# UNIVERSITY OF NAIROBI

**COLLEGE OF BIOLOGICAL AND PHYSICAL SCIENCES**

**FACULTY OF SCIENCE**

**DEPARTMENT OF MATHEMATICS**


**PROJECT WORK**

# ASSESSING THE CAPACITY OF THE DISTRICT EDUCATION OFFICE USING THE MULTINOMIAL LOGISTIC REGRESSION MODEL


BY

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**TABLE OF CONTENTS**

## DECLARATION

I, the undersigned declare that this project is my original work and has not been presented for a degree in any other university.

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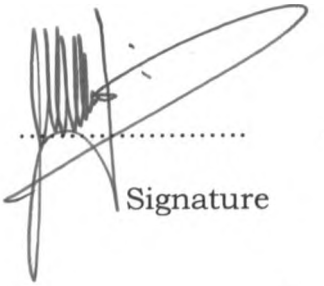

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## DEDICATIONS

This work is dedicated to my son Ratszinger Materu and to the entire Kwayumba's family.

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**ASSESSING THE CAPACITY OF THE DISTRICT EDUCATION OFFICE USING THE MULTINOMIAL LOGISTIC REGRESSION MODEL**


## ABSTRACT

The District Education Office plays a pivotal role in the implementation of education services in Kenya, and in effect, in the attainment of Education for All (EFA) and United Nations 2nd Millennium Development Goal. It is thus, paramount, that the office has requisite capacity to deliver the required services at this level.

Responses in capacity assessment are often measured as ratings or rankings. Usual analysis of variance and linear based analysis are not appropriate for these data. Alternative methods based on the generalized linear models should therefore be applied for analysis of this kind of data. This Project proposes an elaborate and articulate means of assessing capacities of the District Education Office. In this project, Multinomial Logistic Regression has been used to assess the factors contributing to capacity. The response variable is the Capacity to implement KESSP. Eight (8) variables were selected as explanatory variables. These variables represent the six thematic areas used in capacity assessment namely: Organizational home, Leadership, Staffing, Funding, Materials and Work practices.

Model fitting results shows that inasmuch as there is fair Capacity to implement KESSP at the District Education Office level. Factors that are evidently contributing to capacity are on Organizational home and Capacity by Staff. The capacity by staff entails the presence of the requisite number of staff and the skills and qualifications the staff possess.

## LIST OF ABBREVIATIONS AND ACRONYMS

ANOVA- Analysis of Variance

CIAT – International Center for Tropical Agriculture

CIMMYT – Center International De Mejoromieto De Maize Trigo

CSS – Customer Satisfaction Survey

CsPro – Censures and Surveys Processing System

DEO – District Education Office(R)

DFID – Department Fund for International Development

EADEC – East African Development Consultants

EFA – Education for All

ICRAF – International Centre for Research in Agro forestry

KEMACA – Kenya Education Management Capacity Assessment

KESSP – Kenya Education Sector Support Programme

MDG – Millennium Development Goals

MOE – Ministry of Education

OED – Operations Evaluation Department

Organizational Home - An entity, designated for the performance of certain defined functions and activities

PACT- Partnership for Capacity Building in Africa

PSRDS – Public Service Reform Development Secretariat

RTI – Research Triangle Institute International

SNV – Netherlands Development Organization

SPSS – Statistical Package for Social Scientists

TAC – Teacher Advisory Centre

USAID – United States Aid for International Development

# CHAPTER ONE: INTRODUCTION

## 1.1 Background Information

The international aid architecture – the global machine through which funding initiatives for development are deployed to needy communities is failing. Brown (2004) gave an honest assessment that present development will not only fail to meet the Millennium Development Goals in Africa in ten years time but we will also fail to meet them in even one hundred years time.

Many have proposed that the solution lies in capacity building – the "Missing link" in international development. But capacity building too is part of the failing aid architecture, characterized by fragmentation, inefficiency and disengaged decision-making (*ibid*). Further, it has been observed that many countries launch into decentralization and into the delegation of duties and powers to sub-national structures without a proper understanding of the readiness of such sub-national units to absorb those duties and powers. They also do it, more importantly, without any basis for planning the supply of capacity to absorb those duties and powers. Kenya, therefore, took this issue seriously, by first assessing the capacity of education structures to implement programmes. The analysis was done through the implementation of the Kenya Education Management Capacity Assessment (KEMACA)

KEMACA survey was carried out at the request of the Government of Kenya, with funding from USAID. The structures assessed included: the Ministry of Education headquarters, the Semi Autonomous Government Agencies (SAGAs), the Provincial Education Office, The District Education

Office, the Divisional Education Office, the Zonal Educational Office and sampled secondary and primary schools. The exercise was executed by RTI International and East Africa Development Consultants (EADEC). The main objective of the survey was to ascertain capacity weaknesses in the Kenyan education system, which might impede the proper execution of the Kenya Education Sector Support Programme (KESSP).

## 1.2 Survey Findings

Findings from the survey were aggregated at various levels of education system. Specifically, at the district level, the areas of concern were:

(i) Lack of clarity as to procedures for replacing retired teachers (received worst possible rating from 30% of district officials interviewed).

(ii) The whole area of "project management," such as how to specify work for others, how to draft a budget, and so on, is problematic, being rated as worst by some 20% to 30% (depending on sub-skill) of district officials.

(iii) Skills in computer use are drastically poor, 44% of officials giving this area the worst rating. Similarly, skills in any form of quantitative analyses were rated as extremely poor. Interestingly, it is particularly the aspect of computer applications to the skill, rather than the underlying *conceptual* skill, that received the worst ratings. One suspects this may not be real, but it is an important perception. For example, only 19% of district level personnel rated their skills in data

interpretation as a "worst" area, but full 70% rated their ability to use computers for this task as a "worst" area.

(iv) Views of Teacher Advisory Centres (TAC) officers' skills from the district perspective are similar to those from the Head teacher perspective: the TACs are seen, too often (by 29% of district personnel) as meriting the worst judgment.

(v) Some 25% to 50% of district officials gave "worst possible" ratings to the issue of clarity of regulation in a whole array of areas such as tendering, contract performance, tender evaluation, etc.

(vi) Too many (42%) of district officials report not using any performance appraisal system.

## 1.3 Problem Statement

A review of the KEMACA report shows that both the conceptual and methodological approach in data analysis can be improved. As observed, the statistics reported are in the form of generalized proportions (percentages) of districts failing to reach the required threshold capacity level. Another observation is that, even though some capacity gaps have been identified, these gaps have not been appropriately quantified. In order to rectify these shortcomings, there is need to undertake further quantitative analysis on the data from the survey.

## 1.4 Objectives of the Study

The objectives of the study are as follows:

1. To assess the capacity of the District Education Office to implement education programs. Currently the program being implemented by the Ministry of Education is known as the Kenya Education Sector Support Programme (KESSP).
2. To assess if staff is evidently a significant measure of capacity
3. To assess if the material requirement for capacity is uniform across districts

## 1.5 Research Questions

This research project strived to answer the following key questions based on the Kenya Education Management Capacity Assessment (KEMACA) Project.

1. Does the District Education Office have the requisite capacity to implement the Kenya Education Sector Support Programme?
2. Can capacity assessment be done by only assessing the Staff capacity?
3. Is there a significant difference in the material needs across the districts?

## 1.6 Justification

Research study findings will provide evidence on the ability of district education offices to implement education programs and in particular, the Kenya Education Sector Support program. It will also reveal the specific areas in which specific districts would require capacity building. In so doing,

a measure to build capacities of the districts will be targeted not only to specific districts but also by singled-out areas of need. This, in effect, will reduce the cost and time needed to revitalize these structures. An overarching outcome of the project is that the study will inform whether building institutional capacity can be done by simply addressing Staff Capacity.

## 1.7 Literature Review

Conceptually, capacity is defined as the ability to perform tasks with confidence. This definition of capacity is narrow in scope since it equates capacity to skills and it illustrates that poor capacity implies poor or shortage of skills. Hence in order to build capacity one would require training, skills development and consultancy. David and Chava (2004) have noted that treating concepts as though they are concrete truth phenomenon leads to the fallacy of reification. It therefore follows that by defining capacity conceptually one tends to introduce reification. To rectify on this error this study will adopt the operational definition of capacity.

Eliezer (2004) gives a more amenable definition of capacity. He asserts aspects of "whose capacity" and "capacity to do what". This definition follows a framework approach and has also been adopted by the World Bank (2005), PACT (2006) and SNV (2006), among other international donor and development organizations. Eliezer (2004) summarizes that an organization has capacity if, and only if: Its key function(s) and activities have 'organizational homes'; it has effective and efficient leadership; it has adequate financial resources for procuring necessary inputs; it has material resources necessary to carry out its mandate; it has mandatory human resources and; the people working for it follow clear work practices.

Following this operational definition of capacity, the most appropriate method of assessment is to investigate capacity gaps by scores, ranks and rates on elements of the proposed framework. As evidenced from published literature, methods of collecting rating data have also been used in

agricultural research. As described by Ashby (1990) they include tools that give high quality, repeatable and reliable data. Abeyseker (2001) makes the point clear by asserting ranks are greatly enhanced by a baseline survey. In addition, most respondents tend to be more willing to provide scores / ratings than providing exact covariates. It should, however, be noted that a response measure on a continuous scale, using an accurate and unbiased instrument contains more information than the equivalence observation, Richard (2000). The main reason for not using continuous variables to assess capacity particularly in this study is that the data sets involve opinions and perceptions.

Responses on capacity assessment are often measured using ratings (scores on an ordered but arbitrary scale) or rankings (respondents are simply asked to order treatments). Usual analysis of variance (ANOVA) and linear-based-analyses are not appropriate for these categorical data. Therefore, alternative methods based on generalized linear models are applied for analysis of this kind of data. Betty *et al.,* (2003), Thomas (2008), Patric *et al.,* (2008) have shown that logistic regression provides a flexible means of analyzing the association between a binary outcome and a number of explanatory variables. These analyses have also been extended to multinomial logistic model.

The methods of analyzing ranking and rating data have not only so been applied in agricultural research but also in the medical. Agresti (1996) has fully discussed proportional odds model using rating data. Dittich *et al.,* (1998) have used the method for paired comparisons for categorical covariates, and they have also mentioned the possibilities with continuous

covariates. Critchlow and Fligher (1991) have further, illustrated the approach used when comparing more than two treatments (based on categorical data).

As initially intimated, the methods of analyzing score data employed in this project are not new, nor are they intended to be. The Broadley-Terry Model, (Bradley and Terry, 1952), which has been widely used, particularly in social sciences has been used when rating two items. Similarly, this can be extended to this study since it also collects data on two items. An example includes when interviewees are asked to state which of the two methods of training is superior.

In the Customer Satisfaction Survey (CSS) on the Public Service Reforms and Development Secretariat (PSRDS), Irene *et al.*, (2007) have used Logistic regression to compute the CSS index. A notable methodological concern in this analysis is that the researchers collapsed some scores into two groups – those lower than the average are rated poor while those above, good.

## 1.8 Methodology

KEMACA survey was carried out at the request of the Government of Kenya, with funding from USAID. The exercise was executed by RTI International and East Africa Development Consultants (EADEC). The main objective of the survey was to ascertain capacity weaknesses in the Kenyan education system, which would impede the proper execution of the Kenya Education Sector Support Programme (KESSP). The Survey was carried out from July 2006 to January 2008. The Study was censual (collected data and

information from all education districts and municipalities in the country). The respondents included selected ministry of education headquarters officials, Officers from the Semi Autonomous Government Agencies, provincial directors of education, district education officers, divisional educational officers, zonal educational officers, heads of institutions in selected primary and secondary schools and selected teachers from these institutions.

Data was captured using the Census and Survey Processing System (CsPro) and analysis using the Statistical Package for Social Scientists (SPSS). Despite KEMACA being undertaken at the various educational levels, the district education office formed the basis of this research project. Of specific interest is on the data on the measure of capacity; as the response variable and several variables used to explain capacity. The data used in this study has been attached (see appendix 3). Both SPSS and R programs was employed during the analysis. A multinomial logistic regression was undertaken with the view of generating the best-fitting model for the Capacity level at the districts.

# CHAPTER 2: GENERALIZED LINEAR MODELS

## 2.1 Introduction

The unity of many statistical methods was demonstrated by Nelder and Wedderbun (1972) using the generalized linear model. This model is defined in terms of a set of independent random variables $Y_1,....,Y_N$ each with a distribution from the exponential family and with the following properties:

1. The distribution of each $\boldsymbol{Y_i}$ has a canonical form and depends on a single parameter $\theta_i$ ( the $\Theta_i$'s do not have to be the same), thus

$$f(y_i;\theta_i)=\exp[y_i b_i(\theta_i)+c_i(\theta_i)+d_i(y_i)] \qquad 2.1$$

2. The distributions of all the $Y_i's$ are of the same form (for example, all Normal or all Binomial) so that the subscripts on *b*, *c* and *d* are not needed.

Thus the joint probability density function of $Y_1,....,Y_N$ is

$$f(y_1,....,yN;\theta 1,....,\theta N)=\prod_{i=1}^{N}\exp[y_i b(\theta_i)+c(\theta_i)+d(y_i)]$$

$$=\exp\left[\sum_{i=1}^{N} yib(\theta i)+\sum_{i=1}^{N} c(\theta i)+\sum_{i=1}^{N} d(yi)\right] \qquad 2.2$$

Model specification involves a measure on smaller set of parameters $\beta_1,\ldots,\beta_p$ (where $p<N$ ). Suppose that $E(Y_i)=\mu_i$ where $\mu_i$ is some function $\theta_i$ For a generalized linear model, there is a transformation of $\mu_i$ such that

$$g(\mu_i)=X_i^T\beta \qquad 2.3$$

$g$ is a monotone, differentiable function called the link function

## 2.2 Binomial distribution

Consider a series of binary events, called 'trials', each with only two possible outcomes: 'success' or 'failure'. Let the random variable ***Y*** be the number of 'successes' in n independent trials in which the probability of success, ∏, is the same in all trials. Then ***Y*** has the binomial distribution with probability density function.

$$f(y;\pi)=\binom{n}{y}\pi^y(1-\pi)^{n-y} \qquad 2.4$$

Where $y$ takes the values $0,1,2,\ldots,n.$ this is denoted by ***Y~binomial*** **(n, ∏).** Here ∏ is the parameter of interest and n is assumed to be known. The probability function is written as

$$f(y;\mu)=\exp\left[y\log\pi-y\log(1-\pi)+n\log(1-\pi)+\log\binom{n}{y}\right] \qquad 2.5$$

The link function is given by

$$b(\pi)=\log\pi-\log(1-\pi)=\log\left[\pi/(1-\pi)\right] \qquad 2.6$$

The binomial distribution is usually the model of first choice for observations of process with binary outcomes.

## 2.3 Binary Variables and Logistic Regression

Binary random variable can be defined as:

$z=\begin{Bmatrix}1\\0\end{Bmatrix}$ 1; if the outcome is a success and 0; if the outcome is a failure

With probabilities $Pr(z=1)=\pi$ and $Pr(z=0)=1-\pi$ . If there are ***n*** such random variables $Z_1,....,Z_N$ which are independent with $\Pr(Z_j=1)=\pi_j$, then their joint probability is

$$\prod_{j=1}^{n}\pi_j^{z_j}(1-\pi_j)^{1-z_j}=\exp\left[\sum_{j=1}^{n}z_j\log(\frac{\pi_j}{1-\pi_j})+\sum_{j}^{n}\log(1-\pi_j)\right] \qquad 2.8$$

Considering a general case of $N$ independent random variables $Y_1, Y_2, ..., Y_N$ corresponding to the numbers of successes in $N$ different sub-groups or strata, and if $Y_i \sim binomial\ (n_i, \Pi_i)$ the log-like hood function is given by

$$l(\pi_1,...,\pi_N; y_1,...,y_N) = \left[ \sum_{i=1}^{N} y_i \log\left( \frac{\pi_i}{(1-\pi_i)} \right) + n_i \log(1-\pi_i) + \log\binom{ni}{yi} \right] \qquad 2.9$$

## 2.4 Generalized Linear Models Overview

For nominal or ordinal logistic regression one of the measured or observed categorical variables is regarded as the response, and all other variables are explanatory variables.

For log-linear models, all the variables are treated alike. The choice of which approach to use in a particular situation depends on whether one variable is clearly a 'response' (for example, the outcome of a prospective study), or several variables have the same status (as may be the situation in a cross-sectional study).

Nominal and ordinal logistic regression yield odds ratio estimates which are relatively easy to interpret if there are no interactions (or only fairly simple interactions). Log linear models are good for testing hypotheses about complex interactions, but the parameter estimates are less easily interpreted.

## 2.5 Multinomial Distribution

Multinomial distribution provides the basis for modeling categorical data with more than two categories.

Consider a random variable $Y$ with $J$ categories. Let $\pi_1, \pi_2, \ldots, \pi_j$, denote the respective probabilities, with $\pi_1 + \pi_2 + \ldots \pi_j = 1$. If there are $n$ independent observations of $Y$ which result in $y_1$ outcomes in category 1, $y_2$ outcomes in category 2, and so on, then let

$$y = \begin{bmatrix} y_1 \\ y_2 \\ . \\ . \\ . \\ y_j \end{bmatrix}, \text{ with } \sum_{j=1}^{J} y_i = n.$$

The multinomial distribution is

$$f(y|n) = \frac{n!}{y_1! y_2! \ldots y_j!} \pi_1^{y1} \pi_2^{y2} \ldots\ldots \pi_j^{yj} \qquad 2.10$$

## 2.6 Comparison with the Poison Distribution

Let $Y_1,...,Y_j$ denote independent random variables with distributions $Y_j \sim Poison\ (\lambda_1+\lambda_2+....+\lambda_j)$. Therefore the distribution of $y$ conditional on $n$ is

$$f(y|n)=\left[\prod_{j=1}^{J}\frac{\lambda_j^{y_i}e^{-\lambda_j}}{y_j!}\Big/\frac{\left(\lambda_1+....+\lambda_j\right)^n e^{-(\lambda_1+...+\lambda_j)}}{n!}\right]$$

This can be simplified to:

$$f(y|n)=\left(\frac{\lambda_1}{\sum\lambda_k}\right)^{y1}.....\left(\frac{\lambda_j}{\sum\lambda_k}\right)^{yj}\frac{n!}{y_1!...y_j!} \qquad 2.11$$

If $\pi_j=\lambda_j\left(\sum_{k=1}^{K}\lambda_k\right)$, for $j=1...J$, then (2.11) is the same as (2.10) and $\sum_{j=1}^{J}\pi_j=1$, as required.

Therefore the multinomial distribution can be regarded as the joint distribution of poison random variables, conditional upon their sum $n$.

## 2.7 Nominal Logistic Regression

Nominal logistic regression models are used when there is no natural order among order among the response categories. One category is arbitrarily chosen as the reference category. Suppose this is the first category. Then the logits for the other categories are defined by

$$\text{logit}(\pi_j) = \log\left(\frac{\pi_j}{\pi_1}\right) = X_j^T \beta_j, \text{for } j = 2,...,J. \qquad 2.12$$

The $(J-1)$ logit equations are used to simultaneously to estimate the parameters $\beta_j$. Once the parameter estimates $b_j$ have been obtained, the linear predictors $X_j^T b_j$ can be calculated.

From equation 2.12,

$$\widehat{\pi_j} = \widehat{\pi_j} \exp\left(X_j^T b_j\right) \text{ For } j = 2,....,J$$

But $\widehat{\pi_1} + \widehat{\pi_2} + ..... + \widehat{\pi_j} = 1$ so $\widehat{\pi_1} = \dfrac{1}{1 + \sum_{j=2}^{J} \exp(X_j^T b_j)}$ 2.13

And $\widehat{\pi_j} = \dfrac{\exp\left(X_j^T b_j\right)}{1 + \sum_{j=2}^{J} \exp(X_j^T b_j)}, j = 2,...,J$ 2.14

## 2.8 Ordinal Logistic Regression

This kind of analysis is employed in both natural ordered variables and latent variables with defined cut points. The cut points $C_1,...,C_{J-1}$ define $J$ ordinal categories with associated probabilities $\pi_1,....\pi_j$ (with $\sum_{j=1}^{J}\pi_j = 1$).

One of the commonly used models is the proportional odds model.

## 2.9 Proportional Odds Model

If the linear predictor $X_j^T\beta_j = \log\frac{\pi_1+.....+\pi_j}{\pi_{j+1}+...+\pi_J}$ has an intercept term $\beta_{0j}$ which depends on the category $j$, but the other explanatory variables do not depend on $j$, the model arising is the proportional odds model and is expressed as:

$$\log\frac{\pi_1+.....+\pi_j}{\pi_{j+1}+...+\pi_J} = \beta_{0j}+\beta_1x_1+....+\beta_{p-1}x_{p-1}. \qquad 2.15$$

Equation 2.15 is based on the assumption the effects of the covariates $x_1,...,x_{p-1}$ are the same for categories on a logarithmic scale.

# CHAPTER 3: DATA ANALYSIS AND APPLICATION

## 3.1 Variables

The data consists of a single response variable and eight (8) explanatory variables. The response variable in this case is a variable on capacity rating as given by various District Education Officers in various districts across the country; explanatory variables are:

i. Variables used to measure the level of organizational home in an institution or organization. In this case, the data contains two such variables: the first one on the level of function overlap and the other one on the clarity of the reporting mechanism;

ii. Variables to measure the staff capacity. Under this category, the data also contains two variables: one on the staff sufficiency and the other on staff skill level;

iii. A variable to measure capacity by sufficiency of funds;

iv. A variable to measure the leadership level by decision making;

v. Variables to measure the level of best practices of an institution or an organization. The data contains two such variables: one on documentation of best practices and the other one on the dissemination of best practices and;

vi. A variable to measure the sufficiency of materials of the organization.

Table 1 below summarizes all explanatory variables used in the analysis

**Table 3.1: Capacity Issue Vs Explanatory Variables in the Analysis**

| | Capacity Issue | Variable | |
|---|---|---|---|
| 1 | Organizational Home | 1 | Overlap of functions |
| | | 2 | Clarity of reporting mechanism |
| 2 | Staff | 1 | Staff sufficiency |
| | | 2 | Staff skill level |
| 3 | Funds | 1 | Sufficiency of funds |
| 4 | Leadership | 1 | Decision making |
| 5 | Work practices | 1 | Documentation of best practices |
| | | 2 | Dissemination of best practices |
| 6 | Materials | 1 | Sufficiency of materials |

**Table 3.2: Summary of Descriptive Analysis**

| Variable | N | Minimum | Maximum | Mean | Std. Deviation |
|---|---|---|---|---|---|
| Capacity to implement KESSP | 71 | 1 | 4 | 2.48 | .860 |
| Functions overlap | 71 | 1 | 4 | 2.13 | .827 |
| Clarity on Reporting Mechanism | 71 | 1 | 4 | 3.04 | .801 |
| Staff Sufficiency | 71 | 1 | 3 | 1.54 | .581 |
| Staff Skill Level | 71 | 1 | 4 | 2.00 | .655 |
| Funds Level | 71 | 1 | 4 | 1.87 | .735 |
| Decision Making | 71 | 1 | 4 | 2.32 | .713 |
| Best Practices Documented | 71 | 1 | 4 | 2.34 | 1.230 |
| Best Practices Disseminated | 71 | 1 | 4 | 2.23 | 1.278 |

**Note**

More descriptive results are attached (See appendix Table 5.3)

**Table 3.3: Percentage Shortfall in Material Requirement**

| Material | N | Minimum | Maximum | Mean | Std. Deviation |
|---|---|---|---|---|---|
| Offices / rooms | 71 | -88.89 | 1900.00 | 178.4429 | 371.49951 |
| Vehicles | 71 | -97.56 | 1100.00 | 6.6186 | 157.07917 |
| Motor Cycles | 71 | -93.75 | 1200.00 | 22.8681 | 175.66 899 |
| Computers | 71 | -87.50 | 1900.00 | 98.3400 | 280.12873 |
| Type writers | 71 | -96.88 | 100.00 | -7.3358 | 39.77457 |
| Telephones | 71 | -90.91 | 1300.00 | 107.1938 | 300.05720 |
| Printers | 71 | .00 | 1900.00 | 154.4601 | 325.58809 |
| Scanners | 71 | -50.00 | 1600.00 | 45.0704 | 205.31421 |
| Photo copiers | 71 | -99.07 | 1200.00 | -4.3240 | 157.44168 |
| Tables | 71 | -99.35 | 4900.00 | 327.6891 | 1005.53007 |
| Chairs | 71 | -96.00 | 8900.00 | 583.9903 | 1565.44035 |
| Shelves | 71 | -97.14 | 3000.00 | 115.3091 | 453.10239 |
| Cupboard | 71 | -85.71 | 2900.00 | 134.5205 | 433.52200 |
| Electric fans | 71 | -50.00 | 3100.00 | 287.3239 | 675.05123 |
| Floor carpets | 71 | -33.33 | 3100.00 | 238.9671 | 594.09758 |
| Valid N (listwise) | 71 | | | | |

**Note**
A negative values show that there is a surplus of these "materials" in given districts

## 3.2 Development of model

The multinomial logistic satisfaction model with $j^{th}$ categories of dependent variable was expressed as

$$Ln[\frac{p(category_i)}{p(category_j)}] = \beta_{i0} + \beta_{i1}X_1 + ..... + \beta_{in}X_n + e_i$$

Where j=4 (Not at all, Somewhat, Mostly, Very Well) rating on the level overall capacity of the district to implement KESSP.

$X_1$, $X_2$,.....,$X_n$ were explanatory variables of factors influencing the capacity. In this case n=1, 2,....., 6 with $X_1$=Organizational home; $X_2$= Leadership; $X_3$= Finances; $X_4$= Staffing; $X_5$= Materials; and $X_6$= Practices.

## Table 3.4: Results based on Multinomial Logistic Model

**Likelihood Ratio Tests**

| Predictors | Effect | Model Fitting Criteria | Likelihood Ratio Tests | | |
|---|---|---|---|---|---|
| | | -2 Log Likelihood of Reduced Model | Chi-Square | df | Sig. |
| | Intercept | 39.320(a) | .000 | 0 | . |
| Functions overlap | B02 | 47.268(b) | 7.948 | 9 | .539 |
| Clarity on Reporting Mechanism | B04 | 56.761(b) | 17.442 | 9 | .042 |
| Staff Sufficiency | B06 | 51.163(b) | 11.844 | 6 | .046 |
| Staff Skill Level | B07 | 58.813(b) | 19.493 | 9 | .021 |
| Funds Level | B08 | 39.638(b) | .318 | 9 | 1.000 |
| Decision Making | B09 | 49.899(b) | 10.580 | 9 | .306 |
| Best Practices Documented | I16 | 40.695(b) | 1.375 | 9 | .998 |
| Best Practices Disseminated | I17 | 47.957(b) | 8.637 | 12 | .734 |

**Notes about Table 3.4**

*The chi-square statistic is the difference in -2 log-likelihoods between the final model and a reduced model. The reduced model is formed by omitting an effect from the final model. The null hypothesis is that all parameters of that effect are 0.*

*a) This reduced model is equivalent to the final model because omitting the effect does not increase the degrees of freedom.*

*b) Unexpected singularities in the Hessian matrix are encountered. This indicates that either some predictor variables should be excluded or some categories should be merged.*

*The Multinomial model was therefore not fitted since the only significant variable to be included in the model is the intercept. More results on model fitting are attached (see Appendix Table 5.4)*

# CHAPTER 4: DISCUSSIONS, CONCLUSIONS AND RECOMMENDATIONS

## 4.1 Discussion of findings

Descriptive statistics results, as shown in Table 3.2 reveal that the capacity of the District Education Office to implement the Kenya Education Sector Support is at 2.48 - when rated on the scale of 1-4. According to this scale level one (1) represents an opinion of "not at all" while level four (4) represents an opinion of "very well". This is close to the mid-way of the scale. It therefore shows that the capacity of the district education office to implement KESSP is. Naturally for better implementation of the services, the rating should be close to scale four (4) and four under the ideal situations. This result provides a room for improvement.

Most districts seem to be doing well as far as clarity of the reporting mechanism is concerned. This can be attributed to the "who is who syndrome" mostly associated with the public office positions. On other aspects of capacity, staff sufficiency ranks the lowest with an index of 1.54 followed by the level of funding at the institutions at 1.87 the two are below the average scale of two (2). It therefore implies capacity as reflected by these aspects is in dire need. Further, the districts record an average rating on functions overlap, staff skill level, decision making, documentation and dissemination of best practices.

As far as materials needs as element of capacity are concerned, it is evident that there is a high disparity across districts by the material type. It can be seen from Table 3.3 above, furniture, which records an average of at least 100% shortfall, is reportedly most in need as compared to stationery

(photocopiers and typewriters), which record an average of less than 10 %. In fact, instead of shortage, some districts are reporting a surplus of some materials. In building capacity, therefore, these materials should not be provided to the districts that indicated a surplus but to those that are experiencing material shortage in specified areas.

Further insight into the data reveals that capacity can only be related to the clarity on reporting mechanism, staff sufficiency and Staff skill level. As shown in Table 3.4 on the preliminary analysis using the Multinomial logistic regression model, these are the only significant variables on the quantitative analysis. The variables represent the broad aspect of organizational home and Staff as key measures to address when building the capacity of the district education office.

At significance level being of 5 % (0.05), the clarity on reporting mechanism, staff sufficiency and staff skill level are presented at 0.042, 0.046 and 0.021 respectively. This shows that the contribution of these variables in the measurement of the capacity to implement KESSP is not due to chance.

As seen from the data, the inadequate capacity at the district education office can be attributed to rationalization programs that were implemented by the government in early 1990s. These programs affected most of the civil service which includes the Ministry of Education. The rationalization was not, in this case, preceded with a needs assessment that would gauge the required staff level. As a result, most officers were either retrenched or ordered to take an early retirement in order to reduce recurrent funding by the government.

The capacity of the District Education Office can, therefore, be strongly enhanced by:

i. Deployment and Employment of more staff at the offices. This is in order to reach the required authorized establishment. The process can be accomplished through recruitment or re-deployment of officers from other government ministries and departments which are deemed to be in surplus;

ii. Ensuring that the staff deployed have the requisite skills and experience to undertake office duties and assignments;

iii. Ensuring the staff are deployed in the "right places". This implies that there should be a clear terms of reference for specific positions;

iv. The staff should be motivated to deliver the required services and;

v. Setting of a clear reporting mechanism within the district education office

## 4.2 Conclusion

1. **Objective 1**: ***To assess the Capacity of the District Education Office for the implementation of KESSP***

From the findings, it is concluded that the capacity of the district education office to implement KESSP is inadequate.

2. **Objective 2:** ***To assess of staff is evidently a significant measure of capacity***

The findings also reveal that clarity on reporting mechanism and Staff are paramount in assessing capacity. It is thus evident that addressing these key issues would significantly improve the capacity of an organization

3. ***Objective 3: To assess the difference in material requirement for Capacity across the districts***

Survey results show an acute shortage of key material / infrastructure. Most notably, office space and transportation facilities are reported to be key materials needs across districts as opposed to type writers and photocopying machines.

## 4.3 Recommendations

Capacity of an institution is essential in the delivery of services. In this case capacity of the District Education Office in the implementation of the Kenya Education Sector Support should be built. This will facilitate the attainment of the Ministry of Education goals, mission and vision and also in the attainment of global goals on education as stipulated by the Education for All and the Millennium Development (MDGs) goals.

The project findings are indicative since the variables used in the analysis have been operationalized and based on opinions from the District Education Officers. These opinions can differ depending on individuals. Further research needs to be conducted on the key areas that contribute to Capacity using the operational framework as illustrated by international institutions.

## CHAPTER 5: APPENDICES

### 5.1. Abridged Questionnaire used in the Survey

# Section 2: Organization Structure

**For every question / indicator please assign a rank/score/rate from 1 to 4. Where**

**1=No/Not at all/Total Lack;** **2=Some/Sometimes/ somewhat;**

**3= Most of the time/Mostly;** **4=Plenty/always/all/Yes**

| V.No. | Questions / Indicators | Scores/ Rates 1 | 2 | 3 | 4 |
|---|---|---|---|---|---|
| B 01 | In your view, are your core functions at the District sufficiently clear? | | | | |
| B 02 | To what extent do you feel your functions overlap with those of other levels (for instance Provincial and headquarters)?<br><br>**Skip to B 04 if NO OVERLAP** | | | | |
| B 03 | To what extent does the overlap (if it exits) create an effective collaboration? | | | | |
| B 04 | To what extent do you have clarity as to who you | | | | |

| | | | | | | |
|---|---|---|---|---|---|---|
| | should report to? | | | | | |
| B 05 | In regard to KESSP implementation to what extent do you feel there is clarity of your roles and responsibilities? | | | | | |
| B 06 | To what extent are your staff numbers sufficient to perform the office roles and functions of your level? | | | | | |
| B 07 | To what extent do staff at your level have the right level and appropriate mix of skills needed for their respective roles and functions | | | | | |
| B 08 | To what extent are the operational resources of funding for your office sufficient for your tasks? | | | | | |
| B 09 | To what extent is decision making by your superiors sufficiently rapid to allow you to do your job? | | | | | |
| B 10 | To what extent are the Education Service delivery standards clearly defined for the following? | a) Replacing a Head Master | | | | |
| | | b) Replacing a Retired Teacher | | | | |
| | | c) Re Constituting a BOG / SMC | | | | |
| B 11 | To what extent are these Service Delivery | | | | | |

| | | | | | |
|---|---|---|---|---|---|
| | Standards used for the purpose of planning at your level? | | | | |
| B 12 | To what extent are these service delivery standards used in monitoring school performance (i.e. to identify low performing schools)? | | | | |
| I 16 | Are best practices documented at the District level?<br><br>**If NO skip to I 18** | | | | |
| I 17 | Are the documented best practices disseminated in your District? | | | | |

## 5.2 Data on Survey Findings

| Province | District | Capacity to implement KESSP | Functions overlap | Clarity on Reporting Mechanism | Staff Sufficiency | Staff Skill Level | Funds Level | Decision Making | Best Practices Documented | Best Practices Disseminated |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 141 | 2 | 3 | 3 | 2 | 3 | 1 | 1 | 1 | 1 |
| 1 | 115 | 3 | 2 | 4 | 1 | 2 | 2 | 2 | 1 | 1 |
| 1 | 141 | 1 | 2 | 2 | 2 | 1 | 1 | 2 | 2 | 2 |
| 1 | 113 | 2 | 2 | 2 | 1 | 1 | 2 | 2 | 2 | 2 |
| 1 | 112 | 2 | 2 | 2 | 2 | 3 | 2 | 2 | 2 | 2 |
| 1 | 114 | 2 | 2 | 3 | 1 | 2 | 2 | 2 | 3 | 2 |
| 2 | 201 | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 1 |
| 2 | 202 | 3 | 2 | 2 | 2 | 2 | 2 | 2 | 1 | 1 |
| 2 | 202 | 3 | 3 | 3 | 2 | 3 | 2 | 3 | 2 | 2 |
| 2 | 254 | 2 | 2 | 2 | 2 | 2 | 2 | 3 | 3 | 2 |
| 2 | 262 | 3 | 2 | 3 | 2 | 2 | 2 | 3 | 3 | 3 |
| 2 | 203 | 3 | 2 | 3 | 1 | 2 | 2 | 4 | 3 | 3 |
| 3 | 310 | 2 | 3 | 2 | 1 | 2 | 2 | 2 | 1 | 1 |
| 3 | 308 | 2 | 2 | 3 | 1 | 2 | 2 | 2 | 1 | 1 |
| 3 | 307 | 3 | 2 | 4 | 3 | 3 | 3 | 2 | 1 | 1 |
| 3 | 349 | 1 | 2 | 3 | 2 | 2 | 2 | 3 | 1 | 1 |
| 3 | 348 | 1 | 1 | 2 | 2 | 3 | 2 | 2 | 4 | 1 |
| 3 | 311 | 3 | 1 | 4 | 2 | 2 | 3 | 3 | 4 | 1 |
| 3 | 369 | 2 | 3 | 3 | 1 | 2 | 2 | 3 | 2 | 2 |
| 3 | 306 | 2 | 2 | 3 | 1 | 2 | 2 | 2 | 3 | 2 |
| 3 | 357 | 3 | 1 | 3 | 1 | 1 | 1 | 1 | 3 | 3 |
| 3 | 343 | 3 | 2 | 3 | 1 | 2 | 1 | 2 | 3 | 3 |
| 3 | 309 | 2 | 3 | 3 | 2 | 3 | 2 | 2 | 3 | 3 |
| 3 | 360 | 2 | 3 | 3 | 1 | 2 | 2 | 2 | 4 | 3 |
| 4 | 590 | 4 | 4 | 4 | 1 | 4 | 4 | 4 | 4 | 4 |
| 5 | 525 | 2 | 2 | 4 | 1 | 1 | 1 | 1 | 1 | 1 |
| 5 | 553 | 1 | 2 | 3 | 1 | 1 | 2 | 2 | 1 | 1 |

| Province | District | Capacity to implement KESSP | Functions overlap | Clarity on Reporting Mechanism | Staff Sufficiency | Staff Skill Level | Funds Level | Decision Making | Best Practices Documented | Best Practices Disseminated |
|---|---|---|---|---|---|---|---|---|---|---|
| 5 | 571 | 3 | 1 | 3 | 3 | 1 | 2 | 2 | 1 | 1 |
| 5 | 567 | 2 | 2 | 4 | 2 | 2 | 3 | 2 | 1 | 1 |
| 5 | 571 | 3 | 2 | 3 | 1 | 3 | 2 | 3 | 1 | 1 |
| 5 | 521 | 2 | 2 | 3 | 1 | 2 | 2 | 2 | 1 | 1 |
| 5 | 556 | 2 | 1 | 3 | 2 | 2 | 2 | 2 | 1 | 1 |
| 5 | 518 | 2 | 2 | 3 | 1 | 2 | 1 | 2 | 2 | 2 |
| 5 | 517 | 3 | 2 | 3 | 2 | 2 | 3 | 3 | 2 | 2 |
| 5 | 519 | 2 | 1 | 3 | 2 | 2 | 1 | 2 | 3 | 2 |
| 5 | 580 | 4 | 1 | 4 | 2 | 3 | 2 | 2 | 3 | 2 |
| 5 | 552 | 2 | 2 | 3 | 1 | 2 | 1 | 3 | 2 | 3 |
| 5 | 520 | 4 | 1 | 2 | 3 | 3 | 2 | 3 | 3 | 3 |
| 5 | 585 | 2 | 1 | 2 | 2 | 2 | 2 | 2 | 4 | 3 |
| 5 | 529 | 2 | 2 | 4 | 1 | 1 | 1 | 1 | 4 | 4 |
| 5 | 528 | 2 | 4 | 3 | 1 | 1 | 1 | 2 | 4 | 4 |
| 5 | 527 | 4 | 1 | 4 | 1 | 1 | 1 | 2 | 4 | 4 |
| 5 | 522 | 2 | 4 | 3 | 2 | 2 | 2 | 2 | 4 | 4 |
| 5 | 526 | 2 | 4 | 4 | 1 | 2 | 1 | 3 | 4 | 4 |
| 5 | 522 | 4 | 2 | 4 | 2 | 2 | 4 | 3 | 4 | 4 |
| 5 | 524 | 2 | 2 | 4 | 1 | 3 | 1 | 4 | 4 | 4 |
| 6 | 631 | 2 | 2 | 2 | 1 | 2 | 1 | 2 | 1 | 1 |
| 6 | 632 | 2 | 3 | 4 | 1 | 1 | 2 | 2 | 1 | 1 |
| 6 | 666 | 1 | 3 | 3 | 2 | 2 | 2 | 2 | 1 | 1 |
| 6 | 658 | 2 | 1 | 3 | 1 | 2 | 3 | 2 | 1 | 1 |
| 6 | 646 | 4 | 1 | 4 | 1 | 2 | 1 | 3 | 1 | 1 |
| 6 | 631 | 3 | 2 | 4 | 1 | 2 | 3 | 3 | 2 | 2 |
| 6 | 659 | 3 | 2 | 1 | 1 | 3 | 3 | 3 | 4 | 2 |
| 6 | 650 | 2 | 2 | 3 | 2 | 2 | 3 | 3 | 3 | 4 |
| 7 | 761 | 1 | 3 | 1 | 1 | 1 | 1 | 2 | 1 | 1 |
| 7 | 735 | 3 | 2 | 3 | 1 | 2 | 1 | 2 | 1 | 1 |
| 7 | 742 | 2 | 2 | 3 | 2 | 2 | 2 | 2 | 1 | 1 |
| 7 | 736 | 3 | 3 | 3 | 2 | 2 | 2 | 2 | 1 | 1 |
| 7 | 764 | 1 | 3 | 3 | 1 | 1 | 1 | 1 | 2 | 2 |

| Province | District | Capacity to implement KESSP | Functions overlap | Clarity on Reporting Mechanism | Staff Sufficiency | Staff Skill Level | Funds Level | Decision Making | Best Practices Documented | Best Practices Disseminated |
|---|---|---|---|---|---|---|---|---|---|---|
| 7 | 733 | 3 | 2 | 1 | 1 | 2 | 1 | 2 | 3 | 3 |
| 7 | 755 | 3 | 1 | 3 | 1 | 2 | 2 | 2 | 3 | 3 |
| 7 | 765 | 3 | 2 | 3 | 1 | 3 | 2 | 3 | 3 | 3 |
| 7 | 768 | 4 | 2 | 3 | 2 | 2 | 1 | 2 | 4 | 3 |
| 7 | 734 | 2 | 4 | 2 | 2 | 2 | 2 | 1 | 4 | 4 |
| 7 | 751 | 4 | 3 | 4 | 2 | 1 | 1 | 2 | 4 | 4 |
| 7 | 770 | 4 | 1 | 4 | 2 | 2 | 2 | 3 | 4 | 4 |
| 7 | 747 | 4 | 2 | 4 | 2 | 2 | 2 | 2 | 1 | 7 |
| 8 | 870 | 2 | 3 | 4 | 2 | 2 | 2 | 3 | 1 | 1 |
| 8 | 838 | 3 | 1 | 4 | 2 | 2 | 3 | 3 | 1 | 1 |
| 8 | 839 | 3 | 3 | 3 | 1 | 1 | 1 | 3 | 2 | 2 |
| 8 | 837 | 2 | 2 | 4 | 2 | 2 | 2 | 4 | 4 | 4 |

## 5.3 Descriptive Data Analysis Case Processing Summary

| Variable | Responses | N | Marginal Percentage |
|---|---|---|---|
| Capacity to implement KESSP | No/Not at all/Total Lack | 7 | 9.9% |
| | some/Sometimes/ somewhat | 33 | 46.5% |
| | Most of the time/Mostly | 21 | 29.6% |
| | Plenty/always/all/Yes | 10 | 14.1% |
| Functions overlap | No/Not at all/Total Lack | 15 | 21.1% |
| | some/Sometimes/ somewhat | 37 | 52.1% |
| | Most of the time/Mostly | 14 | 19.7% |
| | Plenty/always/all/Yes | 5 | 7.0% |
| Clarity on Reporting Mechanism | No/Not at all/Total Lack | 3 | 4.2% |
| | some/Sometimes/ somewhat | 12 | 16.9% |
| | Most of the time/Mostly | 35 | 49.3% |
| | Plenty/always/all/Yes | 21 | 29.6% |
| Staff Sufficiency | No/Not at all/Total Lack | 36 | 50.7% |
| | some/Sometimes/ somewhat | 32 | 45.1% |
| | Most of the time/Mostly | 3 | 4.2% |
| Staff Skill Level | No/Not at all/Total Lack | 14 | 19.7% |
| | some/Sometimes/ somewhat | 44 | 62.0% |
| | Most of the time/Mostly | 12 | 16.9% |
| | Plenty/always/all/Yes | 1 | 1.4% |
| Funds Level | No/Not at all/Total Lack | 22 | 31.0% |

| Variable | Responses | N | Marginal Percentage |
|---|---|---|---|
| | some/Sometimes/ somewhat | 38 | 53.5% |
| | Most of the time/Mostly | 9 | 12.7% |
| | Plenty/always/all/Yes | 2 | 2.8% |
| Decision Making | No/Not at all/Total Lack | 6 | 8.5% |
| | some/Sometimes/ somewhat | 40 | 56.3% |
| | Most of the time/Mostly | 21 | 29.6% |
| | Plenty/always/all/Yes | 4 | 5.6% |
| Best Practices Documented | No/Not at all/Total Lack | 27 | 38.0% |
| | some/Sometimes/ somewhat | 11 | 15.5% |
| | Most of the time/Mostly | 15 | 21.1% |
| | Plenty/always/all/Yes | 18 | 25.4% |
| Best Practices Disseminated | No/Not at all/Total Lack | 28 | 39.4% |
| | some/Sometimes/ somewhat | 16 | 22.5% |
| | Most of the time/Mostly | 13 | 18.3% |
| | Plenty/always/all/Yes | 13 | 18.3% |
| | Not Applicable | 1 | 1.4% |
| Valid | | 71 | 100.0% |
| Missing | | 0 | |
| Total | | 71 | |
| Subpopulation | | 67(a) | |

a The dependent variable has only one value observed in 65 (97.0%) subpopulations.

## 5.4 Model Fitting Information

| Model | Model Fitting Criteria | Likelihood Ratio Tests | | |
|---|---|---|---|---|
| | -2 Log Likelihood | Chi-Square | df | Sig. |
| Intercept Only | 170.594 | | | |
| Final | 39.320 | 131.274 | 72 | .000 |

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