TECHNICAL EFFICIENCY OF SMALL-SCALE MAIZE PRODUCTION IN KARAGWE DISTRICT

By

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A Dissertation Submitted in Partial Fulfilment of the Requirements for the Degree of Master of Science in Economics - Project Planning and Management (MSC. PPM) of Mzumbe University

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CERTIFICATION

We, the undersigned, certify that we have read and hereby recommend for acceptance by the Mzumbe University, a dissertation entitled **Technical efficiency of small-scale maize Production in Karagwe District** in partial fulfilment of the requirements for the award of the degree of masters of Science in Economics – Project Planning and Management

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DECLARATION

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I, Alistakius Marco Kaijage, declare that this dissertation is my own original work and that it has not been presented and will not be presented to any other university for a similar or any other degree award.

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The accomplishment of this research have been successful with the assistance of many people that in one way or another played an important role towards its achievements. Though only I get to appear on cover of this dissertation but a lot of good people have sacrificed so many things to achieve this. It is not easy mentioning the names of all those who helped me but I assure them that they are all in my heart for their tireless, moral and material assistance.

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DEDICATION

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ABBREVIATIONS AND ACRONYMS

ASA	-	Agriculture Seed Agency
AE	-	Allocative efficiency
DOA	-	Department of Agriculture
FAO	-	Food Agricultural Organization
GCAP	-	Global Climate Adaptation Partnership
MLE	-	Maximum Likelihood Estimation
NPS	-	National Panel Survey
OLS	-	Ordinary Least Squares
TE	-	Technical efficiency
UN	-	United Nations
URT	-	United republic of Tanzania
WB	-	World Bank

ABSTRACT

The measurement of efficiency in agricultural production determines the efficiency level of households in their farming activities. This will also determine whether small-scale farmers make use of all the available potentials in their agricultural activities or not. This study measured technical efficiency (TE) of maize production and identified some determinants of technical inefficiency for the specified variables.

The objective of the study was to determine the level of technical efficiency of small-scale maize producers and to identify the socio-economic features that influence technical efficiency among maize farmers. Questionnaire, interview and focus group discussion were used to collect primary data from 120 small-scale farmers. Cobb-Douglas production function was used to determine the level of technical efficiency and Logistic regression model was used to analyse the variables that have influence the technical efficiency of maize production. Cobb-Douglas results reveal that small-scale farmers in Karagwe District are experiencing technical inefficiency in maize production due to the decreasing return to scale, which means they are over-utilizing factors of production. Logistic regression results indicate that out of eight (7) variables included in the analysis as socio-economic factors, five variables that are purchase of hybrid seeds, farmers' organization membership, farming experience, Extension officers and climatic trend were found to be significant and three variables (3) that are land size, Fertilizer application, and labour system are non-significant. The calculated technical efficiency was 62% meaning that there is still an opportunity to expand maize production using the current level of inputs and the technologies available in the area.

Therefore this study propose that, since maize production is capital intensive and that most farmers are poor and would not manage to self-finance their agricultural activities, then the government should do the on-farm training since farmers mainly depend on trial and error and farmers` should have access to enough and proper use of farm inputs, provision of better extension programs, and farm management trainings that will improve technical efficiency.

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CHAPTER ONE

INTRODUCTION AND BACKGROUND INFORMATION

1.0 Introduction

In Tanzania, the role of maize in national development, both from a poverty alleviation point of view and from a national economic perspective, poses some interesting concerns. Maize production is one of the major farming activities undertaking in many of rural of Tanzania, including Karagwe district but the crop is still grown mainly by smallholders and medium-scale farmers, using traditional techniques resulting in yields, which are significantly lower than its real potential. Self-sufficient and food security in most rural areas has been great hindrances in many of the families. However, the performance of maize production has been dividing due to poor access to credit in spite of numerous agricultural financial support initiations, inadequate agricultural extension servicers, and low price from agricultural market reforms resulting in lower input use, and high level of technical inefficient use. The reason behind was to look if the small-scale maize farmers have the ability to produce at a given level of output at the lowest cost of factors of production by increasing technical efficiency where by resources are limited but high population growth is very common.

Thomas and Maurice, 2013 argued that production of goods and services as maize products can be analyzed using the short and long run concept. The central feature of short-run production analysis is the law of diminishing marginal returns, which results in the short run when larger amounts of a variable input, like labor, are added to a fixed input, like capital. The analysis of short-run production sets the stage to better understand the supply-side of the market and how producers respond to price depends, in part, on their ability to combine inputs to produce output that needs to be governed efficiently in such a way that farmers archives financial benefits.

This chapter covers the introduction to the research. It will mainly focus on the background information; statement of the problem, research objectives and hypothesis, as well as the significance of the study and its contributions, will be

identified and discussed. In the end, scope and limitation of the study together with the analytical framework will be provided.

1.1 Background of the Study

In Africa, maize functions as the staple diet for about 250 million people and indirectly as part of the animal feed consumed in poultry, dairy and meat products and production of ethanol as a biofuel and used for medical purposes (Monsanto, 2014). Effective maize production depends on the correct application of production inputs that will lead to a positive outcome. However, due to low adoption of modern technologies including irrigation, maize production especially in the Sub-Saharan African is faced with severe droughts and high variation in weather leading to unpredictable and low yield, hence farmers should decide on how much of each commodity that it sells its "outputs" or "products", it will produce, and how much of each kind of labour, raw material, fixed capital good, that it employs its "inputs" or "factor of production" it will use during maize production since maize farmers seek to profits or minimize costs subject to a given output level in a production process (FAOSTART, 2013).

Maize is a staple food in the African region where the consumption ranges from 52 to 328 grams/person/day (Ranum et al., 2014). Africa spends about $30 billion annually on imports of agricultural products, the bulk of which is food. It is expected to exceed $100 billion by 2020 (FAOSTART, 2013). Regardless of overall agricultural progress, Sub-Saharan Africa is estimated to have the highest prevalence of undernourishment (23.2% of the population) and a high number of undernourished people (220 million people or around one in four people) compared to other regions. Therefore, intensification of agricultural land and expansion of technology use must be accompanied by resource use efficiency that enhances productivity of factors that will lead to maximum output produced from different combination of factors of production whereby improvements in resource use efficiency hence increase in productivity at optimum efficiency and minimal costs as one of the farmers production objectives hence economies of scale. More importantly, efficient resource

use is the basis for achieving universal food security and poverty reduction strategies particularly in the rural areas (FAO, 2015).

The agricultural sector in Tanzania provides employment and source of livelihood to about 80% of its people and it contributes 27% of GDP and 35% of foreign currency (Daniel, 2013; Baha et al., 2013). With almost 30 million hectares of underutilized arable land, there is huge capacity for greater yields, improved quality, and efficient output. It is mainly dominated by small-scale farmers who grow different kinds of crops from their substance production in rural areas are basically for both domestic consumptions and for cash that facilitates them to meet their daily basic needs in life. Declining soil fertility, climatic extremes, lack of subsidies, high costs of inputs and lack of support for diversified income sources are all critical problems and are widely recognized as major factors responsible for declining agricultural productivity, an increase of food insecurity and increasing rural poverty since quantity of maize produced depends on the quantity of factors of production such as land, labour, capital and time employed during production practices (Simonyan *et* al, 2010).

Maize is the main food crop as it is consumed in all regions of the country and it is cultivated in almost every region due to reliable conditions Baha (2013). Tanzania is the maize basket for the region but the crop is still grown mainly by smallholders and medium-scale farmers, using traditional techniques resulting in yields, which are significantly lower than its real potential (Daily News January 2016). The supply of maize and products in Tanzania is 160.19 grams/capita/day which make the country one of the highest consumers of maize in African region (FAOSTAT, 2016).

According to URT, 2013, the demand for maize in Tanzania is increasing due to the increase in population living in most of the cities and towns however in some areas especially in rural areas has witnessed a poor performance of maize productivity in terms of production per unit efforts and this is due to traditional technical skills and other factors of production. Maize farmers, therefore, require finding out the combination of factors of production that minimizes the total costs of production for a better-given output during production practice.

Cobb-Douglas production function was employed to estimate the level of technical efficiency of small-scale maize production and check out if the production variables have either positive or negative effects in small-scale maize production and the level of technical efficiency from the input-output relationship, economies of scale and to return to scale during maize production practices.

1.2 Problem of the Statement

Daily News of 11th March 2014 the reporter, reported that Agriculture is a priority sector but not everything under this sector is under Big Result Now which is the Government initiative to streamline the growth of priority sectors agriculture inclusive. The focus here is to increase agricultural productivity by addressing key sector bottlenecks and resolving them.

Currently, food security is one of the challenges facing many regions and there has been a declining trend in maize production in Tanzania, these calls for improving yields of maize production for better food security and livelihoods of rural households. The 2013/2014 National food production for maize was 4,424,984 tons while the requirement being 5,131,782 tons the deficit is 706,797 tons, total food produced was estimated to 12% below the trend value, this is according to The Ministry of Agriculture Food Security and Cooperatives (Stephen, et al 2014). This is due to a number of factors that include low soil fertility; insect pests, inadequate financial accessibility, extension officers, climatic change, inadequate of government subsidies, technological adoption, supportive policies, erratic rainfall, and diseases are among the primary constraints in maize production, since most farmers practice subsistence farming with low productivity (Nkonya, 2004).

Due to rapid population increase, the average numbers of undernourished people have increased from 16 to 17 million people in 2013-215 and 2014-2016 respectively due to inadequate consumption of calories and energy-proteins and that is due to some factors which may be caused by inadequate in technical production efficiency and these are such as type of seeds used, inefficient fertilizer application, farming experience, inefficient of enough credits, land size and inadequate services from the

extension officers hence in order to realize increased production and efficiency, small-scale farmers in developing countries need to efficiently utilize the limited resources as the factors of production accessed for improved food security and farm income generation (FAOSTAT, 2016).

Luke, (2011) on his study of technical efficiency of maize production in Nigeria using Cobb-Douglas production function and stochastic frontier suggested that maize production has either marginally improved or remained stagnant, most of the rural farmers lacks some of the factors of production as an inputs resources during their production practices that directly affects the level of output. Since the quantity of maize produced depends on the quantity of factors of production employed during production practices whereby producers respond to price in part, on their ability to combine inputs to produce output, hence there is considerable room for improving the technical efficiencies and farmers should be empowered with appropriate financial means to acquire these inputs and to hire more labour hence that could facilitate them to maximize their output and reduce poverty line.

In that context of Tanzania, various researches have been done in different places in Tanzania. For instance, Bahati and Kuzilwa (2014) carried a study on the technical efficiency of tobacco in Tabora using Cobb-Douglas theory of production and the outcome from the finding was that the calculated technical efficiency was 64.7% with the implication that there was an opportunity to expand the production using the current input and technologies as the factors of production resources. Also, another study was carried by Sesabo, (2012) with the aim of analyzing the technical efficiency and small-scale fishing households in Tanzanian coastal Village with the application of stochastic production frontier. The researcher found that the efficiency of individual fishing households is positively associated with fishing experiences, size of the fishing land and big household size relative to the productivity of output level which depends on the quantity of factors of production employed during production practices.

There is a need for improving agricultural sector in Tanzania so that the sector increase food availability, reduce poverty, enable the country to increase markets for

products, address pressing social needs, and eventually become self-sufficient in basic food requirements. Food production has been failing to meet demand and the country has been importing food so as to meet the demand due to its production shortfalls (Stipro, 2016).

Different analyses on maize production have been conducted. Most of the studies concerning with production are almost similar, others are applicable in the countries where the studies have been done, but there is a need to fit the information provided in the study area case. While attempting to address these underlying issues and question, this research work addressed the technical efficiency of small-scale maize production in the study area.

1.3 Objectives of the Study

1.3.1 General Objective

The broad objective of this study is to examine technical efficiency of small-scale maize production in Karagwe district.

1.3.2 Specific Objectives

Specifically, the study has the following objectives:

i/ To determine the level of technical efficiency of small-scale maize production in Karagwe district.

ii/ To identify the socio-economic features that influence the technical efficiency of small-scale maize producers in Karagwe district.

1.4 Research Hypotheses

In this study the following hypotheses will be tested:

H1: The small-scale maize producers in Karagwe district are not technically efficient.

H2: There are no socio-economic characteristics have no influence on the technical efficiency of small-scale maize producers in Karagwe district.

1.5 Significance of the Study

This study is important as it exposes the factors of Technical Efficiency of small-scale maize production in Karagwe District. This study also contributes to the understanding of resource use in smallholder maize producing farms in Karagwe district, while contributing to the empirical literature with respect to African agriculture more generally, and Tanzanian agriculture in particular. It also helps to determine the technical efficiency of maize production in Karagwe district and compare efficiency levels found in other studies using similar methodologies in Tanzania and other developing countries.

Moreover, also the study shades light to the policy and decision makers such as government and development partners in reviewing existing policy, laws and regulations components for efficient performance of the agricultural sector which is dominated by small farmers in the effort to alleviate poverty in Tanzania.

Not only that but also for planners and other development actors with a genuine interest in maize production, the study provides them a basis for implementing agricultural development projects in an approach that facilitated the improvement of the sector as whole from start to the end point of production.

Furthermore, also the finding adds new knowledge to Karagwe small-scale farmers and at the national and international level on small-scale agricultural production and utilizes the technological opportunities through proper investment in agricultural production.

Lastly, the study also fills the gaps in previous studies carried out by other researchers on investigating the technical efficiency of small-scale maize production in Tanzania and also attracts other researchers to carry out the study beyond this scope.

1.6 Scope of the study

Geographically the study was carried out in Karagwe District in Kagera region of the United Republic of Tanzania. The scope of the study can be in term of physical and background magnitudes. In term of corporeal measurement, the study was carried out in eight villages of among seven wards in Karagwe district. These villages are Kanoni, Kabuli, Rwambaizi, Kibwera, Katanda, Kihanga, Kibona and Runyaga. These villages were selected because there are fertile soil and some water bodies that could allow productivity efficiency. The study was limited to measuring the economic efficiency and allocative efficiency of maize farmers hence based only on technical efficiency.

The study involved only Maize producers in Karagwe District because time constraint, not all farmers were investigated, a sample of the farmers was investigated and a sample of them (120 farmers) was located. Hence, the success of this study depended on respondent answers and the capacity of responding interviews in understanding the language and questions asked in this study. The perception of respondents of this study was influenced with their answers. Some politicians and leaders might think that the results of this study may change their political status and this may lead them to give force answers to the question since the study was conducted during election period.

1.7 Organization of the Dissertation

This study was structured into six chapters. The first chapter entails introduction, problem statement, objectives, significance and scope and justification of the study. The second chapter presents the definition of key concepts, theoretical and empirical literature review, and review of the theories and conceptual framework of the study. The third chapter is the methodology of the study. The fourth chapter focused on data processing, analysis and presentation of the findings. Chapter five presents the discussion of the findings of the study while the last chapter provides conclusion and policy recommendations arising from the research and related areas requiring further research.

CHAPTER TWO

LITERATURE REVIEW

2.0 Introduction

Literature review involves identification and analysis of documents containing information relating to research problem (Gay, 1981). This phase reviews literature in relationship to the research objectives basing on the same empirical studies related to the technical efficiency of small-scale maize production in Karagwe district as presented by the various writers.

The first part of this chapter is the definition of the key terms as the sub-headings which basically focuses on different concepts presented in the topic. The concepts found in the first are part of production, efficiency, smallholders, and technical efficiency that will show the road map under which this study was undertaken. The second phase of this chapter discusses on theoretical literature review which basically focuses on Cobb-Douglas theory of production as input resources used in production process used to produce finished goods and services as an output and the production function is used to present the technological relationship particularly physical capital and labour and other factors of production. Lastly but no least, it covers the technical efficiency of maize production from different parts of the world. Also the relationship between independent and depend on variables is presented by conceptual framework.

2.1 Conceptual definition

2.1.1 Concept of Production

Production in economics generally refers to the transformation of inputs into outputs (Thomas and Maurice, 2013). The inputs are basically the raw materials or any other resources that are combined to give an output. The output refers to the end product or final production of the combination of resources. Mathematically a production function is used in describing the combination of resources to create an output.

Production of different goods and services can be analysed using short and long-run concept. The central feature of short-run production analysis is the law of diminishing marginal returns, which results in the short run when larger amounts of a variable input, like labour, are added to a fixed input, like capital (Thomas and Maurice, 2013).

2.1.2 Concept of Efficiency

According to Whiting, (2015), efficiency is the situation of society getting the maximum benefits from its scarce resources. The measurement of productive efficiency has important implications for the neoclassical theory of production economics and economic policy and measuring productivity efficiency allows one to test competing hypotheses regarding sources of efficiency or differentials in productivity (Rios *et* al., 2005).

2.1.3 Technical Efficiency

This is the engineering concept for measuring the performance of the system given the available resources and when a producer with the aim of maximizing profit makes allocation mistakes that result in inefficiency, then the farmer is considered allocative inefficient. For a farm to be called technically efficient it has to produce at the production frontier level, hence technical efficiency is achieved when a high level of output is realized given a similar level of inputs (Kibirige, 2008)

Technical efficiency can be measured within two main frameworks which are input and output-oriented. In an input-oriented framework, technical efficiency provides the potential input reduction that a farm could apply without reducing its output level. In an output-oriented framework, technical efficiency provides information about the potential output increase that a farm could gain without increasing its use of inputs.

2.1.4 Concept of Small-Scale Production

According to Oettle *et* al. (1998), involves households producing agricultural yields on relatively small plots of land. FAO (2010) explains that, in Tanzania, smallholder farmers cultivate various types of cash and food crops for subsistence on farm sizes

ranging between 0.5 to 5.0 hectares. From the study area most of the famers seemed to practice their maize production in small-scale farms and most of them they do mix many crops into the same farm.

2.2Theoretical literature review

2.2.1 The Theory of Production

In the Encyclopaedia Britannica (2004) the theory of production has been defined as an effort to explain the principles by which a business firm decides how much of each commodity that it sells its "outputs" or "products" it will produce, and how much of each kind of labour, raw material, fixed capital good, that it employs its "inputs" or "factor of production" it will use. The assertions are that there is a producer who seeks to profits or minimizes costs subject to producing a given output level in a process (Henderson et al., 1995). The production process is the transformation of inputs into outputs.

A production process is cost efficient if it costs less of the inputs by producing more of the outputs. This is explained well by the optimization behaviour of the producer (Koutsoyannis, 1992). The behaviour of the producer is under the assertion that a producer 10wants to maximize output for a given cost or minimize cost for a given output level. For the sake of determining the profitability of alternative production opportunities, the physical data must be combined with price and cost information as well as data on the availability of various land, labour, and capital resources. This will help in making appropriate production decisions for the farm or firm (Boehlje et al., 1984). To get reliable and meaningful estimates it is essential to include all relevant variables used in the production process.

2.2.2 Cobb–Douglas Production theory

The theory explains the factors of production, resources, or inputs are what are used in the production process to produce output that is, finished goods and services. The amounts of the various inputs used determine the quantity of output according to a relationship called the "production function". There are three basic resources or factors of production; land, labor, and capital. These factors are also frequently

labeled "producer goods" to distinguish them from the goods or services purchased by consumers, which are frequently labeled "consumer goods." All three of these are required in combination at a time to produce a commodity. The essence of a firm is to buy inputs, convert them to outputs, and sell these outputs to consumers and the firm owners seek to improve their positions by producing goods and service either those they consider most important for themselves or those that can be sold to command the goods they consider most important (Thomas and Maurice, 2013).

Cobb–Douglas production function is a particular functional form of the production function, widely used to represent the technological relationship between the amounts of two or more inputs, particularly physical capital and labour, and the amount of output that can be produced by those inputs. The term has a more restricted meaning, requiring that the function display constant returns to scale in which case $\beta = 1 - \alpha$. In its most standard form for production of a single good with two factors, the function is $Y = AL^{\beta}K^{\alpha}$ whereas;

- Y = total production (the real value of all goods produced in a year)
- L = labour input (the total number of person-hours worked in a year)
- K = capital input (the real value of all machinery, equipment, and buildings)
- A = total factor productivity

α and β are the output elasticities of capital and labour, respectively. These values are constants determined by available technology $\alpha + \beta = 1$, the production function has constant returns to scale, meaning that doubling the usage of capital K and labour L will also double output Y. If $\alpha + \beta < 1$, returns to scale are decreasing, and if $\alpha + \beta > 1$, returns to scale are increasing. Assuming perfect competition and $\alpha + \beta = 1$, α and β can be shown to be capital's and labour's shares of output (Maddala, 2002).

2.2.3 Cobb- Douglas and labour intensive

Labour is the effort that people contribute during production practices. Demand for labour is a concept that describes the amount of labour that an economy or firm is willing to employ at a given point in time. This demand may not necessarily be in

long-run equilibrium, and is determined by the real wage, firms are willing to pay for this labour, and a number of labour workers are willing to supply at that wage. It's increasingly difficult to substitute capital for labour as the capital-labour ratio increases, and vice-versa. Producers choose the mix of capital and labour that minimizes their cost (Krugman, 2012).

As results farmers have substituted man–made inputs, for example, fertilizer for land and tractors for labour during their production practices. Labour is the most easily available input in rural areas, so small-scale farmers tend to overuse it has since they lack some of the substitute factors of production (Ojo, 2005).

The high labour use intensities on small-scale farms are that in the land market smaller peasants face higher effective purchase prices for land. Small-scale maize producers have several implications on the use of labour compered to larger farmers as they use more intensively for each crop; they use more of the available land; they choose more labour intensive crops, and they use their own labour for land improvements. All of these implications lead to the conclusion that small-scale farmers have a higher resource use per unit of land. This factor-use intensity gives small-scale farmers a productivity advantage over larger farmers (Cornia, 1985).

2.2.4 Cobb- Douglas and capital intensive

Capital as one of the Cobb-Douglas input factor of production contributes a lot to small-scale maize producers, small-scale maize producers has to invest in capital input such as hiring of tractors and labour and also purchasing of hybrid seeds for their betterment production practices, many small-scale farmers are facing some of the financial constraints as their burden towards their production practices. Financial capital is any economic resource measured in terms of money used by entrepreneurs and businesses to buy what they need to make their products or to provide their services to the sector of the economy upon which their operation is based (Cornia, 1985).

A production function explains the technical relationship between the inputs and resulting outputs. If estimated empirically from data on observed outputs and input usage, it shows the average level of outputs which can be produced from a given

level of inputs. When the farm produces at the best production frontier, it is considered efficient. The most common assumption is that the goal of the producers is profit maximization, however, it is believed that the objectives and goals of the producer are intertwined with farmers' psychological makeup (Maddala, 2002).

2.3 Empirical Literature Review

Studies conducted either in Tanzania or elsewhere have identified on technical efficiency of small-scale maize production in the study area. Some of these studies are reviewed in this section.

2.3.1 Productivity trend of maize in some of sub-Saharan African countries 2010-2014

FAO, (2015) data presented in Table 2.1 below suggests that Ethiopia is one of the largest producers of maize among the selected countries followed by the United Republic of Tanzania in the Sub-Saharan African countries. To satisfy maize demand, Africa imports about 28% of the crop from beyond the continent. In terms of productivity, data presented in Table 2.1 indicates that in the year 2014 Ethiopia yields (7234955 tons/ha) are relatively higher compared to other countries in this review, followed by united republic of Tanzania (6737197 tons/ha), Kenya (3513171tons/ha), Zambia(3350671tons/ha), Uganda (2763000 tons/ha), Mozambique (1357220 tons/ha), Burundi (127829 tons/ha), and Eritrea (18040 tons/ha), value of maize respectively. Results indicate that all countries are operating below the maximum potential grain yields (Kibirige, 2013). Thus, improved productivity would help countries reduce their import budgets of, especially countries like Kenya and Mozambique with about 513,171tons and 105,000 tons of maize imported in 2011. The data displayed in Table 2.1 suggests that these countries still have room for improved productivity may be by improving on efficient allocation of resources to maximize production at a least cost since maize production tends to fluctuate in terms of tones from year one to another either by increasing or decreasing meaning that the productivity efficiency of maize production it is dynamic in nature from one country to another regardless of the factors of production.

Table 2.1: Productivity trend of maize in some of sub-Saharan African countries 2010-2014

Country	Item	Yea	Unit	Value	Year	Unit	Value
Burundi	Maize	2010	tones	126412	2014	tones	127829
Kenya	Maize	2010	tones	3464541	2014	tones	3513171
Mozambique	Maize	2010	tones	2089890	2014	tones	1357220
United Republic of Tanzania	Maize	2010	tones	4733070	2014	tones	6737197
Uganda	Maize	2010	tones	2373501	2014	tones	2763000
Ethiopia	Maize	2010	tones	4986125	2014	tones	7234955
Zambia	Maize	2010	tones	2795483	2014	tones	3350671
Eritrea	Maize	2010	tones	18000	2014	tones	18040

Source: FAOSTAT (2015)

2.3.2 Productivity trend of maize in Karagwe District in 2013/2014

URT (2013) data presented in Table 2.2 below suggests that Karagwe district is one among the producers of maize in Kagera region it is the second district from the first. The trend level of maize productivity between 2013-2014 basing on two different seasons "short rainy season and long rainy season" and the trend level on the hectare of maize planted in the area, quantity of maize harvested as well as the number of tons harvested as been indicated with the implication that in the short rainy season there was an increasing trend in tons of maize yield in the year of 2013 as 2.991 while in 2014 the number of tons in maize yield decreased up 1.268 tons showing that there was an incremental fluctuation on maize productivity from one year to another with the implication that the level of technical efficiency in the study area from year of 2013/2014 was inefficient keeping the other factors of production constant. The data displayed in Table 2.2 suggests that the district still have room for improved productivity may be by improving on efficient allocation of resources to maximize production at a least cost since maize production tends to fluctuate in terms of tones from year one to another either by increasing or decreasing meaning that the productivity efficiency of maize is dynamic in nature from one season to

another hence they should invest much in irrigation system and current technologies as well as hybrid seeds.

Table 2.2: Productivity trend of maize in Karagwe District in 2013/2014

Short rainy season				Long Rainy Season				Total		
Number of Households	Planted Area (ha)	Quantity Harvested (tons)	Yield (tons/ha	Number of Households	Planted Area (ha)	Quantity Harvested (tons)	Yield (tons/ha)	Planted Area (ha)	Quantity Harvested (tons)	Yield (tons/ha
59,979	36,154	26,000	2.991	49,827	17,014	13,623	1.723	57,321	39,623	1.268

SOURCE: URT (2013).

2.3.3 Empirical literature review on socio-economic features towards technical efficiency

Bahati and Kuzilwa (2014), made the study on the technical efficiency of tobacco production in Tanzania. The purpose was to determine the efficiency level in their farming activities and also determine whether smallholder farmers make the use of available resources or not. The searchers used stochastic frontier to analyse the data in the Cobb-Douglas production function to analyse the technical efficiency of tobacco production in the study area. The outcome from the finding was that the calculated technical efficiency was 64.7% with the implication that there was an opportunity to expand using the current input and technologies. The variables used was farm size, input credit use, off-farm income, education, labour and fertilizer, age of household were by only two of them were significant hence concluded that they is a need for encouraging farmers to participate in input credit system, better provision of extension programs, raising education and farm management that will improve technical efficiency.

A study done by Abba (2012), on the technical efficiency of sorghum production and its determinants used stochastic frontier production function which incorporates a model of inefficiency effects. He used farm-level data collected from a sample of 100 sorghum farmers in Hong local government area of Adamawa state. According

to his study, land, seed, and fertilizer were the major factors that influence changes in sorghum output and education, extension contact and household size were major explanatory variables that had significant effects on the technical inefficiency among the sorghum producers and the mean technical efficiency was 72.62 percent. The implication of the study is that efficiency in sorghum production among the farmers could be increased by about 27 percent through better use of land, seed, and fertilizer in the short term given the prevailing state of technology and recommended that policy interventions by the government in terms of better access to land, improved seed and fertilizer should be emphasized.

Luke, (2011), conducted a research on analyses of technical efficiency differentials and their determinants among maize farmers in Nigeria. The main objective of the research was to make analysis measure on technical efficiency among maize farmers. A researcher used descriptive statistical methods and translog frontier production functions to the data with a total sample size of 300 of respondents from the study area were to test from the input-output and social-economic variables. The results also indicate that the sampled farmers are not technically efficient, with mean technical efficiencies of only 0.5588 and 0.5758 in Oyo and Kebbi states, respectively. The study concludes that there is considerable room for improving the technical efficiencies in the two states and suggested that these farmers are empowered with appropriate financial means to acquire these inputs and to hire more labour hence that could facilitate them to maximize their output and reduce the poverty line.

Baloyi (2011) did a study on analysis of technical efficiency of small-scale maize farmers in South Africa. The main aim of this study was to analyse the technical efficiency of small-scale maize producers. The researcher used purposive and snowball sampling techniques were used to collect primary data from 120 small-scale farmers. Cobb-Douglas production function was used to determine the level of technical efficiency and a Logistic regression model was used to analyse the variables that have influenced the technical efficiency of maize production. The results reveal that small-scale farmers are experiencing technical inefficiency in

maize production due to the decreasing return to scale, which means they are over-utilizing factors of production. The conclusion was that government should do the on-farm training since farmers mainly depend on trial and error and farmers` should have access to enough arable land and tractor services.

Simonyan *et* al (2011), made the study on gender differentials in technical efficiency among maize farmers in essien udim local government area, in Nigeria. The aim of the study was to examine the relative technical efficiency and its determinants on gender basis in maize production. A multi-stage random sampling technique was used to select 100 maize farmers, and Data were collected using a well-structured questionnaire and interview schedule administered on the respondents were analysed using description tools and stochastic frontier production function. Results further indicated that the estimated production function revealed that farm size at 1 percent and quantity of fertilizer at 1 percent significantly influenced the maize production function for male farmers while farm size at 1 percent, labour at 5 percent, maize seeds at 10 percent and quantity of fertilizer at 10 percent significantly influenced that of the female farmers. The results, therefore, call for policies aimed at encouraging the youths who are agile and young and experience to engage in maize production.

Essa, et al (2010), conducted a research on Resource use efficiency of smallholder crop production in the central highlands of Ethiopia. The main objective of the research was to examine the resource use efficiency of smallholder crop production. A random household survey of 700 households was conducted in the central highland district in order to assess farm-level resource use efficiency and to determine factors that influence inefficiencies in the production of wheat. Moreover, a two-limit Tobit regression model results reveal that inefficiency in resource use is positively and significantly affected by family size, farming experience and membership to associations. he results suggest that resource use efficiency and productivity gains are likely to be significantly improved through expansion of nonfarm sectors, reform of farmer related associations and integrating community leadership in various community activities and programs.

Oyewo and Isaac (2011), made a study on the technical efficiency of maize production in Oyo state in Nigeria. The purpose was to detect the technical efficiency of maize production. A researcher used multiple sampling techniques to select 120 maize farmers and also used stochastic production frontier model to determine the relationship between the maize output and the level of input used. The result from the findings indicated that farm size and hybrid seeds were statistically significant at 10% and 1% and the return to scale was 0.587 hence the study concluded that there is a scope of increasing maize production by 39% with the current technologies and inputs that will bust the level of maize production in study area and reduce the rate of poverty in rural areas.

Felix et al. (2011), conducted a research on estimation of farm level technical efficiency in the central region of Ghana. The primary objective of the study was to estimate the level of technical efficiency in small scale production and determine some of social-economic characteristic and management practices which in influence technical efficiency. A researcher used the stochastic frontier approach as a methodological model, and also the marginal product of fertilizer, labor and seeds were calculated as well as average product and return to the scale of inputs, the result indicated that mean of small-scale maize production was 58%resulted from different variables. Hence concluded that due to estimate return to the scale of 1.49 shows there was increased the return to scale in the study area.

Huynh and Mitsuyasu (2011) made an effort to measure the TE of rice production and identified some determinants of TE of rice farmers in Vietnam. They used Vietnam household living standard survey 2005-2006 and analyzed using stochastic frontier analysis method. In their study using the Cobb-Douglas production functional form, the mean level of TE was found to be 81.6 percent. According to their study, the most important factors having positive impacts on TE levels were intensive labor in rice cultivation, irrigation, and education.

Ammani, et al (2012), did a study on climate Change and Maize Production in Kaduna State, Nigeria. The main objective was to investigate the relationship between rainfall, among other factors, and maize crop production. Data were

analysed using multiple regression techniques. An estimated 80% of the maize crop suffers periodic yield reduction due to drought stress and grain filling period may cause losses of 40-90%. Findings of the study showed that annual rainfall contributes significantly and positively to maize production in the study area in spite of climate change, indicating that climate change has not significantly altered the pattern of rainfall in the study area in such a way as to affect maize production negatively.

Peter and Philip, (2003), conducted a research on potential impacts of climate change on maize production in Africa and Latin America. The main objective was to assess the impact of climate change on agriculture may add significantly to the development challenges of ensuring food security and reducing poverty in rural areas. They used high-resolution methods to generate characteristic daily weather data for driving a detailed simulation model of the maize crop and the outcome indicates an overall reduction of only 10% in maize production to 2055, equivalent to losses of $2 billion per year, the aggregate results hide enormous variability: areas can be identified where maize yields may change substantially. Climate change urgently needs to be assessed at the level of the household, so that poor and vulnerable people dependent on agriculture can be appropriately targeted in research and development activities whose object is poverty alleviation.

Jane and Millicent (2015), made a study on the effects of climate change on food security in Kenya. Fixed and random effects regressions for food crop security are estimated. The study further simulates the expected impact of future climate change on food insecurity based on the Special Report on Emissions Scenarios and Atmospheric Oceanic Global Circulation Models. The study is based on county-level panel data for yields of four major crops and daily climate variables data spanning over three decades. The results show that climate variability and change will increase food insecurity. Food security responds positively to favourable agroecological zones, soil drainage and depth, and high population density. The paper recommends strengthening policies on mitigation against and adaptation to climate change.

The literature review above prevails that Cobb-Douglas production function has wider application in analysis of production efficiency. Hence this study will

contribute additional literature, by the analysing efficiency of maize production and determinants of inefficiency from the study area.

2.4 Research Gap

There have been a number of researches done on technical production efficiency among small-scale maize farmers in the world. Most of them are not relevant to Tanzania and they provide the gap of time, place, and industry. Nevertheless, none of those studies attempted to look on technical efficiency of small-scale maize production in Karagwe district. This research, therefore, will bridge the gap in order to come up with the solutions to reverse the trend in Karagwe district and another district of Tanzania.

2.5 Conceptual Framework

After reviewing technical efficiency related literature the researcher comes up with a conceptual framework which shows the relationships' between independent variables and dependent variables.

2.5.1 Farm size and Efficiency

Most of the rural farmers are practicing their farming activities into small-scale since mostly they depend on subsistence production. Farm size matters a lot towards quality and amount of output produced from farming practices, that the higher the size of the farm the higher the amount of output to be produced and vice-versa keeping other factors constant hence efficiency. In most of the rural areas, farmers own about 0-3 hectare farm meaning that they are capable of managing, it is argued in most of the literatures that the lower the size of a farm the higher the productivity and vice-versa.

2.5.2 Extension officers and Efficiency

The roles of extension services could either contribute positively or negatively to the performance of agricultural sector especially in rural areas whereby most of the farmers are practising subsistence agriculture. Accessibility of different agricultural information such as the amount of fertilizer to be applied during production, pests sides to be used and education about how to manage and control the farms are very

important to farmers, hence that it facilitates the positive output and technical efficiency also as well as if they will be information asymmetry to farmers the productivity efficiency will be low.

2.5.3 Fertilizer Application and efficiency

Fertilizers play an important role in securing food supplies for the world. This therefore, implies that reducing fertilizer use may result in a threat to maize production decline (Udoh *et* al, 2011). Application of fertilizer adds nutrients to the crops and support quality of the crops, it is advanced that most of the farmers should take into account the importance of fertilizer in order to improve their soil fertility and hence increase the rate of productivity.

2.5.4 Labour System and Efficiency

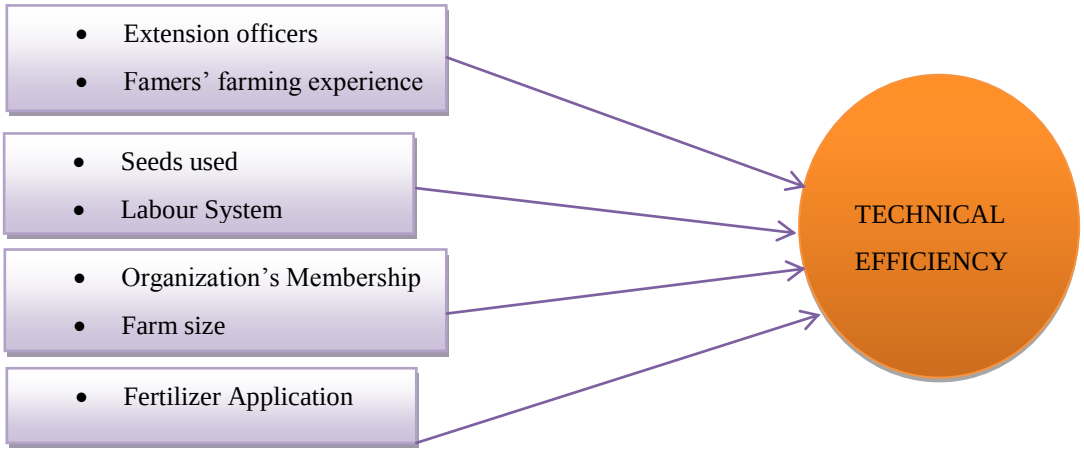
In many regions labour have been the major factors limiting the increase in output. Labour is the most easily available input in rural areas, so farmers tend to overuse it (Ojo, 2005), while fertilizers and agrochemicals, seeds, and high-tech implements are often underused because of high costs which positively affects crop productivity (Akintayo, 2011).

Fan and Connie, (2005), showed that to increase labour productivity, either land productivity or land to labour ratio has to increase. If farm labour is a fixed factor of production (surplus labour lacking alternative uses) and land is fixed it will be difficult to adopt a technically efficient land-labour ratio impact on technical efficiency.

2.5.5 Agricultural Inputs and Efficiency

In order to achieve sufficient agricultural output, the use of modernized input in production practices is well emphasized. Modernized inputs such as hybrid seeds, fertilizer, herbicide and labour contribute a lot towards a positive outcome in production development as well as the quality of food if farmers will either underutilize or over-utilize them during production practices regardless with their applicability.

Figure.2.1: Conceptual Framework



Source: Researcher's Modelling, 2016

Legend:

Dependent variable

Independent variable

2.6 Description of Variable

This diagram shows that there is a direct relationship between the independent variables and the dependent in such a way that at the end of the process they was the possible outcome on technical production efficiency maize farmers in the study area, and one of them was the leading factor influencing the others. The factors towards technical efficiency are farming experience, labour system, and farmers organization's membership, extension officers, farm size, fertilizer application, seeds used as well as climate change. The analyses also considered other factors, not in the conceptual framework but are related to respondents such as age and sex.

CHAPTER THREE

RESEARCH METHODOLOGY

3.0 Introduction

This chapter gives information about research methods which were used for this study. A research methodology is defined as "a system of doing or studying something" (Cambridge dictionaries online, 2011). It is understood as a science of studying how research is done scientifically. The selection of research methods depends on the research topic or researcher's interests. Silverman (2010), states that there is no correct or incorrect method to proceed. This chapter describes the research design, study area, the research approaches, the research sampling, the sample size, data collection methods, data presentation and analysis, model specification for the study, econometric model and data reliability and validity.

3.1 Research Design

The research design is like a complete map that leads the researcher to reach the research objectives. It is an imperceptible structure within which the research is done (Adam and Kamuzora, 2008). It is a strategy of getting from here to there, where here refers to initial questions to be researched and there refers to findings and conclusion about these questions (Yin, 2005).

The design used was cross-sectional in nature because data was gathered once at one specific point in time and conclusion has been drowned based on the collected data as a case study based on Yin (2003) as applicable to several villages from different wards such as; Kanoni, Kihanga, Kituntu and Igurwa ward in Karagwe district. Yin (2005) case study is the preferred design when "what', "how" or "why" questions are being posed, when the investigator has little control over events and when the focus is on a contemporary phenomenon within some real-life context as it is in Kanoni, Katanda, Kihanga, Kibwera, and Igurwa case study.

In this research ‘what” questions were used to gather information based on descriptive. This information was later presented in the form of descriptive statistics. ‘How’ question was used to address the qualitative data since the triangulation of method was used to gather both qualitative and quantitative data. Why question was used to collect explanatory data and the testing hypothesis that were set forth by the researcher. In this study research design was based on Yin (2005), applicable to Karagwe District. Research design can be categorized into three as;

3.1.1 Explorative Design

On Monday morning 6th of August 2015 researcher went to Kanoni ward in Kanoni village. The explorative design used at the beginning at the time the researcher went to Kanoni ward exploring the area like Vasco Da Gama (Yin, 2003). The researchers stayed at Bukara Village where farmers are practicing Maize production. The first day of arrival, the researcher conducted a transect walk to the area of study in Kanoni ward and the nearby villages such as Kibona, Kimuli and Omuchigongo, on the way the researcher observed that Kanoni ward is surrounded by different farmers practicing maize production and other agricultural farm crops.

The second day the researcher had to walk more than 14km to Kihanga ward, on the way the researcher observed that apart from Maize production also Famers were growing other food products such as beans, vegetable gardens, tomatoes, onions, peens, cassava, and also groundnuts hence a focus group discussion were conducted with famers practicing Maize in Kihanga ward and 22 representative attended and that was due to the reason that most of the farmers do practice Maize production far away from their residence especially nearby water sources, few respondents were found.

The third day the researcher had to walk to Katanda village in Kihanga ward were most of the maize farmers are found. On the way, some observations were marked such as small-scale maize farms. Medium and large as well as maize mixed with bananas in the same farm. About 36 Farmers were interviewed that day.

After two days the researcher had to walk to Chanika ward where most of the farmer's practices maize as their main food crop and apart from that on the way some observation were marked that also farmers do practice other food crops even apart from maize in Chanika village were by 16 farmers were interviewed through focus group discussion.

The following day researcher called up a meeting in Chanika ward which included, Village leaders and Extension officers and focus group discussion was conducted whereby 18 maize farmers, 2 village Leaders, and 1extension officer were interviewed, and on the other days researcher continued to collect data in Omulurama village with farmers up to the day of departure after one six days.

3.1.2 Descriptive Design

Descriptive research seeks to provide an accurate picture of observations of phenomena. Descriptive research includes surveys and fact-finding inquiries of different kinds and the major purpose of descriptive research is a description of the state of affairs as it exists at present (Kothari 2004). Not only that but also Yin (2003), explains this type of case study that is used to describe an intervention or phenomenon and the real-life context in which it occurs and its prevalence. The study is descriptive because it describes different factors towards maize production and technical efficiency by agriculturalists from the study area and draws decision.

3.1.3 Explanatory Design

Explanatory studies look for explanations of the nature of certain relationships. This type of case study was used to identify and explain any causal links between the factors or variables that pertain to the research problem. Thus the findings explain on the variables relationship between small-scale maize farmers towards production efficiency in the study area. The case study provided answers to the questions with respect to how, what, and why (Yin, 2005). These questions were asked in this study to gather information from respondents concerning if do maize farmers meet production efficiency in the study area.

3.1.4 Inductive Studies Design

Inductive reasoning moves from specific observation to broader generalization and theories (Burney, 2008). The study is inductive in nature because it started with data collection and observation from Maize production farmers to broader generalizations and then theories as the conclusion were drawn depending on the collected data from Karagwe District. This design will be used because it is comprehensive and suitable where little or nothing is known about the study phenomenon (Silverman, 2004).

3.1.5 Triangulation of Methods Design

Triangulation of method design broadly defined as "the combination of methodologies in the study of some phenomenon (Denzin, 1978). It uses more than one approach to making investigation of the research question in order to facilitate the collection of data. "Any finding or conclusion in any case study is likely to be much more convincing and accurate if it is based on several different sources of information, following corroboratory mode". Qualitative and quantitative data collections were both involved; on the other hand, focus group discussions, interviews, as well as focus group discussion, were employed in the data collection. Furthermore also, Silverman (2004) point out that the use of triangulation for the purpose of validating the findings has been seen as philosophically problematic, but the critics for this technique do not dispute it validity from augmenting findings.

3.2 Area of the Study

The study was conducted in Karagwe district. It was purposely chosen because there has been a change in eating behaviour, shifting from banana to maize due to food insecurity. Karagwe district is one of the 8 districts in Kagera Region. The District borders are the Kyerwa District and the Republic of Uganda in the North, the Republic of Rwanda in the West. In the South, it borders the District of Ngara and Biharamulo and in the East borders Muleba, Missenyi and Bukoba districts (KDC, 2014). The district covers an area 4,630 Km2 with 158 km2 covered by water bodies.

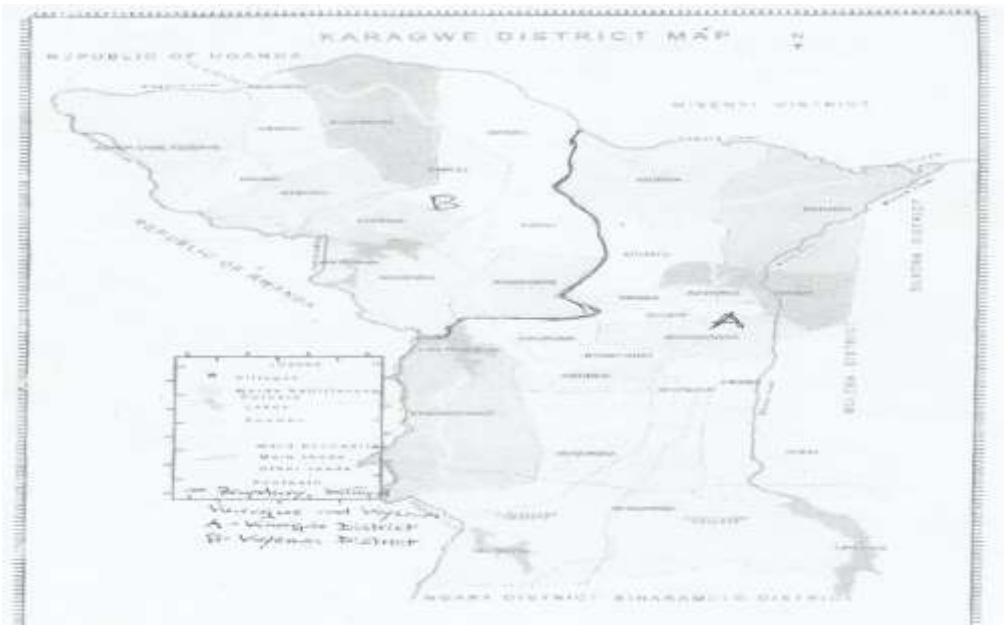
Administratively, the district is divided into 5 divisions, 22 wards which consist of 73 registered villages and 737 subs - villages (hamlets). According to 2012, Tanzania National Census, the total population of Karagwe district was 332,020 inhabitants, of

whom 163,864 are males and 168,156 are females (URT, 2013). Population growth rate was 4.7 percent. The average household income is estimated to be Tanzanian shillings 450,000 (2010) income per capita. This includes the value of cash and kind production and transfer payments. This is below the national average income for rural households (KDC, 2014).

Agriculture is the major economic activity in Karagwe district. The farming system is mainly "Kibanja" where maize is normally intercropped with bananas, cassava, beans, yams, and vegetables all of which are mainly for local consumption. Farmers own small plots of land, with an average farm size of two hectares per household (KDC, 2014). The predominant farming system is subsistence under rain-fed conditions, practiced by over 90% of the population in the district.

The study area was regarded best for studying sources of maize production efficiency as although in recent years, the study area has experienced some expansion of non-farm activities, still, farmers in the district primarily rely on maize production for their livelihoods. Increasing population size and density has also led to the destruction of landholdings for some families so that the distribution is not homogeneous. Therefore, most of the farmers in the study area operate as smallholders or sharecroppers. Furthermore, accessibility of the area and good agronomic practices were also main drivers for selection of this study area.

Figure 3.1 The map of Karagwe District



Source: Karagwe District Council

3.3 Target Population

The study was taken among small-scale maize producers at Karagwe district where the sample of 125 farmers was drawn were by 120 returned the questionnaires. The information was collected regardless of the age, race, working experience, education level, and economic status hence the selected population helped the researcher to obtain important information related to the study hence come up with the real outcome on technical efficiency of small-scale maize production in the selected study area.

3.4. Sample and Sampling Techniques

3.4.1 Sample size

This refers to the number of items to be selected from the universe to constitute a sample (Kothari, 2004). The example size ensures that the sample is the representative of the target population which should be at least 10 percent of the target population (Hampwaye, 2008).

The sample sizes for the farmers were calculated using the following formula

$$n = \frac{N(Z_{\alpha/2})^2 pq}{(N-1)e^2 + (Z_{\alpha/2})^2 pq}$$

n is sample size of the farmers; *N* = 332,020 total population of Karagwe according to the population census of 2012; *p* = 0.8 and *q*= 0.2 are population proportion; *e* = 5% sampling error and α = 5% confidence interval.

$$n = \frac{332{,}020*(1.96)^2*0.8*0.2}{(332{,}020-1)*(0.05)^2+(1.96)^2*0.8*0.2} = 125.3 \approx 125$$

The data was collected from eight (8) wards out of the 22 administrative wards of Karagwe using non-probability sampling method as shown in table 3.1. This is because the wards have similar economic characteristics; they are all rural, predominantly agricultural, with almost subsistence levels of production.

Table 3.1: Distribution of respondents by ward

Ward	Targeted sample	Actual sample	Percent
Kanoni	15	15	100
Nyaishozi	15	15	100
Kituntu	15	15	100
Ihanda	15	14	93.3
Kihanga	15	15	100
Igurwa	20	19	95
Chanika	15	12	80
Bugene	15	15	100
Total	**125**	**120**	**96**

Source: Field Data Survey, 2016

The sample consisted of the following socio-economic characteristics which are age, sex, marital status, education level, and household size.

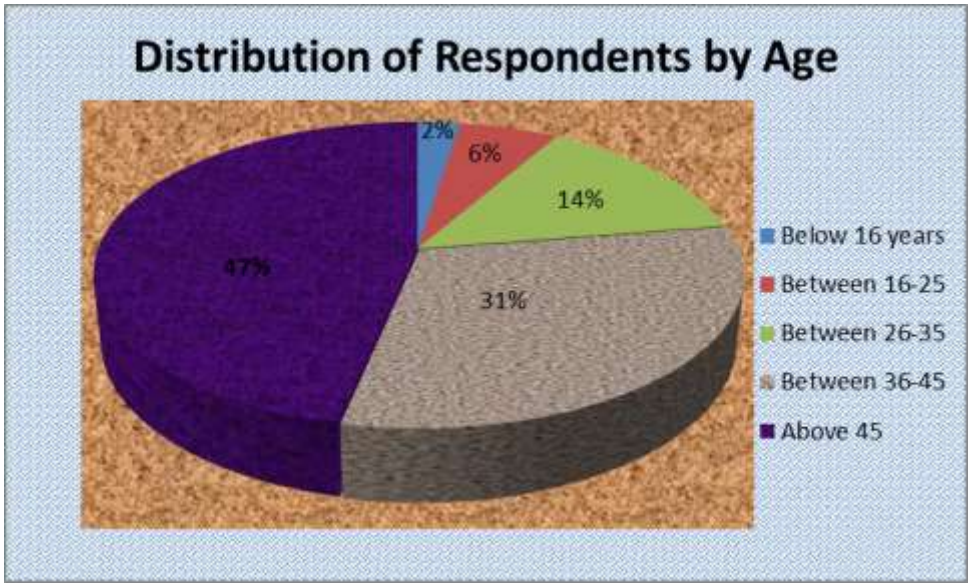
3.4.2 Age Groups of Respondents

In analysing the response to the question; the study considered age as an important variable since it determined various inter households and into households' characteristics, which include ownership and control of important resources such as land and household assets. Among the 120 respondents interviewed, majority 56(46.7%) were aged above 45 years, while 37(30.8%) were aged between 36 - 45

and 17(14.2%) were aged between 26 and 35 years, while 7(5.8%) were aged between 16 and 25 and 3(2.5%) were aged below 16years respectively. The outcome means that most of the respondents interviewed were mature and responsible people as were found engaging in different socio-economic activities in the area. They were therefore in a position of giving not only the information needed but also relevant one to meet the purpose of the study.

This was considered important because most of the demographic events that determine population dynamics such as birth, death, dependency ratio and mobility are highly associated with the age variable. Physical strength depends also on age. Therefore, land acquisition and additional income can be influenced by the age of a person as it was seen in Karagwe district. This indicates that majority of respondents were in active age and they can influence land acquisition in the society and live in rural areas means they would require land for production practices since the age of the household head has some influence in technical efficiencies and could make attributes on efficiency positively or negatively.

Figure 3.2: Distribution of respondents by age

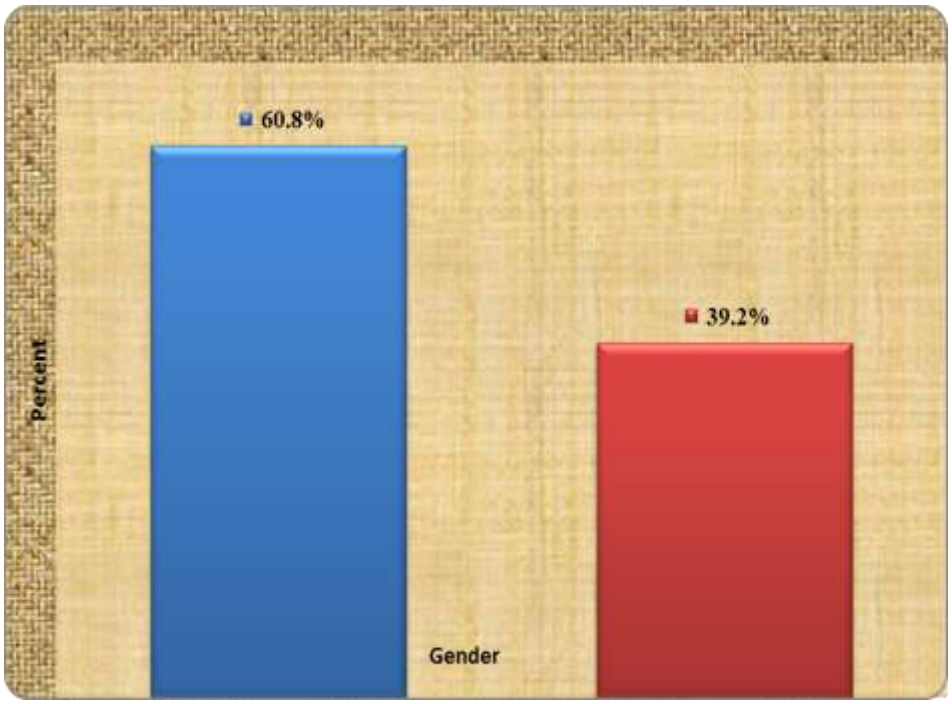


Source: Field Data Survey and SPSS Output File, 2016

3.4.3 Sex (Gender) of Respondents

Categorization of sex basis matters a lot in farming activities in most of the rural areas. The findings show that majority of the respondents 73(60.8%) were male. This pattern was followed by 47(39.2%) who were female-headed households. Based on the obtained findings, it was evident that more men were found mostly involved in Maize production in Karagwe district than women since that in rural areas men are often viewed as being responsible for producing cash crops, while women are responsible for producing substance crops for home consumption. Because of their limited access to essential production resources, such as land, labour, and inputs, women's role in crop agriculture is often restricted to producing subsistence food crops with low potential to generate income. Besides this, it is believed that female farmers are very good in vegetable production and also assist their male counterparts on their farms and the implication of this finding is that the government still has a challenge in amending cultural and historical legacies which keep African women to have limited opportunities to participate in economic activities.

Figure 3.3: Sex (Gender) distribution of respondents

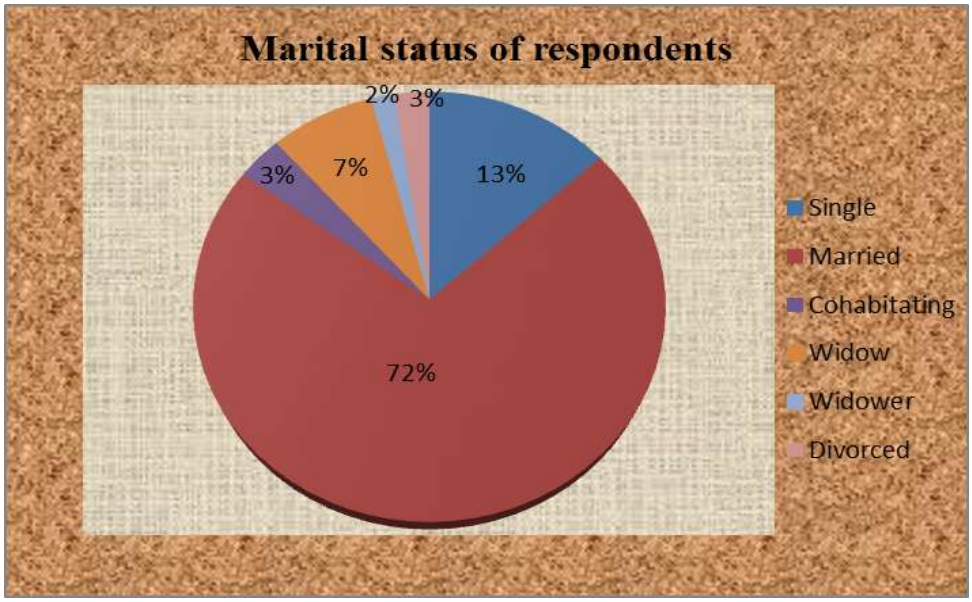


Source: Field Data Survey and SPSS Output File, 2016

3.4.4 Marital Status of the Respondents

The description of either marriage or unmarried is a paramount factor towards farming activities in rural livelihood. The households were asked about their marital status and the findings revealed that 87(72.4%) of the respondents were married, while 18(13.5%) of the respondents were single. The study also shows that the villages had 5(3.4%) who were cohabitating, and 9(7.1%) who were a widow, as well as 4(2.4%) who were widower but also 1.2%, were divorced. That seemed to affect the technical efficiency of maize production either positively or negatively since the percentage of marriage; the category is at a higher level compared to another category hence shown that maize productivity is technically efficient in Karagwe district.

Figure 3.4: Marital Status of Respondents



Source: Field Data Survey and SPSS Output File, 2016

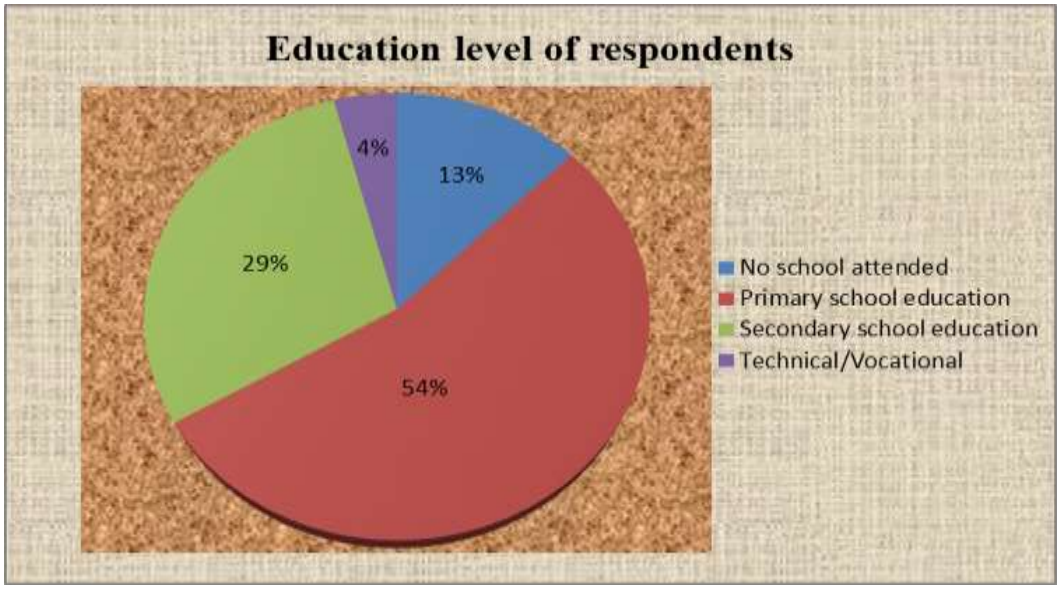
Figure3.4 above is the summary of SPSS output showing marital status the number of respondents. All 120 respondents answered the question that required knowing if they were married, single, cohabitating, and widow and divorced (See question 4 in Appendix 1). The married status category dominates thus due to added workers for the married group, it increases the prospects of participating in economic activities as maize production capable of generating income. This observation is similar to the

national marital status which indicated that married group dominated for persons aged 15 years and above (URT, 2006).

3.4.5 Education Level of Respondents

Education of the household head is taken into consideration. Education of the farmer is expected to have an effect on farm resources use and ability to adopt new technology and hence have a positive impact on technical efficiency. To be in the position to understand the education level of respondents that are dealing with maize production, the research posed the question that asked (What is your education level?) see appendix1 question 3, meaning education level of respondent, in analysing the response to the question the findings reveal that out of 120 respondents interviewed, majority had attained primary school level education 65(54.2%) while a few of them 35(29.2%) attained secondary school education and 5(4.2%) attained Technical/Vocational while as 15(12.5%) they have no school.

Figure 3.5: Education Level of Respondents



Source: Field Data Survey and SPSS Output File, 2016

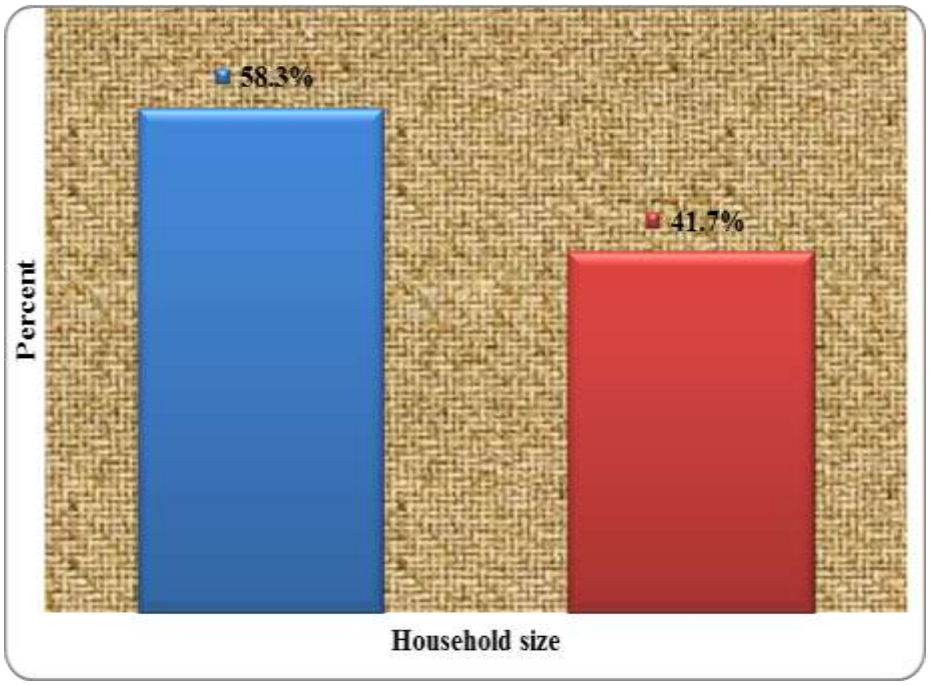
From figure 3.5 level of education contributes a lot toward productivity of goods and services since that if farmers are well educated that will facilitate him/her towards understanding different agricultural aspects such as reading on the insect sides

instructions, and also will have more knowledge on fertilizer application and other resource use. The higher percentage of primary education to households might be contributed by the effort made by the government of Tanzania to expand primary education, increase of pupil's enrolment of girls and boys, abolished school fees and offering free primary education for both rich and poor households which positively can affect the level production management and technical efficiency in production practices, Hoogeveen, (2011).

3.4.6 Household Size

The size of the household contributes either positively or negatively towards technical production efficiency, as it was seen in Karagwe district. The results indicate that out of 120 respondents interviewed, 70 (58%) of the respondents ranged from 2 to 5 members and 50(41.67%) ranged between 6-9 members. As shown in 4.5, results of this study indicated that, in most cases, households size were between 2 - 5 people and between 6 - 9 people.

Figure: 3.6 Household Size



Source: Field Data Survey and SPSS Output File, 2016

On average, therefore, the households' size ranged to an average of 5 people, and that was due to the reason behind that most of the families do not practice "family planning" which can affect the productivity amount which will reduce the level of technical efficiency of maize production, though sometimes the higher the number of households' size may positively contribute towards productivity since most of the families in the study area do use labour intensive system rather than capital intensive hence that tends to assist them during maize production practices. These results imply that the average household sizes were relatively higher when compared to an average household size 4.9 of Tanzania mainland (URT, 2002).

3.5 Sampling Techniques

According to Kothari (2006), sampling refers to the process of picking up few or small units out of the whole population for study. Such unit is expected to be representative of the whole population. The researcher used sample size from the mentioned population. The researcher used simple random technique; maize farmers are going to be chosen randomly from Karagwe District that each farmer has an equal chance to be selected.

3.5.1 Purposive Sampling

In this sort of testing, specialist purposively select particular unit of the universe for making an example on the ground that the little mass they so pick out of colossal one will be a representation of the entire (Kothari, 2004). Purposively inspecting was connected since it allows the analyst to choose respondents that have data that delineates a few components or procedure important to the study.

3.5.2 Random Sampling

Random sampling is a technique of choosing sample which each sample combination has an equal chance of being selected and each element in the population has equal possibility of being included in the sample (Kothari, 2004).

3.6 Data Collection Method

In the course of data collection, the researcher used both primary data and secondary data collection methods.

3.6.1 Primary Data

Primary data are information that obtained directly from the respondents. This research was mainly gathered through, personal interview and semi-structured interviews with farmers and cooperative union leaders who are normally involved in maize production. The process is to ensure that all necessary issues were included in the study.

3.7 Data Collection Instruments

3.7.1 Observation

It discusses the collection of information by way of investigator's own observation, without interviewing the respondents. The information obtained relates to what is currently happening and is not complicated by either the past behaviour or future intentions or attitudes of respondents (Kothari 2004). The purpose was to observe different primary information needed in the study. Different information was observed such as the hectare used to farm maize, the quality of the maize, and different methodological tools used by farmers during maize production practices. This allowed the researcher to obtain first-hand information through experience or seeing what was taking place. Yin (2003) recommended taking photos in the field.

Figure 3.7 Image showing maize farmstead in Katanda village

Source: *Field observation data 2016*

3.7.2 Survey Questionnaire

A questionnaire is a research instrument consists of a series of questions put for the purpose of getting information. Structured questionnaires were used to capture information from respondents simply because large samples can be made use of and thus the results can be made more dependable and reliable and respondents, who are not easily approachable, can also be reached conveniently. The inquiry form was distributed to the respondents found at their famous and at the residences thus that they can read them, understand and fill the answers in the space available after each question.

3.7.3 Personal Interviews

It is an important data collection technique for a case study since case study is about human affairs (Yin, 2003). The human affairs should be reported and interpreted through the eye of specific interviewees who can provide important insight into a phenomenon. Respondents were visited at their homestead and their farms to be asked questions related to maize production and technical efficiency. The researcher communicated with respondent through face to face interview and the non-structured interview was used as it gives interviewer much greater freedom to ask and allow the respondent to express freely.

Figure 3.8 Photo of a Researcher conducting an interview with different farmers in Kihanga Village.

Source: *Field observation data 2016*

3.7.4 Focus Group Discussion

This method was used to collect information in groups. Hamlet meeting was conducted in Kihanga, Kanoni, Katanda and Chanika village where people were organized into small groups of 6-10 people then asked questions concerning maize production with relationship to technical efficiency. Random sampling was used were by respondents receive information concerning the meetings from their village executive officers and chairman. The discussion included both male and female maize producers.

3.8 Data Presentation and Analysis

Data analysis consist of examining, categorizing, tabulating, testing or otherwise recombining both quantitative and qualitative evidence to address the initial proposition of a study (Yin, 2005). The data that were collected and analysed using the Statistical Package for Social Sciences (SPSS) software as tools because it is friendly user and widely accessible. SPSS-20 and STATA-12 were used for data entry, coding, data management and doing descriptive statistics of the study findings while was used in empirical analyses of the study findings collected from open-ended interviews and from the questionnaires. Both qualitative and quantitative were used to summarize the variables. Moreover, information collected and analysed was presented by using frequency, percentages in forms of figures and tables. A logistic regression model was also used to analyse the quantitative data.

3.8.1 Cobb-Douglas Production Function

Cobb-Douglas production function has been employed to analyse the variables that have an influence on technical efficiency on maize production, and this analytical technique was used to determine the technical efficiency of small-scale maize producers in Karagwe district. A Cobb-Douglas production function was used as the functional form of the production function. The reason for choosing this type of production function is that it is linear in its logarithmic form, and allows for the usage of Ordinary Least Squares (OLS). At the same time, this function type has been widely used for production function analysis by many researchers.

Cobb-Douglas production function is expressed as follows:

$Y=AL\alpha\ K\beta\ u$

Where:

Y= output

A= constant

L= labour

K= capital

U = disturbance term

For constant returns to scale, the sum of the parameter coefficients, β and α must be equal to one (1). For increasing returns to scale, they must be greater than one, and for decreasing returns to scale they must be less than one. In mathematical form the returns can be expressed as follows:

$$\alpha = \frac{\partial Y/Y}{\partial /L}$$

$$\beta = \frac{\partial Y/Y}{\partial K/K}$$

Where β and α are the elasticities of production with respect to labour and capital. These are considered the most important properties of the Cobb-Douglas production function.

The operational model for this study relating to the production of Y (output), to a given set of resources X (input), and other conditioning factors is given as follows:

$Y = aX1\beta1\ X2\beta2\ X3\beta3\ X4\beta4\ e$

Where:

Y is total quantity of maize produced (in kg)

X1 is farm size (in hectare)

X2 is family labour /hired labour worker days used (man days)

X3 is capital (Tanzania shillings)

X4 is fertilizer used (in kg)

X5 is seeds used (in kg) and a, β1….. β5 are parameters to be estimated. U is error term.

In order to use the Ordinary Least Squares procedure, the Cobb-Douglas production function was linearized using logarithms.

Taking logarithms on both sides, the model will be:

$Ln(Y) = In(a) + In\beta1X1 + In\beta2X2 + In\beta3X3 + In\beta4X4 + In\beta5X5 + u$

3.8.2 Description of the Variables in the Model

Output- is the total amount of maize produced in that year and it is measured in a kilogram.

Land – is the area of the ground noted as farm used for the production of maize and it is measured in hectares (hectare).

Labour – it is measured in man days and also expressed in adult equivalent days per hectares (ha) and is the sum of family labour and hired labour. Male and female labour is counted equally and individuals who did not spend their holidays on the farm were not considered.

Capital – to represent capital, a cost of purchasing hybrid seeds is used as a substitute of capital. This variable is measured in Tanzania shillings.

Fertilizer – Most of the small-scale farmers use organic manure. It is measured in kilograms (kg)

3.8.3 Logistic Regression Model

This study also used the logistic regression model to supplement the Cobb-Douglas production model as it only concentrates on the production of function, while logistic regression model deals with the socio-economic factors. The logistic regression model was chosen because its dependent variable is binary and can only take two values. Also, it allows one to estimate the probability of a certain event occurring. A logit model is also generally preferred to the probit model due to its simpler mathematical structure. The logit model is based on the accumulative distribution function and yields results that are not sensitive to the distribution of the sample attributes when estimated by maximum likelihood.

The operational of logit model can be written as follows:

Logit (p) = In (p/1-p) = $\alpha + \beta 1X1, + \ldots\ldots + \beta kXk, i$

The ratio p/1-p is the odds ratio

Pi = probability that a farmer is efficient.

1-Pi = probability that a farmer is not efficient

Xi = various independent variables.

βi = estimated parameters and Ui = disturbance term.

Operational of Logistic Regression Model:

To examine the impact of socio-economic factors on efficiency of small-scale maize producers at Karagwe district, the following linear equation is specified and the following linear equation is specified.

$EFF = \beta 0 + \beta 1EXTOF + \beta 2FAREXP + \beta 3FARSZ + \beta 4LABOUST + \beta 6FERTUS + \beta 7PURCH + \beta 8FRORG + Ui$

Table 3.2 Definition of Variable

Variables	Description of variables	Units
	Dependent variable	
EFF	1,if a farmer is efficient,0, otherwise	Dummy
	Independent variables	
EXTOF	1, access to extension officers,0, otherwise	Dummy
FAREXP	Farmer experience	Years
FARSZ	Farm size	Ha
FERTUS	1,if a farmer applies fertilizer, 0, otherwise	Dummy
PURHMSE	1,if a farmer purchases hybrid seed, 0, otherwise	Dummy
FRORG	1,if a farmer has membership to farmers organization, 0, otherwise	Dummy
LABOUST	1, labour system, 0, otherwise	Dummy

Source: Own computation, 2016

3.9 Data Reliability and Validity

Kothari (2006) states that validity and reliability are two features which the researcher should focus on while designing a study, analysing the results and judging the quality of the study. According to Adam and Kamuzora (2008), in a research work, all the right things must be measured. Care should be taken that the appropriate item is measured (validity); in addition, careful attention should be paid to how the measurement is being made (reliability). This study was therefore considering these two key factors during the course of the research. All research questions proposed were tested by the available theoretical analysis and intuitive analysis of the historical evidence on maize production within the period under review.

CHAPTER FOUR

PRESENTATION OF THE FINDINGS

4.0 Introduction

In this chapter, the researcher presents the findings of the study conducted on technical efficiency of small-scale maize production in Karagwe district. The findings are presented using tables, bar graphs and pie charts, which are later analysed by percentages and frequencies under some of the variables and empirical results, are presented in this chapter. The Cobb-Douglas production function model and the logistic regression model were analysed using SPSS 20 version and STATA vision 12 from the research questions asked to the respondents.

4.1. General Socio-economic features that influence the technical efficiency

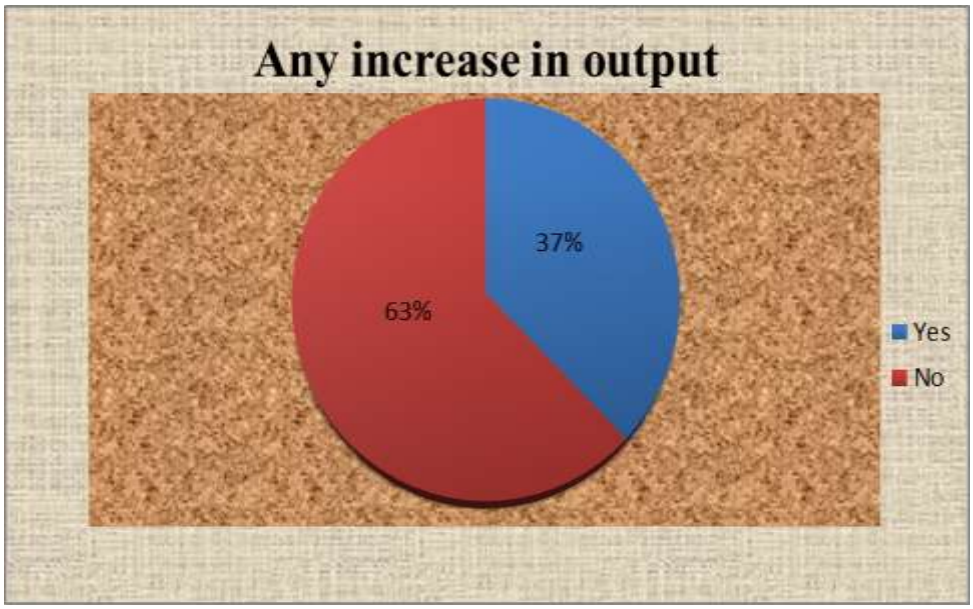
The general description about small-scale farmers gives an overview of the people who took part in the study. In view of the researcher, these demographic and socio-economic characteristics of respondents had so much bearing on responses given by the respondents on the state of Maize production in the district. They had important value attributes to any society as they reflect their behaviour in decision making and the expected responses.

4.1.2 Variation on Number of Bags after Harvest

The level of productivity performance can be measured in terms of output after yield. The findings from the study revealed that, on average, the output bags ranged between 0- 5 bags only 73 (60.8%). In this regard, the respondents said that there has been no increase in the number of bags harvested at the end season. A few 27 (22.5%) reported that there was an increase in the number of bags. Change in climatic condition and other factors such as inefficient use of hybrid seeds, and education from the extension officers contributed much on determining the level of harvest to farmers because agricultural supply was mostly based on rain and highly dependent on the weather. Therefore, for the farmers, the annual weather differences are more important than eventual climate change. The drought was identified as the

main cause for the decrease in maize production which shows that they were inefficiency rate in the study area.

Figure 4.1: Any Increase in Output



Source: Field Data Survey and SPSS Output File, 2015

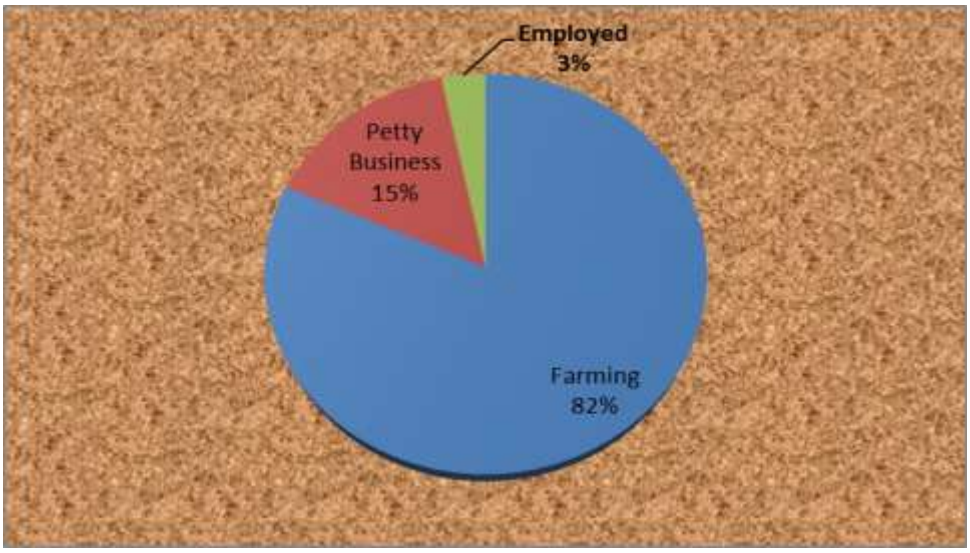
Furthermore, When the respondents were asked to give their opinion/reasons as to why their crop produce was fluctuating in terms of output per unit area, the responses were associated with occurrences of droughts 26 (22%) and heavy rains 53 (44%), fertilizer 41(34%) .With respect to this, these three aspects were identified as the most important factors that were hindering technical maize production in the area. It was further noted that it is important to note that current initiatives to reduce the extent of global warming are mostly aimed at limiting further warming, not too rapidly reverse it. Difficulty and uncertainty make it hard to be precise but it is generally accepted that climate change will affect smallholder maize producers.

4.1.3 Main Source of Households Income

The reflection on households' income on the researched populations is very important towards maize production and technical efficiency because income influences them greatly. The result indicates that out of 120 of all respondents interviewed, 98 (82%) attained their income from farming, 18 (15%) obtained their

income from petty business activities such as through selling food products as beans, peas, cassava, banana "matoke", coffee, and also by selling livestock keeping such goats, sheep, chicken, and cows. While as 4 (3%) earned their source of income from employment, due to that fact most of the farmers do depend on farming activities and that mostly plays a big role to the household's needs and most of the products are imported to the nearby countries especially on the border zones countries such as Uganda, and Rwanda after they have collected them from small maize farmers in the district while others said that they mostly produce for home consumption rather than commercial services.

Figure: 4.2 Main Sources of Household Income



Source: Field Data Survey and SPSS Output File, 2016

Furthermore, when the respondents were asked on their main occupations, majority 116 (96.7%) attained their livelihoods from farming. However, 4 (3.3%) were found engaging in petty business as their main sources of occupation. Moreover, respondents were asked to estimate their income attained per month most of them (94.2%) were below Tanzania shillings 50,000. This result shows that most of the families were subjected to low-income earnings which could not enable them to afford for example to pay fees for their children.

Table 4.1 Respondents' Main Occupation

Category	Frequency	Percent
Farming	116	96.7
Petty business	4	3.3
Total	**120**	**100.0**

Source: Field Data Survey and SPSS Output File, 2016

4.1.4 Income Earned by Farmers

The money that an individual receives for an exchange of goods and services assists a lot in facilitating rural farmers in their production practices. The findings show that 40.8% of the agriculturalists earned from 6000 per year to 100,000 per year this can be explained by the number of units that the farmers produce the lower the harvest the lower the income given that these farmers do not depend on any other economic activity as the source of income. Table 4.2 also shows that there are another 6.7% of farmers who earn above 500,000 these farmers produce a lot of harvest per season but also they sell their crops at a high price. There were 10.8% of the farmers whose income ranged from 196,000 to 289,000 these farmers sold a half of what they produced and leave some for home consumption. The study also showed that 7.5% of the farmers had an income ranging from 290,000 to 384,000 some of these farmers sold their crops at a high price while other at low but a lot of harvests almost all the harvest they produced.

Table 4.2: Income earned by farmers

Revenue earned	Frequency	Percentage
6,000-100,000	49	40.8
101,000-195,000	34	28.3
196,000-289,000	13	10.8
290,000-384,000	9	7.5
385,000-478,000	7	5.8
Above 500,000	8	6.7
Total	**120**	**100**

Source: Field Data Survey and SPSS Output File, 2016

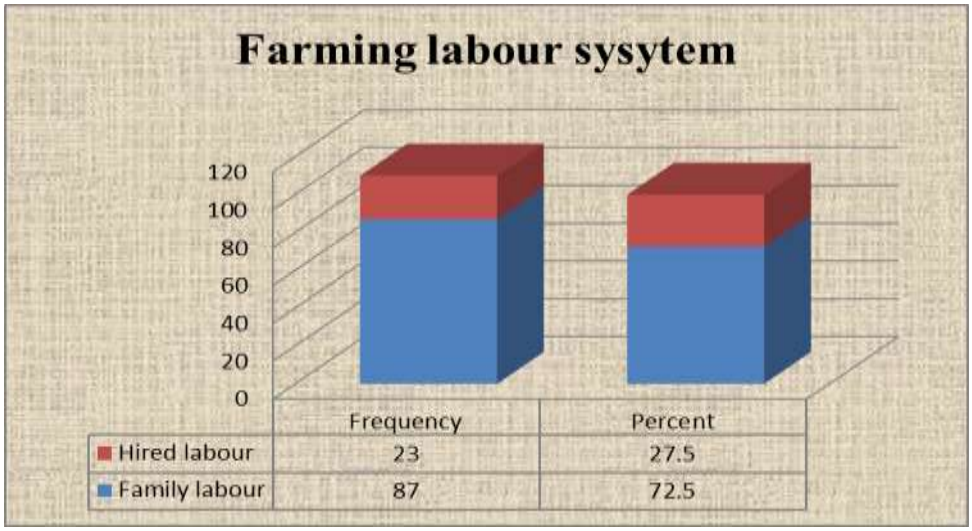
Table 4.2 is the summary of SPSS output showing households' level of income. The results above shows all 120 respondents answered the question that required knowing their level of income (See question 6 in Appendix).The implication here is that the higher the amount of income resulted from the sold output facilitates a lot towards farmers interests on farming practices for the future production and vice-versa as the result of efficiency or inefficiency.

4.1.5 Farming Labour System

In Karagwe district small-scale farmers mainly depend on family labour system, they still hire labour to add to the family labour and usually one or two people are hired which is consistency with "Cobb-Douglas theory of production" that labourers are being used as the factors of production that needs a certain amount of capital to compensate for the hired labour in order to increase the level of productivity in production. Farmers with smaller family size are the ones who usually hire labour in order to be assisted during production practices, hired labour helps in accelerating production at the various stages of farming though sometimes tends to contribute to the negative outcome on the economies of scale since always hired labour to have their own personal interest of making profits rather than producing at quality basis.

The finding shows that 87(72.5 %) of the farmers agree that most farmers depend on family labour since they do not hire labour, while 23 (27.5%) of the farmers hire labour.

Figure 4.3: Farming labour system



Source: Field Data Survey and SPSS Output File, 2016

Figure 4.6 is the summary of SPSS output showing farming labour system of respondents .The results above shows all 120 respondents answered the question that required knowing their farming labour system during maize production (See question 18 in Appendix 1) hence the results indicated that family labour had high influence on technical efficiency of small-scale maize producers since they have the best interest of their farming practices unlike hired labour who are mostly focusing on profit taking, and the family labour system reveals the history of "Nyarubanja system" that is still having its roots background in the district and the hired labour in Karagwe district was applicable by some of the farmers in practicing maize production since that some respondents argued that they don't need money instead they need food stuff such as banana " matoke", beans and some other asks for cash and they are being paid basing on the size of task given "chatile" hence due to that personal interest can affect the amount of productivity hence inefficiency and decrease of the productivity efficiency.

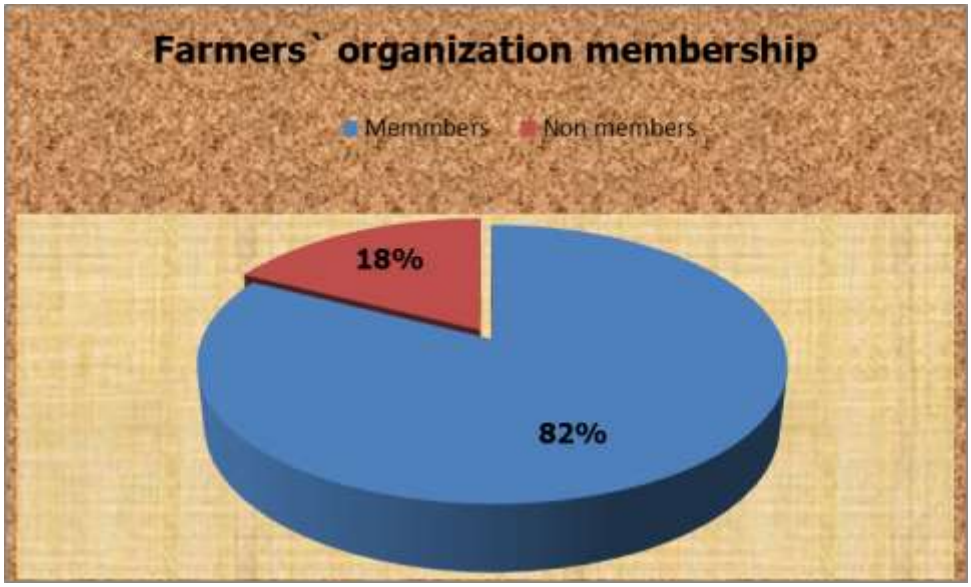
The greater efficiency of family labour on small-scale farms may be due to two factors; first, as the ratio of hired labour to family labour rises, supervision becomes more time consuming and less effective. Second, as the social distance between the supervisors and the hired labour increases, the effectiveness of supervision will decrease.

4.1.6 Membership to Farmers` Organization

Farmers` organizations' groups plays an important role in organizing members into input cooperatives and in creating access to financial services from state and non-government organization (NGO) sectors and seeking access to other financial development agencies. This is an important factor affecting technical efficiency, organization membership in Karagwe district do plays a vital role in assisting towards seeking of financial support as capital for purchasing of some production inputs such as seeds, fertilizers, and also pests, not only that but also some organization group membership try to assist each other during production practices. For example, the most popular group of farming organization the researcher found in the study area were as; "Tweyambe, Tushikamane, and Ntubasa group".

The result shows that farmers who are members of farming organizations are rather small as compared to those farmers who are non-members, with only 17.5%(21) farmers being members and 82.5%(99) who are non-members of farming organizations in Karagwe district.

Figure 4.4: Farmers` organization membership



Source: Field Data Survey and SPSS Output File, 2016

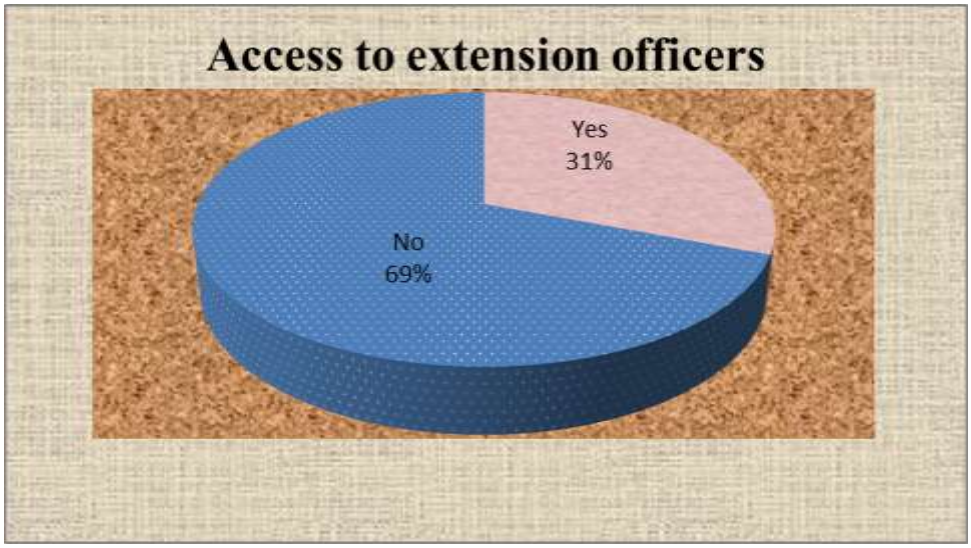
From figure 4.7, is the summary of SPSS output showing households' organization membership indicating that for small-scale farmers, it is important for them to form part of an organization in order for them to get access to credit which they can use to buy new improved inputs, especially seed to increase technical efficiency. Since inputs are expensive they can form a group and buy in bulk as it becomes cheaper compared to individual purchases, and also they can access information from extension officers easier than those who are not in the associations'. They can also have access to extension officers as they are able to help a group of farmers and not individuals that can contribute to the positive outcome on the return to scale during production practices hence improves on the level of technical efficiency.

4.1.7 Access to Extension Officers

The role of Extension officers can result in either positive/negative productivity in any production practices, as it was seen in Karagwe district most of the extension did not attend the farmers who were in need of agricultural education from different perspectives, and the reason behind was that one extension officers he/she was serving the whole ward having many farmers which sometimes becomes difficult to meet all the farmers and most of the villages such Katanda, Kihanga and Kanoni argued that they is a need of increasing the number of agricultural extension officers in their areas since they meet different challenges in relation to the production which is difficult to solve them that needs high knowledge, for example most of the respondents were not aware of the amount of fertilizer to be applied in their farms that positively affects the productivity efficiency of maize production.

The finding shows that out of 83(69.2%) of the respondents said that they were not accessing the services from extension officers while as 37(30.8%) of the respondents agreed that they were benefiting from agricultural extension officers.

Figure 4.5: Access to extension officers



Source: Field Data Survey, 2016

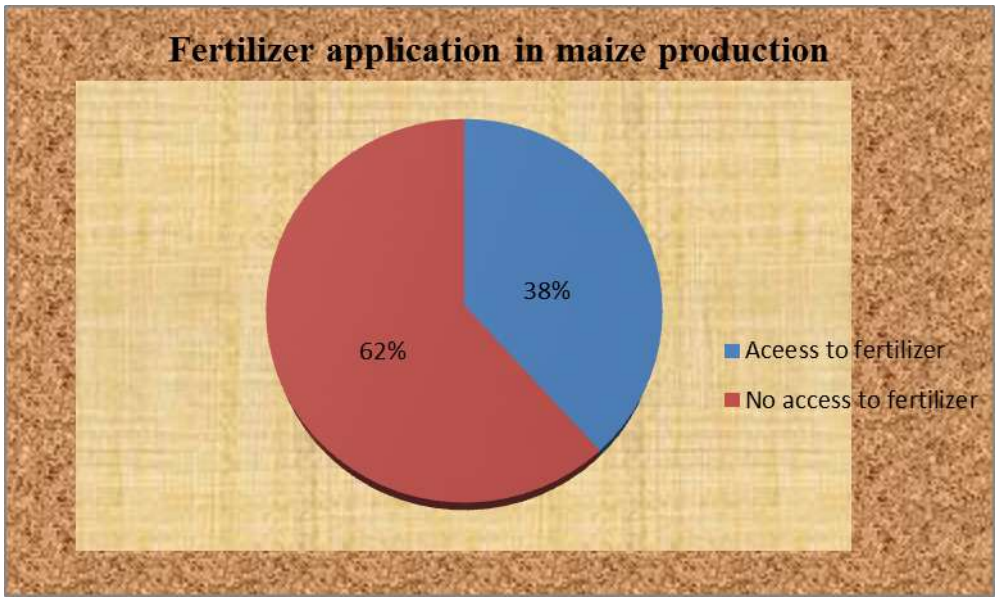
From figure 4.8 above shows the summary of SPSS output indicating the level of extension officers hence from the results above displays that high percentage rate of the farmers were not accessing extension services hence due to that factor the high rate on percentage amount directly tends to effect on the level of technical efficiency in maize production farmers in Karagwe district since education towards agricultural farming practices has a paramount results in production sector as well as in Maize production practices.

4.1.8 Fertilizer Application in Maize Production

Fertilizer plays a great role in maize production no matter how large and small the farm size is if applied properly yields will increase. Small-scale farmers tend to have difficulties in obtaining fertilizer as they lack financial means in the study area. The above results indicate that about 41 (34 %) of the farmers do apply fertilizer in maize production. This includes even those farmers using manure from their livestock keeping and ready-made fertilizer which they get from agricultural shops especially

being supplied as subsidies by the government. About 79 (66%) of farmers have no access to fertilizer and this was due to perception that their lands are always composing manure being left every after harvesting that the decayed remains do create natural manure in their farms hence the land remains fertile after harvesting, also lack of funds to buy and transport the fertilizers from one point to another, inadequate education about the important of fertilizer application in maize production, that the non-application of fertilizer certainly influences negatively on the technical efficiency and the increase in the inefficiency level of performance of yields output.

Figure 4.6: Fertilizer application in maize production



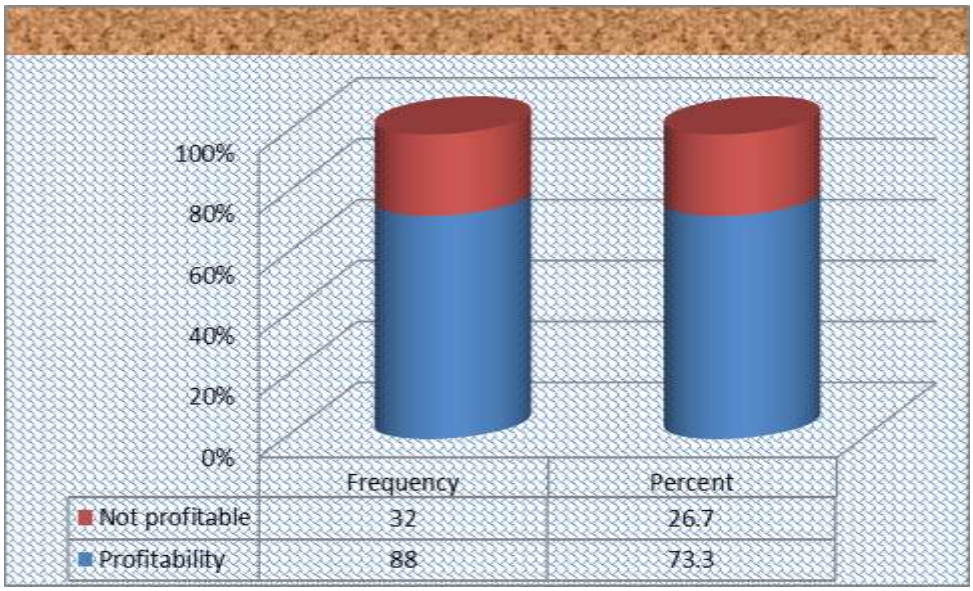
Source: Field Data Survey, 2016

4.1.9 Farmer Perception on Maize Profitability

Economies of scale in any production has a great role to play towards farmers' perception in production practices since most of the respondents in the study area their main production activities was farming that contributed a great role towards farmers social and economic development. Maize has different profitability advantages, according to farmers perception argued that maize mostly acts as food staff for home consumption, also others said that its profitability in the sense that they enjoy the economies of scale as the profit after selling the output which assists

them in compensation of different basic needs and gives morally for the following production season if it has positive outcome as the economies of scale to farmers. The result indicates that 73.3 % of the farmers see maize as a profitable product as they no longer buying maize meal from shops. They process their own maize product after harvest through the miller, and the processing cost is reasonable. However, 26.7 % perceive maize as not profitable.

Figure 4.7: Farmer perception on maize profitability



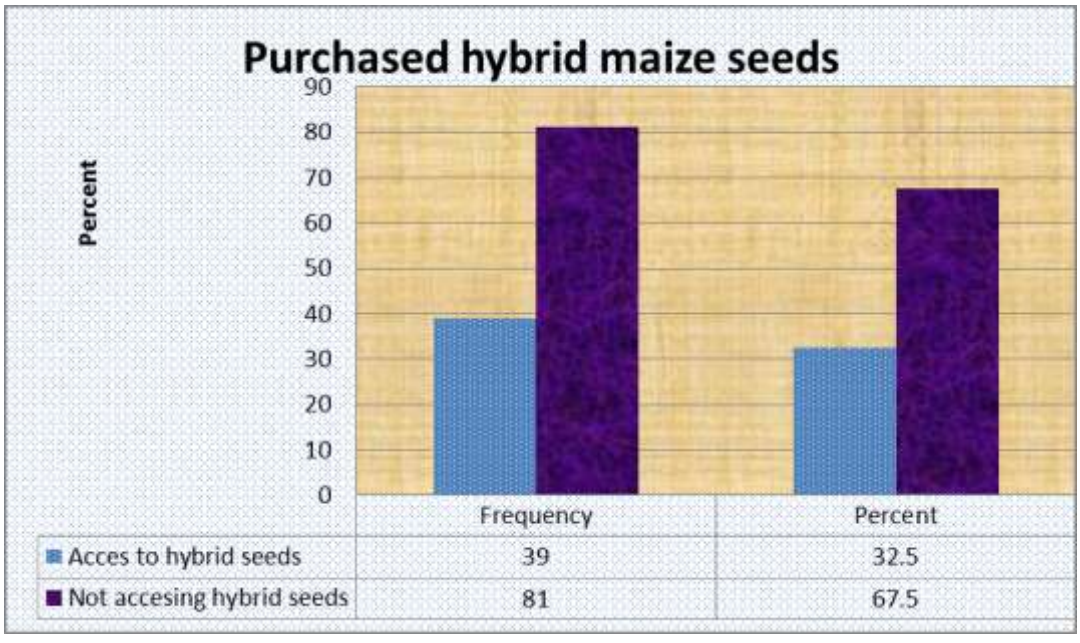
Source: Field Data Survey and SPSS Output File, 2016

From the findings above the reason behind of some percentage 26.7%(32) respondents saying that it's not profitable for the selling price of maize in (Karagwe district) Tanzania are lower compared to neighbouring countries such as of Uganda and Rwanda, as well as may restriction on exporting maize production and other food products from the government, and those who said that its profitable they based specifically on their own family consumption. For the small-scale farmers, it is very important to know if the crop is profitable or not in order to make informed choices with regard to production inputs and the economies of scale and this variable has a relationship with the surplus output after consumption in the study area.

4.1.10 Purchase of Hybrid Maize Seeds

Hybrid maize seed plays an important role in maize production since has been assumed that 1ha of land can produce 1tonne of maize with the use of hybrid seeds which are fortified to increase the yields of maize output after yield. Most small-scale farmers use the same seed they used previously, that after harvesting they store some of the maize in order to use it in the next planting season, a practice which hampers the effort of trying to increase productivity. The results show that (39)32.5 % of the farmers buy hybrid maize seed. These are not the accurate numbers since some farmers buy used seed from their fellow farmers, indicating that those seeds are more affordable than the ones sold at agricultural shops. Not only that but also (81) 67.5 % of the farmers are not purchasing hybrid seed at all; they use their own recycled seed stored from the previous season which is always kept special for the farming in the following season and that is mostly for all crops.

Figure 4.8: Purchased hybrid maize seeds



Source: Field Data Survey, and SPSS Output File, 2016

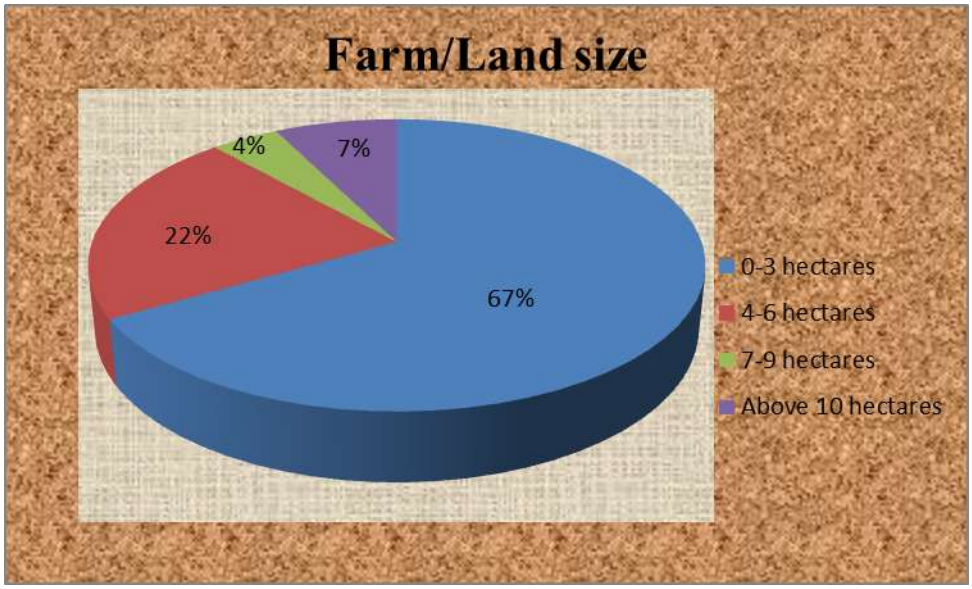
Figure 4.8 above is the summary of SPSS output showing purchased hybrid maize seeds. The study findings show that majority of farmers were not purchasing the hybrid seeds while minority of them did so and the reason behind is that most of the

farmers from different areas of the study argued that they do face some financial constraints of purchasing of the inputs, also the issue of inefficient education towards hybrid that directly hinder farmers from increasing their technical production efficiency.

4.1.11 Farm/Land size

Farm size has an influence on the technical efficiency and the total output of maize production. Land plays an important role in farming activities since the size of the farm is based on the size of land used by the household for maize production. The results show that majority of the farmers 80 (66.7%) own about 0-3 hectare of land that they use for maize production, 26 (21.7%0 of farmers owning 4-6 hectare of land, followed by 5 (4.2%) of farmers owning about 7-9 hectare of land, and 9 (7.5%) of farmers owning above 10 hectares of land.

Figure 4.9: Farm/Land size



Source: Field Data Survey, and SPSS Output File, 2016

The study findings show that low-medium percentage of maize farmers in most of the study area were practicing maize production at small-medium farm size and since technical efficiency is mainly affected by the farm size, owning the small or medium size farms have efficiency advantage over the relatively larger farms hectares and the explanation to this is that farmers finish farm activities on time in small fields

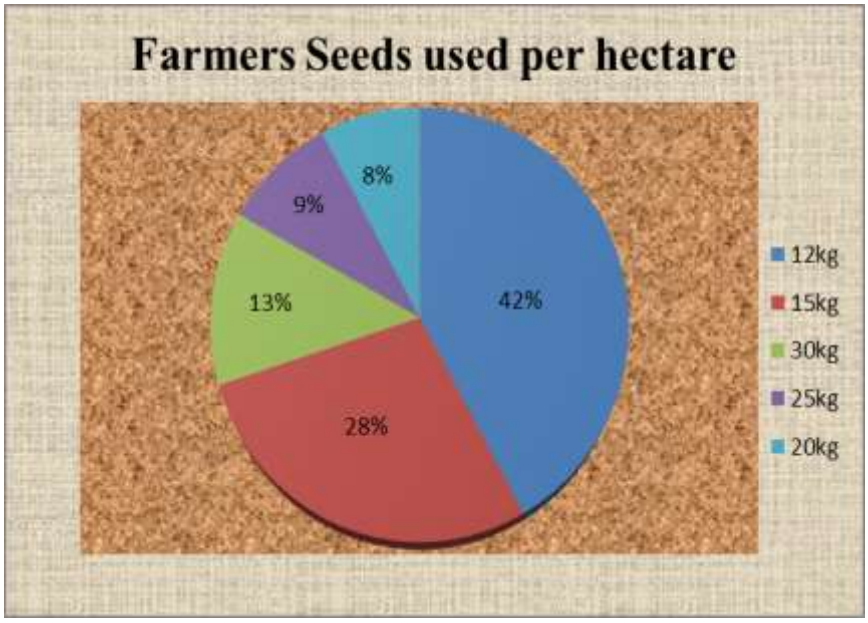
relative to larger fields if similar technology and family size are considered since most of the farmers do practice their maize production as mixed farming with medium size of farm hence that directly seemed to rise the productivity performance.

4.1.12 Farmers Seeds used per Hectare

Most of the small-scale maize producers in the study area are not obliged to use a certain amount of kilograms of seeds per hectare. Any amount of seeds can be used and most small-scale farmers who practice subsistence farming do not buy certified seeds, but they use recycled seeds that are stored after every harvest and that was visible by the researcher in many villages such as Kanoni, Runyaga, Katanda, Kihanga, Kibona, Rwambaizi and at kibwera Village since that seems it's the Banyambo culture, while others buy recycled seeds from their fellow farmers and others from the village executive's office that are supplied by the government though most of those who buys from the government suppliers are those who do not farm at large scale and those who are not engaging in farming activities. This practice affects the crop output every year in terms of quantity as well as quality.

And the findings indicated different kilograms of seeds applied per farmer in the production of maize. About 42 % of farmers apply 12kg of seeds, 28 % apply 15 kg, 30 kg is applied to 13 %, while 9% of farmers apply 25 kg and 20 kg of seeds is applied by 8%. The different amount of seeds applied depends on the size of the farm as maize production ranges from 0-3 ha of land; it was argued by the farmers that the output depends much on the amount and types of seeds used during production practices. For example in Kihanga Village, most of the farmers with a 7-9 hectare of maize farm used local seeds and they accumulate high output after yield.

Figure 4.10: Farmers Seeds used per hectare



Source: Field Data Survey, and SPSS Output File, 2016

4.2 Cobb-Douglas production function model results

Table 4.3 presents the results of a Cobb-Douglas production function as described in chapter 3. The main reason for using Cobb-Douglas production function is to determine the level of technical efficiency of maize production by small-scale farmers in Karagwe District. There are a number of variables that are known to affect agricultural production. As a result, it is important to use a model that relates production to those variables for better understanding of the functional relationships.

Table 4.3 Cobb-Douglas Production Function Model Results

Variables	Std error	Coefficient of Elasticities	t-ratio
Labour	0.897	-0.037	-0.435
Capital	0.336	-0.167*	-1.892
Land	50.148	0.267***	2.080
Fertilizer	0.654	0.236**	2.705
Constant	180.498		2.880
Sum of b's	0.299		
Adjusted R^2	0.534		

Source: Own computation 2016

Note: (***) Indicate level of significant at 1%, (**) Indicate level of significant at 5 %, (*) Indicate level of significant at 10%.

The Cobb-Douglas production variables tested were Labour, Capital, and Land and Fertilizer application; among the four variables/inputs three of them were statistically significant while one were not significant. The implication here is that from the study area there is an input-output positive relationship.

The estimated Adjusted R-square from Cobb-Douglas production function as an elasticity of production was 0.534, meaning that the independent input variables in the model explain about 53% of the variation in maize production in Karagwe district.

4.3 Return to Scale

From table 4.1 the sum of the b's as coefficients added is less than one (1) this means that there is a decrease in return to scale since small-scale farmers are over utilizing the resources which results to inefficient of technical efficiency of maize production from the study area since return to scale on the relationship between rate of increase in output as production relative to inputs as factors of production.

4.4 Logistic regression model

In this section, results of the test for significant and non-significant of the determinants of whether a farmer is efficient or not were given. The logistic model was used in Table 4.2 below which displays the estimated results for the logistic regression model to explain the socio-economic factors influencing the technical

efficiency of maize production. The variables which are significant and non-significant are represented.

Table 4.4 Logistic regression model result

Number of observation =120

LR chi^2 (15) = 103.09

Prob>chi^2 =0.0000

Pseudo R-squared=0.6202

Log likelihood=-31.56569

EFFLEV	Coef	Std Err	Z	P>|Z|	95%coef	Interval
FARMSZ	16.54936	3560.375	0.00	0.996	-6961.658	6994.75
PURHMSE	-5.407115	1.209559	-4.47	0.000***	-7.777808	-3.036423
FARMEXP	3.054264	1.938174	1.58	0.028**	-.7444873	6.853015
LABOUSYT	2.307525	1.527563	1.51	0.131	-.6864448	5.301494
FERTLZ	-22.76831	3560.376	-0.01	0.995	-7000.978	6955.441
ORGMSHP	6.39211	2.536902	2.52	0.012**	1.419874	11.36435
EXTOFFC	-4.558944	2.475285	-1.84	0.066*	-9.410414	.2925254
Cons	1.310567	5337022	2.46	0.014	.2645295	2.356604

Source: Own computation 2016

Note: (***) Indicate level of significant at 1%, (**) Indicate level of significant at 5 %, (*) Indicate level of significant at 10%.

The outcome from chart 4.2 above shows that some of the independent variables are statistically significant while others are not. The statistical significant of the factors is recognized by looking on the P-value as shown in the table. The P-value shows whether the variables which were included in the logistic Regression model were statistically significant or not. If the variable was not statistically significant (P>0.05) it means that the variable involved do not influence the technical efficiency of maize production while if the variable was statistically significant (P<0.05) it means that the factor has an influence on the technical efficiency of maize production. Not only that but also some other variables have positive coefficients while others have a negative coefficient of explanatory factors Beta (β). The meaning is that some

variables have a positive influence on maize productivity in Karagwe district while others have a negative influence.

The outcome shows that out of eight variables that were included in the model five of them are significant which are purchase of hybrid seeds (PURHMSE), Farmers' organization membership (ORGMSH), farming experience (FARMEXP), and extension officers (EXTOFF) which shows that they is technical efficient of small scale maize farmers in Karagwe district. The model correctly predicted at 50%, this implies that 50% of variables are important explaining on the relationship between dependent and independent variables.

The model probability chi-square at 1% meaning that there is a significant relationship between the dependent and independent variables and the Pseudo R-square was 0.6202 which is equal to 62% indicating that the model explains more than 50% of the variability of the respondents' data around its mean. The following were the variables that were found to significant as explained below.

4.4.1 Farmer's Farming Experience

The coefficient of farmer's farming experience is positive and significant 5% with the suggestion that there is a positive correlation connection between the farmers' farming experience and technical efficiency of small-scale maize production that when the output from farmers' farming experience will increase by 1% the output from maize production will also increase by 3.054177% if all other factors remain constant, that will cause the return to scale level of output also increase as the increase in the level of input hence economies of scale will be enjoyed as it is assumed that always the more the experience the farmer has the better the use of the available resources which at hence contribute towards technical production efficient and that was mostly based on the age within the farming practices.

4.4.2 Purchased Hybrid Maize Seeds

The coefficient of purchasing hybrid maize seeds was negative but significant at 1% having the negative coefficient which means that there is correction between purchasing of hybrid seeds and technical efficient, as the level of output increases by

1% the output from maize production will decrease by 5.407114% if all other factors remain constant, and the negative sign implies that if a farmer buys certified seeds instead of using the recycled seeds hence the farmer may tend to maximize the output which can result to the decrease in the level of return to scale as the proportional of desired output will decrease in comparison to the desired input hence affect the level of technical efficient.

4.4.3 Farmers' Organization Membership

The coefficient of farmers' organization membership is positive and significant 5% meaning that a farmers' organization membership assists much in maize production and raises the level of efficiency, hence as the level of farmers' organization membership increase by 1% the output from maize production also increase by 6.39211% if all other factors remain constant, that is to say that even they can buy seeds in the bulk and share, also they can hire a tractor as a group and minimize the cost as smallholders that have a great contribution towards efficient, hence the implication is that it has a great influence on technical maize production and that will result in the increases in return as an output to scale which results in economies of scale as technical efficient of the farmers will tend to expand from small-large production practices hence influence the technical maize production efficiency in the study area.

4.4.5 Labour (Man hours)

The regression analysis result indicates that labour has a standardized coefficient of β positive and not statistically significant, this means that when the labour system increase by 1% the output from maize production decrease by 2.307525% if all other factors remain constant as the effect on return to scale , and that implies labour has a positive influence in maize production from the study area also though in other parts farmers were underutilized this input meaning that they should increase the use of labour as an inputs as the response to high output, the positive sign implies that a decrease in the use of these inputs leads to increase of output in the level of maize production and hence facilitate the level of technical inefficiency.

4.4.6 Capital (Tanzania shillings)

Cost of purchasing hybrid seeds was used as a substitution for capital and the coefficient for purchasing hybrid seeds was negative and significant at 1% level meaning that the input is important but farmers are over utilizing it during maize production practices, in relation to return to scale, this implies that an increase in the level of input by 1% the output from maize production decreases by 5.4071114 if the other factors remain constant in the in comparison to the level of technical maize production efficiency. Capital as one of the factors of the production function, since the probability value of purchasing of hybrid seeds, is at positive and significant and with the negative coefficient that means that capital has both positive and negative influence towards technical efficiency maize production in Karagwe district.

CHAPTER FIVE

DISCUSSION OF THE FINDINGS

5.0 Introduction

This chapter discusses the outcomes presented in chapter four and delivers the deep analysis of what was theorized during literature review, how information was captured and the findings obtained from the study area. The research intended to examine the technical efficiency of small-scale maize production. This chapter also includes the three specific objectives as; firstly to examine the level of technical efficiency among small-scale maize farmers, secondly to identify the socio-economic characteristics that influence technical efficiency among small-scale maize producers and also to explore the effects of climatic change on technical efficiency on maize production.

5.1 The level of technical efficiency among small-scale maize farmers.

The first objective of this study was concerned with determining the level of technical efficiency among small-scale maize producers in Karagwe district. The Cobb-Douglas theory of production was used to present the level of technical efficiency in relationship to return to scale from the study area and some of the factors of production were included as input variables.

The land is one of important factor of production since it explains the different relationship between outputs of each farm after harvest, the size of land used was measured in terms of hectares in order to compare if there is any input to output variation of small-scale maize production from the study area. From table 4.3 the elasticity of land size is positive and statistically significant at 1% level meaning that an increase in one hectare of land size will lead to an increase of 27% of the total production of maize and hence technical efficiency.

Not only that but also capital as one of the Cobb-Douglas factors of production hence purchasing of hybrid seeds and hiring of tractor was used as one of the measures of capital substitute, and the elasticity coefficient of capital is negative but statistically

significant at 10%level , meaning that even though capital is very important but farmers are over utilizing it in production of maize, that also implies that the increase in capital use as an input of production practices will lead to decrease in the level of maize production as well as technical efficiency and increase in return to scale.

Furthermore, also since labour includes both physical and mental work undertaken for some monetary reward in the production process. From the Cobb-Douglas model result table 4.3 indicates that labour elasticity is negative but statistically significant in the production of maize in Karagwe district with the implication that farmers are over utilizing that factor of production hence it results in less output meaning that if one percent of the variable will decrease will lead to 5% of the output loss.

Moreover, also fertilizer was used as a natural substance added to soil in order to increase fertility in a farm of small-scale maize production. The Cobb-Douglas results (Table 4.3) indicated that the elasticity of fertilizer application was statistically significant and positive at 5% level, in connection to that it means that fertilizer application per farm has contributed positively to the production output of maize in Karagwe District, also if 1% increase of quantity of fertilizer application will result in 24% of output if small-scale maize farmers will not underutilize it.

5.2 Socio-economic characteristics that influence technical efficiency.

The second objective of this study was to identify the socio-economic characteristics of respondents have so much bearing on responses given by the respondents from the findings on the state of Maize production in the district. There are some variables which had either positive or negative significant impact towards technical efficiency of maize production as it resulted from the logistic regression analysis.

Farm size an input factor in production practices do influences on technical efficiency and the level of total output, question number (9) questioned about the size of the farm and majority of the farmers own about 0-3 hectare of farmland indicating that farmers are indeed operating on the small-scale farms and since the level of technical efficiency is mainly affected by the farm size. Famers from the

study area are using “Kibanja” system of production that is basing in mixing many farming crops into the same farm which affect the amount of maize output after harvesting. Access to land is by far the most important variable, explaining the differentiation in output. Barners (2008), found the relationship between land holding size and efficiency to be positive in production practices.

The regression result shows that farm size has a positive coefficient but not statistically significant with the implication that there is a positive relationship between farmers farm size and technical efficiency of maize production but farmers are over-utilizing that input meaning that the decrease of that input in production practices will also lead to the increase of technical efficiency. The findings are in the line with Pender et al., (2004) who found that farm size to have a positive and the statistical relationship between technical efficiency which supports the notion that small or medium size farms have an efficiency advantage over the relatively larger farms.

Labour is the most important input for maize production hence farming labour system as one of cobb-Douglas production function do plays a great role in production practices. Small-scale farmers mainly depend on family labour, they hire labour to add to the family labour and that is to those who are having small family size and the do so in order to accelerate the production practices. As it can be seen from (figure 4.3) of the finding that 72.5 % (87) of the farmers depend on family labour, rather than hired labour.

Family labour tends to influence the technical efficiency of small-scale maize producers as they have the best interest of the farmer at heart unlike hired labour and in most areas of the study hired labour were hired especially to those having big farm size, small family size and those whore not capable of finishing the production during farming practices, that shows hired labour do affect negatively the productivity of maize efficiency as it was seen also from the regression result that it was insignificant. The regression analysis result from (table 4.3) indicates that labour has a standardized coefficient of β positive but not statistically significant with the implication that there is a positive relationship between farming labour intensive

system and technical efficiency as an input which means that farmers are not utilizing it in the production of maize which means that an decrease of this input leads to increase in the level of maize production which is Constance with Cobb-Douglas theory of production.

Not only that but also farming experience as one of the input of production practices and determinant of technical efficiency level, and in instruction to capture the farming experience respondents were asked questions as marked in questionnaire from question number 16 farming experience is being determined through number of years a farmer had been in involved in farming practices, from the study area the average farming experience of the farmer was 17 years with the implication that farmers have enough experience in maize production, and most of the farmers with full experience tend to assist in different issues such as prediction of climatic trends, periodic of pests and diseases as well as good management of maize production hence increase the level of technical efficiency.

By connection with the above also the researcher observed that most of the experienced farmers were the elders with age of +45 and above as it is seen in figure 3.1, the relationship between farming experience and technical efficiency was drawn from table 4.4 hence the outcome shows that farmers' farming experience was positive and statistically significant at $P<0.05$ meaning that there are a positive relationship between farmers farming experience and technical efficiency of maize production and farmers seemed to over utilize the input, meaning that the increased level of farming experience will lead to the to the increase of technical efficiency of maize production if other factors remain constant which will also lead to the increase in return to scale.

The assessment of farmers' membership organization in household level was examined and when the respondents were asked if they belong from any membership organization as indicated by question (23), results in figure (4.4) shows that majority of the respondents 82.5% (99) were non-members of farming organizations while as few numbers of respondents of about farmers being members of the farming organization. And the regression result (Table 4.4) show that it is having positive

coefficient and significant at 1% hence implication here is that there is a positive relationship between farmers; farming organization as an input and technical efficiency of maize in the study area meaning that farmers are over utilizing it with the implication that an increase of this input leads to the increase of maize production and technical efficiency. This is also in the line with Essa *et* al (2011), who argued that membership of households in a farmers' association contributes positively and significantly to economic efficiency and farmers who belong to associations are found to be economically efficient.

The researcher included the question of farmers application of hybrid seeds and its cost since it is the most important resource in maize production, and the reason behind was to see if they do so, and the information presented in figure (4.8) shows that majority of the respondents (81) 67.5 % are not purchasing hybrid seed at all while few percent of the farmers buy hybrid maize seed, this implies that since most of the farmers use the recycled seeds from the previous seasons every after harvest. And the regression result from table (4.4) shows that purchasing of hybrid seeds has negative coefficient but statistically significant at 1% meaning that there is a negative relationship between the use of hybrid seeds by farmers and technical efficiency with the implication that farmers are over-utilizing it as an input in production of maize, that the increase of input use in production process will also lead to increase in technical efficiency.

This discussion is in the line with Brazdik (2006), who found that hybrid varieties had a positive influence on the efficiency in production of maize in Malawi and rice in West Java respectively. Furthermore also Kiplan`at, 2003, there is a negative relationship between purchased hybrid maize seeds and the small-scale maize producer`s technical efficiency. However, purchased hybrid maize seeds can still influence efficiency positively, since the use of improved seed in crop production is one way of increasing productivity in terms of quantity and quality. Not only that but also (Heidhues and Buchenrieder, 2004), argued that access to credit from formal and informal institutions is important for agricultural productivity; many poor rural farmers heavily rely on informal credit institutions to cope with food insecurity and its effects as well as to finance the purchase of farm inputs.

Not only that but also the respondents in the study area were asked about the application of fertilizer during maize production as question number (21a,b) asked, the results shows that majority of about 66% (79) of farmers do not apply fertilizer to their maize farms and the reason behind was that most of the farmers assumes that their farms do contains fertilizer since the remains of maize trees and leafs contain fertilizer after they decay, not only that but also other factors such as financial constraints to purchase the fertilizer supplied by government as subsidies, inefficient knowledge about the important of fertilizer application during production practices towards output and other from those who own livestock keeping, the researcher observed that most of the farmers from the study area they mostly use fertilizers obtained from their livestock keeping such as from cows, goats, sheep, pigs and chickens. The findings are in the with (Arua, 2015), arguing that application of manure to agricultural land has been viewed as an excellent way to recycle nutrients and organic matter that can support crop production and maintain or improve soil quality.

The regression model results indicated from (Table 4.4) shows that fertilizer application has a negative coefficient and not statistically significant meaning that there is a negative relationship between fertilizer application as an input and technical efficiency of maize production in the study area and farmers are under-utilizing the input, which means that the increase of fertilizer application as an input in maize production will lead to the decrease of technical efficiency level of maize production. For-example the study done by Chirwa *et* al., (2007), found that application of fertilizers did not explain the variations in technical inefficiency with the implication that most of the farmers did not use the technology properly.

CHAPTER SIX

SUMMARY, CONCLUSIONS AND POLICY IMPLICATIONS

6.1 Introduction

This chapter provides the summary, conclusion and policy implications of the study. The summary of the dissertation provides a brief description of the assessment of technical efficient of small-scale maize production in karagwe district. Finish presents some of the concluding remarks related to research results while recommendation presents the way forward based on the study findings, also the limitation and propose area for further research will be given in this chapter.

6.2 Summary of the Study Findings

The main aim of the study was to investigate on the technical efficiency of small-scale maize production in Karagwe District. The first specific objective was to examine the level technical efficiency of small-scale maize production and the second one was to identify the socio-economic characteristics that influence the technical efficiency of maize production, and the third was to explore the effects of climatic change on technical efficiency on maize production in Karagwe district. Production of maize by small-scale farmers in Karagwe District plays a vital role in alleviating poverty and generating income since maize is the staple food in the district, Tanzania and in African countries as a whole, so high productivity and the technical efficiency in its production are critical to food security in the country.

The sample size for this study involved 120 respondents consisting of farmers aged 16+. Not only that but also statistical Package for Social Science computer and STATA software was used to simplify the analysis of data. Descriptive statistics such as frequencies, percentages, and coefficient of variation were generated and Cobb-Douglas production function, a logistic regression model was used to make an analysis of technical production efficiency whereby significant and the non-significant variables were identified. The descriptive statistics revealed that small-scale maize producers in Karagwe district used different quantities of seeds and fertilizers, while others do not use fertilizer at all, and some of the farmers do not

have access to some of the variables (inputs) while others have access. Many of them depend mainly on family labour and the majority of the farmers interviewed falls under the old age group since young farmers are fewer. Descriptive statistics was used to summarize the data of the study through frequency and percentages. Cobb-Douglas production function results indicate that some of the variables were found to be positively significant, while others were negative but significant, and some were positive but non-significant. Even though some variables were not significant, it still shows that the variables used in the analysis have a positive effect on the output which simply implies that there is a good inputs-output relationship, and the small-scale maize producers in Karagwe district are experiencing a decreasing return to scale.

The factors that are influencing technical efficiency of small-scale maize producers in Karagwe district were as farmer`s farming experience, membership to farmers organization, climatic change, and cost purchasing of hybrid seeds and these factors were found to be significant. However, some of the variables were showing a negative relationship to small-scale maize producers` technical efficiency.

The pseudo R^2 value for the logistic regression model is 0.620 and this means that 62% of the variations in maize output are explained by the factor inputs. The values of the coefficients indicate the elasticity of the various inputs to the output.

6.3 Conclusion

Karagwe district is endowed with fertile land capable of bettering the standard of living of the local people if adequately put to use especially in agricultural practices. Maize being a major cash crop that has good potentials of high yield in the district can be a source of employment to the people of the district who is predominantly farmers if much attention is given to it.

Hypothesis 1: Small-scale maize producers in Karagwe district are not technically efficient. The findings of this study provide support for this hypothesis. Therefore, the hypothesis is not rejected since the empirical analysis has indicated that there is decreasing returns to scale which means that farmers are over-utilizing some of the factors of production/resources used in the production of maize.

Hypothesis 2: There are no socio-economic characteristics influencing the technical efficiency of small-scale maize production in Karagwe district. The hypothesis is rejected as the empirical results show a positive influence of socio-economic factors on technical efficiency. Variables that were found to be highly significant are such as, Purchase of hybrid seeds, membership to farmers` organization, Farmers farming experience, and climatic change. At that juncture, it can conclude that farmers are technically inefficient since they are over-utilizing resources at the farm level and that farmers` technical efficiency can be determined by the influence of certain socio-economic factors in the area of study as well as Tanzania at large.

6.4 Policy Recommendations

Based on the study findings, the following recommendations aimed at improving maize production are made:

- Improvement in input and equipment supply to farmers. Farmers need to be assisted in obtaining input and farm equipment. That will enable households to access such credit at a reasonable cost. This can be effected through the provision of loans which will be paid back during the selling of their produce. Also, it is recommended that a farmer agricultural bank is established in order to solve the problem of credit for farmers and processors. This could be achieved through the government facilitating saving and credit organizations (SACCOS), saving and credit union (VIKOBA), and other cooperative unions that are related to agricultural activities to mobilize resources and form an agricultural bank that will act towards access to farmers inputs and equipment hence that will boost the development of technical production (maize) efficiency in Karagwe district as well in Tanzania.
- Since the land is fixed, the government should encourage the use of fertilizer by providing incentives for the setting up of cooperative shops in order to provide fertilizers to households at an affordable price.
- The threat to Tanzania’s maize production should spur the country’s authorities to design climate-smart practices that might help cushion farmers from worsening losses.

- Development/improvement of training and extension services. Farmers need to access training and extension services in order for them to correctly appraise their investments. Technical skills training such as agronomy, post-harvesting handling and processing is an important component in rationalizing production and marketing of the crop. The increase in yield per hectare can be achieved through improved growing techniques. Inadequate knowledge of organic techniques by farmers can be developed with further training and exposure. Therefore field officers and trainers should be motivated to work hard so that they can provide farmers with adequate and quality extension services. The government should strive to develop roads, water, energy, and communication infrastructure. This will increase smallholder's economic opportunities by reducing transaction costs and allowing farmers to get access to marketing information for productivity and smallholder maize profitability.

- The government should encourage the private sector to invest in credit facilities like small–scale banks to offer credit to farmers at affordable rates. This should be through legislation to facilitate credit creation.

6.5 Limitations of the Study

The following were the hindrances during the research. Firstly, due to time and financial constraints, the study concentrated solely on 120 small-scale farmers within Karagwe District. There are many thousands of small-scale farmers in the district that could be included in the study.

Secondly, Local Government officials during the research time could not fulfil the appointment they gave me (the researcher) giving reasons that they were busy with the administrative work.

Third, some respondent's did not concentrate on the questionnaire; they would put a tick or a circle on the factor that would be answered otherwise according to my view (Researcher). For example, one male farmer assigned a tick on female position before the researcher asked him to make a correction.

6.6 Areas for Further Research

- The study was conducted in Karagwe District only. There is a need therefore to study other maize producing regions in Tanzania.
- Further studies should be carried out using adequate models and panel data (if possible) to verify the magnitude and major sources of the differences in the analysis of technical production efficiency of maize productivity in the various maize producing zones of the country with a view of designing policies based on each zone's peculiarities.
- More research on constraints and challenges faced by women and youth in maize production is needed.

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APPENDICES

Appendix

Questionnaires

Dear Sir/Madam,

My name is Alistakius K. Marco**,** a Master of Science in Economics (Project Planning and Management) student at Mzumbe University. I am here to acquire information on the research "Technical Efficiency of small-scale maize production in Karagwe District. You have been randomly selected to answer this questionnaire and this is purely an academic study and therefore all information will be treated confidentially. The study will also be helpful in finding concrete measures on those factors that will be identified.

A. HOUSEHOLD INFORMATION

(*Please fill in spaces provided or circle the appropriate answer*)

1. Age
    a) Below 16 years
    b) Between 16 and 25 years
    c) Between 26 and 35 years
    d) Between 36 and 45 years
    e) Above 45 years
2. Gender
    a) Male
    b) Female
3. What is your education level?
    a) No school attended
    b) Primary school education
    c) Secondary School education
    d) Technical/Vocational
    e) College/University education

f) Other (Specify).....

4. Marital status of the household head:

Single ( ) Married ( ) Married ( ) Divorced ( ) Widowed ( ) Widower

5. Number of people in the household (who have been living with you for the past three months……..?

6. What is your Occupation?

a) Farming
b) Petty business
c) Employment

7. What your estimated monthly earnings in Tanzanian shillings

a) 6,000-100,000
b) 101,000-195,000
c) 196,000-289,000
d) 290,000-384,000
e) 385,000-478,000
f) Above 500,000

8. What is your main source of income?

a) Farming
b) Petty business
c) Employment

B. CROP PRODUCTION AND MARKETING

9. What is the size of your hectare under Maize?

.....

a) 0-3hectare
b) 4-6hectare
c) 7-9hectare
d) Above 10 hectare

10c. If NO, give reason

a) It is costly
b) Not available
c) Others (specify).....

11. How many bags did you harvest last season?

a) Below 1 bag
b) Between 1 and 3 bags
c) Between 4 and 6 bags
d) Between 7 and 9 bags
e) 10 bags an above

12. How long, in terms of years, have you been involved in farming (years)?

……

13. When did you start cultivating maize? .....

14a. Do you normally hire labour for the production of maize?

a/ Yes……

b/ No……..

14b. If (yes), how many labourers do you normally hire?

……..

14c. How much do you pay them per day? .....

14d. If you do not have any labourers, how do you compensate for the labour?

…….

15. How many days used labour for maize production?

.....

16a. Do you normally hire a tractor for cultivating maize?

Yes ( ) No ( )

16. If (yes), how much does it cost per hour or per ha?

……

20c. If (no), how do you compensate for the tractor?

……

17a. Do you apply fertilizer for the maize production?

Yes ( ) No ( )

17b. If (yes), how many kilograms do you apply per hectare?

……

17c. How much do you spend on fertilizer?

……

18a. Do you purchase hybrid maize seed?

Yes ( ) No ( )

18b.1 If (yes), how much does it cost per kg?

……

18c. If no which type of seeds do you normally use?

19a. Do you belong to any farmers` organization?

Yes ( ) No ( )

19b. how long have you been a member of the organization?

.....

THANK YOU FOR YOUR COOPERATION