010.

That was as a result of implementation of FDSE coupled with expansion strategy of increased class sizes from 40 to 45 students; schools to have at least 3 streams per class; and also schools built out of CDF initiatives expanded access (ROK 2008b). Based on the 2009 census, secondary schools attendance was only 1.8 million out of the 3.5 million boys and girls aged 14-17 years who should have been in secondary schools giving gross attendance of 51.2 percent (ROK 2010).

In order to make secondary education in Kenya affordable, the government introduced FDSE in 2008 and this initiative made enrolment at that level to more than double just within four years. Kenya's former Education secretary Prof. Godia noted that the enrolment in primary schools had increased to 9.4 million in the year 2011 as compared to 5.9 million in 2003, while for secondary schools, enrolment had increased to 1.7 million up from 800,000 in 2008 (ROK, 2012b).

Despite the fact that FDSE was being implemented and that there was a significant increase in secondary schools' enrolments, around 2.7 million secondary school age children were not enrolled. It was important to note that once a child did not graduate from primary level of education, then such a child would never acquire secondary level education; and secondly enough classrooms space must be availed for large numbers of primary level graduates to transit to secondary schools.

Enrolments in secondary level of education could only be improved if the transition rate from primary to secondary level was enhanced and when education resources were efficiently allocated to schools. That could be done by first projecting the enrolments in schools and then estimating the resources required by them. This study endeavored to fill this gap by

projecting enrolments in primary and secondary education, then estimating education resources that could efficiently serve the enrolled children.

2.4 Enrolment of School Age Population

Many countries are struggling to get children into primary schools at the official starting age. In 2008 only 56 percent of children starting school in sub-Saharan Africa were of the official primary school age, and in Eritrea the figure was as low as 16 percent (EPDC 2008). In Tanzania, the share of children starting school at the official age was 14 percent in 1999 and increased to 87 percent in 2007 due to the enforcement of policies such as fee abolition, more stringent regulations on entry age limits and alternative programs for over age children (Lewin and Sabaot, 2009).

Getting children into primary schools was the first part of the UPE contract and once children were in school, then the government needed to address the problems affecting retention, progression, completion, and more so drop out which influenced the other three. In the case of Kenya, the introduction of FPE policy had influenced the dynamics of enrolment in primary schools as stated in table 2.3.

Table 2.3: Primary Schools enrolment Indicators in Kenya

Year	Completion rate	Survival rate to class 5	Dropout rate	Transition rate to form 1
2003	68.2	90.1	2.0	42.7
2004	76.2	84.9	6.5	56.0
2005	77.6	90.33	4.9	67.3
2006	76.3	91.65	6.4	59.6
2007	81.0	72.35	3.5	59.9

Source: MOE-EMIS 2009

As shown in Table 2.4, survival rate to class 5 was higher than completion rate at primary level and transition rates to form 1 over the indicated period. The government then needs to investigate what could be affecting internal efficiency after class 5 in primary schools. – Education Management Information System (ROK 2009).

Therefore there is an urgent need to put strategies in place to increase intake, completion and transition rates to 100 percent to be in line with the government's commitment to offer free and compulsory basic education. The starting point would be to project the enrolments so that estimated education resources could be planned for by the education planners to use when allocating resources. This study projected enrolments and determined estimates of education resources for use by the government when allocating resources.

Baraza (2003) recommended in her study that the government should enact laws that govern enrolment in schools whereby schools should retain all students enrolled and be accountable directly to the Ministry of Education for those students who drop out of schools. Abdulahi (2001) cited decline in school attendance in North Eastern province in Kenya by more than half in term 1 in 2001. It was reported that more than 60 percent of secondary school students in the province had not reported to school because of lack of school fees and food. He further noted that a combination of other factors such as staff shortage, poor infrastructure and low resource allocation by the government hampered educational programs in the region, hence the low enrolment and transition rates.

The two studies were concerned with non-attendance of school age population and noted resource inadequacy as one the causes of non-attendance. For all school age population to be enrolled, then sufficient resources had to be provided in schools. The provision of enough resources to schools could only be provided if enrolments were projected. This study strove

to project enrolments and then estimated education resources which could be efficiently allocated to schools to support the enrolled learners in the schools.

Enrolled school age population was mainly determined by the intake, retention and completion rates of education in a system (EPDC, 2008). Planning for intake of grade 1 pupils in each country was very important and that could only be done if projected intake numbers were known in advance. A 2011 Global Monitory Report on EFA noted that intake patterns had a crucial bearing on subsequent progression. Ensuring that children started school on time was a prerequisite for UPE.

Internal efficiency under UPE was about completing a full primary cycle at the appropriate age while delayed school entry age was associated with increased risks of drop out. One reason was that late entry was often associated with higher rates of repetition in early grades, which could increase the costs of education to households and weaken the internal efficiency of education system (EPDC, 2008). Starting early could also have adverse consequences; repetition rates for under-age children tended to be much higher than for those who started on time. For instance in Kenya, first grade repetition rates were more than twice higher in the cases of children entering schools before the official starting age (EPDC, 2008).

Projections of the future size of school age population enrolled at any level of education constituted the starting point of educational planning. This was so because it provided the basis of estimating the future number of schools, classrooms, teachers and other facilities (Ahmed 2000). Enrolment projections informed us about how many learners were likely to be enrolled at some future time, assuming changes or no changes in the educational system, with past trends continuing unchanged or changed as per educational future plan.

The objective of projection would be to develop a basic frame of reference for the future. The projections were determined on many parameters such as growth of school age population,

the intake ratio, and promotion, repetition and dropout rates (Ahmed 2000). Thus, the factors to be considered would be population of admission age, the admission rate of the first grade, the repetition rates of different grades and the promotion rates at different grades (Ahmed 2000).

This study used the Cohort projection model. The cohort projection model was similar to the ones used by World Bank, UNESCO and many other countries which planned their systems based on projected enrolments. The core of all those models was a matrix of pupil flows where pupils entered the system in grade 1, and each year flowed to the next grade according to the promotion rate, or repeated the grade according to the repetition rate.

This study adopted the past enrolment indicators of a cohort and then extrapolated them into the future. This was done by analysis of what happened to the cohort of students as they progressed through all the grades of a level. Computation depended on past enrolment's intake ratio, retention/survival and repetition rates of the school system. With the enrolment indicators computed from past series of enrolment data, computation of progression through retention and repetition rates between grades for a number of years was examined for possible trends. If no discernable trend emerged for grades, then the averages for the ratios were calculated and then assumptions made of future retention levels. By applying the observed intake ratio, the size of the future starting cohorts could then be estimated from the future school age population. That explanation of the model was summarized in Table 2.4.

Table 2.4: Generic Matrix for Pupils Flows Calculations and Projections

	New entrants[N]	Grade 1 pupils	Grade 2 pupils	Grade 3 pupils	Grade G pupils
Year1	$GIR[t]*E[t]$	$P[1,t]$	$P[2,t]$	$P[3,t]$	$P[G-t]$
Year 2	$GIR[t+1]*E[t+1]$	$N[1,t+1]+P[1,t]*r[1,t]$	$P[1,t]*p[1,t]+P[2,t]*r[2,t]$	$P[2,t]*p[2,t]+P[3,t]*r[3,t]$	$P[G-1,t]*p[G-1,t]+P[G-t]*r[G-t]$
Year 3	$GIR[t+2]+E[t+2]$	$N[1,t+2]+P[1,t+1]*r[1,t+1]$	$P[1,t+1]*p[1,t+1]+P[2,t+1]*r[2,t+1]$	$P[2,t+1]*p[2,t+1]+P[3,t+1]*r[3,t+1]$	$P[G-1,t+1]*p[G-1,t+1]+P[G,t+1]*r[G,t+1]$
Final year	$GIR[T]*E[T]$	$N[1,T]+P[1,T-1]*r[1,T-1]$	$P[1,T-1]*p[1,T-1]+P[2,T-1]*r[2,T-1]$	$P[2,T-1]*p[2,T-1]+P[3,T-1]*r[3,T-1]$	$P[G-1,T-1]*p[G-1,T-1]+P[G,T-1]*r[G,T-1]$

Source: EPDC Cohort Projections Model Pro Enrol matrix

The projection years were symbolized by (t), with (T) for the final year of the projection, and grades were symbolized by (g), with (G) for the final grade of the system. GIR was gross intake rate; E was population of the official entry age; N symbolized new entrants; P (1, t) was pupils in grade 1 in year t; p (1, t) was the promotion rate in grade 1 in year t; r (1, t) was the repetition rate in grade 1 in year t.

2.5 Provision of Teachers

The role of teachers had long been recognized as central to the delivery of instructions as well as to the quality of education. Mackenzie (1983) as cited in Mbutia (2000) noted that effective learning depended heavily on the classroom- teacher centered activities and on the teachers' tasks given that in contemporary times there were hardly any institution other than schools that provided learning opportunities and instructional experiences.

For a school to be functional, it needed teachers in all disciplines to guide the learners in various curriculum areas and in administration of schools. Consequently, the planning of teacher requirement and supply was a central concern in the development and smooth functioning of any education system. Teacher requirement and supply were further central to education planning because of the cost of employing teachers.

RoK (2005a) noted that teachers were an important resource in the learning process, their training and utilization therefore required critical consideration. The demands for teachers depended on the enrolment of learners in schools. Poignant (1976) as cited in Wambua and Nyaga (2011) pointed out that school enrolments in the past enabled educational planners and policy makers to foretell human resources needed in future years. Therefore to forecast the number of teachers needed in future then the number of learners to be taught should be known. This study would therefore aid the education planners in planning for teacher training and recruitment to serve the projected enrolments.

The teacher resource was an important input in achieving the objectives of the education sector. Equitable distribution of teachers had been a challenge in teacher management in Kenya and the number of teachers had remained constant over years despite growth in enrolment and the number of educational institutions. This resulted in a shortage of teachers which impacted negatively to the access and quality of education (ROK 2008b).

In 1997, there was a freeze in teacher recruitment by the government of Kenya where TSC was only allowed to replace the number of teachers exiting through natural attrition. With the introduction of FPE in 2003, there was an upsurge in enrolment in public primary schools. The two factors exerted pressure on the teacher resource hence high PTRs. The number of teachers had remained constant over the years except the 4,000 recruited in 2007/2008 financial year to bring the total to 239,000 teachers (ROK 2008b).

There has been a general increase in PTR from 34 in 2002 to 45 in 2008 nationally in primary schools. There was a need to urgently implement the TSC teachers staffing norms of 2005 that recommended balancing of teachers and decentralization of teacher recruitment for primary and secondary levels of education in Kenya (ROK 2005c). That would allow the government to distribute primary school teachers across regions based on the recommended PTR of 45:1 for high potential and 25:1 for ASAL regions.

Given that school age population in Kenya was bound to keep on increasing due to her high fertility rate and youthful population, the provision of teachers should not be stagnated but should be guided by the enrolments in schools and policies governing staffing of teachers. Enrolled learners could only be sustained in schools if adequate numbers of teachers were attending to them. This study provided optimal number of teachers for the projected enrolments in the next 18 years to be provided to schools by the government.

According to UNESCO (2005) enrolment statistics formed the basis for investment decisions in education and teachers were the most important academic input in education. Teacher requirement was determined by future school enrolment and staffing standards of the school system. The school enrolment was further controlled by the number of school age population, their ages and lengths of attendance, enrolment ratios and pupil: teacher ratios. Staffing standard was based on out- put labour ratio commonly known in education as pupil: teacher ratio (Williams 1971) as cited in (Forojolla, 1993).

TSC came up with a manual on staffing functions in 2008 from a research done in 2005 which stipulated that in primary schools, there would apply two scenarios where first, one teacher per class plus 2.5 percent with no provision for administrative allowance and a second one of PTR of 45:1 in high potential areas and 25:1 in low potential areas with

provision of 0.75 full time equivalent administrative allowance. The projection done then was as shown in Table 2.5.

Table 2.5: Teacher Requirement for Primary Schools in Kenya in 2005

Primary schools	Teachers on duty	Projected total	Gap
Scenario 1 (PS1)	170,611	215,791	45,180
Scenario 2 (PS2)	170,611	193,350	22,739

Source: Study on new teachers staffing norms (ROK, 2005c).

Table 2.5 indicated that scenario 1 would project teacher requirement for primary schools to be 215,791 in 2005 giving a shortage of 45,180 teachers, while scenario 2 gave a projection of 193,350 teachers in 2005 giving a shortage of 22,739 teachers.

The study also used and analyzed two scenarios for the secondary schools as follows. First scenario was based on the existing staffing norm where the weekly work load per teacher was 27 lessons (18 hours) per week of student-teacher contact time and second scenario was based on the recommended staffing norm where the weekly workload per teacher was 30 lessons (20 hours) per week of student-teacher contact time. The projections done then for secondary level were as shown in Table 2.6.

Table 2.6: Teacher Requirement for Secondary Schools in Kenya in 2005

Secondary schools	Teachers on duty	Projected total	Gap
Scenario 1 (SS 1)	57,209	65,609	8,400
Scenario 2 (SS 2)	57,209	63,139	5,900

Source: Study on new teachers staffing norms (ROK, 2005c).

Table 2.7 indicated secondary schools teacher requirement when scenario 1 was used would have 65,609 teachers giving a shortage of 8,400 teachers while scenario 2 projected teacher requirement to have been 63,139 giving a shortage of 5,900 teachers in 2005.

Besides the implementation of new teacher staffing norms that proposed various strategies of teacher utilization, there was need to immediately recruit additional teachers to address the identified shortages. Kenya Vision 2030 proposed a strategy to employ additional 28,000 teachers as one of the flagship projects in the year 2008.

The research done by TSC in 2005 indicated that there was shortage of teachers in both primary and secondary schools in Kenya regardless of the scenario applied. That therefore called for long term projection of enrolments so that training and recruitment of teachers could be done objectively. This study therefore estimated the number of teachers who could effectively handle the enrolments in both primary and secondary schools under the assumption of MDGs, EFA 2015 goals and realization of Kenya Vision 2030.

2.6 Recurrent Free Schooling Funds

Unit cost is an indicator of the investment by countries in learners at different levels of education. Chesswas (1969), as cited in Nyawanda, (2008) notes that education unit cost should be rightly stipulated unit expenditures because it deals only with actual expenditure of funds directly on the educational services. The unit cost commonly used is cost per student.

The unit cost approach helped inject realism in allocation and mobilization of resources, which was a necessary step if desired growth and quantitative improvement were to be achieved in the face of prevailing resource constraints (OECD 2004). Expenditure per student was an indicator of the investment made by countries in each level of education. It was obtained by dividing the total expenditure on educational institutions at that level by the

number of full time students. Only educational institutions and programs were taken into account for which both enrolment and expenditure data were available (OECD 2004).

In Kenya, the average government public spending on education and training rose from Ksh 72.3 billion in 2003/04 to Kshs. 116.1 billion in 2008/09 and reduced as a percent of GDP from 6.36 in 2003/04 to 5.5 in 2008/09 (ROK 2009). At national level, public spending on education was highest when compared with other social sectors, which was 73 percent of the expenditure. In addition, annual budgetary allocation to education in Kenya had risen from 35 to 39 percent from 2000 to 2004, with about 79 percent going towards planning and administration costs (ROK 2005a).

A study by Olel (2000) revealed that PTR, non-teacher recurrent expenditure, teacher qualification, and teacher salary were among the variables that influenced recurrent unit costs. It was notable that expansion in enrolment should be accompanied by quantitative expansion of physical and human resources in schools, hence it called for increased financial resource to meet the increased educational demand.

The unit cost approach helped to inject realism into allocation and mobilization of resources. That was a necessary step if desired growth and quantitative improvements were to be achieved in the face of prevailing resource constraints (Nyawanda 2008). Kenya government introduced a sector-wide approach to planning in KESSP 2005-2010 which manifested the government's pledge to give quality education to all Kenyans. That signaled a move from the previous Harambee spirit system, under which communities were responsible for sourcing for the funds to build schools to a system under which the government was looking forward to provide the required learning resources (ROK 2005b).

The government of Kenya was directly funding the education of learners under FPE and FDSE by then disbursing funds to schools at a unit cost of Ksh 1,020.00 for FPE and Ksh 10,265.00 for FDSE per learner per year (ROK, 2005a).

The cost to be incurred on the teachers' salaries, boarding, lunch programme, and PTA projects were considered out of scope in this study. Gravenir (2006) stated that it was generally agreed that teacher element being usually the largest, should be separated. Likewise it was obviously necessary to separate the cost of boarding element in boarding schools and lunch programme in day schools. This study therefore estimated the amount of FPE and FDSE funds to be disbursed to schools every year for the period under study.

A necessary precondition for free schooling is that central budgets should be large enough to fund the influx of new learners. For instance official public expenditure from 2000/01 to 2003/04, spanning the period before and after the implementation of FPE in 2003 showed that the primary education budget rose roughly nine-fold over this period (ROK 2009). That kind of huge increments in expenditure witnessed when free primary schooling was introduced needed to be maintained and improved as years progressed.

It had been indicated that the government's expenditure on education as a percentage of GDP reduced from 6.36 in 2003 to 5.5 by 2009. That should not have been the case because on the side of enrolments in schools, it significantly went up by the year 2009, and even the government had just introduced FDSE. That could have then led to insufficient education resources being allocated to the enrolled learners. It was therefore important that a country projects on likely future school enrolment as an essential component of educational planning. This study therefore strove to project school enrolments so that estimates of desired education resources could be efficiently availed to the learners, including the free schooling funds.

2.7 Provision of Classrooms

Classrooms were considered as one of the first critical infrastructure facilities used in schools. They protected and accommodated learners from harsh weather conditions and enhanced controlled learning in schools (UNESCO 2007). It further noted that schools in low income areas suffer frequently from overcrowded and poorly ventilated classrooms, lack of qualified teachers and limited resources available for learning materials.

EFA (2010) monitoring report indicates that low achievement levels were often associated with poor school environment. Badly ventilated classrooms, leaking roofs, poor sanitation and lack of materials presented significant barriers to effective learning in many schools. Building the necessary classrooms to improve access and at the same time ensuring that class sizes small enough for effective learning presented enormous challenges for many countries. The report further indicated that the cost of achieving EFA by 2015 were estimated on the basis of building sufficient and good quality classrooms to accommodate all students in classes of 35-40. That allowed children to be taught in group sizes that were manageable for teachers and each teacher was equipped with a single classroom.

A study established that 30 percent of the stocks of classrooms in Sub-Saharan Africa were either temporary constructions or needed serious repairs (Theunyck 2009). UNESCO (2010) noted that achieving EFA goals would require additional 4.3 million classrooms to improve access and at the same time ensured class sizes enough for effective learning. Kenya required additional 15,000 new classrooms at primary and 5,000 at secondary levels as indicated in UNESCO 2008-2015 classroom projection so that each classroom could accommodate 45 pupils in high potential areas and 25 pupils in ASAL areas (ROK 2005c). It was therefore important that the government improved the schools' environment and decongested the overcrowded classrooms for high achievements to be realized in schools. That could only be realized when the government projected enrolments and corresponding education resources

requirements. This study filled that gap by estimating the optimal number of classrooms required to efficiently accommodate the school age population in the schools, the results could then be used by the government to provide the estimated numbers of the classrooms to serve the enrolled learners in order to attain MDGs, EFA 2015 goals and realization of Vision 2030.

Classroom facility was one of the first requirements to impart education. After having enrolment data for the projected year the next task was generally to project the classroom requirements. The algorithm of calculation was as shown below:

Total classrooms [C] = Total enrolment / Average number of pupils per classroom (E/APP).

Total classrooms in the base year = $C_b = E_0 / (E/APP)_b$

Total classrooms in the projected year = $C_t = S_t / (E/APP)_t$

This study therefore determined the number of classrooms which could effectively accommodate the learners enrolled at both primary and secondary levels of education under the assumption of EFA 2015 and in realization of Kenya Vision 2030.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This section described area of study, study design, study population, sample and sampling procedure, instruments of data collection, validity and reliability of the instruments, data collection and data processing procedures.

3.2 Study Design

This study employed trend analysis of past time series data of important indicators of population size and structure; enrolment and internal efficiency parameters like gross intake, promotion and repetition rates of an education system. Ahmed (2000) used trend analysis of past time series data when projecting the population, enrolment and the costs to the state of primary, secondary and higher education in Bangladesh for the period 2000-2020. This study replicated the design by first projecting the school age population from the base year 2009 and the base data which was the 2009 population census. This population was calculated for every age, 6-17 years ages for years 2013 to 2030 by applying demographic survival rates as indicated in model life table, in Table 4.2 on page 51. Once the school age population was projected, the actual enrolments were then projected by applying the past time series indicators of enrolments data as indicated in Tables 4.3 on page 52. The quantities of educational resources required for the projected enrolments were then determined by the use of official government rates. For instance a PTR of 40:1; one classroom for 40 learners; TSC staffing rates from the staffing norms of 2008; and the free schooling grants capitation rate to schools were the official government rates used in this study.

3.3 Area of Study

The study was done in Kenya, one of the East Africa states that lies on the equator, with Indian Ocean to its South East. It is bordered by Tanzania to the South, Uganda to the West, Ethiopia to the North and Somalia to the North East. Kenya had a land area of 582,647 square kilometers in size and lies across the equator on the eastern seaboard of Africa. The coastal line stretched from Somalia border in the North to Tanzania in the South and was 608 km long.

Kenya falls into two regions of lowlands and highlands. Its temperature is influenced by its altitude and proximity to the lakes or the ocean. Approximately 80% of her land is arid and semi-arid; and only 20% is arable. She had diverse physical features such as the Great Rift Valley, Mount Kenya, lakes Victoria and Nakuru amongst others.

Kenya's population was 10.9 million in 1969 and by 1999, it had almost tripled to 28.7 million (CBS 1994, 2001a). The latest census done in 2009 approximated her population as 38.7 million with a population growth rate of 2.8% per year (KDHS 2010).

In the last ten years, the enrolment of learners in primary schools had increased tremendously since FPE was introduced. For instance it increased from 6.0 million in 2002 to 7.2 million in 2003 and by the year 2011, enrolment was approximated to be 9.4 million (MOE 2012). The secondary schools students' enrolment had steadily increased from 30,121 in 1963 to 881,328 in 2008 to an estimated 1.7 million in 2011 (MOE 2012).

The Kenyan economy is predominantly agricultural which forms her strong economic base. There was a gradual decline in the share of the gross domestic product (GDP) attributed to agriculture, from over 30 percent during the period 1964-1979 to 25 percent in 2000-2002. The agricultural sector directly contributed 22 and 23 percent of the GDP in 2007 and 2008 respectively. The manufacturing sector contributed significantly to export earnings,

especially from the Common Market for Eastern and Southern Africa (COMESA) region. The manufacturing sector had increased slightly from about 10 percent of the GDP in 1964-1973 to 11 percent of the GDP in 2008. Kenya was made up of 47 counties which were adopted after the promulgation of a new constitution on 20th August 2010, and are operational.

3.4 Study Population

The proposed study population comprised of all the school age population who were 8,523,018 aged 6-13 years (primary school age) and 3,502,617 aged 14-17 years (secondary school age) as per the 2009 population census. That study population was very crucial for the projection of pupils given that the enrolment ages for this study ranged between 6-17 years of age. The enrolled population between 2003 and 2011 gave past trends of enrolment. It should be noted that data of this kind were available from central points that was Ministry of Education (MOE), Teachers Service Commission (TSC), Kenya National Examinations Council (KNEC), Kenya National Bureau of Statistics (KNBS) and National Council of Population and Development (NCPD) headquarters; hence there would be no need to follow subjects into the field. The respondents were officers from MOE, NCPD, KNEC and TSC offices who were in no way part of the target population.

3.5 Sample and Sampling Technique

This study used saturated sample of 6-17 years old population of 2009 to obtain projections. Similarly, a saturated sample of all enrolled in primary and secondary schools were used and their grades put into respective use per class. Saturated sampling is a non-probability sampling procedure that is referred to as no sample at all. In this technique all members of the population are sampled.

Therefore this research study established the number of school age population in the base year 2009, which was then used to determine enrolments in primary and secondary schools over time to the year 2030. That information was vital for carrying out the necessary projections and therefore the researcher could not afford to use generalizations about any of that data by use of representative samples and sampling procedures.

3.6 Instrumentation

The data were collected by the use of proformas and interview schedules. The researcher referred to past projection studies and the relevant data collection forms generated by MOE – EMIS section in Kenya to develop the proformas. The developed instruments were presented to Maseno University, Department of Education Management and Foundation for review and approval of their use in data collection, examination, and synthesis.

The description of proforma format of the instruments used in data collection in the appendices were; Population of 6-13 and 14-17 years old in Kenya for the stated period and projected age specific fertility rates for the stated age brackets, projected model life tables, and time series enrollment data, which were necessary for one to project the committed enrollment in future. The projected enrolment figures were then used to calculate the required stock of teachers, classrooms and FPE and FDSE funds allocation in the recurrent budget. The interview schedules were used to interview two officers each from the offices of the directors in charge of planning at the TSC and MOE headquarters.

3.7 Validity of Research Instruments

Face validity was done by giving the instruments to the experts in the department of education management and foundations to scrutinize their suitability to collect the relevant information free from errors. Content validity was used to ensure that the information was collected in a rational and logical manner which made it relevant to the study.

3.8 Reliability of Research Instruments

Desk reviews of the proformas was done to align them to already existing data gathering tools in the targeted sources of data like MOE and TSC. Given that the data collection tool should be reliable with ability to consistently yield the same results when repeated measurements are taken of the same individuals under the same conditions, this study applied desk review commonly referred to as documentary analysis.

3.9 Data Collection Procedures

The researcher sought permission from the Maseno University Ethics and Review Board to conduct research. The researcher personally visited the targeted offices to familiarize with the officers, left them with the proformas and then arranged to make a second visit when the proformas were collected and interviews done.

The researcher delivered the profomas to the MOE, TSC, KNEC and KNBS headquarters and then collected the fully filled profomas and any relevant documented data in booklets and reports as agreed on by both the researcher and the respondents. From KNBS, the researcher collected population data from the Director in charge of NCPD per given age and sex for the base year 2009, age specific fertility rates, corresponding reproductive women populations, and model life tables. From the EMIS departments of MOE & TSC, data on past time series of enrolments was collected to work out past intake rates, enrolment rates, survival rates, wastage rates, completion rates and transition rates in both Primary and secondary school levels. Interview schedules were done with the permission of TSC Deputy Director in charge of Policy, Planning, Research and Innovations; and the Senior Deputy Director of Education in Policy and Planning who delegated to their officers directly concerned with the needed information. From KNEC, data on KCPE graduates for the last five years was collected to help in determining the transition rate from primary to secondary levels. These were obtained from the office of Senior Administrator, Examinations. Most of the information and data

collected were compared with the information gathered from various economic surveys for validation.

3.10 Method of Data Analysis

Population projections were based on specific assumptions about future changes of birth, death and migration rates. Estimates of the size of the future changes on the rates rested on the evidences derived from analysis of past and current trends, which were obtainable from UN World population prospects data. These assumptions about the change in the parameters were then applied to the present population. Population projections thus showed the prospects for the future size and structure of the population, given their size, structure and trends over time (Ahmed 2000).

The researcher used the single years in the base population of 2009. To determine the school age population, demographic model life Tables shown in Table 4.1 on page 50 were used to determine the survivors of school age in the population; and for determination of the new born babies who formed part of the school age population at age 6 years, age specific fertility rates indicated in Table 4.2 on page 51 were applied on the reproductive female population.

To forecast enrolments in this projection study, cohort projection ProEnrol model was used in which the gross intake rate, promotion rate and repetition rate were used. That model involved the calculation of several cohorts' grade to grade survival rates as well as repeater rates, after which their weighted averages referred to as compounded relationships as indicated in Tables 4.4 and 4.5 on pages 57 and 58 respectively are used to generate the projected enrolments. "This method of compounded relationships entails the multiplication of the grades weighted averages of gross intake, survival, repetition and transition rates to give the researcher a typical flow pattern that is a sequence of the relationship between entry enrolment and exit graduates; that is entry points and exit points", (Chesswas, 1969) as quoted in Mbuthia (2000).

The analysis derived out of the above description was then compared with the information collected from the interviews conducted and documentary evidence gathered from official government reports and statistical briefs. This triangulation guided the researcher while analyzing the information gathered in this study for the sake of conformity and application of the projections.

CHAPTER FOUR

RESULTS AND DISCUSSIONS

4.1 Introduction

This chapter presents the data collected for the purpose of determining the quantities of education resources required for the projected enrolments. The data collected was analyzed to aid in fulfilling the purpose of the study which was to; estimate the school age population for primary and secondary levels of education between 2013 to 2030, estimate the enrolled learners during the same period, estimate optimal number of teachers for the learners, estimate amount of funds needed to support free schooling and optimal number of classrooms required for the same period.

4.2 Projected School Age Population (6-17years) for the Period 2013 to 2030

The school age population was determined by taking the year 2009 as the base year (0), and the 2009 Kenya Population and Housing census as the reference data. Cohort component method was used to estimate the population of school age from the estimates of fertility and mortality. In this method, each cohort of a population is traced throughout its lifetime according to exposures to fertility, mortality and migration. For national level school age population estimations, the effects of international migrations were assumed to be negligible. In this study, demographic model life tables were used to track a cohort's survival throughout the study period and age specific fertility rates were used to determine the new born babies who were going to attain school age of 6 years and be part of the school age population from the year 2016. New born babies were estimated up to the year 2024 as they were going to be the class one entrants in 2030.

The demographic model life tables used in this study were generated from the information obtained from UN Department of Economic and Social Affairs Division; World Population Prospects and is as summarized in Table 4.1.

Table 4.1: Demographic Model Life Tables

Ages	0	1-4	5-9	10-14	15-19	20-24	25-29	30-34	35-39	40-44	45-49
2010-	.9855	.9913	.9913	1.0	.9993	.9565	.9863	.9346	.9207	.9327	.9573
2015											
2015-	.9880	.9931	.9921	1.0	.9995	.9894	.9628	.9409	.9302	.9397	.9683
2020											
2020-	.9905	.9949	.9930	1.0	.9997	.9925	.9691	.9472	.9398	.9497	.9794
2025											
2025-	.9930	.9967	.9938	1.0	.9998	.9956	.9755	.9536	.9495	.9576	.9907
2030											

Source. UN: Department of Economic and Social Affairs; Population Division. World Population Prospects, 2010.

The demographic model life tables or survivorship rates were then used to estimate the school age population aged 6-17 years by using the 2009 population as base year (0), as shown in Appendix H, on page 95. The children who were born in 2009 joined class one in 2015, and therefore new babies born after 2009 had to be estimated as they were going to be the potential school entrants after 2015. The potential mothers of the babies to be born after 2009 were determined and their age specific fertility rates used to project the expected new born children as shown in Appendix I on page 96. The number of the new born children surviving to school ages of 6-17 years was then determined by the use of demographic model life tables.

The same was done in generating the age specific fertility rates for the reproductive female population, in which the information was obtained from UN World Population Prospects; 2010 Revision, Population Division and is summarized in Table 4.2 on page 51.

Table 4.2 :Age Specific Fertility Rates

Years	15-19	20-24	25-29	30-34	35-39	40-44	45-49
2010-2015	93.6	219.4	219.9	162.1	110.9	46.1	30.4
2015-2020	88.0	206.5	212.1	150.0	96.6	38.2	24.1
2020-2025	83.0	195.2	205.4	139.7	84.2	31.4	18.6

Source. UN: World Population Prospects; 2012 Revision, Population Division.

The population of school ages (6-17 years) corresponding to primary and secondary levels of education for the period 2013-2030 were estimated by using 2009 population as the base data and applying demographic model life tables and age specific fertility rates. The estimated school age population data is shown in Table 4.3 on page 52 for every age and year for the period 2013-2030.

Table 4.3: Projected School Age Population for the Period 2013-2030

Years	2013	2014	2015	2016	2017	2018	2019
6	1,200,100	1,012,846	1,152,739	1,295,253	1,298,837	1,313,580	1,316,346
7	1,157,516	1,189,659	1,004,034	1,143,632	1,285,021	1,288,576	1,303,203
8	1,175,982	1,147,446	1,179,309	996,102	1,134,597	1,274,869	1,278,396
9	1,139,272	1,165,751	1,137,463	1,169,993	988,233	1,125,634	1,264,798
10	1,127,317	1,129,361	1,155,609	1,128,477	1,160,750	980,426	1,116,742
11	1,042,041	1,127,317	1,129,361	1,155,609	1,128,477	1,160,750	980,426
12	1,095,593	1,042,041	1,127,317	1,129,361	1,155,609	1,128,477	1,160,750
13	1,065,875	1,095,913	1,042,041	1,127,317	1,129,361	1,155,609	1,228,477
Total	9,003,696	8,910,014	8,927,873	9,145,744	9,280,885	9,427,921	9,649,138
14	1,198,622	1,065,875	1,095,918	1,042,041	1,127,317	1,128,796	1,155,609
15	842,590	1,198,622	1,065,875	1,095,918	1,042,041	1,127,317	1,128,796
16	1,099,837	842,000	1,197,783	1,065,342	1,095,370	1,041,520	1,126,753
17	961,937	1,099,067	841,411	1,197,184	1,064,809	1,094,822	1,040,999
Total	4,102,986	4,205,564	4,200,987	4,400,485	4,329,533	4,392,455	4,452,157
G/Total	13,106,682	13,115,578	13,128,860	13,546,229	13,610,418	13,820,376	14,101,295

Table 4.3: Continued.....

Years	2020	2021	2022	2023	2024	2025
6	1,330,708	1,343,537	1,291,396	1,297,498	1,364,449	1,383,982
7	1,305,947	1,321,393	1,334,132	1,281,194	1,288,416	1,355,989
8	1,292,908	1,296,805	1,312,143	1,323,592	1,272,226	1,280,428
9	1,268,296	1,283,858	1,287,727	1,301,777	1,314,327	1,264,338
10	1,254,806	1,259,418	1,274,871	1,277,554	1,292,665	1,306,178
11	1,116,742	1,254,806	1,259,418	1,274,871	1,277,554	1,292,665
12	980,426	1,116,742	1,254,806	1,259,418	1,274,871	1,277,554
13	1,160,750	980,526	1,116,742	1,254,806	1,259,418	1,274,871
Total	9,710,583	9,856,985	10,131,235	10,270,710	10,343,926	10,436,005
14	1,228,477	1,160,750	980,426	1,116,742	1,254,806	1,259,418
15	1,155,609	1,228,477	1,160,750	980,426	1,116,742	1,254,806
16	1,128,231	1,155,262	1,228,108	1,160,402	980,132	1,116,407
17	1,126,190	1,127,893	1,154,915	1,227,740	1,160,054	979,838
Total	4,638,507	4,672,382	4,524,199	4,485,310	4,511,734	4,610,469
G/Total	14,349,090	14,529,367	14,655,434	14,756,020	14,855,660	15,046,474

Table 4.3 Continued...

Years	2026	2027	2028	2029	2030
6	1,409,042	1,445,735	1,402,983	1,442,280	1,478,057
7	1,374,294	1,400,306	1,436,771	1,394,285	1,433,337
8	1,346,497	1,365,774	1,391,624	1,427,863	1,385,640
9	1,271,465	1,338,149	1,357,306	1,382,996	1,419,010
10	1,254,488	1,263,582	1,329,852	1,348,891	1,374,422
11	1,306,178	1,254,488	1,263,582	1,329,852	1,348,891
12	1,292,665	1,306,178	1,254,488	1,263,582	1,329,852
13	1,277,554	1,292,665	1,306,178	1,254,488	1,263,582
Total	10,532,183	10,666,877	10,742,784	10,844,237	11,032,791
14	1,274,871	1,277,554	1,292,665	1,306,178	1,254,488
15	1,259,418	1,274,871	1,277,554	1,292,665	1,306,178
16	1,254,555	1,259,418	1,274,616	1,277,299	1,292,407
17	1,116,184	1,254,305	1,259,166	1,274,361	1,277,044
Total	4,905,028	5,066,148	5,104,001	5,150,503	5,130,117
G/Total	15,437,211	15,733,025	15,846,785	15,994,740	16,162,908

The school age population increased by 23.32 percent over the projection period from 13,106,682 in 2013 to 16,162,908 in 2030, with primary level age bracket increasing by 22.55 percent from 9,003,696 in 2013 to 11,032,791 in 2030 and secondary level by 25 percent from 4,102,986 in 2013 to 5,130,117 in 2030.

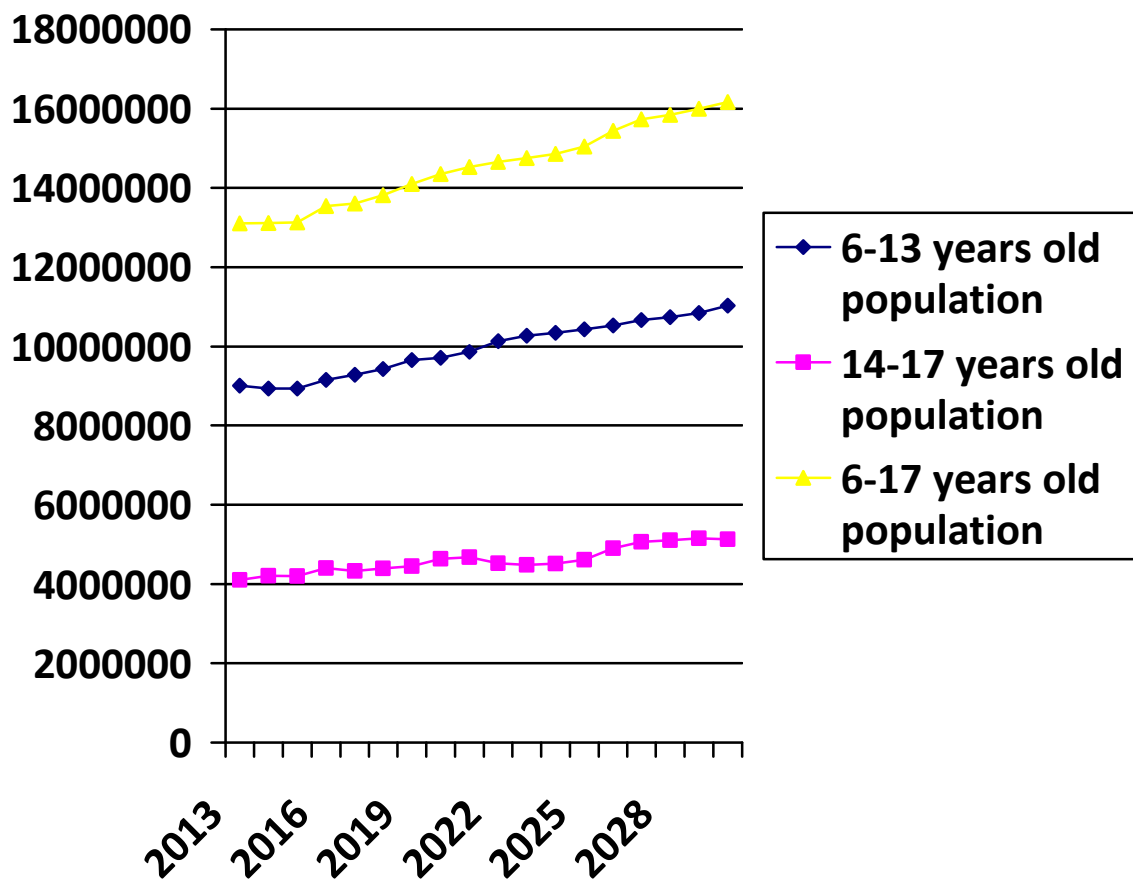


Figure 4.1: The Population of School Age Children Categorized into Primary, Secondary Schools and Total

The graph in Figure 4.1 illustrates the steady increase of school age population for the primary and secondary school levels, and the totals for the period 2013-2030. The growth of primary level population was at a lower rate as compared to secondary level as indicated in Figure 4.1. That could have been due to the high survival rates in the age groups 10-19 years.

4.3 Projected Enrolments of Learners in Primary and Secondary Levels of Education for the Period 2013-2030.

The projected enrolments were estimated by the use of compounded relationships where trend analysis past time enrolment indicators of promotion and repetition rates over time were used. The averages of the promotion and repetition rates together with gross intake and transition rates were then used in cohort projection model explained in Table 2.4 on page 32. These rates were categorized into five year bands with an assumption that internal efficiency would be improving and not static with time. The assumption is that as the government implements the 2010 constitution coupled with more investments in the Education sector, the wastage rate will be reducing as promotion rates improve towards a unitary value. The gross intake rate would be reducing with time towards a unitary value as children would be joining school at the right age of 6 years as time progresses. The transition rates would also be improving towards 100 percent as secondary education which falls under the compulsory basic education is expanded and equally made affordable to the learners.

Table 4.4: Trends of Internal Efficiency at Primary Level and Assumptions into Future Years

Class/Years	2010-2015		2015-2020		2020-2025		2025-2030	
	Prom rate	Rep rate	Prom rate	Rep rate	Prom rate	Rep rate	Prom rate	Rep rate
One	.9403	.0299	.9953	.015	.9628	.0075	.9666	.0038
Two	.9716	.0142	.9787	.0071	.9823	.0036	.9841	.0018
Three	1.0068	.0200	.9968	.0100	1.00	0.0	1.00	0.0
Four	.9590	0.0	.9690	.010	.9740	.005	.9765	.0025
Five	.9824	.0080	.9864	.0040	.9884	.0020	.9894	.0010
Six	1.0178	.0150	1.0103	.0075	1.0065	.0038	1.0046	.0019
Seven	0.8010	0.0	.8085	.0075	.8123	.0038	.8142	.0019
Eight	72%	.0100	80%	.0050	90%	.0025	95%	.0013
Gross intake rate	1.1568		1.0784		1.0392		1.0196	

Source; MOE and Various Economic Surveys

The internal efficiency rates in Table 4.4 above were generated from past enrolment trends at the primary level as indicated in Appendix L on page 104 which were then used to project the primary level enrolments as shown in Table 4.5 on page 58. It was assumed that the promotion rates improved toward a unitary value with time while the wastage rate decreased to an insignificant value as the government improved the learning environment, allocated resources efficiently and enforced the legal instruments in place with a view to fully implementing the compulsory basic education in Kenya as envisaged in the Constitution of Kenya 2010 and Basic Education Act 2013.

Table 4.5: Trends of Internal Efficiency at Secondary Level and Assumptions into Future Years

Class/years	2010-2015		2015-2020		2020-2025		2025-2030	
	Prom rate	Rep rate	Prom rate	Rep rate	Prom rate	Rep rate	Prom rate	Rep rate
Form-one	.9693	.0154	.9847	.0077	.9924	.0039	.9963	.0020
Form-two	.9950	.0025	.9910	.0013	.9988	.0007	.9995	.0004
Form three	.9820	.0090	.9910	.0045	.9955	.0023	.9978	.0012
Form-four		0.0		0.0		0.0		0.0

Source; MOE and Various Economic Surveys

The internal efficiency rates in Table 4.5 were generated from past enrolments trends at secondary level as indicated in Appendix Mon page 104 which were then used to project secondary level enrolments. It was assumed that internal efficiency improved with time as the government implemented progressive programs in the education sector in order to achieve Kenya Vision 2030. The repetition rate in form four was insignificant.

**Table 4.6: Projected Primary and Secondary Levels Enrolments for the Period
2013-2030**

Class/Years	2013	2014	2015	2016	2017	2018
One	1,388,317	1,213,171	1,369,762	1,437,756	1,422,222	1,437,898
Two	1,307,417	1,305,474	1,159,282	1,304,449	1,370,445	1,356,777
Three	1,321,355	1,296,713	1,291,554	1,152,189	1,288,186	1,354,136
Four	1,334,211	1,330,340	1,305,531	1,300,336	1,161,505	1,295,678
Five	1,273,660	1,289,697	1,286,114	1,262,293	1,265,075	1,130,559
Six	1,267,156	1,270,251	1,286,052	1,282,769	1,259,318	1,257,315
Seven	1,177,086	1,289,711	1,292,862	1,308,944	1,305,602	1,281,734
Eight	890,809	951,754	1,042,577	1,046,008	1,058,924	1,056,376
Total	9,960,011	9,947,111	10,033,734	10,094,744	10,131,277	10,170,473
F-one	643,811	651,298	695,293	839,416	843,270	853,633
F-two	517,077	625,339	632,867	685,478	827,464	831,444
F-three	515,485	519,131	626,885	634,106	686,618	828,486
F-four	449,194	506,207	509,787	621,243	628,399	680,439
Total	2,125,567	2,301,975	2,464,832	2,780,243	2,985,751	3,194,002
G/Total	12,085,578	12,249,086	12,498,566	12,874,987	13,117,028	13,364,475

Table 4.6: Continued....

Class/Years	2019	2020	2021	2022	2023	2024
One	1,441,116	1,456,652	1,470,720	1,353,049	1,358,508	1,428,125
Two	1,371,322	1,373,986	1,401,295	1,421,054	1,307,832	1,312,680
Three	1,341,419	1,355,527	1,358,275	1,376,492	1,395,902	1,284,684
Four	1,362,760	1,350,754	1,364,697	1,365,099	1,383,318	1,402,819
Five	1,260,034	1,325,555	1,314,183	1,331,843	1,332,271	1,350,017
Six	1,124,613	1,251,332	1,316,912	1,303,943	1,321,348	1,321,838
Seven	1,276,674	1,145,772	1,269,950	1,330,298	1,317,474	1,334,944
Eight	1,037,233	1,037,377	931,544	1,033,910	1,083,186	1,072,892
Total	10,215,171	10,296,955	10,427,576	10,515,688	10,499,839	10,507,999
F-one	851,674	836,345	836,342	841,652	933,802	978,510
F-two	841,653	834,738	824,634	830,564	835,837	927,291
F-three	833,094	843,298	836,450	825,569	831,827	836,747
F-four	821,030	825,596	835,709	832,686	821,854	828,084
Total	3,347,451	3,339,977	3,333,135	3,330,471	3,423,320	3,570,632
G/Total	13,562,622	13,636,932	13,760,711	13,846,159	13,923,159	14,078,631

Table 4.6: Continued.....

Class/Years	2025	2026	2027	2028	2029	2030
One	1,448,945	1,442,166	1,479,552	1,435,799	1,476,005	1,512,636
Two	1,379,725	1,403,034	1,396,524	1,432,649	1,390,422	1,431,991
Three	1,289,446	1,357,788	1,380,726	1,374,320	1,409,870	1,368,315
Four	1,291,698	1,292,676	1,361,020	1,384,129	1,377,781	1,413,315
Five	1,369,046	1,262,712	1,263,561	1,330,300	1,352,933	1,346,752
Six	1,339,380	1,357,079	1,251,906	1,252,546	1,318,579	1,339,745
Seven	1,335,503	1,348,079	1,365,883	1,260,260	1,260,702	1,327,040
Eight	1,087,058	1,088,780	1,099,022	1,113,531	1,027,552	1,027,800
Total	10,540,801	10,552,314	10,598,194	10,583,534	10,613,844	10,767,594
F-one	969,419	1,034,644	1,036,411	1,039,494	1,055,941	978,287
F-two	971,074	966,221	1,031,203	1,032,989	1,036,061	1,052,449
F-three	928,103	970,960	966,903	1,031,848	1,033,711	1,036,784
F-four	832,982	926,062	968,824	964,776	1,029,578	1,031,437
Total	3,701,578	3,897,887	4,003,341	4,069,107	4,155,291	4,098,957
G/Total	14,242,379	14,450,201	14,601,535	14,652,641	14,769,135	14,866,551

The enrolments increased by 23 percent between 2013 and 2030 from 12,085,578 to 14,866,551. Primary sub-sector recorded 8.1 percent, from 9,960,011 to 10,767,594 while the secondary sub-sector recorded 92.84 percent, from 2,125,567 to 4,098,957. The available data in the Ministry of Education (ROK 2014b) indicated that the primary schools actual enrolments for 2013 and 2014 were 9,856.6 and 9,950.7 in thousands respectively which compared closely with the study's findings for those years (9,960,011 and 9,947,111 respectively). Secondary schools enrolments for the 2013 and 2014 in the Ministry's data record indicated 2,104.3 and 2,331.7 in thousands respectively which compared quite closely to the study's findings (2,125,567 and 2,301,975 respectively).

The small increase in estimates observed in the primary level could have been as a result of the initial high gross enrolment rates which moped most over aged learners in the system and that reduced with time; coupled with improved gross intake rate towards a unitary value and internal efficiency whereby the right school aged learners were enrolled in their corresponding classes. This was confirmed by the ROK (2014b) which indicated that primary schools net enrolment ratio in 2014 was 88.2 percent while gross enrolment rate was 103.5 percent. The secondary level had a higher increase in the estimate as a result of improved transition rate from primary, improved internal efficiency and expanded access among others. There were many potential secondary school age population not enrolled initially hence more learners were bound to enroll at this level once conditions were made attractive for them. That was attested to by the ROK (2014b) report which indicated that secondary schools net enrolment in 2014 was only 47.4 percent while the gross enrolment rate was equally low at 58.7 percent. This means that most of secondary school age population was not enrolled despite the resource constraints already being experienced. Attracting this non enrolled into the schools will demand that resources provided to schools are efficiently allocated to make learning environment conducive.

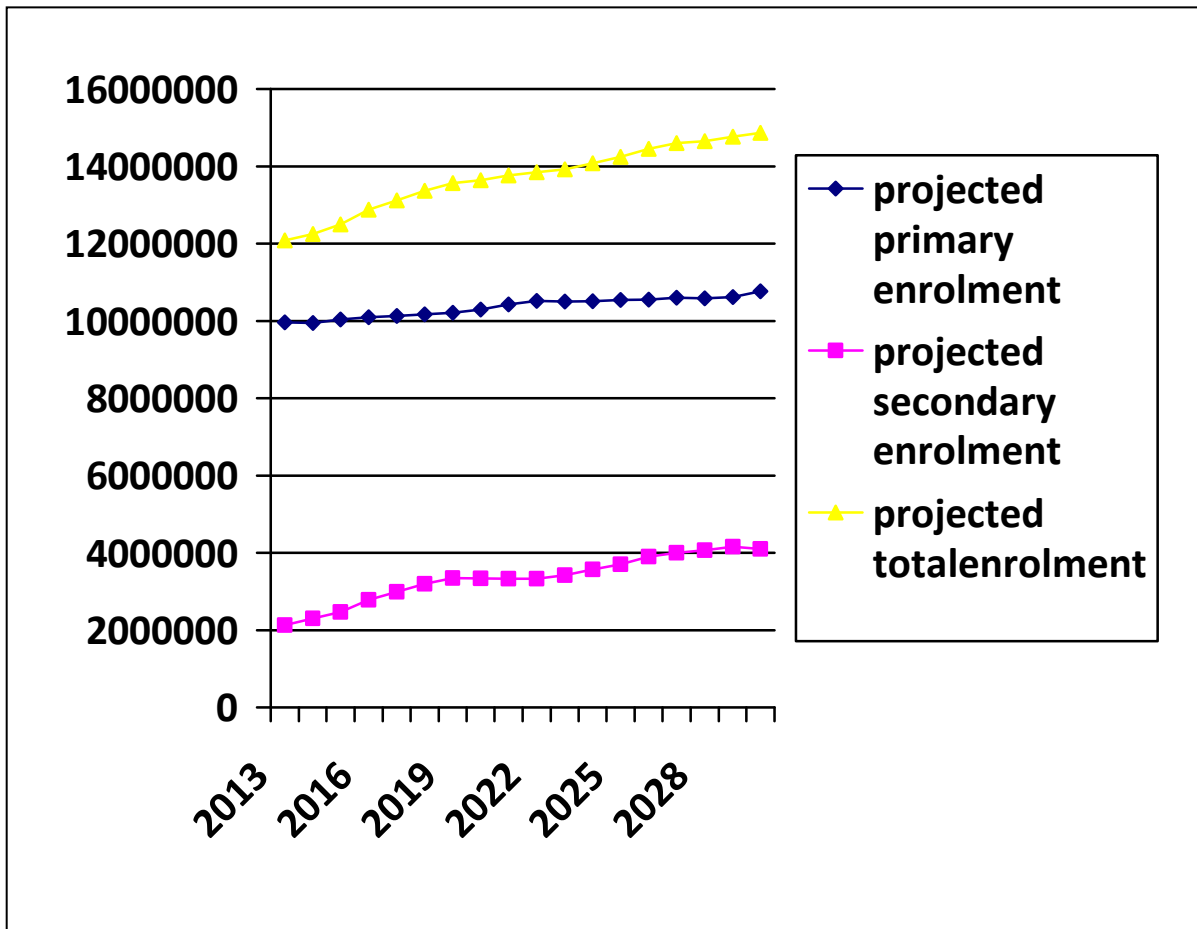


Figure 4.2: Projected Enrolments in Primary and Secondary Levels Plus Their Totals for the Period 2013-2030

The graph in Figure 4.2 indicated that the projected enrolments in secondary level almost doubled from 2,125,567 to 4,098,957 over the period under the study while primary level had a slight increase from 9,960,011 to 10,767,594.

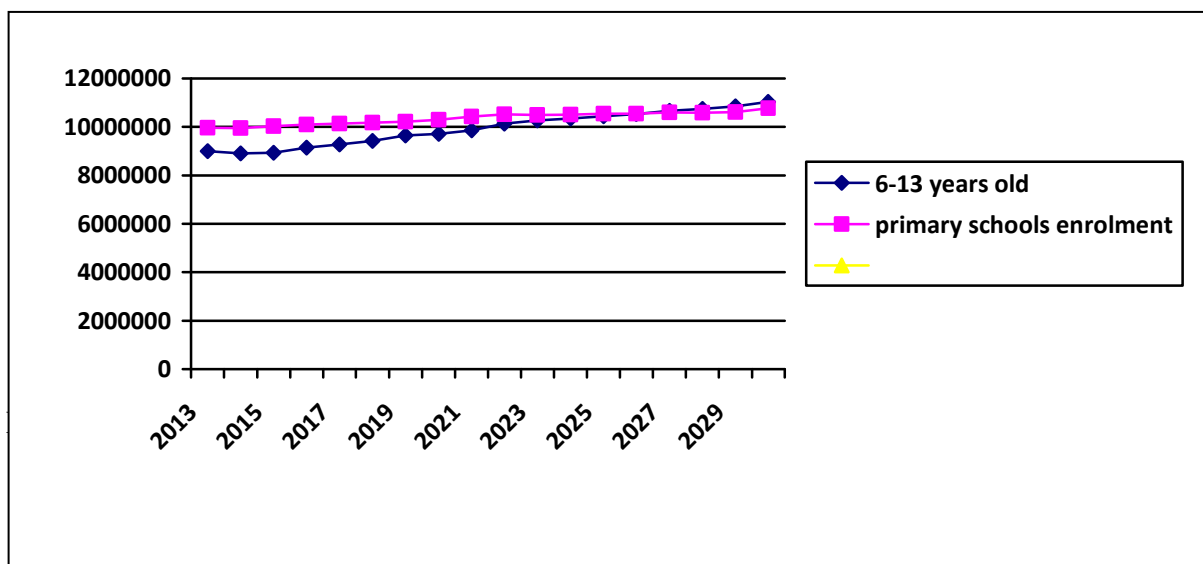


Figure 4.3: Level Enrolments for the Period 2013-2030 Compared

Figure 4.3 illustrates that the projected 6-13years old population increased at a faster rate as compared to that of projected primary level enrolments. This implied that the education system was becoming more efficient with time and the children would be attending school at the right age, and possibly attaining a gross enrolment rate of 100 percent in the year 2026. Fig 4.3 in page 52 has primary school age estimated as 10,532,183 and Fig 4.6 in page 66 has primary enrolment estimated as 10,552,314 translating to a gross enrolment rate of 100.18 percent.

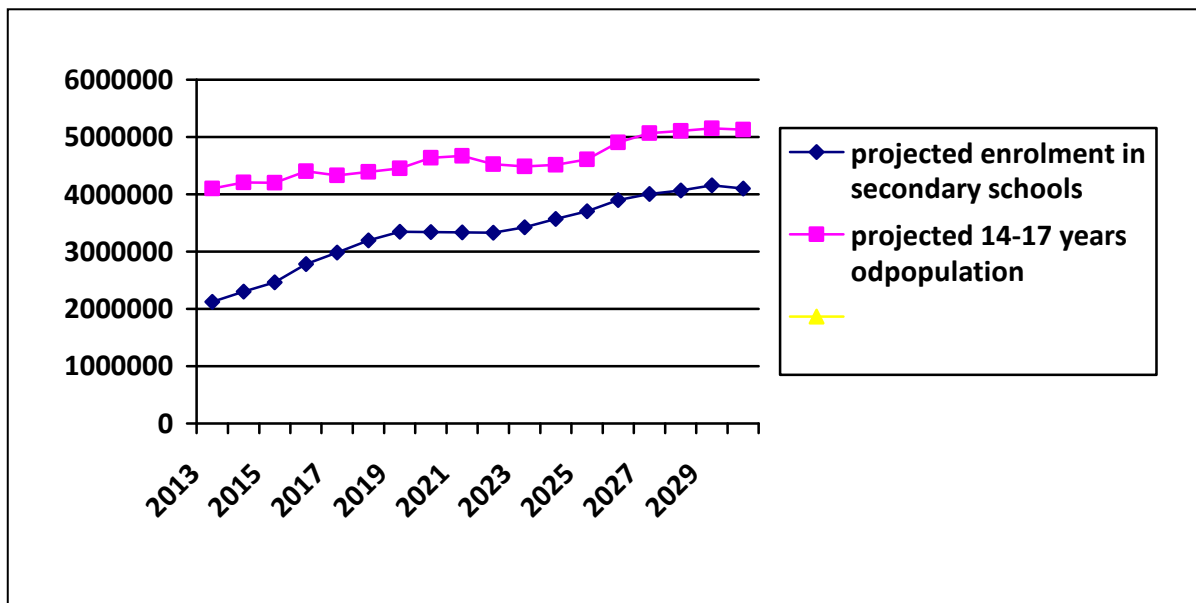


Figure 4.4: Projected 14-17 Years Old Population Compared with Enrolments in Secondary Schools for the Period 2013-2030

Figure 4.4 illustrated that the gap between the 14-17 years old population which corresponds to secondary school ages and the enrolments in secondary schools reduced with time. It showed that in 2013, many of the secondary school age population were out of school and with time, most of them had access to schools. That could possibly be due to the progressive efforts made by the government to attract them to school, for instance FDSE, more schools being built, improved transition rates, better legislations and expanded access among others. Some secondary school age children will still be not enrolled by the year 2030 due to the opportunity cost of attending school in that age group, some will be in the labour market and others may be the ones heading their households due to orphan hood hence very hard to have them in school.

4.4 Estimates of the Optimum Number of Teachers Required for the Projected Enrolments in Primary and Secondary Levels of Education in Kenya for the Period 2013-2030

The estimates of the required teachers for the projected enrolments were given in a segregated way in which the primary and secondary levels were done separately. This was done so because the teachers' staff establishment was calculated differently at the two levels.

According to Teachers Service Commission's staffing manual of 2008, deployment of teachers in primary schools is based on an establishment of one teacher per class plus 2.5 percent of the total number of teachers in a sub-county. This is applied while at the same time maintaining the official PTR of 40: 1 given that the government of Kenya while registering basic education institutions officially indicates in the certificate of registration one classroom to accommodate 40 learners being handled by one teacher at any given instructional time. Therefore the estimation factor for establishing the projected primary schools teachers required each year is total enrolment in a year divided by 40 and then add 2.5 percent, which is summarized as $(N/40)+(2.5/100*(N/40))$ where n stands for total enrolment.

In secondary schools, deployment of teachers according to the TSC staffing manual of 2008 is as per the curriculum based establishment (CBE) of a school, however each teacher is required to teach a minimum of 27 lessons per week translating to 18 hours in a week. Each stream of a class has got at least 9 lessons of 40 minutes a day translating into 30 hours in a week. Institutional administrators are however allocated a lower work load to allow them more time for administrative duties. This is done while at the same time striving to achieve the official PTR of 40: 1 as already explained above. The estimation factor for the projection of secondary schools teachers required in a year is generated as follows: one stream is allocated 30 hours in a week while one teacher covers 18 hours per week giving a factor of

30/18*N/40 which is summarized as 1.667*N/40 where N is the total secondary schools enrolment in a given year.

Table 4.7: Projected Estimates of Optimum Number of Teachers Required for the Period 2013-2030 in Kenya

Year	Primary Enrolment	Primary Teachers	Secondary Enrolment	Secondary Teachers	Total Teachers
2013	9,960,011	255,225	2,125,567	88,566	343,791
2014	9,947,111	254,895	2,301,975	95,916	350,811
2015	10,033,734	257,114	2,464,832	102,702	359,816
2016	10,094,744	258,678	2,780,243	115,852	374,530
2017	10,131,277	259,614	2,985,751	124,417	384,031
2018	10,170,473	260,619	3,194,002	133,094	393,710
2019	10,215,171	261,764	3,347,451	139,177	400,941
2020	10,296,955	263,860	3,339,977	139,177	403,037
2021	10,427,576	267,207	3,333,135	138,892	406,099
2022	10,515,688	269,465	3,330,471	138,781	408,246
2023	10,499,839	269,059	3,423,320	142,650	411,709
2024	10,507,999	269,268	3,570,632	148,789	418,057
2025	10,540,801	270,108	3,701,578	154,245	424,353
2026	10,552,314	270,403	3,897,887	162,425	432,828
2027	10,598,194	271,203	4,003,341	166,820	438,023
2028	10,583,534	271,203	4,069,107	169,560	440,763
2029	10,613,844	271,980	4,155,291	173,151	445,131
2030	10,767,594	275,920	4,098,957	170,804	446,724

Table 4.7 illustrated that total teacher requirement over the study period would increase by 29.9 percent from 343,791 in 2013 to 446,724 in 2030. Teachers required projection by the government (ROK 2012b) was to increase by 17 percent from 263,060 in financial year 2011/2012 to 370,846 in financial year 2015/2016. The study estimated the teachers required in 2016 to be 374,530 which compared favorable to the governments projection for that year.

The primary sub-sector teachers would only increase marginally by 8.1 percent while the secondary would increase by 92.86 percent, which is after replacing those teachers who leave the service annually. It implied that if the government could have provided adequate primary level teachers by 2012, then new teachers requirements at that level was going to be lighter. At the secondary level, more teachers would be needed to serve the expected influx of learners at that level.

According to ROK (2014b) report, the actual data of teachers in primary schools in Kenya in 2014 were; public primary TSC teachers were 201,622 and School Management Committee (SMC) teachers were 40,449 giving a total of 242,971. The private schools employed 75,406 teachers for primary level. Overallly 317,477 teachers were teaching the learners enrolled in primary schools in 2014. This resulted in a PTR of 41.5:1 for TSC teachers; 34.5: 1 overall public schools and 21.1:1 in private schools. Overallly the PTR in primary schools was 31.3:1.

This study estimated the teachers required to handle the projected primary level enrolment in 2014 to be 254,895. This estimation was done using the PTR of 40; 1 which is the official government rate. It is therefore important to note that the teachers who were in schools in 2014 were not efficiently allocated to schools. The reason for this is that the PTR was as low as 31.1:1 while the education sector still experienced teacher shortages some schools then, implying that teachers were not efficiently balanced in schools. The imbalance is at times caused by the regional disparities between the high potential and the low potential areas in terms of enrolments.

The ROK (2014b) report indicated that TSC had engaged 72,194 secondary school teachers while the Boards of Management (BOM) engaged 35,524 teachers giving a total of 107,718 teachers in public schools. Private secondary schools engaged 10,890 teachers. In total, there were 118,608 teachers handling all the learners enrolled in secondary schools in 2014 in

Kenya. These resulted in PTR of 30:1 for TSC in public schools; 20: 1 in public schools for both TSC and BOM teachers; 14:1 in private schools and an overall PTR of 19.7.

This study estimated secondary schools teachers required in 2014 to be 95,916, at a PTR of 40: 1. It can be noted that the actual teachers in secondary schools, both public and private; both TSC and privately engaged were not efficiently allocated to schools. This is attested to by the low PTR in all the instances cited above from the ROK (2014b) report. It is therefore noted that the teachers in secondary schools in 2014 were not efficiently allocated to schools due to the overall low PTR of 19.7: 1 while many schools were still understaffed at the time (ROK, 2014b).

4.5 Projection of Free Schooling Funds

This study used current government capitation rates for funding free schooling in primary and secondary schools. Given that there was no government policy regulating how the capitation was increased with time, it was assumed that the current capitation would be applicable during the study period. Kshs 1020.00 for FPE and Kshs 10,265.00 for FDSE were used from 2013 to 2014, and then the new rates of Kshs 1,420.00 for FPE and Kshs. 12,870.00 for FDSE announced by the government in 2015 were applied for the rest of the study period. Given that the government had only adjusted the capitations only once, a trend could not be established to come up with a factor to be used to determine future disbursements, hence the current rate was used.

In case the government in future revises the capitation grand rates upwards, then the already estimated enrolments per year would be applied to the revised rates. The estimated free schooling funds using the current government capitation grand rates are as presented in Table 4.8 in page 71.

**Table 4.8: Projected Free Schooling Funds Required to Support FPE And FDSE
For the Period 2013-1030 in Kenya**

Year	Primary enrolment	FPE funds (Kshs. billions)	Secondary enrolment	FDSE funds (Kshs. billions)	Total (Kshs billions)
2013	9,960,011	10.16	2,125,567	21.82	31.98
2014	9,947,111	10.15	2301,975	23.63	33.78
2015	10,033,734	14.25	2,464,832	31.73	45.98
2016	10,094,744	14.35	2,780,243	35.78	50.13
2017	10,131,277	14.39	2,985,751	38.43	52.82
2018	10,170,473	14.45	3,194,002	41.12	55.57
2019	10,215,171	14.51	3347,451	43.08	57.59
2020	10,296,955	14.63	3,339,977	42.99	57.62
2021	10,427,576	14.81	3,333,135	42.90	57.71
2022	10,515,686	14.94	3,330,471	42.87	57.81
2023	10,499,839	14.91	3,423,320	44.06	58.97
2024	10,507,999	14.92	3,570,632	45.96	60.88
2025	10,540,801	14.97	3,701,578	47.64	62.61
2026	10,552,314	14.99	3,897,887	50.17	65.16
2027	10598194	15.05	4,003,341	50.91	65.96
2028	10,583,534	15.03	4,069,107	52.37	67.40
2029	10,613,844	15.08	4,155,291	53.48	68.56
2030	10,767,594	15.29	4,098,957	52.75	68.04

The projections in Table 4.8 in page 71 revealed that FPE funding would increase by 50.49 percent; that is from Kshs. 10.16 billion to Kshs. 15.29 billion during the study period, while the FDSE funding would increase by 141.75 percent; that is from Kshs. 21.82 billion to Kshs. 53.48 billion. Overall the funding for free schooling would increase by 112.76 percent, from Kshs. 31.98 billion to Kshs. 68.04 billion during the study period. The Kenya education sector mid-term review of financial year 2013/2014 reported that the government spent Kshs. 10.0 billion and Kshs.21.82 billion to fund FPE and FDSE programmes respectively. This study equally estimated that the free schooling fund required to fund FPE and FDSE in the year 2013 would be Kshs.10.16 and Kshs. 21.82 billion which closely estimated with the actual spending then.

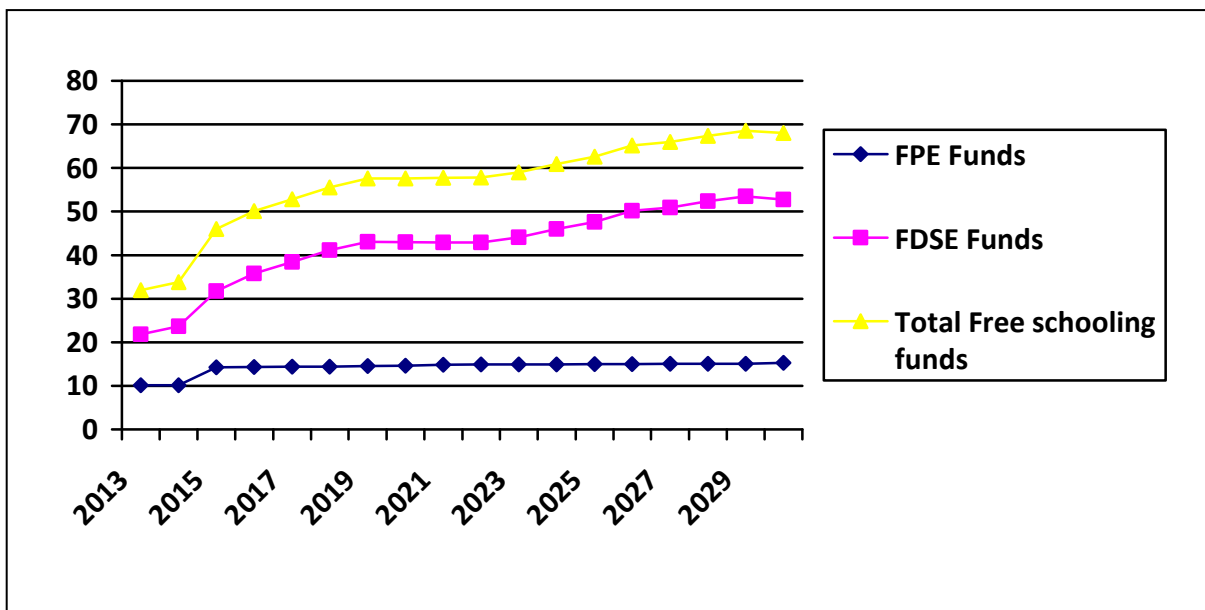


Figure 4.5: Projected Free Schooling Funds (FPE and FDSE Funds) Required for the Period 2013-2030 in Kenya.

There was a sharp increase in funding between 2014 and 2015 due to the increased capitation by the government in the year 2015.

4.6 Projection of Optimal Number of Classrooms

Thus study used the recommended learners to classroom ratio of 40: 1 to estimate the number of classroom required to optimally accommodate the projected learners at both primary and secondary levels. This is the ratio which is officially used by the government to allocate to a school its expected optimal enrolment figure depending on the streams when registering institutions of basic education in Kenya. The estimation factor is therefore $N/40$ where N is the total enrolment. The estimated optimal number of classrooms required for the projected enrolments in this study was as indicated in Table 4.9 in page 74.

Table 4.9 : Projected Classrooms Required to Accommodate the Learners for the Period 2013-2030 in Kenya

year	Primary enrolment	Primary classrooms	Secondary enrolment	Secondary classrooms	Total classrooms	no.
2013	9,960,011	249,001	2,125,567	53,140	302,141	
2014	9,947,111	248,678	2,301,975	57,550	306,228	
2015	10,033,734	250,844	2,464,832	61,621	312,465	
2016	10,094,744	252,369	2,780,243	69,506	321,875	
2017	10,131,277	253,282	2,985,751	74,644	327,926	
2018	10,170,473	254,262	3,194,002	79,850	334,112	
2019	10,215,171	255,380	3,347,451	83,787	339,067	
2020	10,296,955	257,423	3,339,977	83,450	340,873	
2021	10,427,576	260,690	3,333,135	83,329	344,019	
2022	10,515,688	262,917	3,330,471	83,262	346,179	
2023	10,499,839	262,496	342,3320	85,583	348,079	
2024	10,507,999	262,700	3,570,632	89,266	351,966	
2025	10,540,801	263,520	3,701,578	92,540	356,060	
2026	10,552,314	263,808	3,897,887	97,448	361,254	
2027	10,598,194	264,955	4,003,341	100,084	365,039	
2028	10,583,534	264,588	4,069,107	101,728	366,316	
2029	10,613,844	265,346	4,155,291	103,883	369,229	
2030	10,767,594	269,190	4,098,957	102,474	371,664	

The Table 4.9 revealed that during the period under study, classrooms requirement would increase by 23 percent; which were disaggregated as 8.1 percent for primary and 92.84

percent for secondary schools. However the primary level would require 167,716 more classrooms than the secondary level in the year 2030 as indicated Table 4.9 in page 74.

ROK (2014b) indicated that there were 236,389 permanent and 67,758 temporary classrooms in primary schools in 2014 in Kenya. This resulted in class sizes of 36 learners. This study estimated permanent classrooms required as 248,678 in 2014 at a class size of 40. This shortage of 12,000 permanent classrooms concurs with the UNESCO 2008-2015 classrooms projection report that that Kenya required additional 15,000 new classrooms at primary level, taking into consideration the temporary classrooms and the class sizes.

ROK (2014b) further indicated that there were 54,648 permanent and 6,375 temporary classrooms in secondary schools in Kenya in 2014. This resulted in class sizes of 38 learners. This study estimated permanent classrooms required in 2014 as 57,550 in 2014 at a class size of 40 learners giving a shortage of 2,902 classrooms. Taking into perspective the temporary classrooms which should be made permanent ,this study results concurs with the UNESCO 2008-2015 classrooms projection report that indicated that Kenya required an additional 5,000 new classrooms for secondary schools.

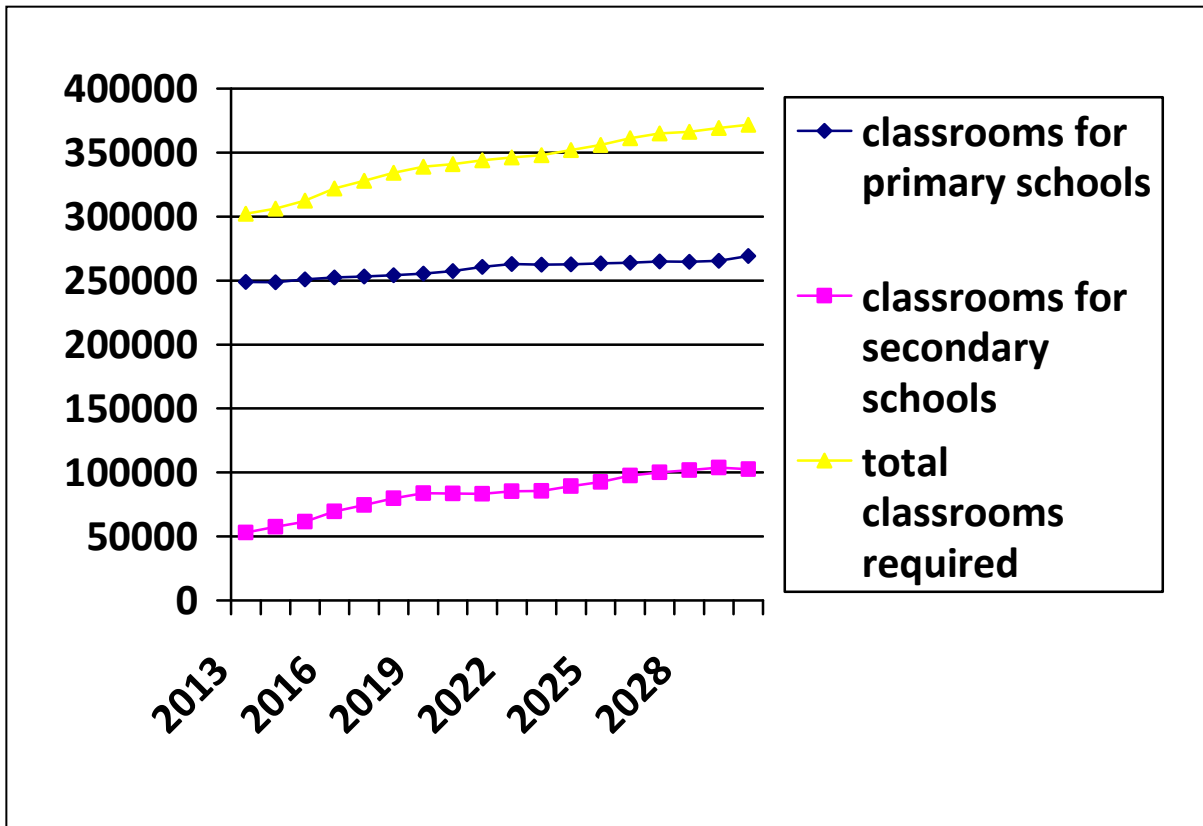


Figure 4.6: Projected Classrooms Required From 2013-2030

Figure 4.6 illustrated that the number of classrooms required increased with time. The number of required classrooms increased at a higher rate in the secondary level than the primary level.

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

Kenya's past efforts to attract all school age population to schools by introducing free schooling has always resulted in significant increment in enrolments. The increased enrolment led to overcrowding in classrooms and overburdened teachers among other inadequacies. The main problem has been that educational resources availed to schools in most cases have not been adequately and efficiently allocated to schools to serve the school age population. This study therefore used trend analysis of time series data and demographic variables to project educational resources which would efficiently serve the projected enrolments in the period under study that is 2013-2030.

5.2 Summary of the Main Findings

The school age population (6-13 years) was projected for the years 2013-2030. The population would increase by 23.32 percent from 13,106,908 to 16,162,908 between the years 2013 to 2030 respectively. Primary level population increased by 22.55 percent from 9,003,696 to 11,032,796 while the secondary level population increased by 25 percent from 4,102,986 to 5,130,117. The school age population was revealed to be increasing in numbers over this period, and being the potential population to be enrolled in schools, it meant that education resources in the schools must be expanded to serve the increasing numbers.

Under the prevailing enrolment trends in Kenya's education system, the expected enrolments in the schools for the period 2013-2030 were estimated. In total, the enrolments were projected to increase by 23 percent from 12,085,578 to 14,866,551 with the secondary level projection registering a massive 92.84 percent increment while the primary level would only register 8.1 percent.

The slight increase in primary level could have been influenced by the improved internal efficiency leading to mainly 6-13 years old attending school as compared to the initial enrolments which even recorded gross enrolment rates beyond 110 percent. The massive increase in secondary level enrolments could have equally been caused by the improved internal efficiency hence attracting the potential learners of 14-17 years who were initially locked out of the education system, making this sub sector to record gross enrolment rates below 60 percent. In addition, there is a consensus in the literature that secondary education long neglected is now the fastest growing in the developing world (World Bank, 2005). This finding therefore means that a lot of education resources would have to be injected in the secondary level of education to cope up with the expected sharp increase in enrolment as compared to the primary level.

Required teachers for the projected enrolments were estimated to increase by 29.9 percent from 343,791 to 446,720 teachers during the period under study. The primary sub sector of education teacher requirement would increase from 255,225 to 275,920 giving an increase of 8.1 percent, while the secondary sub sector would increase from 88,566 to 170,804 giving an increase of 92.86 percent. According to TSC records, teachers in the service in 2012 were 191,054 at primary and 64,338 at secondary levels. This implied that as per this projection then teacher shortages at the beginning of 2013 were 64,191 at primary and 24,228 at secondary levels giving a total shortage of 88,419 teachers at the beginning of 2013. The official teacher shortage according to TSC in 2012 was 75,574 teachers, which conforms to the projected teacher requirement. These shortages should be first bridged and there after 5,800 teachers be recruited annually to cope up with the increasing enrolments.

Free education funding in Kenya would equally be increased to cater for the projected school enrolments for the period 2013-2030. It was estimated that the funds would have to be increased by 112.76 percent from Kshs. 31.98 billion in 2013 to Kshs. 68.04 billion in 2030. FPE funding would increase by 50.49 percent that is from Kshs. 10.16 billion in 2013 to Kshs. 15.29 billion and FDSE funding would increase by 141.75 percent from Kshs. 21.82 billion in 2013 to Kshs.53.48 billion in 2030. The Kenya education sector mid-term review 2013/2014 reported that the government spent Kshs. 10.0 billion and Kshs. 21.85 billion to fund FPE and FDSE programmes respectively. This report was in conformity with the funding projection in this study for that financial year, hence attesting the reliability of the estimates.

The increased enrolments projected meant that new classrooms would also have to be constructed to accommodate the learners. The expected number of classrooms would increase by 23 percent from 302,141 to 371,664 classrooms. The secondary schools would require more new classrooms as compared to the primary level due to the sharp enrolment increase revealed in secondary level. While the primary level would require around 20,000 new classrooms after offsetting the shortages by 2012, the secondary level would require additional 49,000 new classrooms during the study period. It therefore implied that the government needed to construct approximately 3,833 new classrooms annually to accommodate the new entrants.

5.3 Conclusion

It can be concluded from the results of this study that the school age children increased in numbers by 23.32 percent from 13,106,682 to 16,162,908 between the years 2013 to 2030. The primary schools age bracket increased by 22.32 percent and secondary schools age bracket by 25.00 percent. The demand for secondary education would therefore be higher than the primary education and more education resources would be required to meet the demand.

The estimated enrolments in schools during the period 2013 to 2030 would be as follows; overall the enrolments would increase by 23.00 percent from 12,085,578 to 14,866,551. Primary level of education would have an increment of 8.1 percent, from 9,960,111 to 10,767,594 while the secondary level of education would have an enrolment increase of 92.84 percent from 2,125,567 to 4, 098,957.

The estimated teachers required in schools during the period of study would be as follows; the total increase would be 29.9 percent from 343,791 to 446,724. The primary schools teachers required would increase by 8.1 percent from 255,225 to 275,920 while the secondary schools teachers required would increase by 92.86 percent from 88,566 to 170,804 over the study period.

The free schooling funds for FPE was projected to increase by 50.49 percent from kshs 10.16 billion to kshs 15.29 billion while the FDSE funds required would increase by 141.75 percent from kshs 21.82 billion to kshs 53.48 billion during the 2013-2030 study period.

Classrooms required for the primary and secondary schools during the period 2013-2030 would increase by 23.00 percent from 302,141 to 371,664. The primary schools classrooms required would increase by 8.11 percent from 249,001 to 269,190.

For secondary schools, there would be a 92.84 percent classrooms required from 53,140 to 102, 474.

This study has, therefore made projected estimates of quantities of teachers, classrooms and free schooling funds for the period under study which would efficiently serve the expected enrolments once provided. The adequate and efficient provision of the resources coupled with improved internal efficiency in the education sector would produce a society with skilled and competent work force to participate in the knowledge based economy.

5.4 Recommendations

5.4.1 Policy Recommendations

The main revelation of this study was that the school age population continued to rise on a yearly basis and hence the demand for education would equally continue to grow in Kenya.

Therefore there would be a need to train and recruit more teachers who would handle the increasing enrolments. The government should bridge the deficit of 88,000 teachers estimated in 2013 and then continue recruiting 5,800 additional teachers annually to satisfy the demand.

For the compulsory basic education to succeed, the free schooling funds should be enhanced by allocating more funds to the FPE and FDSE kitty by at least Kshs. 2.0 billion annually. The per capita disbursement to schools should also be reviewed periodically to be in tandem with the GDP growth and inflation rates.

In order to make schools attractive and their environment friendly to the learners, more infrastructure especially classrooms should be constructed. The government would have to

bridge the current deficit and then continue building approximately 3,800 new classrooms annually to accommodate the ever increasing enrolments.

5.4.2 Recommendations for Further Studies

Further research could be done in establishing secondary schools teachers' requirement by subject area of specialization for training purposes.

The study could also be replicated in various regions and counties in order to establish their specific resource requirements but in a shorter time frame of possibly 5 years.

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APPENDICES

Appendix A: To Kenya National Bureau of Statistics (KNBS) Headquarters: Population Estimates for the Given Years, Ages and By Sex

POPULATION ESTIMATES FOR THE GIVEN YEARS, AGES AND BY SEX

YEAR	2015	2020	2025	2030
AGES				
0-4				
5-9				
10-14				
15-19				
20-24				
25-29				
30-34				
35-39				
40-44				
45-49				

Appendix B: To Kenya National Bureau of Statistics (KNBS) Headquarters: Demographic Life Table and Age Specific Fertility Rates

DEMOGRAPHIC LIFE TABLE AND AGE SPECIFIC FERTILITY RATES

AGES IN YEARS	LIFE TABLE OR SURVIVORSHIP	AGE SPECIFIC FERTILITY RATES
0-4		
5-9		
10-14		
15-19		
20-24		
25-29		
30-34		
35-39		
40-44		
45-49		

Appendix C: To Ministry of Education Headquarters: Enrolment Data for Primary Schools

ENROLMENT DATA FOR PRIMARY SCHOOLS

	STD 1	STD 2	STD 3	STD 4	STD 5	STD 6	STD 7	STD 8	TOTAL
YEAR									
2003									
2004									
2005									
2006									
2007									
2008									
2009									
2010									
2011									

Appendix D: To Ministry of Education Headquarters: Enrolment Data for Secondary Schools

ENROLMENT DATA FOR SECONDARY SCHOOLS

YEAR	FORM 1	FORM 2	FORM 3	FORM 4
2008				
2009				
2010				
2011				

Appendix E: KNEC Proforma Candidates Registered For The National Exams

	KCPE CANDIDATES	KCSE CANDIDATES
YEAR		
2003		
2004		
2005		
2006		
2007		
2008		
2009		
2010		
2011		

Appendix F: Interview Schedule for TSC Deputy Director of Policy, Planning, Research and Innovations

This interview will be conducted for the purpose of a research study to fulfill partial requirement for the award of a master degree in planning and economics of education, Maseno University

1. What are the latest official teachers understaffing figures for the primary and secondary levels of education in Kenya?
2. What are the current pupils to teacher ratio in Kenya for both primary and secondary levels of education?
3. What is currently the approximate number of trained primary and secondary schools' teachers trained but yet to be engaged by TSC?
4. The enrolment of pupils both at primary and secondary levels of education has been increasing while the number of teachers has remained almost the same, what is the TSC's long term plan to ensure that the nationally recommended ratio of pupils to teacher ratio of 40:1 is attained?
5. Some reports and research studies do reveal that urban areas experience teachers overstaffing while rural and ASAL experience the opposite, what then are the challenges faced by TSC when it comes to equitable distribution of teachers?, and what are the measures being put in place to normalize balancing of teachers?
6. Does TSC have a policy to regularly network with teacher training institution to update them on secondary schools teacher specialty areas of demand as per the TSC teacher requirement projections in Kenya? If yes, then briefly describe the nature of the policy implementation strategies.

Appendix G: Interview schedule for the MOE Senior Deputy Director of Education, Policy and Planning Directorate.

This interview will be conducted for the purpose of a research study to fulfill partial requirement for the award of a master degree in planning and economics of education, Maseno University.

1. Is the government of Kenya on track to achieve the MDG No. 2 and EFA goals by 2015? If yes, then what initiatives are being put in place to enroll the last 5% which is normally difficult to enroll; and if no, then what are the main challenges being faced by the government?
2. Are there plans by the government to adjust FPE and FDSE funds per pupil allocation in future in correlation with the inflation rates? If yes, what would be the simulation model to be used?
3. What is the government's long term plan on the provision of infrastructure, more so the classrooms?
4. What are some of the legislation measures put in place to enforce the implementation of Article 53 of the Constitution?
5. What would the Vision 2030 flagship projects for the education sector be in the next phase of 2013-2017 implementation periods in regards to access, infrastructure, teacher recruitment and budgetary allocations?

Appendix H: Kenya Population in the Base Year 2009

Ages	Male	Female	Total	Ages	Male	Female	Total
0	616,843	605,094	1,221,937	26	287,628	318,801	606,429
1	535,669	522,409	1,058,078	27	301,149	307,594	608,743
2	627,496	615,292	1,242,788	28	284,397	325,692	610,089
3	602,260	596,431	1,198,691	29	252,254	259,315	511,569
4	618,171	599,641	1,217,812	30	408,767	436,575	845,342
5	600,714	579,082	1,179,796	31	208,824	192,856	402,680
6	590,310	577,107	1,167,417	32	258,945	263,059	522,004
7	541,370	528,350	1,069,720	33	182,163	179,514	361,677
8	561,120	553,788	1,114,908	34	197,336	190,467	387,803
9	539,155	526,720	1,065,875	35	322,130	317,533	639,663
10	612,711	585,911	1,198,622	36	179,097	180,115	359,212
11	418,412	424,178	842,590	37	172,970	166,333	339,303
12	567,671	532,930	1,100,601	38	174,949	188,033	362,982
13	487,708	475,577	963,285	39	155,215	152,257	307,472
14	478,811	450,946	929,757	40	279,503	287,743	567,246
15	459,517	436,317	895,834	41	120,396	111,398	231,794
16	434,776	421,622	856,398	42	141,166	133,262	274,428
17	423,615	400,013	823,628	43	104,889	105,089	209,978
18	456,815	430,878	887,693	44	97,640	95,083	192,723
19	348,930	357,060	705,990	45	188,301	192,067	380,368
20	449,030	518,139	967,169	46	119,888	116,652	236,540
21	304,475	338,394	642,869	47	108,445	108,866	217,311
22	353,807	415,489	769,296	48	110,739	116,301	227,040
23	327,503	382,716	710,219	49	107,903	103,583	211,486
24	319,290	366,260	685,550				
25	403,688	460,708	864,396				

Source; Statistical Abstract 2013, KNBS

Appendix I: Projected Mothers, New Born Babies and Class 1 Entrants In 6 Years Time After Being Born

Years	Mothers population	New born babies population	Years	Class1 entrants 6 years later
2010	9,386,987	1,374,586	2016	1,298,837
2011	9,427,972	1,386,271	2017	1,313,580
2012	9,500,705	1,396,307	2018	1,316,346
2013	9,516,602	1,408,983	2019	1,330,708
2014	9,619,291	1,412,751	2020	1,343,537
2015	9,810,848	1,353,124	2021	1,291,396
2016	9,994,741	1,360,888	2022	1,297,498
2017	10,235,735	1,431,629	2023	1,364,449
2018	10,338,318	1,438,655	2024	1,383,982
2019	10,449,963	1,461,008	2025	1,409,042
2020	10,674,254	1,501,302	2026	1,445,735
2021	10,893,011	1,449,476	2027	1,402,983
2022	11,187,955	1,487,385	2028	1,442,280
2023	11,364,582	1,521,528	2029	1,478,057
2024	11,545,213	1,557,639	2030	1,481,061

Source; Generated from base year (0) 2009 population census.

Appendix J: Past Enrolments for Primary Schools (000s)

Year/Class	Class 1	Class 2	Class 3	Class 4	Class 5	Class 6	Class 7	Class 8
2003	1,311.7	1,018.4	945.2	922.6	854.8	793.2	762.1	551.5
2004	1,252.4	1,139.4	953.7	923.4	846.5	818.7	817.5	643.1
2005	1,206.2	1,127.6	977.4	963.6	859.9	842.9	873.0	651.7
2006	1,161.3	1,089.9	1,062.2	1,040.5	898.2	848.7	895.0	635.8
2007	1,243.1	1,162.3	1,188.3	1,093.8	992.2	908.7	831.0	704.7
2008	1,316.1	1,228.5	1,180.6	1,171.4	1,082.0	979.5	903.9	701.9
2009	1,326.6	1,289.9	1,213.0	1,149.7	1,136.0	1,035.1	954.1	727.1
2010	1,468.5	1,336.0	1,250.8	1,241.8	1,167.4	1,120.1	1,054.7	741.5
2011	1,503.9	1,379.9	1,312.1	1,322.5	1,243.6	1,183.0	1123.2	704.7

Source; Ministry of education, Economic surveys for various years

Appendix K: Past Enrolments For Secondary Schools

Year/Form	Form 1	Form 2	Form 3	Form 4
2008	387,673	313,360	337,573	297,301
2009	445,321	377,143	312,860	337,310
2010	498,933	443,944	398,609	311,898
2011	521,601	460,021	413,045	373,053
2012	532,128	513,938	457,427	411,330

Source; Ministry of Education and various economic surveys

Appendix L: Candidates for KCPE and KCSE Examinations

YEARS	KCPE Candidates	KCSE Candidates
2003	587,961	207,730
2004	657,747	222,676
2005	671,455	255,260
2006	666,432	237,576
2007	704,737	265,310
2008	695,710	301,400
2009	727,100	333,816
2010	746,080	354,341
2011	776,214	410,586
2012	811,930	432,443

Source; KNEC Reports and various Economic Surveys

Appendix M: Research Approval Letter



**MASENO UNIVERSITY
SCHOOL OF GRADUATE STUDIES**

Office of the Dean

Our Ref: PG/MED/037/2010

Private Bag, MASENO, KENYA
Tel:(057)351 22/351008/351011
FAX: 254-057-351153/351221
Email: sgs@maseno.ac.ke

Date: 16th June, 2014

TO WHOM IT MAY CONCERN

**RE: PROPOSAL APPROVAL FOR OLOO FREDRICK ODUOL —
PG/MED/037/2010**

The above named is registered in the Master of Education in Planning & Economics of Education Programme of the School of Education, Maseno University. This is to confirm that his research proposal titled "*Efficient Allocation of Educational Resources in Primary and Secondary Schools in Kenya. A Projection for the Period 2013-2030*" has been approved for conduct of research subject to obtaining necessary permissions/clearances that may be required beforehand.



Pauline Andang'o

Dr. Pauline Andang'o

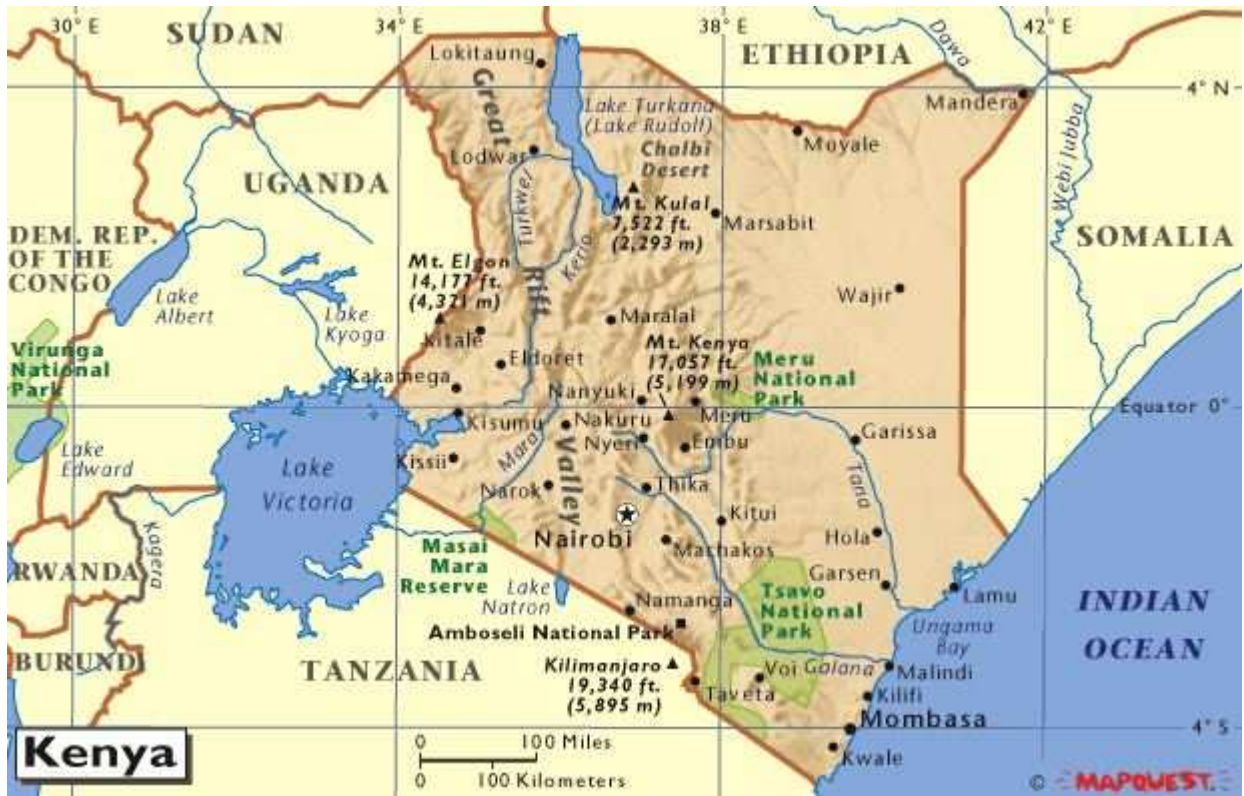
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Appendix N: Map of the Study Area and Its Boundaries



Source: Google Earth System, 2017