DETERMINING THE OPTIMAL ENROLMENT IN PUBLIC SECONDARY SCHOOLS OF MARAKWET DISTRICT

BY

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DECLARATION

This research project is my original work and has not been presented for a degree in any other university.

KIROP REUBEN KIPKEMOI DATE

This research project has been submitted with my approval as the university supervisor.

PROF. G. MSE DATE

Department of Educational Administration, Planning and Curriculum Development
Kenyatta University
DEDICATION

To my beloved wife Sarah and our dear children Kipkorir and Chebet
ACKNOWLEDGEMENT

I would like to thank all those who helped in one way or another in the course of this research project. The preparation of the same has been a challenging task made possible through a number of individuals. I am grateful to the department of education administration, planning and curriculum development of Kenyatta University. I am grateful to Dr. Ogeta, Dr. Onyango and Dr. Shiundu for taking me successfully through the course.

My special thanks go to Prof. G. Mse who was my supervisor. I attribute the success of this project to his tireless efforts and hard work.

Thank you all and may our lord bless you.
ABSTRACT

The issue of school size has been a central issue in school administration. This has been so because of the fact that it has been a (dependent) variable in which other educational variables (especially cost and quality) depend upon. The challenge faced by stakeholders in the educational sector has been that of determining the school size that was considered optimal. This was the enrolment in which efficiency could be realized. The problem under investigation in this study was how to determine the optimal school size.

Some of the Research questions that guided the study included: what was the optimal size for secondary schools in the district, was there any relationship between school size and school expenditure, what was the recurrent per pupil expenditure and what was the perception of the school managers on the optimal school size.

The purpose of this study was to determine the optimal school size that enhances internal efficiency in the operation of secondary schools in Marakwet District. The study was also aimed at determining the minimum school enrolment point above which the unit cost of education increases and below which it is fiscally uneconomical to operate it.

The study was to provide important information to educational planners and policy makers to determine the optimal size of secondary schools. Both theoretical and conceptual framework was used in the study. A theoretical framework of a cost function in education was used. Regression equations were estimated in linear forms to determine the coefficients of the variables and their significances. A conceptual framework that showed how optimal school size was determined through appropriate combination of school inputs was used.
Literature related to the study was reviewed. It was studied under the following subheadings: school enrolment size, internal efficiency in schools, enrolment and summary.

A research design for this study was descriptive. Data for study was collected from a population of 26 secondary schools in the district. 12 schools were sampled out from the population for the study. A pre-testing of the research instrument used was done to attest its validity and reliability. The research instruments used was a questionnaire, which was completed by the principals of the 12 sampled schools.

The research found out that there was an inverse correlation coefficient between the per student recurrent expenditure and the school size. This implied that as the school size was increased, the cost thereof decreased and vice versa.

The correlation coefficient of school size squared was positive. This meant that the long run cost curve was parabolic which depicted that school size could not be increased indefinitely. The optimal school size for the schools in the study was 320 students. The unit cost of education at the optimal school size as Kshs.17,503.30.

Most of the sampled schools were not operating at the optimal size hence there existed internal inefficiencies in their operations.

The research recommended that school managers and stakeholders should be guided by such studies in their planning in order to avoid inefficiencies and diseconomies of scale. Schools that were under-enrolled should be matched while those that are over-enrolled should create more streams so as to enjoy economies of scale.
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### ABBREVIATIONS AND ACRONYMS

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<tr>
<td>ASAL</td>
<td>Arid and Semi Arid Lands</td>
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<tr>
<td>ATC</td>
<td>Average Total Cost</td>
</tr>
<tr>
<td>CDF</td>
<td>Constituency Development Fund</td>
</tr>
<tr>
<td>DEB</td>
<td>District Education Board</td>
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<tr>
<td>EFA</td>
<td>Education for ALL</td>
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<tr>
<td>FPE</td>
<td>Free Primary Education</td>
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<tr>
<td>GDP</td>
<td>Gross National Product</td>
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<tr>
<td>GoK</td>
<td>Government of Kenya</td>
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<tr>
<td>KCSE</td>
<td>Kenya Certificate of Secondary Education</td>
</tr>
<tr>
<td>MC</td>
<td>Marginal Cost</td>
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<tr>
<td>MoE</td>
<td>Ministry of Education</td>
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<td>NGOs</td>
<td>Non Governmental Organization</td>
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CHAPTER ONE: INTRODUCTION

The relationship between school size and educational outcomes has been a vital issue in the process of educational planning and policy making because of its manpower and fiscal implications. It is a significant variable in any formula of optimization of the educational system and reconciliation of educational quality with limited economic resources.

1.1. Background to the study

The increase in school enrolments at all levels and among almost all the less developing countries is the most dramatic feature of educational development over the past two decades. (Table 1.1). Two major forces were behind this dramatic increase in enrolments. First was the strong social and political demand for education and the second is the force pushing up enrolments has been the growth of population. As enrolments have expanded, it has been difficult, and more often impossible for education systems to maintain the level of quality and efficiency of the pre-expansion era. Facilities-classrooms, equipment and teaching materials-have not kept pace with the expanding number of students. (MOEST, Statistical booklet 1999-2002)

During the period before 1963, education in Kenya was provided on a racial basis. The education system was designed to meet the needs of the colonial regime as a result, the colonial administration spent little money on African education and therefore the enrolment was low at various educational levels. Kenya attained independence in 1963 the government quite aware of the role of education in national development, had to abolish racial segregation in the education system and allocate more financial resources to education. (Ndiritu, 2004).

Kenya saw that her immediate challenge was to reform the education system so as to meet the growing demands. National Development Plans were drawn up in the country which included the expansion of the education system as an ingredient for national development. The first National Development Plan observes, "Education and national development are so closely
related to in a developing country that it is almost impossible to speak of one without the other" (Republic of Kenya, 1966-1970).

Kenya like most developing countries faced great shortages of trained manpower at all levels and they wished to replace expatriate workers as quickly as possible. In the former colonial territories, the local people had often received little public sponsored education and they had to make up this by seeking further education in the independent government. What made the situation more difficult was the fact that demand for education feeds upon itself i.e. that once people graduate from primary schools; they increasingly wish to enter secondary school. Also should the employment prospects for primary dry up, then the demand for secondary level increase and so on up the educational ladders. Secondary education was perceived as a level where manpower was developed to replace the colonial departing masters. As it was in the 1966-1970 Nation Development Plan, "the highest priority in education is the rapid expansion and diversification of secondary schools," (Republic of Kenya, 1966 -1970).

Following the introduction of Free Primary Education (FPE) in January 2003, the enrolment of children increased from 5.9 million in 2002, to 7.4 million in 2004 and further 7.7 million in 2007. The Gross Enrolment Rate (GER) for 2004 stood at 108% for boys and 101.6% for girls giving an overall GER of 104.8% at the primary level. This is a remarkable improvement over the figure for 2002, which stood at 88.2%. According to Ministry of Education (MOEST) statistical booklet, (1999 - 2002), these pupils received instructions in 17,804 public and 1839 private schools. Another 103,628 primary school age children were enrolled in a non-formal schools and centres. The repetition rate at primary level declined from 13.2% in 1999 to 9.8% in 2003. The dropout rate declined from 4.9% in 1999 to 2.0% in 2003. The primary school completion rates stood at 76.2% in 2004 compared to 62.8% in 2002.
According to MoE statistics, there were 4111 secondary schools, including public and private schools in 2004. The total enrolment for the period was 926,149 with 48% being female students. This enrolment at the secondary school level had grown by 18.3% from 882,390 students in 2003 to 1,043,467 in 2006. The number of secondary schools had increased from 4071 in 2003 to 4506 Kenya Certificate of Secondary Education (KCSE) centres in 2006. The GER in secondary schools has remained low at 30% throughout 1990s and in the early part of 2000. In 2004, the national GER was 31.7% for boys and 27.3% for girls. With the implementation of FPE, the institutional imbalance between primary and secondary education had grown and the situation was more acute in urban slums and Arid and Semi-Arid Lands (ASAL) areas. In Marakwet District for example, there were 368 primary schools in 2006, a total of 14,720 pupils enrolled in standard eight, all vying for places in secondary schools, which could only admit a maximum of 1,170 students.

Table 1.1: Size of Enrolment in Kenya (1990 - 2006)

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<tbody>
<tr>
<td>Primary</td>
<td>5,392,319</td>
<td>5,536,396</td>
<td>5,692,319</td>
<td>5.9m</td>
<td>7.2m</td>
<td>7.7m</td>
</tr>
<tr>
<td>Secondary</td>
<td>618,461</td>
<td>632,388</td>
<td>661,824</td>
<td>868,390</td>
<td>926,149</td>
<td>1,043,467</td>
</tr>
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Source: MOEST (Gender policy in Education, 2007).
Efficiency in the allocation and utilization of educational resources

According to the World Bank, (1974), most developing states seem to allocate too much on education but in actual fact high cost is due to inefficient utilization of the available resources. An area of interest that arose out of rapid educational expansion is that of efficiency. The education system had an obligation to see that within its accepted objectives, these resources were allocated and utilized efficiently. Insufficient facilities and school equipment implies that choice had to be made between retraining teachers, provision of classrooms and school supply such as textbooks with the dwindling GDP so as to maintain high quality education.

The third National Development Plan on the efficient utilization of resources pointed out the government's intention to lower the unit cost of education by expanding on the basis of existing institutions rather than building new ones. It intended to make a three stream school the minimum size of a school.

Education, in common with all activities which uses scarce resources, must be analyzed and placed in the overall perspective of a community's united resources on one hand, and its diversity of aspiration on the other. Among the major Concerns of any public sector planners were the problems of ensuring that;

- The total volume of resources devoted to the sector as a whole was of the right magnitude.
- The total resources of a sector were optimally allocated among the different claimants within the sector e.g. teachers' salaries, equipment and so on.
- The resources within departments were utilized in the most economically efficient way.
Since education is now a major sector in so many countries, and accounts for such a large expenditures, it seems certain that efficiency questions will continue to receive growing attention in the coming years. The present economic problems and the possibility of an even more serious situation in future have made it imperative that education resources should be optimally utilized.

Education in Kenya seems to be facing a growing financial constraint. As pointed out by World Bank (1980), the increasing demand of education on public finance at a time when government funds are stagnating or even falling in many countries can only be resolved by either finding additional sources of financial support or reducing unit cost through greater efficiency.

The ever-growing demand for education, the resultant expansion of education systems, rising costs in education because of inflation and the need for more and more sophisticated (and thus more expensive) equipment, have all led to massive increase in spending in education in Kenya. Education in common with all other countries which use scarce resources, must be analyzed and placed in the overall perspective of a community's limited resources.

Comparative costing for an educational system should be made on the basis of expenditure per pupil and could then be prepared to draw up any cost difference associated with variations in school size.

Enhancing internal efficiency in Kenya's educational sector is a worthwhile end and that should be pursued. An attempt should be made to reduce unit cost by ensuring efficient resource utilization.
1.2. Statement of the Problem

Teachers wanted small school size; those who manage the educational system generally wanted larger classes. These opposing forces succeeded in most instances in finding a tolerable equilibrium (optimal school size). The issue of school size has been debated and discussed for decades in research journals, state legislatures, boardrooms and staffrooms. Depending upon the seat in which one sat, the bias of the arguments was quite different. School mangers recall with fondness the bygone days when a teacher taught a class of about 50 students and everyone learned the multiplication facts. Teachers on the other hand, intuitively know that they could do a better job with 30 or so students than with 50.

Regardless of the lack of empirical evidence, school boards and state legislatures recognize that there was a certain school class size maximum beyond which effective teaching and learning (internal efficiency) could be jeopardized. Teachers content that the -minimum set by the MoE of 40-45 students per class was too high while school mangers reiterated that reducing class size by even one student across all classrooms could cost a fortune. Both sides were correct, and therein laid the dilemma. The concern of this study was to determine the optimal school size and internal efficiency in secondary schools of Marakwet District.

1.3. Purpose of the Study

In using the cost function to analyze secondary school optimal enrolment, the study was to do the following: Use data on school expenditure to determine the school optimal size, find out if there existed internal economies of scale in the secondary schools and draw conclusions and recommendations that could help policy makers and implementers to lower the unit cost in the operation of secondary schools.
1.4. Objectives of the Study

The specific objectives that the study was expected to achieve included:

i) To determine whether internal efficiency exists in the schools.

ii) To find out the relationship between school expenditure and size.

iii) To determine school optimal size and draw conclusions and some recommendations on how policy makers may lower the unit costs in the operation of secondary schools.

1.5. Research Questions

i) What is the position of the schools as far as internal efficiency was concerned?

ii) What is the per pupil recurrent expenditure for these schools?

iii) What is the relationship between school size and school expenditure?

iv) In which ways could the school resources be combined to attain the same results at different costs?

v) What is the optimal size for these public secondary schools?

vi) What was the perception of school managers on the optimal school size?

1.6. Significance of the Study/Rationale

i) The study was to provide useful information for educational planners and policy makers to determine the optimal size of secondary schools.

ii) Head teachers would be able to understand the major determinants of efficient resource allocation in schools.

iii) Board of Governors and the school administrators would be able to determine whether efficiency existed in their schools.

iv) MoE and DEBs would use it as a guide to allocate resources e.g. grants to schools and regulate inputs into educational system.
v) Principals would be able to know how much it would cost the school if it had to enroll more students (i.e., the unit cost).

1.7. Assumptions of the Study

The following assumptions were made for the purpose of the study:

i) There was a direct relationship between the number of students enrolled and the school expenditure.

ii) Schools with low enrolment-resource ratio incurred high unit cost than those with high enrolment-resource ratio when all other variables were held constant.

iii) A ceteris paribus assumption was made as far as Government intervention in school size was concerned.

iv) A ceteris Paribus assumption was made on other contravening variables.

1.8. Limitations and Delimitations of the Study.

i) Obtaining the information on school finances was not easy. The data collection may not have been accurate.

ii) Prices of commodities keep on changing. This was because the economy was not static.

iii) There was a lot of drop-out and transfers among the students in this area of the study.

iv) The instrument used, principals’ Questionnaires, was only filled by the head teachers.

v) The area of study was small.

vi) The infrastructure of the area was poor.

vii) Being self-sponsored, finance was a limitation.
To achieve the objectives, the study only used endogenous inputs. Due to its complexity, exogenous variables were not included in the study.

1.9. Theoretical Framework

Education is a production process, which uses up scarce resources that have opportunity cost as noted by Jencks et al. 1972. "It is true that schools have 'inputs' and outputs and that one of their nominal purpose is to take human 'raw materials' (i.e. children) and convert it into something 'valuable'," (Jencks et al., 1972: 256). The production function theory can be applied in education industry. A production function is a mathematical statement of the relationship between various inputs and output arrived at by trial and error analysis which suggests the best contribution of inputs needed to produce the output. (Atkinson, 1983). The pressure for efficiency not only entails the minimization of cost of a given output, but also ensures selection of the most efficient optimal output level.

Schools operate under several variables, number of teachers, class size, school size, and home backgrounds, social, economic and cultural factors of the students which affect educational output. Psarchoropoulos and Woodhall (1985) and Atkinson (1983) refer to the analysis of input-output relationship in education as educational production function which causes a change in the learners.

Education production function is a complex mathematical statement that involves many variables. To measure the entire efficiency of education system, there is need to go beyond examination results as a measure of output of the school system. There is a need to look at the rates of return of a given level of education system. This is what is referred to as external efficiency of the education system. To meet the objectives of the present study however, no attempt made to determine the effects of educational inputs on the outputs. Since the study was
not concerned with the external efficiency of the secondary schools, no attempt was made to come up with a regression analysis between the dependent variable and the independent variables.

In determining whether internal efficiency and economies of scale exist in the secondary schools, there is need to determine the average cost curve over the long run. A production function framework was used in this estimation. Suppose the total output of any school unit, that is, the number of students in the school in a given year, is given by,

\[ Q = F(s_1, s_2) \] \hspace{1cm} (i)

For a school to produce a certain level of output, it has to combine inputs in some proportions. To determine the internal efficiency of a secondary school, the cost function over the long run had to be found out. In resource utilization, cost function analysis helped to shed some light on the way total cost of inputs or their average cost changed in relation to the size of an industry or institution. Through this, one was able to determine the most efficient (optimal) size for an institution. Suppose the total output of any school unit (number of pupils) in a given year was given by,

\[ F(S_1, S_2) = F(S_3, S_4, \ldots, S_n) \] \hspace{1cm} (ii)

Where

\[ S_3, S_4, \ldots, S_n = \text{unit measure of input into the school system.} \]

If the price of input was represented by \( P \), then the unit cost of all the input that went to the production of a given quality of education will take the form,

\[ C = F(S_1, S_2, P_1, P_2, \ldots, P_m, S_4, \ldots, S_n) \] \hspace{1cm} (iii)
If the major factors affecting the unit cost of a pupil were the prices of the major goods and services which served as inputs into education, then the long run cost function was as follows,

\[ C = F (a, b, c, d, e, f, g, h) \] ................................. (iv)

Where,

- \( C \) = per pupil recurrent expenditure
- \( a \) = School size
- \( b \) = per pupil non-school recurrent expenditure
- \( c \) = Teacher qualifications
- \( d \) = Teacher experience
- \( e \) = Average teacher salaries
- \( f \) = Student - teacher ratio
- \( g \) = Average class size
- \( h \) = School size squared.

Substituting \( X_1 \) for \( C \) and \( x_2, x_3, \ldots, x_n \) for \( a, b, \ldots, h \) for equation (iv). The equation can be written as a regression model as below:

\[ X_1 = a + bX_2 + cx_3 + dx_4 + ex_5 + fx_6 + gx_7 + hx_2^2 \] ........................ (vi)

Where
- \( a \) = constant
- \( b, c, d, \ldots, h \) = coefficient estimates

To test whether internal economies of scale existed in their operations of the secondary schools, a parabolic relationship was assumed to exist between per student recurrent expenditures and school size.
1.10. Conceptual framework

Education is a voracious consumer of resources. It uses limited resources which have opportunity costs. Education like a production process incurred costs. The costs incurred by a school over the long-run was used to depict the optimal enrolment of the same.

Figure 1.1 Components of optimal school size
Education uses a variety of resources to produce a given level of output. Efficiency is normally thought of as minimization of the production cost of any given level of output. The pressure for efficiency not only entailed the minimization of cost but also right allocation of resources. From the figure, educational process was like a production process which used inputs (raw materials) to produce output. There were various ways of combining these inputs to produce a certain quantity of output at various input combinations.

Education, like a production process, aimed at minimizing costs (inputs) and maximizing outputs (graduates). Students are a special kind of input that could be combined with other inputs to produce a maximum number of graduates. The educational resources were categorized into two; exogenous and endogenous. Exogenous inputs were inputs which the school did not have direct control over. Endogenous inputs were the inputs which the school had direct control over and could therefore combine (vary) them appropriately. Examples of endogenous variables were textbooks, classrooms, facilities and class size among others.

Endogenous resources were divided into two categories, variable inputs and fixed inputs. Variable inputs were those which could be altered within a short period of time e.g. textbooks, laboratory requirements and so on. Fixed inputs were inputs that took a comparatively longer time to acquire e.g. libraries, laboratories, and classrooms. When those educational resources were efficiently utilized, they could determine the optimal enrolment size of a school. These resources could dictate the number of students that could be admitted to a school. Those inputs were to be combined appropriately with the enrolled students to bring about optimal school size.
1.11 Definitions of Operational Terms.

Ceteris paribus: An assumption of nothing else changing apart from cost and enrolment.

Diseconomies of scale: Disadvantages of large scale enrolment.

Division: An area under the administration of a District Officer.

Economies of scale: Reduction in minimum average cost that came about through increase in size (enrolment) of a school and equipment.

Endogenous inputs: Inputs that the school has direct control over.

Exogenous inputs: Inputs that the school has no direct control over.

Internal efficiency: The maximum use of resources allocated to a school to achieve the maximum output.

Long run: A period of time long enough for all inputs to be varied.

Optimal size: Most efficient school size.

Opportunity cost: The most desired goods or services that are foregone in order to do something else.

Recurrent expenditure: The cost of running a school. The day to day financial Expenditure of a school.

School size: Total student population in a school.

Unit cost: Ratio of a particular expenditure over a variety of units.
CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

This chapter reviewed literature related to the study. It dealt with what others had done as far as the determination of school optimal size was concerned. It was organized under the following headings: school enrolment, internal efficiency in schools and summary.

2.2 School Enrolment Size

A number of studies have been conducted to determine the school size that was quite efficient (optimal). Some of them concluded that small school sizes were more effective than large ones. One of the most comprehensive of these studies was conducted by Furno and Collins over a five year period. They found that some schools were internally efficient than others. Woodson in 1968 conducted also a comprehensive study of school size in 95 school systems in the US. He concluded that there existed a point on school enrolment that all the inputs were at equilibrium where maximum output is realized. Glass and Smith (1979) said teachers worry about school size more than nearly anything else. Administration wants to increase it, its economically important. According to them, the possibility of reducing school size below the optimal point was fiscally impossible in most schools and dropping the class size from 30 to 28 was not warranted when one considered the cost against the small achievement gains.

Ayot and Briggs (1992), pointed out that there seemed to be an optimal size for schools, however, which if exceeded could cause a fall in efficiency. Nafukho (1991) carried out a research in Kenya in which the established that the optimal size for secondary schools during 1989 was 574. He concluded that at this level of enrolment, schools in Kakamega Districts would be able to lower unit costs. Consequently, the findings revealed that economies of scale were a reality in the operations of secondary schools in the district. Savings that could be
realized by increasing enrolment from 250 to 500 students would be Kshs. 635.25 per pupil. If the school size exceed the optimal, fewer savings would be realized i.e. Kshs. 35.25 per pupil.

Ndiritu, (2004) carried out a research in Kenya in which he established that the optimal size for the schools in the study was 400 students i.e. the most efficient (optimal) size for the schools. At this point there was efficient utilization of resources. He found out that at the optimal size, the minimum amount that could be spent to produce a single output was Kshs. 29,787.19. Any increase beyond the optimal point could result to over utilization of the resources and cost of production could be high. From his regression analysis, if a school with 100 students doubled its enrolment the savings that would result from this would be Kshs. 805 per student. If a school with 200 students increased its size to 300, the savings that would result would be Kshs. 482.20 per pupil. If a school with 200 students attained the optimal size (400 students there could be Kshs. 642 saving per pupil.

Oguntoy, (1982) in a study of the major determinants of secondary education in Ogun state of Nigeria, collected data in 49 secondary schools in 1977. He examined the determinants of secondary schools in the state by use of cost functions. He found out that the optimal size of the secondary schools calculated in the study was 1,333 students, whereas the average enrolment of secondary schools in the state was 599 students. The study showed that if a school with 500 students doubled its enrolment, the savings that could emanate from this measure would be 7.65 Nira per student. If a school with 1000 students raised its enrolment to the optimal point of 1,333 students, the reduction per pupil recurrent expenditure would be 0.34 Nira per student.
2.3 Internal efficiency in schools

An area of interest that arose out of rapid educational expansion was the efficiency question. It was not unreasonable for stakeholders and the government to adopt the position that as a legitimate claimant of increasing proportions of national resources, the educational system has the obligation to see that within its accepted objectives, these resources were allocated and utilized efficiently.

The third National Development Plan on the efficient utilization of educational resources pointed out that the government intended to lower the unit cost of education by expanding on the basis of existing institutions rather than building new ones. Bennet (1972) carried out a study in Uganda using the cost function. In the study, significance of Marginal Cost (MC) as an indicator of extra expenditure incurred when enrolment was increased by one was evaluated. The result of this study was used to plan the expansion of Makerere University in 1966 to 1977.

The study by Burkhead et al (1967) found out that small schools incurred high costs of operation, but as enrolment increased, cost decreased up to the optimal point and the cost of operation increased. Cohn and Hue (1973) examined costs of secondary schools in Michigan State United States of America. From the findings of the study, it was concluded that significant economies of scale existed at varying levels of enrolment in consistency with the theory.

Eicher (1984) in a World Bank study of sub-Saharan Africa examined the potential for reducing unit costs as a way of increasing enrolment within an existing budget. The study recommended that in order to reduce the educational costs, there was need to improve the internal efficiency of educational systems.
Expenditures increase dramatically with a decrease in class size due to additional classroom teachers, classroom equipment and materials and administrative services. Parrel and Schiefelbein (1974) calculated that a 15% increase in the average class size in Chile would produce an annual saving equivalent to 5% of the 1970 annual budget. Since on the basis of available data, no optimum class size could be scientifically established as a function of educational benefits, decisions regarding class size bound by fiscal policy on one hand and curriculum policy on the other. The former dealt with the question of cost-effectiveness of investment in optimally enrolled schools.

2.4 Summary

From the foregoing literature review, it was clear that efficiency and size do not necessarily go hand in hand. Small schools incurred high operational costs but as enrolment increased, cost decreased. As enrolment increased beyond an optimal point, unit costs started to increase hence diseconomies of scale. Production function curves in the long-run could be used to summarize the above.

**Figure 2.1 Production function curves**

![Production function curves diagram](image-url)
Marginal Cost (MC) and Average Total Cost (ATC) functions were used to determine the optimal school size. The marginal cost was the additional cost that was a result of an increase or a decrease in the enrolment of one student while ATC was the total cost divided by the total enrolment. Optimal school size was at the point of intersection of the MC and the ATC. From the figure, the optimal school size was at $E_0$ and the corresponding unit cost was at $C_0$. If the enrolment was increased beyond the optimal point, $E_0$ at $E_2$, the unit cost could increase to $C_2$ which was above the $C_0$, the optimal cost. Similarly, reducing enrolment to $E_1$ could make the operation of the school expensive. The optimal school size was the most efficient size that a school operated at equilibrium.
CHAPTER THREE: METHODOLOGY

3.1 Introduction
This chapter details the approach that was used in the research project. This included design, locale, target population, sample and sampling procedures, research instruments, validity and reliability, data collection procedures and data analysis.

3.2 Research Design
The researcher used descriptive research design. This was because it could describe the state of affairs, as it existed (Kerlinger, 1969). This approach was appropriate because the study would involve fact finding and enquiries of the most efficient (optimal) size in secondary schools.

Orodho, (2003), observed that the descriptive research was designed to obtain information concerning the current phenomena and where possible to draw valid general conclusions from facts discussed. This study sought to determine the optimal school size that was most efficient.

3.3 Locale
Marakwet District has seven divisions; Tot, Tunyo, Tirap, Kapcherop, Chebiemit, Kapyego and Kapsowar. It boarders Baringo and Pokot East districts to the East, Keiyo district to the South, Uasin Gishu and Trans-Nzoia to the West and West Pokot to the North. The district has 26 secondary schools of which nine are provincial schools. Among them are two mixed, five boys and 2 girls' schools. The remaining 17 are district schools. Five among them are girls' boarding schools, three boys' boarding schools, five mixed day schools and four mixed boarding schools.
3.4 Target population

The 26 secondary schools in the district formed the target population of the study. The respondents were drawn from 12 of the 26 principals in the district.

Table 3.1 Target population

<table>
<thead>
<tr>
<th>Type of school in the district</th>
<th>Number of schools</th>
</tr>
</thead>
<tbody>
<tr>
<td>Provincial boys</td>
<td>5</td>
</tr>
<tr>
<td>Provincial girls</td>
<td>3</td>
</tr>
<tr>
<td>District mixed day</td>
<td>3</td>
</tr>
<tr>
<td>District mixed boarding</td>
<td>6</td>
</tr>
<tr>
<td>District boys boarding</td>
<td>5</td>
</tr>
<tr>
<td>District girls boarding</td>
<td>4</td>
</tr>
<tr>
<td>Total</td>
<td>26</td>
</tr>
</tbody>
</table>


3.5 Sampling Technique

Stratified random sampling and purposive sampling technique was used to select samples for the study. As recommended by (Mugenda and Mugenda, 1999), stratified random sampling was used to group the schools in different categories. From each category the actual schools were selected randomly in such a way that each school could have an equal chance of being selected. The schools were categorized into six categories, provincial boys, provincial girls, district mixed day, district mixed boarding, district boys boarding and district boarding girls' schools. Two schools were then chosen randomly from each category to give 12 schools to be studied.
3.6 Research instruments

One research instrument, principal’s questionnaire, was used in the study. A principal's questionnaire on school expenditure, resource endowment and enrolment was developed. The questionnaire contained both structured and semi-structured questions. According to Kinoti, (1998), semi structured could elicit a lot of good quantitative data. The instrument was administered to the school principals.

3.7 Validity and Reliability

(a) Validity

Validity is the degree to which results obtained from the analysis of the data actually represent the phenomenon under study. Piloting was done to check the questionnaire’s content, structure, sequence, meaning and ambiguity of questions. The researcher pre-tested the instruments to ensure that respondents were providing the correct information in relationship with the objectives of the study.

(b) Reliability

Reliability is a measure of the degree to which a research instrument yields consistent results or data after repeated trials. According to Miles and Michael (1994), reliability refers to consistency of measurement: the more reliable an instrument is, the more consistent the measure. The researcher randomly selected a pilot school to test the reliability of the principal's questionnaire through test-retest technique. A correlation coefficient of 0.80 was obtained, then it implied that there was a high degree of reliability of the data.
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3.8 Data Collection Procedure

An introduction letter from Kenyatta University was obtained to enable the researcher to administer questionnaire to the principals. After the approval, a research permit was obtained from MoE, the researcher then personally visited the schools to administer the questionnaire to the principals. This was necessary because some explanations were needed.

3.9 Data Analysis Plan

Before the actual data analysis, the gathered data was validated, edited and then coded. During the validation process, the questionnaire was checked to determine its accuracy and completeness. After going through all the questionnaires, uniform categories of responses were put together, classified and entered into appropriate category in a computer worksheet using SPSS. Rubin and Luck (1992), observed that in any study, it was imperative that an appropriate analytical technique be adopted that would bring out the quantitative meaning of the data.

Descriptive statistics were used which enabled the researcher to meaningfully describe a distribution of measurements using statistics. Data was presented in a number of ways that was easy to interpret such as frequency distribution, tables, histograms and bar charts.

Prior to the actual analysis of the collected data, the raw data was edited and coded. Uniform categories of responses were put together and presented in tabular form. Descriptive statistics was used because it could give the quantitative meaning of the data. Descriptive statistics was also used to enable the researcher to describe the data using statistics.

The variables used in the analysis were the per student recurrent expenditure, per student non recurrent expenditure, school size, number of teachers, average class size, student-teacher ratio and the school size squared to investigate the long run cost curve of these secondary schools. The per student recurrent expenditure was taken as the dependent variable while the other variables as the independent variables.
Linear regression equation was used for all other variables except for school size which used a quadratic equation of the form

$$X_1 = a + bx_2 + cx_2^2$$

Where,

$X_1 = \text{per student recurrent expenditure}$

$x_2 = \text{school size}$

$x_2^2 = \text{school size squared}$

$a = \text{constant}$

$b = \text{coefficient of } x_2$

$c = \text{coefficient of } x_2^2$

This quadratic equation was used to shed some light on the relationship between expenditure level and other educational inputs into the secondary schools.
CHAPTER FOUR: DATA ANALYSIS, RESULTS AND DISCUSSION

4.1. Introduction
This chapter contains the findings of the study on the determination of the optimal school size and existence of internal efficiency in public secondary schools of Marakwet district in the year 2007. The main objectives of the study was to determine the optimal school size and find out whether internal efficiency existed in the public secondary schools of Marakwet district.

4.2. Internal Efficiency
The indicators of internal efficiency in schools include the length in which the school had been in operation (Table 4.1), student composition (Table 4.3) operation of the schools, number and qualification of teachers, the performance of the school in the National Examinations and resource endowment in the school. From the above information, it was observed that most of the school in the district had inadequate number of teachers and teaching – learning resources. The performance in KCSE (Table 4.8) was poor. It was found out that the schools in the district were internally inefficient.

The following data relating to school internal efficiency was analyzed.

Table 4.1 year of school Establishment

<table>
<thead>
<tr>
<th>Year</th>
<th>Number of schools</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1963-1970</td>
<td>2</td>
<td>16.7%</td>
</tr>
<tr>
<td>1971-1980</td>
<td>4</td>
<td>33.3%</td>
</tr>
<tr>
<td>1981-1990</td>
<td>3</td>
<td>25%</td>
</tr>
<tr>
<td>1991-2000</td>
<td>1</td>
<td>8.3%</td>
</tr>
<tr>
<td>2001-2007</td>
<td>2</td>
<td>16.7%</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>12</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>
From the table, 16.7% of the schools sampled in the district were established between 1963 and 1970. Most of the schools established during this period were all Private (Church) sponsored schools. One was a girl school while the other was a boy school. 33.3% of the sampled schools were established between 1971 and 1980. Most of them were Public schools. 25% of the sampled schools were established between 1981 and 1990. This was mostly as a result of Kamunge report of 1988. 16.7% of the sampled schools were established after 2001. They were basically established through the constituency development fund (CDF).

Table 4.2 sponsors of the schools

<table>
<thead>
<tr>
<th>Sponsor</th>
<th>Number of schools</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Private</td>
<td>9</td>
<td>75%</td>
</tr>
<tr>
<td>Public</td>
<td>3</td>
<td>25%</td>
</tr>
<tr>
<td>Total</td>
<td>12</td>
<td>100%</td>
</tr>
</tbody>
</table>

From table 4.2, 75% of the sampled schools were church sponsored. The Africa inland church (AIC) and the Catholic Church were the only churches that established schools in this district. The high percentage of church sponsored schools vis a vis the government sponsored was attributed to the fact that the district was marginalized and ASAL. Only 25% of the sampled schools were government established through harambee and CDF.
Table 4.3 student composition

<table>
<thead>
<tr>
<th>Composition</th>
<th>Number of schools</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Girls</td>
<td>4</td>
<td>33.3%</td>
</tr>
<tr>
<td>Boys</td>
<td>3</td>
<td>25%</td>
</tr>
<tr>
<td>Mixed</td>
<td>5</td>
<td>41.7%</td>
</tr>
<tr>
<td>Total</td>
<td>12</td>
<td>100%</td>
</tr>
</tbody>
</table>

From table 4.3, 33.3% of the sampled schools were girl schools while 25% were boys’ schools. Mixed schools were 41.7% of the sampled schools. There were more girls’ schools than boys’ schools because of campaigns initiated by the community and NGO’s in the mid 1980s to promote girl – child education in the district.

Table 4.4 Operation of the schools

<table>
<thead>
<tr>
<th>Operation</th>
<th>Number of schools</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boarding</td>
<td>9</td>
<td>75%</td>
</tr>
<tr>
<td>Partly boarding</td>
<td>1</td>
<td>8.3%</td>
</tr>
<tr>
<td>Day</td>
<td>2</td>
<td>16.7%</td>
</tr>
<tr>
<td>Total</td>
<td>13</td>
<td>100%</td>
</tr>
</tbody>
</table>

Table 4.4 reveals that most schools sampled were boarding schools. There were 75% of the sampled schools which were boarding schools. The reason behind this was attributed to long distance between the schools coupled by the low population density in the district. This was also so because of the poor infrastructure in the district which made commuting difficult. Only 8.3% of the sampled schools were partly boarding. In most of them, girls were boarders while boys were days scholars. 16.7% of the sampled of the schools were day schools.
Table 4.5 information about the teachers

<table>
<thead>
<tr>
<th>gender</th>
<th>Number of schools</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>132</td>
<td>73.3%</td>
</tr>
<tr>
<td>Female</td>
<td>48</td>
<td>26.7%</td>
</tr>
<tr>
<td>Total</td>
<td>180</td>
<td>100%</td>
</tr>
</tbody>
</table>

Table 4.5 shows that 73.3% of the teachers in the sampled schools were male. This high percentage of male teachers was attributed to the fact that the district was as hardship district. Only 26.7% of the teachers were female. Most of the female teachers were in girls schools which happened to be situated in accessible areas.

Table 4.6 Teachers experience

<table>
<thead>
<tr>
<th>Period of service</th>
<th>Number of schools</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than three years</td>
<td>108</td>
<td>60%</td>
</tr>
<tr>
<td>Over three years</td>
<td>72</td>
<td>40%</td>
</tr>
<tr>
<td>total</td>
<td>180</td>
<td>100%</td>
</tr>
</tbody>
</table>

The 4.6 shows that many of teachers 60%, in the sampled schools had less than three years in service, 40% of the teachers in the sampled schools had been in service for a period of over three years. This was attributed to a high rate of teachers’ transfers out of the district.
Table 4.7 Teachers qualification

<table>
<thead>
<tr>
<th>Qualification</th>
<th>Number of schools</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Untrained</td>
<td>9</td>
<td>5%</td>
</tr>
<tr>
<td>Diploma</td>
<td>45</td>
<td>25%</td>
</tr>
<tr>
<td>Degree</td>
<td>126</td>
<td>70%</td>
</tr>
<tr>
<td>Total</td>
<td>180</td>
<td>100%</td>
</tr>
</tbody>
</table>

70% of the teachers in sampled schools were graduates while 25% were diploma holders. This research found out that most of the diploma teachers pursuing their degree courses in education in various universities on schools based programmes. Only 5% of the teachers in the sampled schools were untrained. Many of the untrained teachers were BOG employees. They were employed to curb the teachers' shortages in most schools in the district. In the 2008 district price giving day, the DEO said that the district had a deficit of over 50 teachers in the secondary level.

Table 4.8 KCSE performance

<table>
<thead>
<tr>
<th>Mean score</th>
<th>Number of schools</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>8-12</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td>6-7</td>
<td>4</td>
<td>33.3%</td>
</tr>
<tr>
<td>4-5</td>
<td>6</td>
<td>50%</td>
</tr>
<tr>
<td>2-3</td>
<td>2</td>
<td>16.7%</td>
</tr>
<tr>
<td>1</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td>Total</td>
<td>12</td>
<td>100%</td>
</tr>
</tbody>
</table>
One of the indicators of internal efficiency in secondary schools is the KCSE performance. It measured the quality of education offered in the school. Table 4.8 shows how the schools performed in 2007 KCSE. None of the sampled schools and in fact not one of all the schools in the district had a mean of 8 and above in 2007 KCSE. 33.3% had a mean of between 6 and 7 while those with a mean of 5 and below were 66.7%. The table shows that there was a general poor performance in the sampled schools in 2007 KCSE. This shows that there was some inefficiencies in the samples schools.
Table 4.9 Teaching learning Resources in the schools.

<table>
<thead>
<tr>
<th>Physical resources</th>
<th>Number of schools</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physics laboratory</td>
<td>8</td>
</tr>
<tr>
<td>Chemistry laboratory</td>
<td>11</td>
</tr>
<tr>
<td>Biology laboratory</td>
<td>8</td>
</tr>
<tr>
<td>Mathematics laboratory</td>
<td>0</td>
</tr>
<tr>
<td>Libraries</td>
<td>8</td>
</tr>
<tr>
<td>Adequate text books</td>
<td>6</td>
</tr>
<tr>
<td>Class rooms</td>
<td>12</td>
</tr>
<tr>
<td>Toilets (adequate)</td>
<td>12</td>
</tr>
<tr>
<td>Workshops</td>
<td>1</td>
</tr>
<tr>
<td>Electricity</td>
<td>6</td>
</tr>
<tr>
<td>Water</td>
<td>12</td>
</tr>
<tr>
<td>Playing grounds</td>
<td>10</td>
</tr>
<tr>
<td>Dining Halls</td>
<td>8</td>
</tr>
</tbody>
</table>

Most sampled schools had one laboratory that was used for all the science practical lessons. Most of them had chemistry laboratories – 91.7%. Only one school had no laboratory at all among the sampled schools. 50% of the sampled schools had adequate text books. This may have been the reason for the general poor performance of the sampled schools. In general the schools in the district were poorly endowed with teaching learning resources.
4.3. Average school size

The researcher used the following variables in the study. Per student recurrent expenditures—which was taken as the dependent variable while the following were taken as the independent variables: school size, school size squared, per student, non-human expenditure, average class size, student–teacher ratio and the number of teachers.

The table below is the analysis of the variables used.

**Table 4.10 major variables**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Unit</th>
<th>Mean</th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Per student recurrent expenditure</td>
<td>Shillings</td>
<td>19,916</td>
<td>11,000</td>
<td>28,000</td>
</tr>
<tr>
<td>2. Schools size</td>
<td>Students</td>
<td>267</td>
<td>57</td>
<td>590</td>
</tr>
<tr>
<td>3. Number of teachers</td>
<td>Teachers</td>
<td>15</td>
<td>6</td>
<td>26</td>
</tr>
<tr>
<td>4. Average class size</td>
<td>Students</td>
<td>59</td>
<td>19</td>
<td>124</td>
</tr>
<tr>
<td>5. Per student non human expenditure</td>
<td>Shillings</td>
<td>1750</td>
<td>1000</td>
<td>2000</td>
</tr>
<tr>
<td>6. Student teacher ratio</td>
<td>Ratio</td>
<td>1:17</td>
<td>1:10</td>
<td>1:24</td>
</tr>
</tbody>
</table>

From table 4.10, the mean size for the sampled schools was 267 students where the smallest school had 57 students and the largest school had 590 students. The mean per student recurrent expenditure was sh. 19916. The lowest was sh. 11,000 and the highest was sh. 28,000.

The mean class size for the sampled schools was 59 students. The school with the lowest class size was 19 students while the highest was 124 students. The average student teacher ratio was 1:17. The highest was 1:24 while the lowest was 1: 10. The mean number of teachers was 15 teachers.
4.4. Per pupil recurrent expenditure

Regressions analysis is a type of analysis used when a researcher is interested in finding out whether independent variables predict a given dependent variable or variables (Mugenda and Mugenda, 2003).

A multiple regression model of the form

\[ X_1 = a + bx_2 + cx_2^2 + dx_3 + cx_4 + fx_5 + gx_6 \]

Was used. Where,

- \( X_1 \) = per student recurrent expenditure
- \( X_2 \) = school size
- \( X_2^2 \) = school size squared
- \( X_3 \) = number of teachers
- \( X_4 \) = average class size
- \( X_5 \) = per student non human expenditure
- \( X_6 \) = teacher student ratio

This model was used to predict the variation of the dependent variable from the independent variables in the model. It was based on the assumption that there was a cause-effect relationship between the values of the variables- both dependent and independent variables. A linear assumption was made on all variables except for school size that was assumed to have a parabolic relationship with the dependent variable. This assumption was held in order to investigate the long run cost curve in the public secondary school in Marakwet district.

Table 4.11 shows the correlation coefficients of the variables. This depicted the relationship between them. The correlation technique was used to analyze the degree of relationship between the variables.
Table 4.11. Correlation coefficient

<table>
<thead>
<tr>
<th></th>
<th>X1</th>
<th>X2</th>
<th>X22</th>
<th>X3</th>
<th>X4</th>
<th>X5</th>
<th>X6</th>
</tr>
</thead>
<tbody>
<tr>
<td>X1</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>X2</td>
<td>-0.8498</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>X22</td>
<td>0.8139</td>
<td>0.9755</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>X3</td>
<td>0.8900</td>
<td>0.9680</td>
<td>0.9230</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>X4</td>
<td>-0.8491</td>
<td>1</td>
<td>0.9782</td>
<td>0.9659</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>X5</td>
<td>0.1930</td>
<td>0.0748</td>
<td>-0.0863</td>
<td>0.1916</td>
<td>0.05918</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>X6</td>
<td>-0.6537</td>
<td>0.8929</td>
<td>0.8438</td>
<td>0.7783</td>
<td>0.883</td>
<td>0.1</td>
<td>1</td>
</tr>
</tbody>
</table>

The regression analysis assumed that:

a. Each independent variable was linearly related to the dependent variable
b. The observations were independent of each other, which implied that the sample was drawn at random
c. Homogeneity of variance existed. I.e., at each level of $X_1$, the variance of $X_2$,...,$X_6$ values were constant
d. $X_1$ values were normally distributed around the mean at each level of $X_2$,...,$X_6$ in the population.

From table 4.10, the per student mean recurrent expenditure was Ksh 19,916. The highest per student recurrent expenditure was Ksh 28,000 while the lowest was Ksh 11,000.

From table 4.11, it is shown that there was a high positive correlation between the school size and the number of teachers. The correlation of 0.8900 indicated that as the school size was increased the number of teachers required should be increased and vice versa.
There was a negative correlation coefficient between the per student recurrent expenditure with the school size. This implied that as the school size was increased, the cost thereof decreases and as the school size was decreased, the recurrent expenditure increased. The teacher-student ratio had a negative coefficient correlation. This depicted that they were inversely related i.e. as the independent variable increased, the dependent variable decreased and vice versa. Teacher-student ratio had a positive correlation coefficient with the school size. This implied that as one of the variables was increased, the other variable increased as well and vice versa. The number of teachers and school size were positively correlated such that when the school size was increased, the number of teachers should increase also.

4.5. School size and school Expenditure

From table 4.11, there was a -0.8498 correlation coefficient between school size and the per student recurrent expenditure. This implied that small schools incurred more expenditure than the larger ones. As the school size was increased, the cost thereof decreased.

The high positive correlation coefficient between the per student recurrent expenditure and the number of teachers implied that both of them vary directly with each other. When one variable increased, the other increased as well. Increased wages and salaries paid to teachers increased the recurrent expenditure incurred by the schools. The correlation coefficient of school size squared was positive 0.8139. This meant that the long run cost curve was curvilinear or parabolic. This curvilinear curve was u-shaped which depicted that school size cannot be increased indefinitely. There was a point in the enrolment, beyond the optimal school size, where the per student recurrent expenditure could start to rise. At this point, internal inefficiencies could be realized which meant that further enrolment could result to increased costs.
4.6. Optimal school size

To estimate the optimal school size, the model which was used to analyze data was given by the equation

\[ X_1 = F(x_2, x_2^2, x_3, x_4, x_5, x_6) \]

Regressive technique was used to estimate the coefficient of the cost functions.

Table 4.12 shows the coefficients of the costs functions

<table>
<thead>
<tr>
<th>Independent variable</th>
<th>Coefficient</th>
</tr>
</thead>
<tbody>
<tr>
<td>( X_2 )</td>
<td>-25.77</td>
</tr>
<tr>
<td>( X_2^2 )</td>
<td>0.0402</td>
</tr>
<tr>
<td>( X_3 )</td>
<td>642.44</td>
</tr>
<tr>
<td>( X_4 )</td>
<td>-103.58</td>
</tr>
<tr>
<td>( X_5 )</td>
<td>2.458</td>
</tr>
<tr>
<td>( X_6 )</td>
<td>-161.96</td>
</tr>
<tr>
<td>Constant</td>
<td>21,633.2</td>
</tr>
</tbody>
</table>

The cost function for the school was given by:

\[ X_1 = 21,633.2 - 25.77x_2 + 0.0402x_2^2 + 672.44x_3 - 103.58x_4 + 2.458x_5 - 161.96x_6. \]

From table 4.12, the regression coefficients for the school size(\( X_2 \)), average class size(\( X_4 \)) and student teacher ratio were inversely related with the dependent variable meaning that as the independent variables increased, the dependent variable decreased and vice versa.

The negative coefficient (-25.77) of the school size implied that as the school size was increased, to the optimal school size, the unit cost decreased. The optimal school size for the schools in the study was 320 students (Appendix) that was the most efficient school size for the schools in the district in 2007. The cost of educating a student in a school that was operating at the optimal school size (320 students) was ksh17,503.30. The mean enrolment of the sampled
schools was 267 students at this enrolment, (267), the unit cost of educating a student was Ksh17, 618.40. A school could save Ksh14.90 per student if it had to increase its enrolment from 267 to 320 students. This was to translate to Ksh36, 768 to be saved.

The cost of educating a student by a school with an enrolment of 400 was Ksh17, 757.20 which was Ksh.81, 248.80 more than a school that was operating optimally. This implied that in either way, internal in inefficiencies were experienced by schools that had their enrolments above or below the optimal size (320 students). An increase in the school size beyond 320 students could lead to diseconomies of scale as depicted by the positive coefficient of school size squared (Table 4.12). The fact that the coefficient of schools size squared (Table 4.12) is positive demonstrated that the long run cost curve was a parabola. This means that the schools cannot increase their sizes indefinitely. At one point beyond the optimal size, the diseconomies of scale in the production process will emerge meaning further enrolment will result to loss. This will be the emergencies of inefficient utilization of available resources.

The optimal school size shows that, holding other things constant; all the school related inputs can comfortably handle 320 students. Any increase beyond the optimal point will result to over utilization of resources and the cost of production will be higher in the short run. Enrolment beyond 320 students could mean that the available resources could be overstretched which will lead to shortages. The student teacher ratio will increase therefore reducing personal attention of the teacher on the students. Text book to student ratio will increase and congestion in all the facilities in the school; will result.

Any school that enrolls below the optimal school size will experience a lot of wastages of resources. Facilities will be lying idle hence internal diseconomies of scale. The cost of running such schools is high because of some costs that are fixed. The teachers, dormitories, classrooms and libraries among other facilities will be underutilized.
CHAPTER FIVE: SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

This chapter summarizes the whole research process. It first provides a brief summary of the whole study with particular reference to the research problem, methodology results, the main contribution of the research and recommendations. The study was designed to determine the optimal school size and existence of internal efficiency in public secondary schools of Marakwet district in 2007.

Chapter one was an overview of the background to the study. A statement of the problem was deduced from the background of the study. The purpose of the study followed the statement of the problem. Prior to the research questions, objectives of the study were highlighted then the rationale of the study and thereafter the assumptions of the study followed. Limitations and delimitations followed the assumptions of the study. Also in chapter one was the theoretical and conceptual framework. The last part of chapter one was the definition of operational terms.

Chapter two reviewed literature that was related to the study. Literature in school enrolment size and internal efficiency were reviewed. It showed that similar studies had been carried out in other parts of the country but such study had not been carried out in Marakwet district. This study was aimed at drawing conclusions on the optimal enrolment size of public secondary schools in Marakwet district and may be applied in other ASAL districts which have the same features.
Chapter three was devoted to study methodology used in the research. This chapter studied the design used in the research. A brief overview of the locale is found in this chapter and also the sampling and sampling procedures. The research instrument, which was principal’s questionnaire used was also part of this chapter, validity and reliability of the research instruments was described here. Data collection procedure and data analysis plan was the last part of chapter three.

Chapter four dealt with the empirical results of the study. The results were in two sections, section one was about the general characteristics of the sampled schools in the district while section two was about the regression analysis of the cost function used in the study.

5.2 Summary

The study was about the determination of the optimal school size and the existence of internal efficiency in public secondary schools in Marakwet district in 2007. The variables used in the study were, per student recurrent expenditure ($x_1$), school size ($x_2$), school size squared ($x_2^2$), number of teachers ($x_3$), average class size ($x_4$), per student non human expenditure ($x_5$) and student teacher ratio.

The per student recurrent expenditure was taken as the dependent variable while the rest were taken as independent variables. On general information about the schools, 16.7% of the sampled schools were established between 1963 and 1970. A quarter of the schools were established as from early 90s up to 2007. The researcher found out that 75% of the sampled schools were established and sponsored by the church and (mission). On student composition, there were more boys than girls in the sampled schools. Mixed schools were 41.7% of the sampled schools while girls’ schools formed 33.3% of the schools were day schools while the rest were boarding schools. On teacher composition, it was found out that 73.3% of the teachers were male whereas 26.7% were female. Most of these teachers, 60% had an
experience of over three years. 70% of the teachers of which many of them were pursuing their
degree courses on both school based or full time basis.
KCSE performance being an indicator of internal efficiency in school, 2007 KCSE results
among the sampled schools depicted that 33.3% of the schools had a mean score of six and
above. The KCSE performance in the district was poor. This may have been attributed to
poverty and retrogressive cultural practices and beliefs like female genital mutilation. Most
schools had the minimum teaching–learning facilities required in the schools.

The school mean size was 267 students. The school with the lowest enrolment among the
sampled schools had 57 students while the largest enrolment was 590 students. On average
class size, the mean was 59 students with a minimum of 19 and a maximum of 124 students
(table 4.10).

On the regression analysis results, it was found out that the correlation coefficient between the
per student recurrent expenditure (dependent variable) and the school size was - 0.8547. This
showed that the two variables were inversely related such that when one variable increased the
other decreased. As the school size increased, the recurrent expenditure decreased and vice
versa. The correlation coefficient of class size was -0.7292 (table 4.11). The correlation
coefficient between school size squared and non human per student expenditure was – 0.1864.
This depicted that they were inversely related indicating that as the school size squared is
increased; the non human expenditure reduced and vice versa.

The model used to analyze data was given as
\[ X_1 = a + bx_2 + cx_2^2 + dx_3 + ex_4 + gx_5 + hx_6 \]

The cost function for the sampled schools was given as
The optimal school size was 320 students. At the optimal enrolment size the unit cost for educating a student was Ksh17,503.30. The correlation coefficient of the school size squared was positive which implied that the schools could not increase enrolment indefinitely because when enrolment went beyond 320 students, optimal school size, the cost of operating started to increase hence diseconomies of scale (internal inefficiencies). Most of the sampled schools did not operate at the optimal size hence there were a lot of internal inefficiencies in the sampled schools.

5.3 Conclusion

Optimal school size is the most efficient school size. It is the enrolment size in which the unit cost of operation is minimal. The optimal school size in Marakwet district in 2007 was 320 students. Most schools were not operating optimally because there were cases of over and under enrolment. A school had a student population of 590 students. In such a case, the resources at their disposal were over utilized hence creating some shortages. Another case was a school had 57 students. This was a serious case of under enrolment and resources were under utilized hence internal inefficiencies were realized in the both cases above. Another indicator of internal inefficiencies experienced in the district was depicted by the poor KCSE performance in the district in 2007.

The following was a summary of 2007 KCSE performance in the district.

Table 5.1 2007 KCSE Analysis

<table>
<thead>
<tr>
<th>Grade</th>
<th>A</th>
<th>A-</th>
<th>B+</th>
<th>B</th>
<th>B-</th>
<th>C+</th>
<th>C</th>
<th>C-</th>
<th>D+</th>
<th>D</th>
<th>D-</th>
</tr>
</thead>
<tbody>
<tr>
<td>No of students</td>
<td>0</td>
<td>7</td>
<td>37</td>
<td>57</td>
<td>108</td>
<td>202</td>
<td>258</td>
<td>295</td>
<td>253</td>
<td>124</td>
<td>25</td>
</tr>
</tbody>
</table>

41
5.4 Recommendations

The principals, stakeholders and school managers should put in mind the optimal school size while planning for education provision. They should be guided by studies of this kind in their planning to avoid inefficiencies and diseconomies of scale. Schools that are under enrolled should be matched with others in order to attain the optimal size because it is very expensive to run such schools. Schools that are over enrolled (above the optimal size) should create more streams that establish more schools in order to enjoy economies of scale.

The government should provide the minimum physical human and financial requirements to schools. Government intervention on the school size should be based on well researched studies according to the unique features of all schools and districts. Blanket policies should not be applied to all schools as far as funding is concerned.

5.5 Suggestions for Further Research

Research on various categories of secondary schools should be undertaken. Research on Day school, Boarding schools, provincial schools, and National schools should be undertaken separately. Research also on all levels of education should be carried out from primary level, secondary level, tertiary level, and University levels of education.
REFERENCES


Farel J.P and Schiefebein E. (1974), Expanding the scope of Education Planning:
The experience of Chile.


Mugenda O.M and Mugenda, A.G (1999), *Research methods qualitative and
Quantitative Approaches, Act Press, Nairobi.


APPENDICES

Appendix 1

Questionnaire cover letter

Dear respondent,

This questionnaire is designed to gather information on the optimal enrollment size and internal efficiency in secondary school of Marakwet District. The study is being carried out in partial fulfillment of the requirement for Masters Degree in Education in Kenyatta University.

The information in this questionnaire will be treated with confidentiality and at no instance will your name be mentioned in this research. Also, the information will not be used for any other purpose than of this research. Your assistance in facilitating the same will be highly appreciated.

Thank you in advance.

Yours faithfully,

KIROP R. KIPKEMOI
Appendix II

Headteacher’s Questionnaire on school size and school inputs

The questionnaire is to assist the researcher to gather some information on school size and inputs. The information will be treated confidentially and will only be for this research purpose.

Thank you.

SECTION A

General Information

1. Which year was the school established.

2. Is your school provincial or District.

3. Is your school day or boarding.

4. Is it mixed or single sex.

5. If single sex, is it Boys or Girls.

6. What is the current total enrollment in your school

   \[ F_1 \]
   \[ F_2 \]
   \[ F_3 \]
   \[ F_4 \]
   Total

SECTION B

48
School inputs/ Resources

7. How many classroom do you have.................................
8. Are they sufficient..................................................
9. How many libraries do you have.................................
10. What is their sitting capacity..................................
11. Are the books that you have adequate .....................
12. What is the ratio of the textbooks to students..............
13. How many laboratories do you have.........................
14. Is it enough...........................................................
15. If you school is boarding, how many dormitories do you have..........
16. What is the bed capacity ........................................
17. Do you have a dinning hall......................................
18. How many teachers do you have.............................
19. How many are BOG employees.................................

SECTION C

Recurrent expenditure incurred by the school

1. Total amount of expenditure on BOG employees Kshs.............
2. Boarding expense Kshs...........................................
3. Tuition expenses Kshs...........................................
4. Capital assets (e.g. building) Kshs.............................
5. Other expenses (specify) Kshs...................................
6. In your opinion, how do you think school ensure efficiency in its administration ........................................
7. What is the average cost per student in a year....................
SECTION D

The school enrolment

1. Do you think the school enrolment is optimal......................

2. If yes, what do you think will happen if you increase the school enrollment or decrease it..........................

3. What is the opinion of your teachers on the present enrollment ...............
### Table A.1: Work Plan

<table>
<thead>
<tr>
<th>Activity</th>
<th>November</th>
<th>December</th>
<th>January</th>
<th>February</th>
<th>March</th>
<th>April - July</th>
<th>November</th>
</tr>
</thead>
<tbody>
<tr>
<td>Topic selection</td>
<td></td>
<td></td>
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<td></td>
<td></td>
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<tr>
<td>Chapter 1 &amp; 3</td>
<td></td>
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<tr>
<td>Drafting the final copy</td>
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<td>Handing in</td>
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<td>Data collection</td>
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</tr>
<tr>
<td>Handing in</td>
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</tr>
</tbody>
</table>
## Appendix IV

### Budget

**Table A2**

<table>
<thead>
<tr>
<th>Particulars</th>
<th>Amount (Kshs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Typing and secretarial duties</td>
<td>8,000</td>
</tr>
<tr>
<td>Stationery</td>
<td>1,000</td>
</tr>
<tr>
<td>Photocopy</td>
<td>200</td>
</tr>
<tr>
<td>Transport</td>
<td>20,000</td>
</tr>
<tr>
<td>Subsistence</td>
<td>8,000</td>
</tr>
<tr>
<td>Miscellaneous</td>
<td>5,000</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>42,200</strong></td>
</tr>
</tbody>
</table>
Appendix V

List of Participants

1. Principal Kerio Valley Secondary School
2. Principal Kapsowar girls Secondary School
3. Principal Marakwet Boys Secondary School
4. Principal Santa Maria Girls-Cheptulon
5. Principal Kapcherop Mixed Secondary School
6. Principal St. Michael’s Embobut Secondary School
7. Principal Queen Peace Day School
8. Principal Liter Girls Secondary School
9. Principal Kapcherop Girls Secondary School
10. Principal Chesewew Boys Secondary School
11. Principal Chebara Boys Secondary School
12. Principal Hossen Mixed Day Secondary School
Appendix VI

Calculation of correlation coefficient

The machine formula of the following form was used to calculate the correlation coefficients.

\[ R_{x_1x_2} = \frac{N \sum X_i X_{i1} - (\sum X_i)(\sum X_{i1})}{\sqrt{N \sum X_i^2 - (\sum X_i)^2} \cdot \{N \sum X_{i1} - (\sum X_{i1})^2\}} \]

Where

\( R_{x_1x_2} \) = correlation coefficient between \( x_1 \) and \( x_2 \)

\( \sum \) = summation sign

\( \ell + 2, 3, 4, 5, 6 \)

\( \Sigma X_i \) = sum of per student recurrent expenditure

\( \Sigma X_{i1} \) = sum of the dependent variables

\( N \) = Number of sampled schools (= 12)

\( (\sum X_{i1})^2 \) = sum of the dependent variables squared

\( (\sum X_i)^2 \) = sum of dependent variables squared

Appendix VI: calculation of the cost functions coefficients

\[ b = \frac{r_{x_1x_2} \cdot s_{x_1}}{s_{x_2}} \]

\[ r_{x_1x_2} = \frac{s_{x_1}}{s_{x_2}} \]

Where

\( s_{x_1} \) = the standard deviation of the dependent variables

\( s_{x_2} \) = the standard deviation of the independent variables (\( x_2 \)) school size
\( r_{x_1x_2} = \text{correlation between } x_1 \text{ and } x_2 \)

Appendix VII

Calculation of the optimal school size

\[ X_1 = a + bx_2 + cx_2^2 \]

At optimal, \( \frac{dx_1}{dx_2} = 0 \).

Differentiating \( x_1 \) w.r.t. \( x_2 \)

\[ \frac{dx_1}{dx_2} = b + 2cx_2 \]

\[ b + 2cx_2 = -b \]

\[ 2cx_2 = -b \]

\[ x_2 = -\frac{b}{2c} \]

From table 4.12

\[ x_2 = (25.77) \]

\[ (0.0402) \]

= 320 students

Appendix VIII

Calculating the cost of education

From table 4.12

\[ X_1 = a + bx_2 + cx_2^2 \]

\[ = 21,633.2 - 25.77x_2 + 0.0402x_2^2 \]

\[ = 17,503.30 \]

Cost of education when enrollment is 267 students

\[ X = 21,633.20 - 25.77(267) + 0.0402(267)^2 \]

\[ = 17,618.40 \]

Cost of education when enrollment is 400 students
\[ X_2 = 216, 33.20 - 25.77 (400) + 0.0402(400)^2 \]

\[ = 17,757.20 \]
The Permanent Secretary
Ministry of Education, Science and Technology
P.O. Box 30040-00100
NAIROBI

REF: LETTER OF INTRODUCTION – KIROP REUBEN KIPKEMOI REG. NO. E55/10532/06

This is to certify KIROP REUBEN KIPKEMOI REG. NO. E55/10532/06 that who is a student in the Department has completed his coursework and examination in the area Economics of Education. He is in the process of writing his project entitled: "DETERMINING SCHOOL OPTIMAL SIZE AND INTERNAL EFFICIENCY IN PUBLIC SECONDARY SCHOOLS OF MARAKWET DISTRICT" which will lead to attainment of M.Ed. Degree of this University.

He requires a research permit to this end. Any assistance accorded him will be highly appreciated.

Thank you.

Dr. S.N. Waweru
Chairman,

SNW/tnk
RE: RESEARCH AUTHORIZATION

Following your application for authority to carry out research on, 'Determining School Optimal Size and Internal Efficiency in Public Secondary Schools of Marakwet District'

I am pleased to inform you that you have been authorized to carry out research in Marakwet District for a period ending 30th November 2008.

You are advised to report to the District Commissioner and the District Education Officer Marakwet District before embarking on your research.

On completion of your research, you are expected to submit two copies of your research report to this office.

M. O. ONDIEKI
FOR: PERMANENT SECRETARY

Copy to:

The District Commissioner
Marakwet District

The District Education Officer
Marakwet District