

**Market access and productivity of smallholder maize farmers in Lepelle  
nkumpi municipality, Limpopo province, South Africa**

by

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## **Dedication**

This dissertation is dedicated to my mother, my brother Kgonene Rangoato, my late father Joseph Rangwato and all of my family. Your support and love is highly appreciated.

## Declaration

I, declare that (Market access and productivity of smallholder maize farmers in Lepelle nkumpi municipality, Limpopo province, South Africa) hereby submitted to the University of Limpopo, for the degree of Master of Science in Agriculture, Agricultural Economics has not previously been submitted by me for a degree at this or any other University; that this is my own work in design and in execution, and that all material contained therein has been duly acknowledged.

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April 2018

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Surname, Initials (title)

Date

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## **Abstract**

Agriculture is the backbone and a very important sector of the South African economy. This is because it provides food and employment to a lot of people in the country especially those living in the rural areas. Smallholder farmers also play an important role in livelihood creation and also alleviation of poverty among the population in Limpopo province, but despite this, their productivity is low. A decline in agricultural productivity reduces market access resulting from low quality and quantity of produce by smallholder farmers which invariably affect their accessibility to market.

This study therefore examined the determinants of market access and productivity among smallholder maize farmers in Lepelle-Nkumpi municipality using the Probit model and Cobb Douglas production functions. While the Probit regression model was used to analyse the effect of socioeconomic characteristics of smallholder maize farmers on market access, the Cobb Douglas production function was used to examine the determinants of productivity among the farmers in the study area. The results of the Probit regression analysis indicated that farm size, hired labour and maize produced per hectare had positive significant influence on probability of farmers accessing markets. Farm size and maize produced per hectare were statistically significant at 1% and hired labour was statistically significant at 5%. The results of Cobb Douglas Production Function indicated that the elasticities of market access, farm experience, fertilizers, capital and membership of association were significant and positive. Based on the study findings, it is recommended that farmers should be provided with market infrastructure and marketing information services. This will help the farmers in a way that the transaction cost will be minimised and farmers will not incur more cost when they participate in the markets. Farmers in the study area indicated that transportation cost is the major challenge facing them. This is because of the poor conditions of roads in the study area. Therefore, the study recommends that there should be inputs subsidy that helps farmers to improve their productivity.

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## **List of abbreviations and acronyms**

ABET	Adult Basic Education and Training
DAFF	Department of Agriculture, Forestry and Fisheries
MSc	Master of Science
NDA	National Development Agency
ARC	Agricultural Research Council

# CHAPTER ONE

## INTRODUCTION

### 1.1 Background

Agriculture is the backbone and a very important sector of the South African economy. This is because it provides food and employment to majority of people in the country especially in the rural areas. Limpopo province is regarded as the garden of South Africa because it produces more of agricultural scarce products. Many of smallholder farmers constitute large section of the rural population in Limpopo province and they are involved in maize productivity so as to alleviate poverty and hunger and this is the case in Lepelle Nkumpi municipality.

Smallholder farmers play an important role in livelihood creation and also alleviation of poverty among the population in Limpopo province, but despite this their production is low. Smallholder farmers are characterised by use of out-dated technology, low returns and high seasonal labour fluctuations which are dictating the productivity of farmers in the rural areas (Daff, 2012).

The declining agricultural productivity has been a major cause of poverty among the rural population. If there is a decline in agricultural productivity, market access will be affected in the sense that the quality and the quantity of the produce by smallholder farmers determine their accessibility to market. Even though the availability of emerging markets offer high returns, it is sometimes accompanied by various risks. This is because agricultural productivity highly depends on weather conditions that are caused by the climate change (IPCC, 2007). Emerging farmers will contribute to economic growth by increasing productivity and employment, but in order for that to happen access to credit, training and capacity building of farmers should be enhanced (Fairlamb and Nieudwoudt, 1990).

Smallholder farmers are situated in the former homelands where lack of infrastructures limits the smallholder farmers to expand. An example of infrastructure is lack of proper roads which limits farmers to transports inputs and their produce. Even if government intervene by offering subsidies their major focus is on the commercial sectors that are able to give greater returns. According to Delgado et al (1998), smallholder farmers are being undermined in most of the African countries because smallholder farmers

operate in small area of land, lacking investments and institutional supports while the white commercial farmers receive subsidies to enhance their productivity.

Marketing skills and financial skills are some of the issues of concern when coming to smallholder farmers because most of the farmers do not have those skills. This results in farmers unable to meet the quality standards set by the markets and food processors. When farmers do not have production knowledge they end up producing lower quality products which also resulted from lack of production resources. Majority of smallholder farmers produce lower quantities of products that are of poor quality, which leads to their products being rejected by the markets and processors (DAFF, 2012).

According to Baloyi (2010), for the smallholder farmers to produce for the market it calls for more resources including production means such as land, water, on-farm and off-farm infrastructure, labour force, capital; and good management of these resources. If farmers have poor access to these resources this will affect the way in which smallholder farmers can benefit from opportunities in agricultural markets, more especially in terms of the volume of products traded and the quality and quantity of those products. In order for smallholder farmers to enjoy the benefit of agricultural growth they have to access the markets. It may be easy to access the market, but retaining the position in the market is more difficult which is a serious challenge to most of smallholder farmers (Reardon, 2005).

## **1.2 Problem statement**

A sizable number of smallholder farmers live in the rural areas and their income is very low such that they are experiencing poor market access. According to Mpandeli (2006), most rural households consist of farmers who are disadvantaged. Farmers are vulnerable to food insecurity because they practice agriculture in the semi-arid areas. Smallholder farmers lack infrastructures, which limit them to expand. According to Delgado *et al.* (1998), smallholder farmers are being undermined in most of the African countries because smallholder farmers operate in small area of land, lacking investments and institutional supports.

Although financial institutions have been established to assist farmers, smallholder farmers are still facing a challenge of accessing credit. Smallholder farmers have low income which results in lower productivity. They also face a challenge of accessing markets and also having access to resources that will improve their agricultural productivity. In order for smallholder farmers to have access to improved market there is a need to improve the competitiveness of their produce. For these reasons the study strives to examine productivity and market access of smallholder maize farmers in Lepelle-Nkumpi municipality.

## **1.3 Motivation of the study**

Maize is an important grain crop in South Africa, produced throughout the country under diverse environmental conditions and it has a dominant portion in the diets of rural and urban poor. Therefore, it is vital to note that a study on market access will not only assist in enhancing productivity but will boost the food security status of the households in the study area. The study findings will help in improving the productivity of smallholder maize farmers in Lepelle-Nkumpi municipality by providing relevant information on determinants of market access and productivity.

## **1.4 Purpose of the study**

### **1.4.1 Aim of the study**

The aim of the study was to examine market access and productivity of smallholder maize farmers in the Lepelle-Nkumpi municipality.

### **1.4.2 Objectives of the study**

- i. Identify and describe socioeconomic characteristics of smallholder maize farmers in Lepelle-Nkumpi municipality.
- ii. Examine the determinants of productivity among smallholder maize farmers in the study area.
- iii. Analyse the effect of socio economic characteristics of smallholder maize farmers on market access in Lepelle-Nkumpi municipality.
- iv. Identify the constraints to productivity and market access by smallholder maize farmers in the study area.

#### **1.4.3 Hypothesis of the study**

- i. Socioeconomic characteristics of smallholder maize farmers do not have effect on market access in Lepelle-Nkumpi municipality.
- ii. Socioeconomic characteristics of smallholder maize farmers do not influence productivity in Lepelle-Nkumpi municipality.

### **1.5 Organisational structure**

The research paper consist of five chapters, with chapter one providing the introduction of the paper in general. Chapter one consist of the background, problem statement, aim and objectives and the hypothesis of the study. Chapter two consist of the literature review where the previous studies, both locally and internationally related to the study were conducted. Chapter three shows the methodology and the analytical tools that were used to carry out the study. With chapter four showing the results that are obtained from the study and also their interpretation. The last chapter of the research is Chapter five, which consist of the summary, conclusion and policy recommendations.

### **1.6 Theoretical definitions**

**Market access** - is a situation where producers of a particular commodity can sell to a certain markets outlets. These market outlets could be specialty markets, organic markets or a fair trade market. The linkage can be individually or collectively through associations (Poulton et al., 2005).

**Productivity** - reflects improvements in the ability to transform inputs into outputs (Heisey, 2001).According to Smit et al. (2002), productivity is the quantity of output produced per production input in a unit of time and is a measure of how efficiently the input is used.

## CHAPTER TWO

### LITERATURE REVIEW

#### 2.1 Introduction

This chapter gives the review of previous studies on smallholder maize farming. Definition of smallholder farmers, market access by smallholder farmers and factors affecting productivity and market access of smallholder maize farmers are discussed here.

#### 2.2 Review of Previous Studies

##### 2.2.1 Concept of smallholder farmers

The concept of smallholder farmers refers to those rural farmers who cultivate on small farm areas on a dense population (McC. Nettin, 1993). Most sources defined smallholder farmers looking at the farm size, and as those farmers who have less than 2 hectares of land for cultivation. Hazell *et al.* (2007) defines smallholder farmers as those farmers who depend on household members for most of their labour with the aim of producing food for household consumption. In this paper, smallholder farmer is defined by those with less than 2 hectares, limited resources and needs external support so that they can farm successfully. Kirsten and Van Zyl (1998) define smallholder farmers as backward, non-productive and non-commercial subsistence agriculture found in the former homelands.

Smallholder farming has a potential in increasing the Gross Domestic Product of South Africa but this can only happen if the smallholder farmers have access to markets and also have resources to produce high quality products. Integration in agricultural sector will only be successful when smallholder farmers fully participate in the market (Makhura, 2001). Everatt and Zulu (2001) found that lack of physical infrastructure in rural areas remains a major obstacle to smallholder agricultural growth in South Africa.

Eicher (1994) suggests that the government of African countries should focus on the development of both the smallholder and middle farmers. In Zimbabwe the smallholder farmer who produces less than 2 hectares have tripled their maize production between 1980 and 1987 because of the programmes introduced to improve maize production (Eicher, 1994). According to Lauw *et al.* (2007) In South Africa, smallholder farmers



find it difficult and are excluded from participating in the food markets because of their poor production. Smallholder farmers are associated with high transaction costs and poor quality of their produces which makes them to be less competitive.

### **2.2.2 Maize production in South Africa**

Maize is a very important crop in South Africa and is produced throughout the whole country. NDA (2009) found that maize is the second largest crop produced in South Africa after sugar cane. Maize is the major cereal crop grown that plays an important role in the diet of rural people (ARC, 2002). In regards to South Africa, despite being a surplus maize producer, rising global commodity prices have translated into increasing food processing, transportation and distribution costs. The domestic commodity market is adjusting to a new equilibrium, which is joined by increased food price volatility particularly among staple food (Vermeulen *et al.*, 2009).

A study by Geta and Bogale *et al.* (2013), assessed productivity of maize under smallholder production and determines technical efficiency of smallholder farmers. The study found that productivity of maize was significantly influenced by the use of labour and fertilizers. This is because the use of human labour has a significant and positive effect on maize production at 10 percent level of significant. Maize plays an important role in income generation for the commodity value chain agents which are buyers, processors, exporters and also the transporters (Ortmann and Machethe, 2003).

Maize is the primary staple food in South Africa and most of African countries (FAO/GIEWS, 2011). In South Africa, maize is mostly grown in Gauteng, Mpumalanga, North-West Province and the Free State at large-scale basis (Chabane, 2002). Majority of smallholder farmers are poor and they lack resources and credit. This has resulted in low productivity of most smallholder farmers and this limit the them from participating in the markets (Obi *et al.*, 2011).

Maize is mostly produced by commercial sectors in South Africa because maize production is highly capital intensive with the commercial sector producing about 98% of maize and the 2% is produced by the smallholder farmers (Agricultural statistics, 2005). Monde (2003) indicated that successful maize production depends on the correct and effective application of resource inputs.

### 2.2.3 Agricultural productivity

Agricultural productivity is increasing in most of the developed countries and this is because the developed countries have highly invested in research and development, labour, land, capital and improved use of inputs such as fertilisers, machinery use and others (DAFF, 2011). A study conducted by Barrett (2008) found that a market is equivalent to production technology. This means that production technology affect the ability of the farmer to participate in a markets by affecting its productivity. Sandal (2007) further found that in order for a farmer to produce for the markets, production resources are required and these resources include land, water infrastructures and capital (Sandal, 2007).

Thirtle et al (1993) studied about agricultural productivity and found that agricultural production is fluctuating. In some years productivity was increasing whilst in others productivity was decreasing. A study conducted by Zepeda (2001) examined agricultural productivity in developing countries. Different models where used to examine the change in output to identity the relative contribution of different inputs to output growth. The results found that there is a relatively weak relationship between physical capital and growth, as compared to investment in technology and human capital.

Kamara (2004) indicated that the use of high yielding seeds varieties and labour inputs have a positive determinant on agricultural productivity. According to Shiferaw *et al.* (2009), farmer organisation can form a basic for improving market access. Furthermore, farmer organisation has the potential to improve the imperfections in the markets. Land is the most significant productive assets that ensure that rural households are able to have food. According to Mabuza *et al.* (2012), Land is a serious challenge to most of smallholder farmers in the rural areas. The study investigated the factors influencing the use of alternative land cultivation technologies in Swaziland. The study concluded about 49% of the farmers had total arable land below the threshold of 2 hectares.

In a study conducted Mazvimavi (2012), the results indicated that the adjusted  $R^2$  was 0.42. This means the dependant variables were only able to explain 42% of the variation in the study. Furthermore Kibirige (2015), studied agricultural efficiency of smallholder farmers in the Eastern Cape Province of South Africa. The results

indicated the adjusted  $R^2$  of was 0.240. The results indicated that only 24% of the variation was explained by the variable in the study.

#### **2.2.4 Market access by smallholder maize farmers**

Smallholder farmers require more improved access to agricultural markets in order for farmers to improve their productivity. Majority of smallholder farmers operate in a poor environment where it is difficult for farmers to access market due to high marketing costs, poor access to marketing information and supporting services. Smallholder farmers operate in the rural areas with few buyers competing for their surplus output which has resulted in farmers being reluctant to adopt new technologies and produce for the market (Chamberlin and Jayne, 2011).

Smallholder farmers are constrained by high transaction costs and missing markets in the marketing environment. Transaction costs that affect most smallholder farmers are those associated with transport cost, thus Heltberg and Tarp (2002) found that farmers who are in a position of owning a transport increase their market participation. Farina and Reardon (2000) further argue that smallholder farmers are constrained by absence of grades and standards and also lack of market information which results in poor market access. Most of the household depend on agriculture and rely on agriculture for poverty reduction. There is increasing recognition that the opportunity for smallholders to raise their incomes from agricultural production and this depends on their ability to participate actively in the markets.

According to Makhura *et al.* (2001), Smallholder farmers are characterised by low participation in the market because of different transaction cost that incurred when participating in maize market. The study applied the selectivity procedure to determine the factors influencing the decision of farmers to participate in maize market. The results are in support of most previous studies that suggest that the existence of transaction cost constraint smallholder farmers to participate in the market. The results also suggest that an increase in the arable land will results in an increase in maize sales. Pension earnings, average education, ownership of tractor or vehicle and conditions of the roads were other positive factors that affect maize farmer's participation in the market.

Kherallah and Minot (2001) found that there are two types of markets which are the informal and formal. Informal markets embrace unofficial transactions between farmers and from farmers directly to consumers. Formal markets have clearly defined grades, quality standards and safety regulations and prices are formally set. According to Louw *et al.* (2006), dominant supermarkets and processors have tended to favour suppliers who can ensure consistent volumes and quality, and they have thus engaged in long-term production arrangements (informal contracts) with such suppliers. Transaction costs are the determinants of whether farmers should participate in the market or not. Smallholder farmers are facing different opportunities of accessing the markets and that has affected their productivity (Bagamba, 2007). Poor market access is a problem to smallholder farmers who are residing in the rural communities (Machete 2004).

Smallholder farmers are affected by high transport costs because in most rural areas, the roads are underdeveloped and these results in high transaction costs. Jagwe *et al.* (2010), also found that the ownership of transport and the location of the farmer is critical for market access. Most smallholder farmers are situated in the remote areas with poor transport and market infrastructures and these increase the transaction costs of smallholder farmers (Key *et al.*, 2000).

The study conducted by the IPCC (2007) has found that the emerging markets are having high returns for smallholder farmers but there is a challenge of high considerable risks. This is because most smallholder farmers rely on rainfall as the source of water for irrigation which results in production being vulnerable to volatile weather conditions caused by the climate change.

Barrett (2008) found that the probability of being a net seller of staple grain increase significantly with land holdings of 4 hectares and above. The study also found that farmers with access to adequate assets and infrastructures engage actively in the markets while those who do not access assets and infrastructures do not engage in the market. Market access is not uniform more especially for smallholder farmers because smallholder farmers are faced with different transaction costs to participate in the markets (Renkow *et al.*, 2004). Mathijs and Noev (2004) also found that availability of land is the most important determinant of whether the farmer participates in the market or not.

Farmers' cooperative plays an important role in the production and marketing functions in the farms of rural countries (World Bank, 2008). According to Feder *et al.* (1990), agricultural credit played an important role in the adoption of modern technologies in the farming sector. This is because credit access allows farmers to have capital that can be used to buy inputs that are required for their productivity. Availability of inputs will result in high quality of produce by small farmers which in turn makes smallholder farmers to access market through their quality products. Therefore it is important for farmers to access credit because this will enable them to increase their productivity and quality produce which will result in market access.

Smallholder farmer's access to credit is viewed as an important way in which farmers can be able to raise enough funds for farming (Jacobs, 2009). Hence the productivity of smallholder farmers is low because it is difficult to access credits. The provision of credits by the government is very strict because of the conditions put in place which does not favour women and small farmers. Smallholder farmers are not allowed to use their land as collateral to access funds in the commercial banks and these result in farmers lacking funds for their production. The prices of inputs are fluctuating each and every year which pose a serious challenge to smallholder farmers because it becomes very difficult to access those inputs since they can't access credits.

A study conducted by Raphela (2014) used a qualitative approach to research the challenges and constraints of access to agricultural markets. The study found that there is a high need for smallholder farmers to access credits in order to expand their agricultural productivity. The study also added that, training on how to use and manage their funds will be valuable to them because the farmers acknowledge their limitations on how to manage their funds and budget properly.

### **2.2.5 Empirical studies on productivity and market access**

Kamara (2004), in a study based on the data collected from 100 farmers in Machakos district adopted variance analysis to develop and estimate a three stage least square regression model. The study used the model to assess the effect of market access on agricultural productivity and distribution of market generated benefits among small and large farmers. The results indicate that aggregate physical productivity with improvement in market access. The study also indicated that there is a difference in the distribution of market generated efficiency gains between small and large farmers

and between farmers who find it difficult to access market and those who easily access the market.

Anyaegbunam et al (2009) used a multistage randomized sampling method to examine the socioeconomic characteristics of the farmers and determinants of farm size productivity among small-holder cassava farmers. The results have shown that there is an inverse relationship between farm size and productivity. This call for policies aimed at redistribution of land targeted towards giving land to small-holder farmers in order to improve productivity. Dercon and Zeitlin (2009) also found that the use of improved technology improves the productivity of smallholder farmers.

Study by Raphela (2014) indicated that access to land, to agricultural inputs, to credit, market information, infrastructure and farmer support services were barriers to market participation. Lack of these resources affect farmer from accessing the market. Oparinde and Daramola (2014) found that insufficient capital, high cost of transportation, poor road network, poor storage facilities, lack of credit facilities, inadequate agricultural inputs are some of the factors that constraint smallholder farmers to access the markets.

Mpandeli and Maponya (2014) investigated the Constraints and Challenges Facing the Small Scale Farmers in Limpopo Province using the formal surveys and focus group meetings in the Tshakhuma, Rabali and Tshiombo areas. The results indicated that Lack of transport, Poor access to market information and Lack of formal education by the majority of farmers are the reasons why the smallholder farmers in the study area are excluded from participating in the formal markets. This is in line with the study by Msuya *et al.* (2008), who found that farmers with low level of education, lack of extension services and limited capital and land fragmentation have a negative effect on the productivity.

Osmati and Hossain (2015) used the Probit model to examine the relationship between the smallholder farmers' decision to participate in the market and the factors that affect these farmers' decision. The results of the study indicate that farm size, household labour, income from livestock and farm income might be the main factors that affect the smallholder farmers' decision to participate in the output market.

Hlongwane, Ledwaba and Belete (2014) used the logistic regression model to analyse the factors affecting the market participation of small-scale maize farmers in Greater Giyani municipality. The results revealed that gender, access to credit, marital status, market information and market infrastructure were found significant. While the distance to the market, experience in farming and external source of income were insignificant. The results also indicate that government can influence the market participation by encouraging farmers to have group market participation

Hlomendlini (2015) employed a binary probit model to determine key factors influencing smallholder market participation in the former homelands of South Africa. The results of the study indicate that there are specifically five factors that has statistical effect on market participation. These factors are household size, land size, access to credit, use of tractor when cultivating and age. Furthermore, Barrett (2008) found that the problem for smallholder farmers not to participation in the market is because they don't have access to market prices, no production technologies and no infrastructures in order to produce marketable surplus.

### **2.3 Chapter summary**

This chapter was specifically focussing on previous studies that were conducted focussing specifically on market access and productivity of smallholder maize farmers. The chapter reviewed studies that were conducted both in South Africa and Internationally. The literature review defined smallholder farmers by those with less than 2 hectares, limited resources and needs external support so that they can farm successfully. Literature also found that in order for a farmer to produce for the markets, production resources are required and these resources include land, water infrastructures and capital. Smallholder farmers are constrained by high transaction costs and missing markets in the marketing environment.

## **CHAPTER THREE**

### **RESEARCH METHODOLOGY**

#### **3.1 Introduction**

This chapter aims to describe the study area, method of data collection and explain the analytical tools used to obtain the results of the study. Information on socio economic characteristics of smallholder maize farmers, market access resource used and the constraints faced by smallholder maize farmers were highlighted in this chapter.

### **3.2 Description of the study area**

Limpopo province is a small area with the potential in agricultural production. Limpopo province has five districts namely: Mopani, Vhembe, Sekhukhune, Capricorn and Waterberg districts. Capricorn District is located on the northern side of South Africa. Capricorn region is predominantly rural in nature. It consists of the following five local municipalities: Aganang, Blouberg, Lepelle-Nkumpi, Molemole and Polokwane (Lepelle-Nkumpi, 2012).

The study was conducted in Lepelle-Nkumpi local Municipality, one of the local municipalities within the Capricorn District Municipality found in the Southern part of the Capricorn district, about 61km from Polokwane. The area was chosen based on the fact that the majority of households are unemployed and some earn lower incomes, so most people are engaged in farming. This area is pre-dominantly rural with a population of approximately 241 414 people, 58 483 households and covers 3,454.78 km<sup>2</sup>, which represents 20.4% of the district's total land area (Lepelle-Nkumpi, 2012).

### **Capricorn district with Lepelle-Nkumpi Local Municipality**





**Figure 3.1: Map of Capricorn District**

*Source: South African Treasury, 2011/2012*



**Figure 3.2: Maize farmer weeding the maize**

Figure 3.2 indicate a farmer in Lepelle-Nkumpi municipality working on her 3 Hectares maize farm. The image shows the farmer with her employees weeding maize.

### **3.3 Data source and sampling method**

Data was collected using semi-structured questionnaires to achieve the objectives. Multistage sampling was used for the study because larger clusters were further subdivided into smaller, more targeted groupings for the purpose of surveying. Lepelle

Nkumpi municipality is very huge therefore villages from each Traditional Authorities were selected. Hence from the villages selected, a total of 180 smallholder farmers were interviewed. Structured questionnaires were used of which 72 farmers in Gampahlele, 60 smallholder maize farmers in Magatle and 48 in Mafefe villages were interviewed based on probability proportion to size. The information about the availability of the farmers was provided by extension officers from Capricorn District under Lepelle-Nkumpi municipality.

### **3.4 Analytical technique/models**

The data collected for the study was analysed using the descriptive statistics, Binary Probit models and the Cobb Douglas regression model.

#### **3.4.1 Objective (i) and (iv) were addressed using the descriptive statistics**

Smallholder maize farmers' socioeconomic characteristics and constraints to productivity and market access were analysed using descriptive statistics such as tables, means, percentages etc. Statistical Package for Social Science (SPSS) was used. Tables and percentages were used to describe the constraints that are faced by smallholder maize farmers.

#### **3.4.2 Cobb Douglas regression model**

The Cobb Douglas production function was used to examine the determinants of productivity among smallholder maize farmers in Lepelle-Nkumpi municipality. The Cobb Douglas production function is expressed as follows:

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

Where: Y= Output, A= Constant, L= Labour, K= Capital and U= Disturbance term,  $\alpha$  and  $\beta$  are elasticities of production with respect to labour and capital.

Therefore the general models for this study, Y, to a given set of resources, X and other conditioning factors are given as follows:

$$Y = \alpha X_1^{\beta_1} + \alpha X_2^{\beta_2} + \alpha X_3^{\beta_3} + \alpha X_4^{\beta_4} + \alpha X_5^{\beta_5} + \alpha X_6^{\beta_6} + \alpha X_7^{\beta_7} + U$$

Where :

X<sub>1</sub> = Land devoted to maize production.

$X_2$  = Seed used in kg.

$X_3$  = Fertilizer used in kg.

$X_4$  = Family and hired worker days used in arable crop production.

$X_5$  = Capital.

$X_6$  = Expenses on pesticides, in Rands.

$X_7$  = Access to water for irrigation (Dummy, access to water 1 and 0 otherwise).

U = Disturbance term.

Y = Annual total farm output of maize measured in Kg/Ha.

$\alpha$  is a constant,  $\beta_1, \beta_2, \beta_3, \beta_4, \beta_5, \beta_6$  and  $\beta_7$  are elasticities to be estimated.

#### **3.4.2.1 Model specification**

For ease of the estimation, the linearized form of the Cobb Douglas function was used using the logarithm and the function gives the following specification (Coudere and Marijse's, 1991):

$$\ln Y_i = b_0 + b_1 \ln X_1 + b_2 \ln X_2 + b_3 \ln X_3 + b_4 \ln X_4 + b_5 \ln X_5 + b_6 \ln X_6 + b_7 \ln X_7 + U$$

#### **3.4.2.2 Description of variables**

Output (Y) is the total quantity of maize produced per hectare. Is measured in Kg

Land ( $X_1$ ) total area of farm used to plant maize.

Labour ( $X_2$ ) is the total amount of labour used for arable crops production. Both hired and family labour;

Capital ( $X_3$ ) used to present tractor costs used

Fertilizer ( $X_4$ ) includes both basal and top dressing fertilizers. Although some smallholder farmers use animal manure, it is also included and is measured in Kg

Pesticides ( $X_5$ ) pesticides costs, measured in rands

Seed (X6) certified and home produced, is considered and is measured in kg

Irrigation water (X7) is the amount of water used for irrigation. Measured in Mm

### 3.4.3 Binary Probit models

The Binary Probit model was used to analyse the effect of socio economic characteristics of smallholder maize farmers on market access in Lepelle-Nkumpi municipality. Market access is a situation where producers of a particular commodity can sell to a certain markets outlets (Poulton *et al*, 2005).

Therefore we assume that  $Y^*$  can be specified as follows:

$$Y^*_i = B_0 + B_1X_1 + B_2X_2 + \dots + B_kX_k + U_i$$

And that:

$$Y_i = 1 \text{ if } Y^* > 0$$

$$Y_i = 0 \text{ Otherwise}$$

Where  $X_1, X_2, \dots, X_k$  represents the explanatory variables,  $B$  represents a vector of unknown parameters and  $U$  represents the disturbance term (Nagler, 1994)

#### 3.4.3.1 Model specification

$$Y_i = B_0 + B_1X_1 + B_2X_2 + B_3X_3 + B_4X_4 + B_5X_5 + B_6X_6 + B_7X_7 + B_8X_8 + B_9X_9 + B_{10}X_{10} + B_{11}X_{11} + B_{12}X_{12} + B_{13}X_{13} + \mu$$

**Table 1: Description of variables used in the Probit Regression analysis**

Variables	Descriptions	Measurements
-----------	--------------	--------------

Smallholder Farmers market access(dependant variable)	1 if farmer has Market access, 0 otherwise	Dummy
Farm size	Estimated hectares cultivated	Ha
Household size	number of members in the household	Number
Gender of the Farmer	1 if the farmer is male,0 otherwise	Dummy
Age of the Farmer	Age of the farmer	Years
Marital status	1 if the farmer is married, 0 otherwise	Dummy
Education	1 if the farmer passed matric,0 otherwise	Dummy
Market information	1 if the farmer has market information, 0 otherwise	Dummy
Farming experience	Years of farming experience	Years
Distance to nearest market	Distance from farm to the market	Km
Extension services	1 if the farmers receives extension services, 0 otherwise	Dummy
Hired labour	1 if the farmer hire labour, 0 otherwise	Dummy
Production fertilizers.	Amount of fertilizers used	Kg

Access to credit	1 if farmer access credit, 0 otherwise	Dummy
------------------	---	-------

*Source: From survey data*

**Table 2: Analysis of objectives**

Objectives	Data needs	Analytical tool
Identify and describe socioeconomic characteristics of smallholder maize farmers in Lepelle-Nkumpi municipality.	Frequencies, means and percentages	Descriptive statistics
Examine the determinants of productivity among smallholder maize farmers in Lepelle-Nkumpi municipality.	Land, Labour, Capital, Seeds, Fertiliser, Pesticides, Water for irrigation	Cobb Douglas
Analyse the effect of socio economic characteristics of smallholder maize farmers on market access.	Farm size, Household size, Gender of the Farmer, Age of the Farmer, Education, Farm income, Farming experience, Land ownership, Extension services, Hired labour, Access to production inputs.	Probit regression model
Identify the constraints to productivity and market access by smallholder maize farmers in the Lepelle-Nkumpi municipality	Frequencies, means and percentages	Descriptive statistics

Source: From survey data



### **3.5 Limitations of the study**

- Most of the farmers in the study area were not available in the database of the extension officers from department of agriculture, therefore the sampling was a challenge. Through the help of the farmers who were in charge in the particular villages, the farmers were identified.
- Most of the farmers were not keeping records of their information and it was difficult for them to answer some of the questions asked.
- Long distance and poor infrastructure was a challenge of reaching other farmers. This challenge was surmounted by the help of the extension officer who arranged a meeting with the farmers and the survey was collected after the meeting in order to ease long distances.

### **3.6 Chapter summary**

The chapter showed the study areas where the data was collected, analytical procedures that were used and also the models adopted in the study. Probit regression model was used for smallholder maize farmer's access to market and the Cobb Douglas production model was used to determine productivity of smallholder maize farmers in the study area.

## CHAPTER FOUR

### RESULTS AND DISCUSSION

#### 4.1 Introduction

The aim of the study was to examine market access and productivity of smallholder maize farmers in the Lepelle-Nkumpi municipality. This chapter describe the nature of the data used in the study and summarises the variables which were considered and their measures. The empirical results analysed to achieve the objectives are discussed in this chapter. The results are presented in tabular, charts and interpreted.

#### 4.2 Socio-Economic characteristics of smallholder maize farmers

Table 3: Socio-Economic characteristics of smallholder maize farmers

Variables	Total (180)	Access market (134) (74%)	No-Market access (46) (26%)
Age in years	64	63	67
Family labour	142 (79%)	103 (57%)	39 (22%)
Land ownership	174 (97%)	131 (73%)	43 (24%)
Extension services	Yes 135 (75%)	101 (56%)	34 (19%)
	No 45 (25%)	34 (19%)	11 (6%)
Access to credit	Yes 9 (5%)	9 (5%)	0 (0%)
	No 171 (95%)	159 (88%)	12 (7%)

Source: From survey data

##### 4.2.1 Age of the household head

Age of the farmer was thought to be important variable because it is believed that age is related to experience that one has in market access and agricultural production. As indicated in the table 1, the average age of the smallholder maize farmers was 64 years, with those who have access to market being 63 years and that of no-market access being 67 years.

#### **4.2.2 Family labour**

Family labour is mostly used by smallholder farmers because they cannot afford to pay hired labours since smallholder farmers are associated with low financial capital. As shown on the table 1, 142 (79%) farmers use family labour with 103 (57%) farmers accessing market and 39 (22%) farmers having no-market access. The results indicate that most of farmers who access market use family labours compared to farmers with no-market access.

#### **4.2.3 Land ownership**

Land is the main factor that determines the quantity to be produced by the farmer, therefore availability of land is the most important determinant of whether the farmer participates in the market or not. Out of 180 smallholder farmers, 174 (97%) farmers own the land and 6 (3%) farmers do not own the land. The results also indicate that 131 (73%) farmers who own the land access market whereas 43 (24%) farmers have no-market access.

#### **4.2.4 Extension services**

Extension officers works closely with the farmers in order to help them make better decision to increase their productivity and also to transfer information related to agricultural productivity. On average 135 (75%) of the sample get extension services, with 101 (56%) of market access and 34 (19%) of no-market access receiving extension services. These results indicate that farmers who access market receive more extension services than their non-market access counterparts.

#### **4.2.5 Access to credit**

Provision of credit has been identified as the most important instruments in improving agricultural productivity through financial investments. Smallholder farmers in South Africa are facing a challenge of accessing credit because creditors target clients with ownership of relatively high value property of which the smallholder farmer do not have. The results indicate that only 9 (5%) farmers from the sample access credit while 171 (95%) farmers do not access the credit, with 9 (5%) of farmers accessing market and 0 (0%) of no-market access receives credits. This results shows that farmers who

access markets received more credits than no-market access who doesn't receive credits at all.

**Table 4: Demographic Characteristics of Smallholder Farmers in the Study Area**

<b>Variables</b>	<b>Frequency</b>	<b>Percentages (%)</b>
<b>Age</b>		
≤ 30	2	1.1
31 – 40	4	2.2
41 – 50	15	8.3
51 – 60	44	24.4
> 60	115	64
<b>Gender</b>		
Male	48	27
Female	132	73
<b>Household size</b>		
1 – 5	87	48
6 – 10	82	46
11 – 15	8	4
>15	3	2
<b>Marital status</b>		
Single	19	10
Married	144	80
Widowed	16	9
Divorced	1	1
<b>Access to credit</b>		
Yes	9	5
No	171	95
<b>Access to extension services</b>		
Yes	135	75
No	45	25

Source: From survey data

On table 4, the sample suggests that the largest proportion (64%) of the farmers had above 60 years, with 24.4% between 51 – 60 years. Although majority were having above 60 years very few were bellow or equal to 30 years with 1.1%. Most farmers were headed by females with 73% and the males having 27%. The female dominance may be due to the recent policies that support women participation in agricultural activities.

Household size in most rural villages of African countries is mostly the main source of farm labour (Kibirige, 2008). The results indicated that most farmers had household size between 1-5 with 48%, followed by household size between 6-10 with 46%. Household size above 15 were fewer with 2%. The results also suggest that large proportion of the sample were married (80%), even though a handful were single (10%) and 9% were widowed and very few (1%) were divorced.

#### 4.2.9 Gender

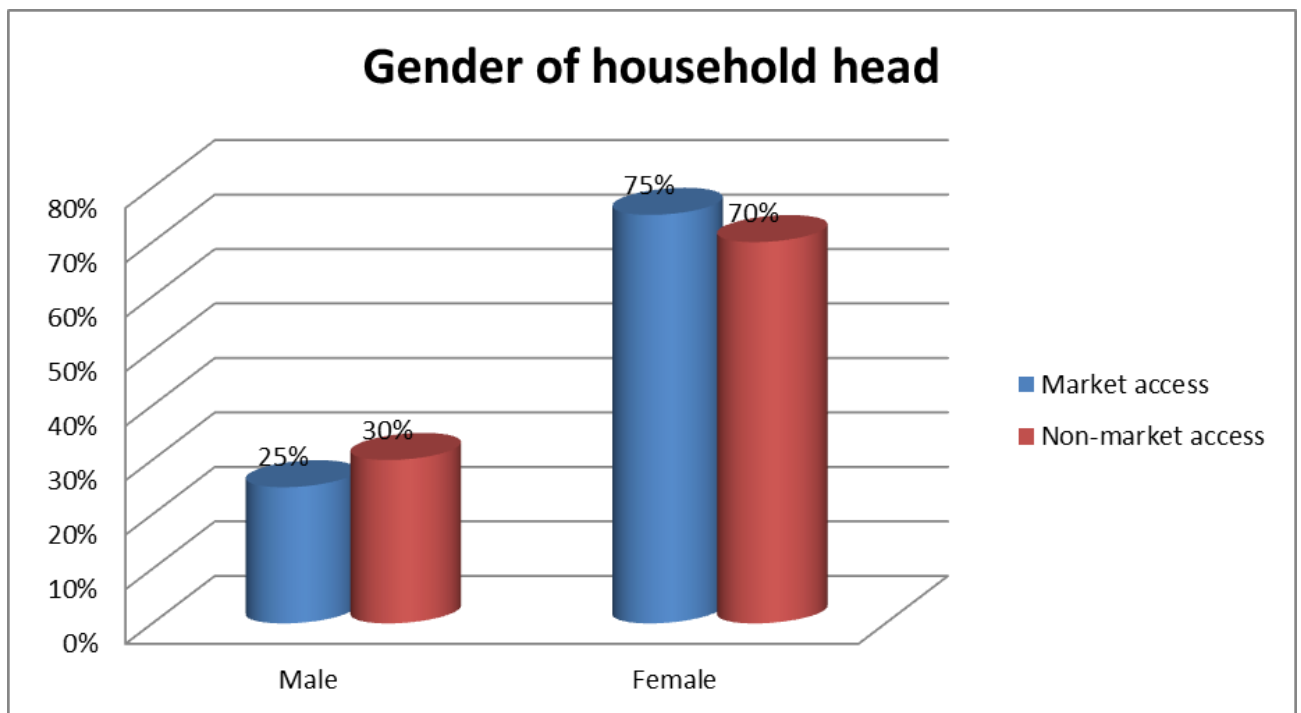


Figure 4.1: gender of household head

Source: From survey data

Figure 4.1 shows the results of the respondents in terms of gender. The results indicated that 25% of males have access to market while 70% of females did not have access to the market. Overall a large number of female smallholder maize farmers had access to markets compared to their male counterparts.

#### 4.2.10 Marital status

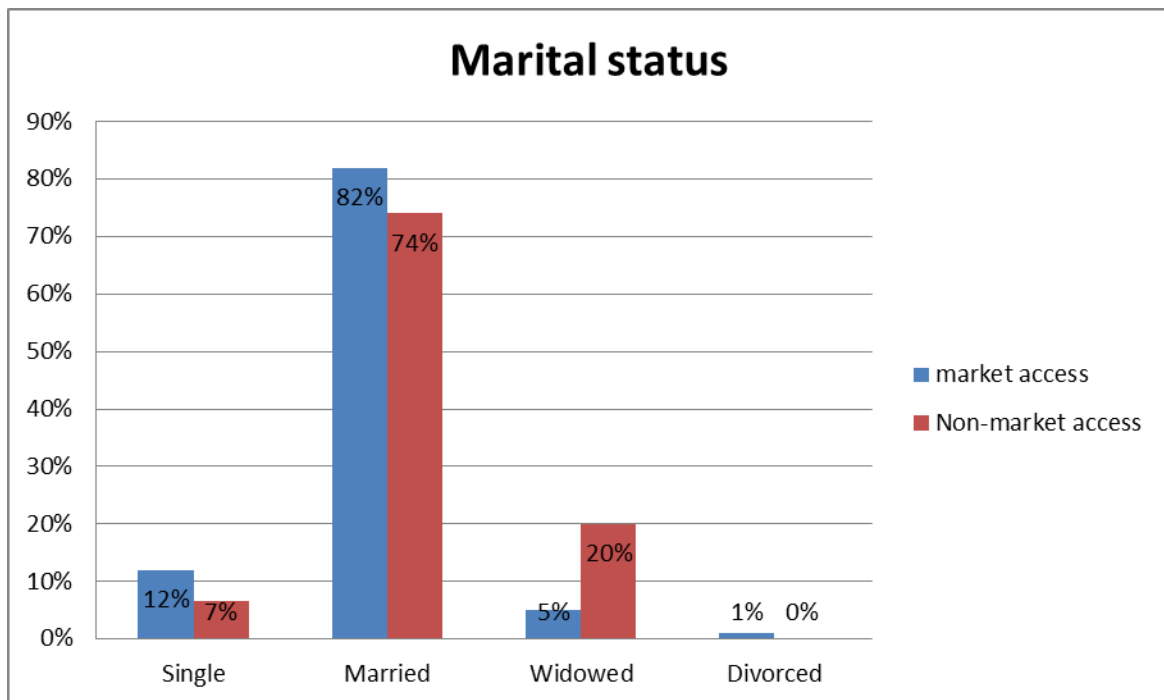


Figure 4.2: Marital status of household head

Source: From survey data

Marital status was thought to be one of the important aspects in the study because of the role played by different family members in a household and it directly affects the market access and productivity of smallholder farmers. Marital status was divided into four categories which are single, married, widowed and divorced. On average 10% of smallholder maize farmers are single, 80% are married, 9% are widowed and 1% are divorced. The results from figure 4.2 indicate that majority of households who are married access market than their counterparts.

#### 4.2.12 Education level

Level of education was divided into five categories which are, smallholder farmers who never went to school, the ones who went to primary school, the ones who went to secondary, the ones who went to tertiary and the ones who went to ABET which are shown in figure 4.3. The results indicate that 29% of the sample never went to school, 44% went to primary school, 23% went to secondary school, 3% went to tertiary and 1% of the sample went to ABET.

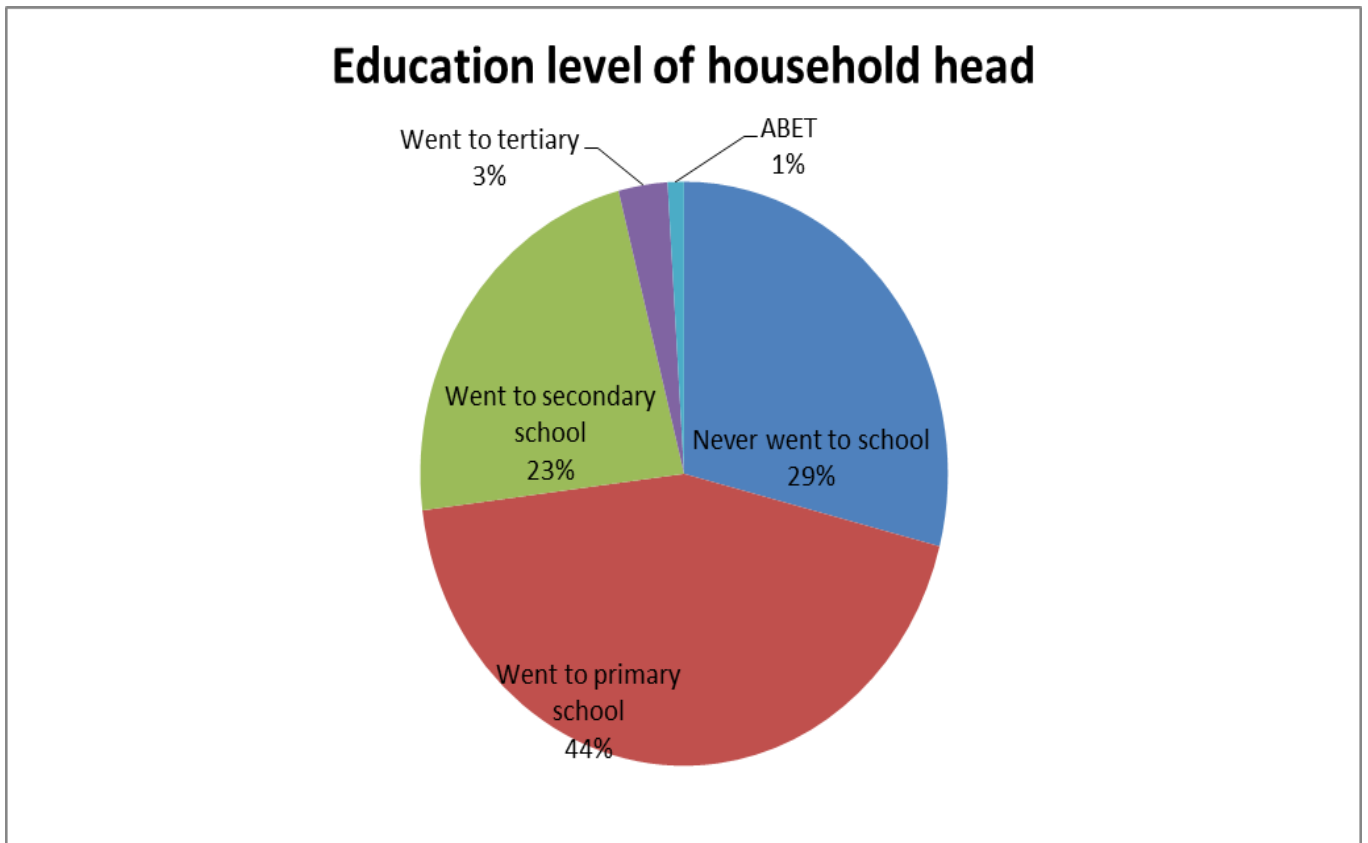


Figure 4.3: Education level of household head

Source: From survey data

#### 4.2.13 Tenure status

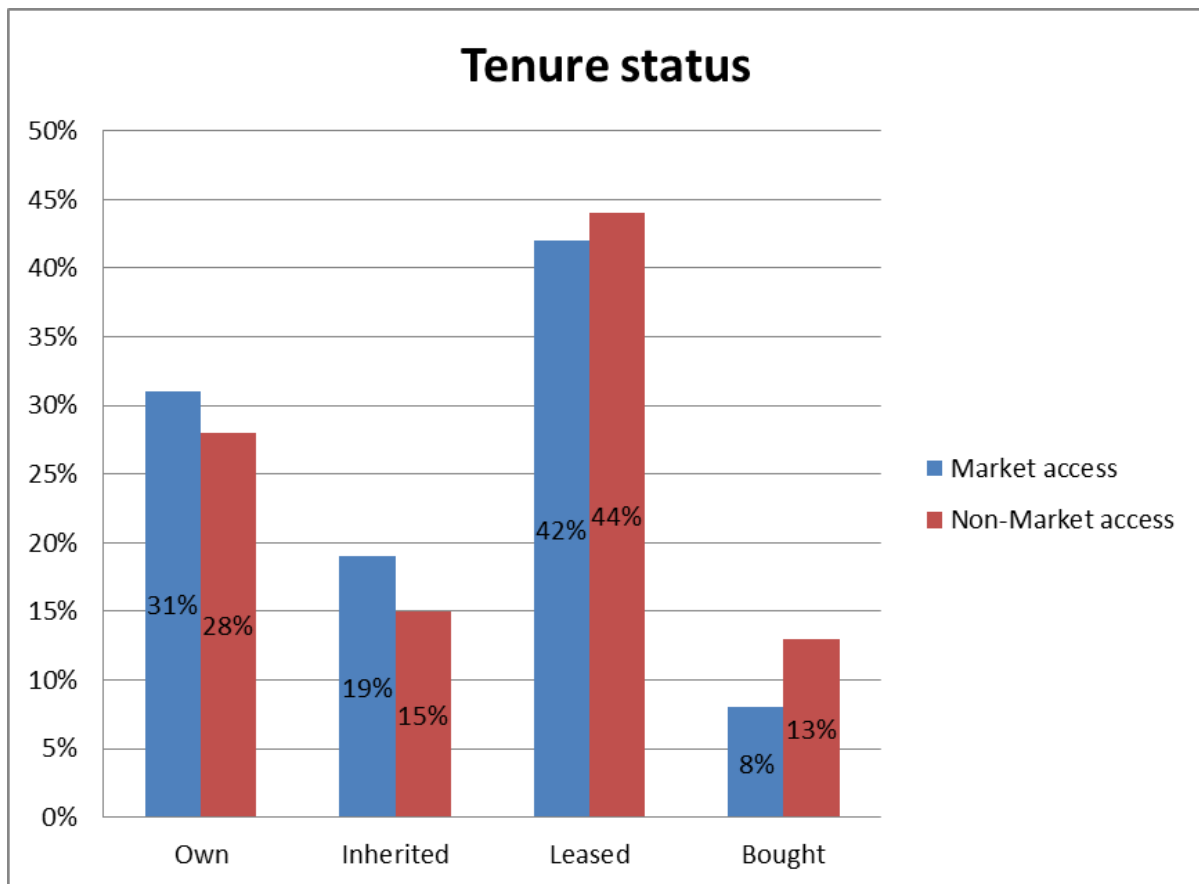


Figure 4.4: Tenure status of household head

Source: From survey data

Land tenure was divided into four categories namely, owns the land, inherited the land, leased the land and bought the land as indicated in figure 4.4. On average 30% of the sample own the land, 18% of the sample used the inherited land, 43% used the leased land and 9% used the land they bought. The results further indicated that 31% of market access owns the land while 28% of non-market access owns their land.



#### 4.2.14 Farming experience

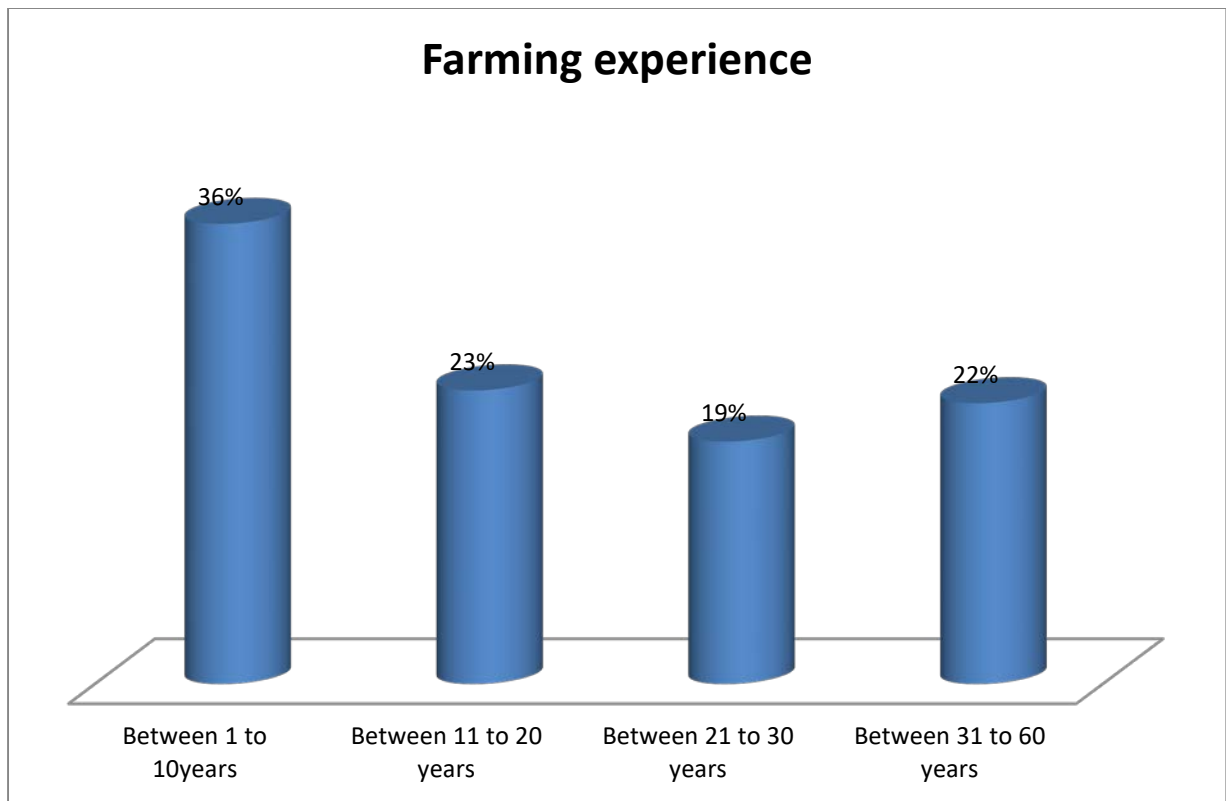


Figure 4.5: Farming experience

Source: From survey data

Figure 4.5 above shows the percentages of farming experience of smallholder maize farmers in the study. Farmers who have maize experience of between 1 to 10 years were found to be the maximum at 36%. Experience between 11 to 20 years was found at 23% and between 21 to 30 years was found at 19%. Farmers with many years of experience was between 31 to 60 years was found at 22%. The results of this study shows that 64% of the farmers in the study area have the experience of more than 10 years and this may lead to improvement in productivity level and more market access.

### 4.3 Cobb Douglas Production Function results

Productivity of maize producers in Lepelle-Nkumpi municipality was determined using Cobb Douglas Production Function with a given set of variables. The variables were, market access, Farm size, household size, Gender, Age, Farm experience, fertilizers, Years in school, Years in school, Labours hired, Family members assisting, Capital, Pesticides cost, membership association and extension services. The results are of the study are presented in table 4.3.

**Table 5: Estimated Cobb Douglas Production Function for smallholder maize farmers.**

**Dependant variable= Maize Productivity**

Variables	Estimated coefficient	dy/dx	Z	P>z
Market access	0.2665*** (0.0576)	0.2665 (0.0576)	4.62	0.000
Farm size	-0.1408 (0.1222)	-0.1408 (0.1222)	-1.15	0.249
Household size	0.0091 (0.1170)	0.0091 (0.1167)	0.08	0.938
Gender	0.0332 (0.0574)	0.0333 (0.0574)	0.58	0.562
Age	-0.2552 (0.3226)	-0.2552 (0.3226)	-0.79	0.429
Farm experience	0.1425*** (0.0588)	0.1425 (0.0588)	2.42	0.015
Fertilizer	0.0832*** (0.0339)	0.0832 (0.0339)	2.46	0.014
Years in school	-0.0115 (0.0655)	-0.0115 (0.0656)	-0.18	0.861
Labour hired	0.0301 (0.1116)	0.031 (0.1116)	0.27	0.787

Family members assisting	-0.0001	-0.0001	-0.00	1.000
	(0.1029)	(0.1029)		
Capital	0.1773***	0.1773	2.56	0.011
	(0.0693)	(0.0693)		
Pesticides cost	-0.0167	-0.0167	-0.58	0.565
	(0.0290)	(0.0290)		
Membership association	0.1332***	0.0857	1.64	0.101
	(0.0522)	(0.0522)		
Extension services	0.0857	0.1332	2.08	0.038
	(0.0641)	(0.0641)		
Adjusted R <sup>2</sup>	0.2921			
*** Significant at 1%				
** Significant at 5%				
* Significant at 10%				

Source: From survey data

Table shows the estimates of the production function and resulted in the Adjusted R<sup>2</sup> of 0.2921. This implies that the inputs used in the model were able to explain about 29% of the variation in maize production by smallholder maize farmers who access markets and no-market access. The other 71% is due to other factors that were not included in the study.

#### 4.3.1 Elasticities of production

According to Truran and Fox (1979), as cited by Lefophane (2012), elasticity of coefficient indicate the percentage increase or decrease in output that would results if an input is changed by one percent while holding other inputs constant. The results of the study indicated that the elasticities of market access, farm experience, fertilizers, capital and membership association were significant and positive. Farm size, household size, gender, age, years in school, labours hired, family members assisting and pesticides costs and extension services were not significant.

#### **4.3.2 Market access**

When there is improvement in the market access the productivity of smallholder farmers will increase. A study by Kamara (2004), who conducted the impact of market access on input use and agricultural productivity in Machakos district found that aggregate physical productivity increases with the improvement in market access. The results of the study revealed that, elasticity with respect to market access was found to be positive and statistically significant at 1%. This implies that smallholder farmers who access markets will results in their productivity increasing.

#### **4.3.3 Farm experience**

The variable farming experience has a positive sign and statistical significant at 1% level. The results indicate that there is a positive relationship between the farmers' farm experience and productivity of smallholder maize farmers. The results also indicate that one year increase in farm experience will increase productivity by 0.1425 Kilograms. The results are supported by Tshilambilu (2011), who found that there is a positive relationship between farm experience and productivity.

#### **4.3.4 Fertilizer**

Fertilizer was positive and statistically significant at 1% level. The results indicate that fertiliser is very important to productivity of smallholder maize farmer, with the value of 0.0832. This indicates that if the money spent on fertiliser cost increases by one percent, the total output of smallholder maize farmers will increase by 0.0832%. The use of fertilisers is commonly known as the method used to improve agricultural productivity. The results are supported by Tshilambilu (2011) and Lefopane (2012) who both found that fertiliser was statistically significant and positive on productivity of smallholder farmers, which means increase in fertilisers increase agricultural productivity.

#### **4.3.5 Capital**

Tractor cost was used as the proxy for capital. The elasticity of capital was found to be statistically significant and positive at 1% level, with the value of 0.1773. These results indicate that if the money spent on capital increase by 1% the total production of maize will increase by 0.1773%. This implies that as more capital is used in the

production of maize, the output will increase. The results are supported by Lefophane (2012) and Kibirige (2013) who found similar results.

#### **4.3.6 Membership of association**

Schotanus et al. (2010), emphasize that the key success factor of the association is influenced by the commitment and contribution of the members through communication and coordination of activities in the association. The results indicate that membership association was statistically significant (1%) and positive, with the value of 0.0857. This implies that farmers' organisation plays a fundamental role in maize production.

#### **4.3.7 Farm size**

The farm size was found to be not significant and had a negative influence on maize productivity, with the value of -0.1408. This indicates that a unit increase in hectare of land will decrease productivity of maize by smallholder farmer. The more the land available allows smallholder farmers to produce less maize. The results are in contrast with Rahman *et al* (2016), who found that elasticity value of 3.88 for the land variable indicating that a one percent increase in land area under maize will increase output supply by a substantial 3.88 percent.

#### **4.3.8 Household size**

Household size was found to be insignificant and had a positive influence on maize production with the value of 0.0091. The higher the number of the farmers household members will results in an increase in the level of output. The results are in contrast with Kibirige (2013) who found that household size was significant at 10% level.

#### **4.3.9 Gender**

Variable gender was found to be insignificant and positively influence maize productivity with the value of 0.0333. The study found that 73% of the farmers were females and 27% were males. The results are in contrast with Koru and Holden (2008), who found that productivity, was lower for female-headed household than their male counterparts.

#### **4.3.10 Age**

The age of the farmer was found to be statistically insignificant. The relationship between the age of the farmer and productivity was found to be negative, with the value of -0.2552. The results indicate that age of the farmer negatively affects the farmers maize productivity. Which means the older the farmers the less the maize output of the farmer. When the farmer is old their daily activity is reduced due to the fact that they are no longer active, and thus results in their output decreasing. The results contrast with Olujenyo (2008), who found a positive relationship between age and output.

#### **4.3.11 Years in school**

The variable years in school was found to be statistically insignificant. The relationship between years in school and productivity was found to be negative, with the value of -0.0115. This is due to the fact that majority of the farmers in the study area are old people and many of them never went to school if not gone to primary school. Dr Ekou (2015) who investigated whether primary education has any effect on maize production in Ivory Coast, found that primary education has positive effect on productivity.

#### **4.3.12 Hired Labour**

The results found that labour has a positive relationship with productivity of smallholder maize farmer, with the value of 0.031. The relationship was found to be statistically insignificant. The results indicate that increasing labour hired by one man power may lead to an increase in productivity of maize by 0.031 kilograms. The results mean that the more labour hired the more the output of maize will increase. Lefophane (2012) supports the results.

#### **4.3.13 Family members assisting**

Family members assisting in the farm was found to be statistically insignificant. The relationship between family members assisting in the farm and productivity was found to be negative, with the value of -0.0001. This means that the more the family members assisting the lower the output. This is because majority of the farmers in the study area prefer to use hired labour than the family member. Msuya et al (2008) support the results.

#### 4.3.14 Pesticides cost

A pesticides cost was found to be statistically insignificant. The relationship between pesticides costs and productivity of maize was found to be negative, with the value of -0.0167. The non-significance of pesticides is because of the fact that most of the farmers in the study area are not using pesticides in their production of maize. Lefophane (2012) found also found similar results because farmers in the sample did not use pesticides to spray maize.

#### 4.3.15 Extension services

According to Enki *et a.* (2001) the important source of information and advice to smallholder farmers towards farming is extension service. The results indicate that extension service was found to be statistically insignificant and had a positive influence on maize production. This implies that extension service play a role in maize production.

#### 4.3.16 Return to scale

**Table 6: Return to scale**

<b>Explanatory input variable</b>	<b>Elasticity</b>
Farm size	-0.1408
Fertilizer	0.0832
Labours hired	0.031
Family members assisting	-0.0001
Capital	0.1773
Pesticides costs	-0.0167
<b>Total return to scale</b>	<b>0.1339</b>

*Source: From survey data*

According to Chen (2007), returns to scale has three decision rules which are increasing return to scale, constant return to scale and decreasing return to scale. Return to scale is increasing if  $\alpha + \beta > 1$ , return to scale is constant if  $\alpha + \beta = 1$  and return to scale is decreasing if  $\alpha + \beta < 1$ . Cornia (1985), found that there is a constant return to scale if the coefficient falls between 0.95 and 1.05 and below 0.95 for decreasing return to scale and above 1.05 for increasing return to scale.

The results as shown in table 6 above indicate the return to scale of 0.1339, which is less than one indicating a decreasing return to scale. This may be because the smallholder maize farmers are over utilising the resources at their disposal which results in farmers being inefficient in their production. This implies that farmers are experiencing more cost and the returns are lower. Therefore farmers should reduce their inputs in order to reduce their cost of production. This result is consistent with Tshilambilu (2011).

#### 4.4 Probit regression model

**Table 7:** Probit regression on factors influencing smallholder farmers' access to markets

Variables	Estimated coefficient	dy/dx	z	P>z
Farm size	0.475***	0.126	2.76	0.006
	(0.172)	(0.044)		
Household size	0.040	0.011	0.93	0.352
	(0.043)	(0.011)		
Gender	-0.447	-0.129	-1.56	0.118
	(0.286)	(0.089)		
Age	-0.0136	-0.004	-1.07	0.286
	(.0127)	(0.003)		
Farm experience	-0.009	-0.002	-1.02	0.305
	(0.008)	(0.002)		
Extension service	0.194	0.053	0.70	0.482
	(0.275)	(0.079)		
Labours hired	0.563**	0.149	2.10	0.036
	(0.268)	(0.072)		
Kg of fertilizers	0.004	0.001	1.06	0.289
	(0.004)	(0.001)		
Kg produced per ha	0.001***	0.0003	2.80	0.005
	(0.001)	(0.0001)		
Landownership	-0.225	-0.055	-0.62	0.538
	(0.365)	(0.082)		



Years in school	-0.002	-0.0004	-0.06	0.952
	(0.029)	(0.0078)		
Log likelihood	-78.069955			
Cases correctly estimated(%)	81.80			
*** Significant at 1%				
** Significant at 5%				
* Significant at 10%				

Source: From survey data

According to Gujarati (1992), the sign of a variable indicates how the variables are influencing the dependant variable. If the variable coefficient is positive, it means that a higher value of the variable increases the likelihood of smallholder maize farmers' access to agricultural markets. On the other hand, a negative coefficient decreases the likelihood of smallholder maize farmers' access to agricultural markets.

The results shows that farm size, labour hired and maize produced per hectare in kilograms had positive significant influence on probability of farmers accessing agricultural markets. Gender of the household head had a negative insignificant influence on access to the market. Household size, extension services and fertilizers in kilograms had positive insignificant influence on market access. Other variable such as farm experience and land ownership do not have any influence on farmer's access to the market.

#### 4.4.1 Farm size

Farm size was statistically significant at 1% and had a positive influence on the probability of farmers' access to the markets. The marginal effect of farm size was 0.126 indicating that a one unit increase in the hectares of land will probably improve market access. The implication of the results suggests that chances of farmers accessing the markets increase with the size of the farm. This is supported by Osmani and Hossain (2015), in the study that was conducted in Durgapur Upazila under Rajshahi District in Bangladesh, farm size has positive influence on the decision for market participation of households. A study conducted by Makhura *et al.* (2001), found

that larger areas of land provides greater opportunity of surplus production, which helps farmers to access the markets. The result is in line with Okezie et al. (2012)

#### **4.4.2 Hired labour**

Hired labour was statistically significant at 5% and has a positive influence on the probability of accessing agricultural market. The results showed that the probability of farmers accessing markets increases with more hired labour by 0.149. This means that if hired labourers were to increase by 1%, the likelihood of accessing agricultural markets would increase by 0.15%. The results also indicated that farmers who hired more labourers were more likely to access market as compared to farmers who hired fewer labourers. The implication of this is that more hired labours increases the productivity of farmers such that they are able to access markets.

#### **4.4.3 Maize produced per Ha in Kilograms**

The results indicated that maize produced per Hectare was statistically significant at 1% and have a positive influence on the probability of accessing agricultural markets. The probability of maize produced per hectare in kilograms was 0.0003. The results indicate that if maize produced per hectare increases by 1 kg, the likelihood of accessing agricultural markets would increase by 0.0003%. Therefore, this means that increasing the productivity of farmers will increase the probability of farmers accessing the markets.

#### **4.4.4 Household size**

Household size has turned to have a positive but insignificant effect on farmers' access to the markets. This is probably because most farmers prefer to use hired labour instead of family labour for their production, which is the case in the study area. In the study areas majority of farmers are old and their children are married, so farmers have to hire labour to help them in their production. The results is supported by Sikwela (2013), who found out that household size was insignificant, however the results are in contrast with Hlomendlini (2015), who found that household size was positively associated with market participation, with a statistically significant effect of 5%.

#### **4.4.5 Extension service**

Extension service has a positive but statistically insignificant effect on farmers' access to the market. This is probably because smallholder maize farmers in the study area do not depend on extension services in order for them to improve their productivity such that they access the markets. The results are in contrast with Osmani and Hossain (2015), who found that extension services correlate significantly and positively with the market access in the study area. This means that smallholder farmers' market access increases if they have access to extension services.

#### **4.4.6 Fertilizers in Kilograms**

According to Jayne (1998), Fertilizer use has increased the land and labour productivity. The variable Kilograms of fertilizer was positive but has statistically insignificant effect on farmers' access to the market. This means that fertilizer use by smallholder farmers does not determine whether farmers access agricultural market.

#### **4.4.7 Gender**

The gender of the household head was found to be not significant and had a negative influence on the probability of accessing markets. The descriptive results show that 27% of the sampled household was male-headed households and 73% were females. The female-headed household have a greater likelihood to access agricultural market. This is supported by the study conducted by Hlomendlini (2015), who found that females are the main participant in market access than males. However, these findings are in contrast with Reyes et al. (2012), who found that households that are headed by males are more likely to participate in the market compares to the females headed households.

#### **4.4.8 Age**

The age of the farmer was found to be insignificant and had a negative influence on the probability of accessing markets. The value of coefficient was -0.004 which shows that age of the farmer has a negative relationship with market access. This means that the more the farmer is old the less likely the farmer will access market. This may be because the farmer is too old to compete and produce quality and more products that meet the market grades. This is in contrast with Hlomendlini (2015), who found age has a significant impact on market access.

#### **4.4.9 Farm experience**

The experience of the farmer was found to be insignificant and had a negative influence on the probability of farmers accessing the market. The value of the coefficient was -0.002, which indicates that farmers' experience has a negative relationship with market access. This means that the more the farmer is experienced, the less likely the farmer will access the market. This is in contrast to Sebatta *et al* (2014), who found that farm experience promotes farmers' decision to access markets.

#### **4.4.10 Land ownership**

Land ownership was found to be insignificant, with the negative coefficient of -0.055. This may be because the majority of the farmers in the study area do not own the land that they use. When farmers do not own the land that they are producing at, they will experience more cost of production because they will have to pay rent to the land owner. This will result in the farmer experiencing more cost of production and will result in the farmer producing less such that they don't access the market.

#### **4.4.11 Years in school**

The results found that years in school was insignificant and had a negative influence on market access, with the value of -0.0004. This is because the descriptive results show that 29% of the farmers in the study area never went to school and 44% only went to primary school and 23% went to secondary with 3% went to tertiary and 1% went to ABET. The farmers with less education had a greater likelihood to access the market. The results are consistent with Osmani and Hossain (2015).

### **4.5 Constraints to productivity and market access by smallholder maize farmers in Lepelle-Nkumpi municipality.**

**Table 8: Descriptive statistics of constraint faced by smallholder maize farmers**

Constraint	Frequency	Percent
No constraints	53	29,4
Transport costs	86	47,8
Competition	12	6,7
Fencing	12	6,7
Drought	5	2,8
Storage facilities	2	1,1
Finding the market	1	0,6
Flooding	1	0,6
Infrastructure	1	0,6
Manure	1	0,6
Pesticides	1	0,6
Quality Products	1	0,6
Resources	1	0,6
Road problems	1	0,6
Seeds	1	0,6
Water	1	0,6
Total	180	100,0

*Source: From survey data*

The table present the descriptive results of the constraints faced by smallholder maize farmer in the Lepelle-Nkumpi municipality. The table indicates the constraint together with the frequency and the percentages of the farmers who face those constraints.

The results indicate that 29, 4% of the farmers were not affected by any constraints to market access and productivity of smallholder maize farmers in Lepelle-Nkumpi municipality whilst 70,6% said they are affected by those constraints. Out of 180 smallholder maize farmers interviewed, 86 farmers said they are challenged by transportation costs. High transport cost is caused by lack of infrastructure and poor communication services in the rural areas (D’Hease and Kirsten, 2003). Smallholder maize farmers in the study area are situated in the dispersed area and they are far from agricultural markets, which results in long distances together with poor

infrastructure. This results in high transportation costs for smallholder maize farmers in the study area. The farmers also indicated that it is very expensive to hire transport to take their products to the market which results in most of the farmers not being able to afford to sell at agricultural markets. Transport costs were found to be the most important constraints faced by smallholder farmers since it has the highest frequency.

Competition is the second important constraint in the study area. In order for smallholder farmers to be able to compete with other farmers for the same markets, information is very important. Schleberger (1998), found that smallholder farmers require information about the business trends and market in order to be competitive in the market. 12 smallholder maize farmers indicated that they have a challenge of competition.

It was also found that 6, 7% of the farmers face a challenge of fence. Farmers indicated that lack of fencing has resulted in animals feeding on their output which has resulted in the reduction in maize production. Lower output level means the farmers cannot produce enough to meet the markets demand which results in farmers not accessing the markets. Drought has affected the maize producers negatively in the study area. This is because drought decreases the production level of smallholder farmers. The results indicated that 2, 8% of the farmers were affected by drought. Bhavnani *et al.* (2008) found that drought results in loss of agricultural production and also reduces water levels which will also reduce the production level of agricultural producers.

Storage facilities were found to be one of the constraints faced by farmers in the study area. Storage facility helps farmers to store their output such that they can sell to the markets at reasonable price when there is a demand. The results indicate that 1, 1% of farmers faced the challenge of storage facility. Access to storage facility increases farmers' ability to sell their products and also have the bargaining power (Bienabe *et al.*, 2004). Other constraints faced by farmers in the study area include Finding the market, Flooding, Infrastructure, manure, Pesticides, Quality Products, Resources, Road problems, Seeds and water.

#### **4.6 Chapter Summary**

The chapter indicated the socio-economic results from the study. The chapter further presented the determinants of productivity and market access results of the

smallholder maize farmer in Lepelle-Nkumpi municipality. Constraints faced by smallholder maize farmers were discovered and discussed in the chapter.

## **CHAPTER FIVE**

### **SUMMARY, CONCLUSION AND POLICY RECOMMENDATIONS**

#### **5.1 Introduction**

This chapter gives a summary of the study and also indicating the conclusion and policy recommendation of the study. The recommendations discussed are suitable to enhance productivity and market access of smallholder maize farmers in the Lepelle-Nkumpi municipality.

## **5.2 Summary of findings**

The aim of the study was to examine market access and productivity of smallholder maize farmers in the Lepelle-Nkumpi municipality. The objectives of the study were to identify and describe socioeconomic characteristics of smallholder maize farmers in Lepelle-Nkumpi municipality, examine the determinants of productivity among smallholder maize farmers in Lepelle-Nkumpi municipality, analyse the effect of socioeconomic characteristics of smallholder maize farmers on market access in Lepelle-Nkumpi municipality and identify the constraints to productivity and market access by smallholder maize farmers in the Lepelle-Nkumpi municipality.

There are different analytical techniques that were used to address each objective. The two objectives which are: to identify and describe socioeconomic characteristics of smallholder maize farmers in Lepelle-Nkumpi municipality and to identify the constraints to productivity and market access by smallholder maize farmers in the Lepelle-Nkumpi municipality, were both analysed using the descriptive statistics. The Cobb Douglas production function was used to examine the determinants of productivity among smallholder maize farmers in Lepelle-Nkumpi municipality. The Binary Probit model was used to analyse the effect of socioeconomic characteristics of smallholder maize farmers on market access in Lepelle-Nkumpi municipality.

The socio-economic results found that the average age of the total smallholder maize farmers in the study area was 64 years, with the average age of farmers who access market being 63 years and the no-market access being 67 years. Education level of the farmers indicated that, 29% of the sample never went to school, 44% went to primary school, 23% went to secondary school, 3% went to tertiary and 1% of the sample went to ABET. The results also indicated that 25% of males have access to market while 70% of females did not have access to the market. Overall a large number of female smallholder maize farmers had access to markets compared to their male counterparts.



The Cobb Douglas Production Function was used to examine the determinants of productivity among smallholder maize farmers in Lepelle-Nkumpi municipality. The results were discovered and the study indicated that the elasticities of market access, farm experience, fertilizer, capital and membership association were significant and positive at 1% significant level. Farm size, household size, gender, age, years in school, labours hired, family members assisting, pesticides costs and extension services were not significant. The return to scale of 0.1339 was discovered, which is less than one indicating a decreasing return to scale.

The Probit regression model results were found after analysing the effect of socio economic characteristics of smallholder maize farmers on market access in Lepelle-Nkumpi municipality. The results shows that farm size, labour hired and maize produced per hectare in kilograms had positive significant influence on probability of farmers accessing agricultural markets. With farm size and maize produced per hectare being statistically significant at 1% and labours hired being statistically significant at 5%. Household size, extension services and fertilizers in kilograms had positive insignificant influence on market access. Gender, age, farm experience, land ownership and years in school were found to be statistically insignificant.

The results also discovered the constraint to productivity and market access faced by smallholder maize farmers in Lepelle-Nkumpi municipality. The results found that 70.6% of the respondents were affected by those constraints while 29.4% were not affected. Out of 180 smallholder maize farmers interviewed, 86 farmers said they are challenged by transportation costs, with 12 smallholder maize farmers indicated that they have a challenge of competition. It was also found that 6, 7% of the farmers face a challenge of fence.

### **5.3 Conclusion**

The study had two hypotheses. The first hypothesis was; socioeconomic characteristics do not influence productivity of smallholder maize farmers in Lepelle-Nkumpi municipality. The second hypothesis was; socioeconomic characteristics do not influence productivity of smallholder maize farmers in Lepelle-Nkumpi municipality.

**Hypothesis one:** Socioeconomic characteristics do not have effect on market access of smallholder maize farmers in Lepelle-Nkumpi municipality. The hypothesis is therefore rejected since the Probit regression indicated that farm size, labour hired and maize produced per hectare in kilograms had positive significant influence on probability of farmers accessing agricultural markets. With farm size and maize produced per hectare being statistically significant at 1% and labours hired being statistically significant at 5%. Household size, extension services and fertilizers in kilograms had positive insignificant influence on market access. Gender, age, farm experience, land ownership and years in school were found to be statistically insignificant.

**Hypothesis two:** Socioeconomic characteristics do not influence productivity of smallholder maize farmers in Lepelle-Nkumpi municipality. The hypothesis is also rejected since the Cobb Douglas Production Function indicated that the elasticities of market access, fertilizers and capital were significant and positive at 1% significant level and farm experience was statistically significant at 5%. Farm size, household size, gender, age, years in school, labours hired, family members assisting and pesticides costs were not significant.

The results of the study also found that smallholder maize farmers can also be characterised by their age, education, land ownership, household size, marital status and size of the farm. The results also indicated the constraints to productivity and market access faced by smallholder maize farmers in Lepelle-Nkumpi municipality. Constraints identified are transportation costs, theft, competition, Fencing, drought, storage facilities and infrastructure.

#### **5.4 Policy Recommendations**

- The study recommends that farmers should be provided with the market infrastructure and also the marketing information services. This will help the farmers in a way that the transaction cost will be minimised and farmers will not incur more cost when they participate in the markets.
- Farmers should engage in cooperative associations so as to improve farmer's production and access to the markets. This can be through income generated from cooperative, assistance from government and skills from cooperative training in agriculture.

- Government should improve land access for smallholder farmers by establishing a proper, consistent and equitable distribution of land to rural household (land reform policy). By so doing smallholder farmers will have enough land to increase their production.
- Government should subsidise smallholder farmers with inputs such as tractor and fertiliser so that they can produce high quality outputs. Policies on comprehensive producer support should be effectively implemented.
- Most programs implemented towards improving productivity of smallholder farmers should be reviewed since most rural farmers do not benefit from them.

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**APPENDIX: QUESTIONNAIRE**

**Title:** Market access and productivity of smallholder maize farmers in Lepelle nkumpi municipality, Limpopo province, South Africa.

Department of Agricultural Economics and Animal Production

Researcher: PHAKISHO MANGAWA AMAGOLO RANGOATO

This questionnaire is meant to be completed by farmers with the help of the enumerators. It meant to generate information on market access and productivity of smallholder maize farmers in Lepelle-Nkumpi municipality. The information provided will be used only for the purpose of the research and will be treated with confidentiality, without mentioning names in the analysis. Please tick the correct answers and fill the blank spaces provided.

I agree to complete the questionnaire and do so in a completely voluntary manner. I understand that the responses will be kept confidential. Signature.....

Name of Enumerator.....

Date of interview .....

Name of municipality.....

Community name.....

Name of respondent.....

### SECTION A: SOCIO-ECONOMIC CHARACTERISTICS

1. What is the size of household? .....
2. Age of the Farmer.....
3. Gender of the farmer 1. Male 2. Female (Tick the right answer)

4. Marital status	1=single	2=Married	3=widowed	4=Divorced
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5. Level of education?

1	2	3	4	5
Never went to school	Completed primary school	Completed secondary	Completed tertiary	ABET

6. How long have you been Farming? .....
7. What is your farm size in ha? .....
8. Land ownership 1.Yes 2. No
9. If yes do you have title deeds 1.Yes 2. No
10. What is your tenure status?

1	2	3	4	5
Own	Inherited	Leased	Bought	Others

11. What is the source of income for the farmer?

1	2	3	4	5
Salary	Farming	Pension	Grant	Other

**SECTION B:**

**DETAILS OF LABOUR**

12. How many family members assist in farming? .....

13. Which of the following sources of labour have you used for the past year?

1	2	3	4
Family labour	Hired labour	Friends and relatives	Other (specify) .....

14. If the labour is hired what is the method of payments?

1	2	3	4
Own cash	Credit	Farm income	Others

15. Have you ever been short of labour? 1. Yes 2. No

16. If Yes, what is the main reason?.....

17. Do you hire tractor for maize production? 1. Yes 2. No (Tick the right answer)

18. If Yes, how much does it cost per hectare? R.....

19. Do you apply fertilizer for Maize production? 1. Yes 2. No (Tick the right answer)

20. If Yes, how many kilograms of fertilisers per hectare?.....

21. How much do you spend on fertiliser? R.....

22. Do you use any type of pesticides? 1. Yes 2. No (Tick the right answer)

23. How much does it cost per hectare? R.....

24. How many kilograms of seeds do you use per hectare?.....

**WATER USE INFORMATION**

25. Do you have access to water for irrigation? 1. Yes 2. No (Tick the right answer)

26. If Yes, what is your main source of water for maize irrigation?

1	2	3	4	5	6
River	Dam	Taps	Boreholes	Rain	Other

27. How many hectares of maize are under irrigation?.....

28. How much water do you use to irrigate one hectare of maize in litres? .....

#### EXTENSION INFORMATION

29. Do you have extension services? 1. Yes 2. No (Tick the right answer)

30. If Yes, for how long have you been getting the services? .....Years.

31. Who provides the extension services

1	2	3	4
Government departments	Non-government organisation	Development agent	Other

32. How many times did the extension officer visit in the last 12 months?

#### ACCESS TO CREDIT

33. Do you have access to credit? 1. Yes 2.No (Tick the right answer)

34. If Yes where did you get the money? .....

35. Who provide the credit?.....

36. How much did you borrow? R.....

#### MAIZE PRODUCTION INFORMATION

37. How many years have you been in maize farming?.....

38. How many hectares do you use to produce maize?.....

39. How many kilograms of maize do you normally produce per hectare?.....

40. What is the main reason for maize production?

1	2	3	4	5
Income generation	Home consumption	Employment creation	Commercial purpose	Other

41. Name all the other crops that you are farming and their hectares.

CROP	HECTARES
1.	



2.	
3.	
4.	

**MARKET INFORMATION**

42. Do you have access to the markets? 1. Yes 2. No (Tick the right answer)

43. If Yes, where do you sell your produce?

1	2	3	4	5	6
Hawkers	Wholesalers	Middlemen	Retailers	Local supermarkets	Other

44. How accessible are the markets? .....

45. What is the distance from point of production to the nearest market?.....Km

46. Do you have access to market information? 1. Yes 2. No (Tick the right answer)

47. What do you think can be done to meet the grades required in the market?

.....  
 .....  
 .....

48. What other marketing constraints do you experience?

a).....  
 b).....  
 c).....

49. Did you gain maize production skills in the last 5 years? 1. Yes 2. No (Tick the right answer)

50. If Yes, give details of those skills.....

.....

51. If Yes, what is the source of information?

1	2	3
Other farmers	Extension officers	Other

52. Who provide transportation from the farm to the final destination?

1	2	3	4
Transporter	Self transport	Collective transport	Buyer transport for themselves

53. Are you involved in any project that helps with productivity and market access?

1. Yes 2. No (Tick the right answer)

54. If Yes, what is the name of the project?.....

55. How did the project help you to access market?.....

56. What is your view on the constraints to market access?

.....

.....

.....

.....

.....

57. What do you think should be done to improve the productivity of farmers?

.....

.....

.....

**THE END!!!!!!!!!!!!**

Thank you very much for your patience