COMPARATIVE ANALYSIS OF TECHNICAL EFFICIENCY LEVELS OF EMERGING MAIZE AND GREEN BEANS FARMERS WITH AND WITHOUT ACCESS TO FORMAL AGRICULTURAL CREDIT ALONG FOOD VALUE CHAINS IN MARULENG MUNICIPALITY, LIMPOPO PROVINCE OF SOUTH AFRICA

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by

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Co-supervisor: Dr I. Jacobs (Water Research Commission)

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DECLARATION

I declare that the mini-dissertation 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 it is my work in design and in execution, and that all materials contained therein has been duly acknowledged.

_____ _____

Surname, Initials (title) **Date**

DEDICATION

This study is dedicated to my parents who have been my pillar of strength as well as my wonderful niece, Motlatso Desrey Lefophane and my nephew Katlego Austin Lefophane, for being the reason I have been working hard throughout my studies. I'm very proud to be your aunt. The study is also dedicated to all land reform beneficiaries in Maruleng Local Municipality.

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ABSTRACT

Access to credit has long been argued to be an engine of agricultural development across the world. The inaccessibility of agricultural credit is a central problem which has an indirect impact on other production factors that in turn negatively affect farmers' output and efficiency. Therefore, the influence of credit access on technical efficiency of emerging farmers cannot be overestimated. The main question to ask is whether credit accessibility is really necessary to improve farmers' technical efficiency.

The aim of the study was to compare technical efficiency levels of emerging farmers with and without access to formal agricultural credit in Maruleng Local Municipality in Limpopo Province. The main objectives of the study were to determine socio-economic characteristics and factors to access formal agricultural credit and to compare technical efficiency levels of emerging maize and green beans farmers. In this regard, maize and green beans were the two crops used in the study. The study further mapped maize and green beans value chains in Maruleng Municipality.

The study used primary data which was collected through face to face interviews using structured questionnaires. The study employed stratified random sampling in its data collection strategy due to the fact that some farmers had access to credit while others did not. Emerging farmers were classified as borrowers and non-borrowers of formal agricultural credit and farmers were stratified according to gender. The total sample size comprised 62 emerging farmers across Maruleng Municipality.

The Probit regression model was used to analyse variables which were considered to have an influence on the probability of accessing formal agricultural credit while the Cobb-Douglas production function was used to compare technical efficiency levels of borrowers and non-borrowers of credit. For analytical purposes, data was captured into the Statistical Package of Social Sciences (SPSS), and a regression analysis was carried out.

Results from the Probit regression analysis indicated that the level of education of the household head, land ownership, size of the farm, off-farm income, as well as credit repayment records have a significant positive influence on the probability of accessing formal agricultural credit. In addition, gender of the household head, total livestock of the household, credit awareness and farming experience had insignificant positive influence. On the other hand, age of the household head, family labour and level of interest rate had a significant negative influence on the probability of accessing credit. Similarly, the existence of an extension service had insignificant negative influence.

Results from the Cobb-Douglas regression analysis revealed that the technical efficiency level of borrowers of formal agricultural credit was significantly higher than those of non-borrowers. The results also revealed that the level of technical efficiencies varies widely, being 9.843 for green beans borrowers of formal agricultural credit farmers and 2.892 for maize non-borrowers of formal agricultural credit. The results further indicated that overall, the technical efficiency level of green beans and maize borrowers is higher than their non-borrowers counterparts.

Estimates from the Cobb-Douglas analysis on the use of irrigation water were found to be insignificant for maize producers (both borrowers and non-borrowers) and negative but statistically significant for green beans producers (that is; both borrowers and non-borrowers). The non-significant result for maize is in accordance with the fact that most farmers produced maize under dry land condition. The negative elasticity of estimate for irrigation water implies that as more and more hectares of land is being irrigated, output tends to decline. These results are in accordance with the fact that majority of emerging farmers in the study area shared water from the irrigation schemes and as such they tended to compete amongst each other for water, resulting in over-utilization of irrigation water.

The study recommended that existing agricultural credit programmes should be reviewed to accommodate the needs of emerging farmers, be refocused, more accessible, and be accommodative of younger farmers. Based on the food value chain maps for maize and green beans in Maruleng Municipality, it is recommended that future researchers should focus on determining the margin share for each of the

role players in the food value chain. In addition, future researchers should also determine how much value is added at each stage of the food value chain.

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LIST OF ACRONYMS

ABET	: Adult Basic Education and Training
ABSA	: All Banks of South Africa
ACS	: Agricultural Credit Schemes
ARC	: Agricultural Research Council
CASP	: Comprehensive Agricultural Support Programme
CLARA	: Communal Land Rights Act
COLS	: Correlated Least Square
CSIR	: Council for Scientific and Industrial Research
DBSA	: Development Bank of Southern Africa
DEA	: Data Envelopment Analysis
DoA	: Department of Agriculture
DRDLR	: Department of Rural Development and Land Reform
FNB	: First National Bank
FSP	: Farmer Support Programme
GRAIN SA	: Grain South Africa
IDP	: Integrated Development Plan
IPG	: Infrastructural Provincial Grant
MAFISA	: Micro Agricultural Financial Institutions of South Africa
MALA	: Ministry of Agriculture and Land Affairs
MLM	: Maruleng Local Municipality
NCEC	: National Crop Estimate Committee
NDA	: National Department of Agriculture
MLE	: Maximum Likelihood Estimation
LAND BANK	: Land and Agricultural Development Bank
LDA-GIS	: Limpopo Department of Agriculture- Geographic Information System
LED	: Local Economic Development
LNWB	: Lepelle Northern Water Board
LRAD	: Land Redistribution for Agricultural Development
LARP	: Land and Agrarian Reform Project
OLS	: Ordinary Least Square
PMG	: Parliamentary Monitory Group

PLAS	: Proactive Land Acquisition Strategy
PSU	: Post Settlement Unit
RDG	: Restitution Discretionary Grant
RLCC	: Regional Land Claims Commissioner
SLAG	: Settlement Land Acquisition Grant
SPG	: Settlement Planning Grant
STATS SA	: Statistics South Africa

CHAPTER 1: INTRODUCTION

1.1 Background to the study

Agriculture is the backbone of South Africa's economy and will continue to be so in the foreseeable future. This includes Limpopo Province and more especially Maruleng Municipality where it is the main source of income and employment for the majority of residents (Roth and Haase, 1998). In addition, agriculture, in general, has an important role to play in the economy through the development of emerging farmers and alleviation of poverty. In order for emerging farmers to exit the poverty cycle and experience sustainable economic growth through increased employment and productivity, support services such as access to credit, training and capacity building need to be created for the emerging farm sector (Fairlamb and Nieudwoudt, 1990). This mini-dissertation therefore focuses on the relationship between emerging farmers' access to credit and the degree to which it helps or hinders a farmer's technical efficiency. It then attempts to go beyond an analysis of on-farm technical efficiency and also links the phenomena of access to credit to the degree to which emerging farmers can access food value chains. Firstly, it is noteworthy to define key concepts used in this study.

1.1.1 The importance of productive use of land by emerging farmers

Most emerging farmers in South Africa are involved in small-scale and subsistence farming, mainly due to poor resource endowment and numerous constraints related to access to support services (DBSA, 2005). The existing low level of productivity in food production, low levels of technical efficiency and failure to use modern technology amongst emerging farmers, hinders efforts to achieve progress of agricultural development (Seyoum *et al*. 1998).

The South African government has, in recent years, been spending a huge amount of its budget on supporting the development of emerging farmers. Nevertheless, various constraints still hinder the emerging farmers from reaching their full potential. These constraints, for example lack of access to credit and resource endowment amongst others, make it very difficult if not impossible for the emerging farmers to

participate successfully in commercial agricultural markets despite some of them having had improved access to agricultural land (DBSA, 2005).

South Africa cannot afford to lose the potential of its agricultural land under the control of emerging farmers and as such, the emerging farm sector needs to be capacitated and be assisted in order for it to use this agricultural land productively and also contribute to the welfare of the country as a whole (Van Renen, 1997). As asserted by Moloi (2008), one of the ways that previously disadvantaged farmers can be part of the economic base of rural economies is through the commercialisation of the emerging farm sector and the reduction of socioeconomic constraints.

1.1.2 Access to credit in developing countries

Access to credit is a key determining factor of emerging farmer success in many developing countries. Formal financial institutions provide agricultural credit for the purposes of production and development. Agricultural credit is offered specifically for the purchase of agricultural inputs including seed, fertilizer, plant protection chemicals, poultry or animal feeds and medicines, water charges, labour et cetera. On the other hand, development loans are supplied for the purchase of agricultural equipment such as tractors, cutter binders, threshers, trolley, and installation of tube walls, spray machines among others (Hanif *et al*. 2004).

There are two types of rural credit markets in developing countries and these are formal and informal credit markets (Yehuala, 2008). The role players responsible for lending in informal credit markets include professional money lenders, traders, commission agents, land lords, private individuals, friends and relatives (Mohieldin and Write, 2000). The banks are the major players in formal credit markets, while informal institutions (such as relatives, friends, money lenders, and rotating savings and credit associations, microfinance institutions) are active in informal financial markets (Yadav *et al*. 1992; Aryeetey, 1994; Soyibo, 1994; Aryeetey and Nissanke, 1998). In South Africa, the Land Bank is the main source of funds for emerging farmers (Bradstock, 2005).

Access to agricultural credit from either formal or informal financial institutions has an impact on the efficiency of agricultural production and therefore cannot be ignored. The challenge facing most formal credit institutions is whether or not smallholder farmers will be able to repay loans and thus credit access is an issue of concern for both the credit institutions and emerging farmers. A study conducted by Hedden-Dunkhorst *et al.* (2001) indicated that credit has a positive and significant influence on the net income of the farm. Moloi (2008), however, argued that credit though necessary, is not a sufficient condition for emerging farmers to be efficient. Thus, credit without other production factors such as land, capital, labour, water and seed input cannot be efficient and if not used for its intended purpose it therefore cannot improve emerging farmers' efficiency levels.

Credit access can be defined as the supply side phenomenon of credit markets because the lenders decide whether borrowers can access credit or not (Okurut, 2006). The credit access process entails two different stages. In the first stage, borrowers who express a demand for credit decide how much funds to apply for and from which particular credit lending institution (either formal or informal sector) at the prevailing market interest rates level. This process constitutes the demand side. In the second stage, the lenders decide who accesses credit and what amount, which constitutes the supply side of credit markets (Zeller, 1994).

1.1.3 The link to food value chains

The food value chain is a vital element of this study since it provides a useful conceptual framework for the analysis. As a product moves from the producer to the final consumer, a number of transformations and transactions take place along a chain of interrelated activities, and value is added successively at each stage of the chain. The term value chain is used to characterise the set of interconnected and co-ordinated links and linkages that take place as a product moves from the primary production unit to the final consumer. Kaplinsky and Morris (2001) defined the chain as the full range of activities that are required to bring a product from conception, through the intermediary stages of transformation until delivery to final consumers.

The concept of the value chain is complemented by that of the value system which basically refers to the interlinkages between various value chains. One of the reasons why a value chain analysis is so important, especially with regards to the successful operation of the South African maize market, is because it offers an explanation of the distribution of benefits that accrue to those participating in the global economy. The importance of this is that it helps in identifying policies which can be implemented by individual producers as well as countries, in order to increase their gains from participating in the global economy (Kaplinsky and Morris, 2001).

Presented in graphical format, a value chain map would depict all the major players in a targeted value chain. It illustrates several supply channels that transform raw materials into final products and how these products are then distributed to final consumers and diverse types of markets to which products are traded. On the other hand, draft value chain maps can be illustrated utilising information provided by well-informed individuals and then later refined as more accurate information is collected (Lusby and Panlibuton, 2007).

1.1.4 Technical efficiency

Technical efficiency is a broadly defined concept and one that has produced a range of meanings. It is defined as the process of attaining the highest level of output with available resources; while the allocative efficiency refers to the ability to obtain optimal input levels for given resource factor prices (Xu and Jeffrey, 1997). Economic efficiency is the combination of both the technical and allocative efficiencies (Mushunje *et al*. 2003). A study on the measurement of economic efficiency is therefore incomplete without a study of technical efficiency and it is the frontier production function that enables the measurement of technical efficiency level of farmers (Elsamma and George, 2002).

Technical efficiency can also be defined as the ability of the farm to attain maximum level of output from a given set of physical inputs. Allocative efficiency on the other hand, is defined as the ability of a farm to choose the inputs in optimal proportions given their respective prices (Rukuni, 1994). According to Mushunje (2005), following the classical definition of Farrell (1957), a farmer is considered to be technically efficient if he/she obtains the highest level of output given the amount of inputs used and available technology.

This study looked at technical efficiency since it is an important subject in developing agriculture where farmers are constrained by socio-economic conditions and use limited resources at their disposal and need external support from government to move from small-scale to commercial production. The study on the technical efficiency of emerging farmers in South Africa is relevant because the government's land reform programme is aimed at increasing efficiency in food production. As argued by Van Zyl *et al*. (1996), the efficiency of land reform relates to the increased redistribution of agricultural land to small holders and total factor productivity and efficiency in the long run.

This study focused on comparing technical efficiency levels of emerging farmers who are borrowers and non-borrowers of formal agricultural credit. The rationale for the study derives from the need to determine the extent to which credit access has been able to meet capital needs of emerging farmers and improve their technical efficiency levels. Maize was used in the study because it is the main staple food of emerging farmers in the study area and constitutes a large percentage of the total grain production in South Africa, while green beans was used because it is the main crop that brings additional cash income for emerging farmers in the study area. However, this does not conclusively suggest that emerging farmers are not involved in other crop production activities.

1.2 Problem statement

Although financial institutions have been established in South Africa to assist farmers to access credit, most emerging farmers still do not have access to credit. The issue is whether provision of credit will result in emerging farmers taking advantage of the opportunity to increase their production level and maximise their profit. Most of the previous studies that have been done on agricultural credit in South Africa are skewed towards small-scale farmers, with few on emerging farmers since they are new to agriculture. However this does not negate the fact that small-scale farmers can also constitute emerging farmers. In essence, this study attempts to investigate the link between small-scale farmers that are also beneficiaries of land reform, that is; emerging farmers, and analyse the degree to which they have received adequate support to use land productively. Recommendations derived from purely small-scale focused studies could not provide a policy response to accommodate the needs of emerging farmers because they are a unique unit of analysis. It is against this backdrop that the study strives to identify socio-economic characteristics and factors influencing emerging farmers to access formal agricultural credit and compare technical efficiency levels of farmers with and without access to credit.

1.3 Motivation of the study

Appropriate agricultural credit policy interventions need to take into account the socio-economic characteristics of the target group or individuals. An understanding of socio-economic characteristics and factors influencing farmers to access formal agricultural credit will enable policy makers to adjust current credit policies to meet the needs of emerging farmers. The rationale for the study derives from the need to determine the extent to which credit access has been able to meet capital needs of emerging farmers and improve their technical efficiency levels. Based on the current high maize and green beans production in Maruleng Municipality, there is an urgent need to examine the current food value chain system in the area to provide sufficient information that will be made available for critical analysis of potential investment into the food value chain in the area.

1.4 Aim and objectives of the study

1.4.1 Aim

The aim of the study was to compare technical efficiency levels of emerging maize and green beans farmers in Maruleng Municipality.

1.4.2 Objectives

i. To determine socio-economic characteristics and factors influencing emerging farmers to access credit in Maruleng Municipality.
ii. To compare technical efficiency levels of emerging maize and green beans farmers with and without access to credit in Maruleng Municipality.
iii. To map alternative maize and green beans food value chains in Maruleng Municipality for emerging farmers that differ from conventional food value chains for these commodities in commercial settings.

1.5 Hypotheses

i. Socio-economic characteristics and factors do not influence emerging farmers to access credit in Maruleng Municipality.
ii. There is no difference in technical efficiency levels of emerging maize and green beans farmers with and without access to credit in Maruleng Municipality.
iii. An alternative maize and green bean food value chain in Maruleng Municipality for emerging farmers does not differ from conventional food value chains for these commodities in commercial settings.

1.6 Research questions

i. What are the socio-economic characteristics and factors that influence emerging farmers' access to credit in Maruleng Municipality?
ii. Is there a difference in technical efficiency levels of emerging maize and green beans farmers with and without access to credit in Maruleng Municipality?
iii. What is the alternative maize and green beans food value chain in Maruleng Municipality for emerging farmers that differs from conventional food value chains for these commodities in commercial settings.

1.7 Scope and delimitation of the study

The study was aimed at comparing technical efficiency levels of borrowers and non-borrowers of formal agricultural credit and to map the current maize and green beans food value chains. The scope was only limited to emerging farmers in the study area. The analytical techniques usually employed to analyse food value chains included among others, Data Envelopment Analysis (DEA) and Stochastic Trans-Log Production Function. Since the scope of the study was only limited to map the current food value chain for maize and green beans in the study area, the study could therefore not be extended to detailed food value chain analysis. In the light of the above, the study made recommendations for future studies to explore this aspect.

Water was one of the inputs which were considered in the technical efficiency analysis of emerging farmers with and without access to credit. Due to shortage, unreliable and inconsistent information about the amount of water used for irrigation, irrigated land was then used as a proxy for the amount of water used for irrigation. A detailed analysis on water use efficiency in this regard was therefore not possible.

1.8 Organisation of the study

This study is organised into six chapters. Chapter one constitutes the introduction, which outlines the background on the subject, problem statement, aim and objectives guiding the study, hypotheses, research questions and motivation for undertaking the study. An empirical and theoretical review of issues related to the study is presented in Chapter two. Chapter three presents the research methodology employed in the study, which includes a brief description of the study area, data collection method and analytical techniques used in the data analysis. Chapter four provides a report on descriptive results and a discussion thereof. Chapter five presents empirical results of the study. The summary and conclusion of the major empirical findings, and policy recommendations together with recommendations for future research are presented in Chapter six.

CHAPTER 2: LITERATURE REVIEW

2.1 Introduction

This chapter presents an overview of formal agricultural credit in South Africa and also highlights post settlement support programmes which have been put in place to encourage land reform beneficiaries to be efficient. Other issues of concern related to the study such as the concept of the 'emerging farmer', land issues, the role of credit in agricultural development, maize production in South Africa, green beans production, credit access and efficiency, and determinants of credit access are also discussed in this chapter.

2.2 The concept of the emerging farmer

The concept of the 'emerging farmer' is understood to refer to farmers who have a 'desire' to increasingly commercialise their production (Niewoudt, 2000). Emerging farmers are seen as representing evolutionary steps on a linear development trajectory from subsistence farmer to emerging farmer to commercial farmer (Makhura *et al*. 1996). This study defines an emerging farmer as a farmer who is a beneficiary of one of the government's land reform programmes (e.g. SLAG, LRAD and PLAS) or a farmer who is in the developmental stages of commercialisation and/or a farmer who utilizes his/her resources at his disposal and needs external support to farm successfully and fully participate in the markets (Gelderblom, 2003; NDA, 2006).

2.3 Formal agricultural credit in South Africa

Generally, developing countries have established parastatal institutions with the aim of channeling credit to small scale and emerging farmers (Machethe, 2004). The establishment of parastatal institutions, with a mandate to channel credit to emerging farmers, is one of the approaches used by governments in developing countries to promote smallholder agricultural development. Some of the parastatals that were established in the former homeland of South Africa have collapsed as a result of transformation of agriculture in the country, thus leaving the emerging farmers

without access to credit services. The Land Bank, South Africa‘s primary formal agricultural credit institution, was expected to fill the problem created by the demise of homelands parastatals (Machete, 2004). However, the Land Bank is not able to reach all small farmers and emerging farmers with loans since the majority of the small farmers and emerging farmers still do not have access to formal agricultural credit (Hedden-Dunkhorst *et al.* 2001; Machete, 2004).

Smallholder agricultural growth cannot be attained without farmer support services (Machete, 2004; DBSA, 2005). International experience has shown that, with adequate access to farmer support services, smallholder agriculture can significantly contribute to an increase in agricultural growth. The Farmer Support Programme (FSP) is a sub-programme of the Department of Agriculture which provides extension, support, and training to farmers, with a special focus on developing emerging farmers, and the implementation of land reform programmes and agricultural rural development projects. The Farmer Support Programme (FSP) is aimed at promoting structural change away from subsistence agricultural production and towards commercialisation of agriculture through the provision of support services to emerging farmers in South Africa (DBSA, 1988).

According to DBSA (2005), unless an effective and tailor-made Farmer Support Programme is put in place, smallholder farmers will have a limited chance of escaping poverty and agriculture’s role in creating sustainable livelihoods will remain limited. Studies by Van Rooyen *et al.* (1987) and Kirsten *et al*. (1993) linked the impact of the Farmer Support Programme (FSP) to improvement of farm income and farming structure.

The realisation of insufficient progress made in improving access to credit by small-scale farmers prompted the government to establish the Micro-Agricultural Finance Institutions of South Africa (MAFISA) in 2005 (DBSA, 2005). The Scheme was supposed to address credit needs of small scale farmers while the Land Bank concentrated on lending to established commercial farmers (AGRITV, 2006). The launch of MAFISA pilot project was considered as a great initiative as its objectives were:

(a) To test delivery systems and channels.

(b) To identify problem areas for solution prior to full rollout.
(c) To determine the acceptability of terms in the market.
(d) To obtain information on performance for future business case projections (National Department of Agriculture (NDA, 2006).

Unfortunately, the full rollout of MAFISA was not as expected. It was noted that in respect of MAFISA, the Department of Agriculture faced major challenges in terms of implementation of the programme. These challenges included the fact that disbursement of MAFISA loans had started late, and there had been an interruption due to the suspension by the Land Bank and expiry of the pilot agreements. Further challenges included the lack of capacity, delayed establishment of accreditation committees, prolonged process lead-times, reliance on over-worked extension officers and a need to change the mindset of final users to address high interest rates and address difficulties in accessing financial services (PMG, 2008).

2.4 Post settlement support

A range of financial assistance packages are available to land reform beneficiaries/emerging farmers, although most of these have not fallen under the responsibility of the DRDLR. In Limpopo province, this responsibility falls under the jurisdiction of the Provincial Department of Agriculture, and specifically, the Post-Settlement Unit (PSU) established by the Limpopo Regional Land Claims Commissioner (RLCC), the first of its kind in the country (Jacobs *et al*. 2011).

In 2004, the Provincial Department of Agriculture implemented the Comprehensive Agricultural Support Programme (CASP), the biggest support sub-programme at provincial level in all provinces except Gauteng and the North West Province (Greenberg, 2010). CASP is a once-off grant and is designed to help black famers to participate in a market that is dominated by white agri-business, but without altering the logic of the market or production system. The fund that is awarded as part of CASP is used mainly for bulk infrastructural development, that is; warehouses, access roads, irrigation systems, poultry houses. Part of the funds is also spent on training and capacity building of emerging farmers. Farmers apply on a yearly basis and grants are awarded for a five year period. To date, the success of

implementation of the CASP programme has been uneven, although most provincial farmer support programmes have been expanded (Greenberg, 2010).

In 2000, the government replaced SLAG with the Land Redistribution for Agricultural Development (LRAD) programme as the main instrument to advance redistribution. LRAD was designed as a market-driven programme, providing larger grants to emerging black farmers with the aim to create 70 000 black commercial farmers within 15 years. LRAD was seen as a vehicle for advancing the policy objective of distributing 30% of (white-owned) commercial agricultural land to black farmers. By 2003 over 2.3 million hectares had been transferred to emerging farmers (Charman, 2008).

A range of other post-settlement support grants have been developed including; LRAD Grants, which is now replaced by PLAS, the Restitution Discretionary Grant (RDG) administered by the RLCC. Other support programmes include the Settlement Planning Grant (SPG) managed by the DRDLR, the Development Assistance Grant (DAG) administered by the RLCC, the Agricultural Credit Scheme (ACS). The Micro-Agricultural Finance Schemes of South Africa (MAFISA) that provides funding to financial institutions such as the Land Bank for on-lending to beneficiaries of land reform was established in 2005. In addition, the Infrastructural Provincial Grant (IPG) and the Land and Agrarian Reform Project (LARP), both managed by the Limpopo Department of Agriculture have been also developed to assist emerging farmers (Jacobs *et al*. 2011).

2.5 The role of credit in agricultural development

In terms of the role of agricultural credit, Musuna and Muchapondwa (2008) argued that it is an important vehicle for agricultural development because it helps farmers cope with the capital demands required to boost efficiency levels. The continous fluctuation in prices of inputs required in agricultural production is among the major problems that farmers face each year. Inputs include seed, fertilizer, chemicals, labour and transport. Availability of credit makes it easier for farmers to acquire the necessary inputs.

According to Feder *et al*. (1990), agricultural credit played a significant role in the adoption of modern technologies in the farming sector. Credit was used as working capital to input purchase as well as for consumption. Farmers immediately need funds after the harvesting period for the next cropping season because of cash scarcity and non-payment of new crops. Most of the production factors such as high-yielding seeds and fertilizers are purchased through cash or on credit, thus more and more farm households depend upon credit markets. Efficient credit markets provide an opportunity for farmers to meet the consumption requirements and balance input use, which result in the betterment of the farmers.

Malik (1999) also indicated that credit plays an enormous function in making the farming sector more productive and efficient all over the world. The shortage of credit availability or capital constraint faced by farmers is one of the major problems in the adoption of modern technologies and efficiency improvement in the agricultural sector. The lack of resources not only constrains the possibilities to realize opportunities in increased productivity but also the ability to smooth consumption.

According to Rukuni and Eicher (1994), smallholder farmers in Zimbabwe doubled their maize and cotton production in the 1980s when extension, marketing services and finance were provided to them. Similar results were achieved in South East Asia after some households that were engaged in informal activities moved to agriculture production (Machete, 2004). This was achieved after the provision of the support services. D'haese and Mdula (1998) found that one of the factors that lead to low productivity among the emerging farmers is poor infrastructure or lack of access to support services.

Access to credit has long been argued to be an engine of agricultural development. Although credit is not a direct factor of production, it can help farmers to purchase the production input needed in the production process. Most of the previous studies on the role of credit in agricultural development failed to consider the fact that in as far as credit is important, it is the ability to obtain and use credit that which enables farmers to realise the actual significance of credit. This study then strived to take into account the issue of credit access by identifying the main factors affecting farmers' access to credit. Furthermore, the study investigates whether or not there is a

difference in terms of efficiency levels of credit and non-credit users which is essential for agricultural development.

2.6 Land and emerging farmers

Access to land is essential if the poor are to enjoy the benefits of agricultural growth, and creating such access is expected to improve productive capacities of the marginalised. However, land ownership in South Africa is highly skewed due to past policies. To correct this imbalance, the government launched its land reform programme in 1994, comprising of tenure reform, restitution and redistribution programmes. Tenure reform aims to address insecure tenure; restitution involves giving back land or providing equivalent compensation to those who were dispossessed of their land through apartheid laws after 1913, while redistribution aims to address racial imbalances in land ownership (DBSA, 2005).

The government, in particular, the Department of Agriculture, has ensured that previously disadvantaged farmers have access to land at a speedy rate and has also ensured that the redistributed land is used productively at both provincial and municipal level of government through provision of support services and capacity building programmes. Due to inequalities in terms of access to land and tenure insecurity, an increasing volume of land at disposal to the rural poor households for improving their tenure rights is often recommended as an important component of poverty reduction programme (Moloi, 2008).

According to French (2007), the farm household is the level at which most resource allocations are made. A central factor affecting investment, production and conservation decisions is the farmers' level of control over his land. A farmer with secure tenure is more likely to think of long term production and conservation activities. The problem of security of tenure or ownership of communal land is supposed to be addressed by the Communal Land Rights Act 11 of 2004 (CLARA) which aims to provide legal security of tenure by transferring communal land to communities.

Most Land Reform Programmes in developing countries have been developed with the implicit assumption that small sizes of land that characterize traditional agriculture is the contributing factor to low farm income and labour inefficiency (Rakodi, 1999). Tenure insecurity, either with legal titles or customary rules, limits crop production and this is the case among emerging farmers. It is on this basis that the Land Redistribution for Agricultural Development (LRAD) was designed to empower black farmers to invest in vibrant agriculture in terms of efficiency in production, and income generation (DoA, 2001). Insecure land tenure implies that emerging farmers cannot use land as a means of collateral when applying for financial assistance while it also limits the possibility of expanding their farming activities (Senyolo, 2006).

Bates and Sokhela (1996) indicated that an increase in land access from 13% to 20% would result in an increase in total production to 14%. These results were however not exclusive of support services supplied to farmers. A study by Bates (2002) asserted that one of the major problems facing emerging farmers is the small size of land for production purposes. According to Moloi (2008), successful participation of emerging farmers in commercial agriculture cannot only be achieved through massive transfer of agricultural land but will also need provision of support services that would ensure that the land acquired is used productively.

According to Machete (2004), access to land for production is an essential requirement for the poor to enjoy the benefits of agricultural growth. The access to land through initiatives such as Land Reform is aimed at promoting smallholder agricultural development. According to Bates (1996), the increase in production appears to be positively correlated with an increase in the total area planted and not necessarily with an increase in productivity per unit area.

Land is the main collateral that farmers can offer formal credit institutions and as such, it is considered as one of the factors that can influence credit accessibility among emerging farmers. However, financial institutions seem to be cautious when using land as collateral due to land reform issues. It is on this basis that the study categorised land ownership into title deed, inherited, communal and leased land

since land ownership patterns have become a significant issue in terms of investment, credit access, and government support.

2.7 Maize production in South Africa

In South Africa, maize production is carried out by a wide range of farming systems, dominated by mostly subsistence oriented small-scale farmers, emerging farmers and commercial farmers. The production is also generally characterised by low output regardless of farm size, that result in high unit costs and lead to low farm returns (DoA, 2002).

In 2005, Grain SA stated that South Africa has about 8 000 commercial maize farmers. Since deregulation of the industry, the price of maize has been derived from international prices and is therefore dependent on the exchange rate. The value of maize crop varies from below 10% to over 20% of total agricultural production in the country. Large-scale maize production is highly capital intensive and due to rising inputs costs, farmers become increasingly tied to credit, input suppliers and marketing agents (DoA, 2005).

Maize production is composed of maize harvested for a particular season, imports and carryover stocks from the previous seasons. Commercial farm sector produces about 98% of maize in South Africa, while the remaining 2% is produced by the small-scale and emerging farm sectors. Over the past ten years, area planted for maize has slightly decreased by about 1.2%. Maize production, however, has increased by approximately 5% (Agricultural Statistics, 2005). According to Jiggins *et al.* (1999), this indicated an improvement on the method of production as producers were able to harvest more on the same amount of piece of land.

Maize is the most important grain crop in South Africa and is produced throughout the country under diverse environments. Successful maize production depends on the correct application of production inputs that will sustain the environment as well as agricultural production (Monde, 2003). Maize production in South Africa has

declined; the reduction is chiefly due to the unavailability of credit, high input cost, and cost of finance (NCEC, 2008).

According to ARC (2002), maize is the most important cereal crop widely grown and it is a major part of the diet for both rural and urban communities in South Africa. As such, the crop occupies a strategic position in the country's food security alongside sugar cane and potatoes. Maize also provides income to all commodity value chain agents: farmer's households produce buyers, processors, exporters and transporters. It is therefore an important crop from both a food security and income generation point of view (Ortmann and Machethe, 2003).

South Africans from all walks of life consume maize in some form or another. Maize meal is eaten as a staple food by the majority of South Africans. Alternately it is very popular as breakfast porridge or as "pap" with a "braai". Many other everyday commodities such as pharmaceuticals, confectionary, toothpastes, popcorn, soups, etcetera. Most of the livestock are fed on maize which is then consumed by humans as meat, dairy products, cheeses or eggs. Maize is more often than not infected with various fungi (Kirsten *et al.* 1998).

Maize plays a vital role in food security for many poor households and is a critical food and cash crop with a per capita consumption over a 100kg. Both large and small-scale commercial farmers produce maize. Maize production is unstable because of erratic rainfall, and yields range from 1 to 4 tons/ha. Trends towards lower rainfall in the drier areas of Southern Africa suggest these areas are becoming increasingly unsuitable for maize production in South Africa, the area planted with maize has decreased with the deregulation of the industry from over 5 million ha in the mid to late 1980s to around 3.5 million ha in 2004 (DoA, 2005).

2.8 Green beans production

Green beans are among the most important fresh vegetables exported from developing countries, and several African countries have focused on exporting green beans to high-value European markets. Historically, green bean production (mostly

for export) has come predominantly from small- and medium-scale farmers in Africa, although imposition of food safety standards has more recently re-allocated market shares away toward larger holdings (Okello, 2007).

According to DAFF (2008), green beans production seasons vary depending on the area of production. In the middleveld area, planting can start at the end of August until Mid-February. However, the best planting time is September and Mid-January to avoid bacterial plight. In the lowveld area, planting time is usually from February to September.

2.9 Value chain conceptual frame work

The value chain analysis addresses the issue of who controls the global commodity trade, how they do so and what consequences might be experienced in developing countries (Gereffi, 1994, 1999, and Daviron and Gibbon, 2002). The institutional economics theory differentiates between spot and contract-based market transactions and non-market based transactions (for example, hierarchies and vertical integration) that are used by exchange parties to minimize the costs of exchange.

Gereffi (1994; 1999), distinguishes between buyer-driven and producer-driven supply chains. In a producer-driven supply chain, the producer makes decisions on what to produce, how much to produce, and how to produce it. In contrast, the buyer-driven chain is governed by the needs of importers, retailers and branded companies. The retailers not only wield considerable influence on the chain, but also develop their own brands with the aim of: 1) competing with others (Reardon and Farina, 2002); 2) meeting consumer demands expressed through increased demand for food safety; and 3) complying with due diligence requirements (Fulponi, 1994; 2005).

Dolan and Humphrey (2002) identified a number of ways that retailers can influence the value chain, including: 1) requiring that the products be customized to meet their specified parameters; 2) requiring various grades of a given product; 3) requiring product labels that provide information about nutritional content and safety; and 4)

requiring certifications that provide information about the processes followed during production.

Dolan and Humphrey (2002) discussed two types of global commodity chain networks: 1) those that bring together firms with different competencies (traditionally called “networks”), and 2) those that bring together firms showing a marked asymmetry in competence and power, wherein a lead firm specifies what is produced, how it is produced and provides the necessary monitoring (called a “quasi-hierarchy”). They further indicated that, the nature of the product and its market determines the type of coordination necessary for delivering produce meeting the buyer’s specifications. The nature of the network coordination, on the other hand, affects the type of supply chain chosen by the producer, which in turn affects the nature and extent of adjustments (investments) the producer must make to meet buyer requirements.

According to Okello (2007), traditionally, public sector activities such as extension, research and development, and price and marketing policies have been largely commodity-based, and thus may not provide the support smallholders require for entry into a high value supply chain. The private sector has traditionally been directly involved in the production, marketing and distribution of agricultural commodities, and the rise in high value commodities has given the private actors an ever-larger and more specific function. By working together, the public and private sectors can play a complementary role in helping small farmers overcome the challenges of developed country standards.

This section provided literature on studies which investigated different types of value chain commodities and the organisational dynamics such controls of trade within the value chain, how it is done, and how transactions take place. For the purpose of this study, two of the most popular crops produced in the study area (maize and green beans) were used in an attempt to map value chains for these commodities that differ from the traditional value chain for these crops in commercial settings in the area. In developing these value chains, the study only focused on identifying the role players and the function of each of the role players within the value chain.

2.10 Credit access and efficiency

Spio (2002) discovered that the difference in productivity between credit and non-credit users of formal agricultural credit is due to both the use of credit and the pre-existing inherent characteristics of small-scale farmers. The difference measured up to 40% of which 21% is due to credit use. This implies that credit can increase the output of a randomly selected farmer by 21%. The results of the study was supported by the study in Zimbabwe by Rukuni and Eicher (1994) which showed that small-scale farmers doubled maize and cotton production in the 1980s support services such as finance, extension and marketing services were provided. In addition, Mushunje and Belete (2001) also found that the provision of training and financial services through credit is important to increase efficiency levels of resource-poor farmers.

Saima *et al*. (2010) examined the effect of farming credit on technical efficiency of farming households in Pakistan. The technical efficiency estimation was carried out through Data Envelopment Analysis (DEA) method. The study also examined sources of inefficiency through Tobit regression model. The results clearly showed that a higher percentage of farmers using credit were at higher efficiency levels of 0.42 to 1.00 compared to 0.23 to 1.00 technical efficiency of non-borrowers. The results further indicated that farming experience, education, access to farming credit, herd size and number of cultivation practices had positive and significant correlations with the efficiency of the farmers.

Hussein and Ohlmer (2008) examined the influence of credit constraint on production efficiency of farm households in Southern Ethiopia. A parametric approach was used to access farm households' specific technical efficiency. The technical efficiency of credit constrained respondents was calculated using maximum likelihood estimator. The study found out that all input variables except herbicides and land were found to be statistically significant. The results of the study revealed that credit constrained farming households used lower levels of capital intensive inputs due to binding financial constraint. The results further showed that the credit constrained farming households had a lower mean productive efficiency.

Omonona *et al*. (2008) studied credit constrained condition and output supply of COWAN farmers in Oyo state, Nigeria. Descriptive statistical tool, Probit regression and switching regression models were used to analyse primary data. The findings of the study revealed that majority of the farmers (80%) were constrained and therefore this affected their productivity. The results showed that age, sex, farm size, level of education, marital status, contact with extension agent, land acquisition and income of household head are the determinants of credit constraints conditions. A test of hypothesis on the difference in the value of the output of the farmers showed that credit unconstrained farmers have their output supply higher than that of credit constrained farmers.

Nwaru *et al.* (2006) examined the relative efficiencies of credit using and non-credit farmers in resource use in Imo state, Nigeria. The data was analyzed using the stochastic frontier production function modeling. The results of the study revealed that credit using farmers were more technically efficient than their non-credit using counterparts. Age of the farmers, household size, level of formal education, farming experience and membership of farmer association/cooperatives were statistically significant factors influencing technical efficiency.

Taddese and Krishnarmmorthy (1997) examined the level of technical efficiency across ecological zones and farm size groups in paddy farms of the Southern Indian State of Tamil Nadu. The results of the study revealed that there was a difference in technical efficiency across farm size groups with paddy farms on small and medium-sized holdings operating at a higher level of efficiency than large farms. They argued that because accessibility of institutional finance depends on asset position, particularly land, small farms were forced to allocate their meager resources more efficiently.

Adewale and Aromolaran (2009) investigated the effect of micro-credit on technical efficiency in food production in Ogun State, Nigeria. The use of maximum likelihood estimation technique of stochastic production frontier, showed the returns to scale value of non-credit user's farmers (1.30) being greater than that of credit user's farmers (0.40). These results suggested that variation in production is due to technical efficiency by those values, and that technical inefficiency is higher among

credit user's farmers than non-credit user's group. The study recommended that policies design should emphasise more rural financial outlets to the financial institutions, whose lending should be timely and in larger amounts without discriminating against small farm holdings farmers.

Olagunju and Adeyemo (2007) examined the differentials in the production efficiency of borrowers before and after merging of the institutions in South-western Nigeria. A multi-stage sampling technique was used to collect primary data using structured questionnaire from 216 beneficiaries from selected financial institutions in the study area. The results of the study showed that the after-emerging beneficiaries were found to be more technically efficient than the before-emerging beneficiaries. The study further revealed that more loanable funds were available due to merging effect and hence had increased the resource base and gross output value of borrowers.

Nwaru and Onuoha (2010) assessed the impact of credit use on the technical efficiency of smallholder food crop farmers in Imo State of Nigeria. The study used primary data from a simple random sample of 187 food crop farmers consisting of 75 farmers producing with credit and 112 others producing without credit. Data analyses were by the estimation of stochastic frontier production functions by the methods of maximum likelihood and ordinary least squares. The results of the study indicated that food crop farmers producing without credit perform better than their counterparts producing with credit. The results were contrary to *a priori* expectations but agreed with the result from Okike *et al.* (2001) who reported that receiving credit contributed to farmers' inefficiency. This could be as a result of disbursement of credit in cash rather than in kind or agricultural loan misuse as a result of resource poverty.

In view of the above studies on the relationship between credit access and efficiency, this study examined the relative technical efficiency levels of borrowers and non-borrowers of formal agricultural credit. Data analysis was by Cobb-Douglas production function instead of Data Envelopment Analysis, switching regression models and stochastic frontier function. The study examined whether or not farmers using credit were better than non-credit users in terms of technical efficiency levels. In addition, the study also examined the extent to which the study findings differ or concur with some of the previous studies on credit access and efficiency.

2.11 Empirical studies on determinants of credit access

Miller and Ladman (1983), in a study based on the data from a sample survey of 699 randomly selected peasant farmers applied discriminant analysis to identify a set of socio-economic, physical and psychological factors that influence credit use among small farmers. The study did this by differentiating between borrowers, potential borrowers, and non-borrowers. The results of the study indicated that borrowers were characterised by higher resource base, farm size, higher level of education, large number of cattle, higher household incomes, higher level of market integration, greater use of improved technology, larger operating costs and investments, higher risk ability, etc. Potential borrowers were characterised by further distance from markets, low level of market integration, higher transaction costs, less number of cattle, et cetera. The results of the study further revealed that, non-potential borrowers were characterised by lack of interest to expand production, lower level of education, limited use of improved technology, shortage of labour and proximity to the market.

In a study by Lyne (1996), emerging farmers were found to have had limited access to factors of production, credit and information. Furthermore, the study by D'haese and Mdula (1998) in the then Northern Province, now Limpopo Province, found that lack of access to credit was the main constraint to the emerging farmers to generate more income. According to them, access to credit seems to be the main factor contributing to the various problems the emerging farmers are faced with. In the developing regions of the former Kwa-Zulu Natal, Lebowa, Venda and Kangwane, it was found that high transaction costs, low wealth and poor debt servicing capacity impeded use of formal credit (Coetzee, 1995 and Fenwick and Lyne, 1995).

A study by Atieno (2001) indicated that income level, distance to credit sources, past credit participation and assets owned were significant variables that explained the participation in formal credit markets. Padmanabhan (1996), comparing the informal credit sector from the formal stated that proximity, comfortable atmosphere, quick credit, all times access, freedom of deployment, repayment flexibility and lower transaction costs were the advantages of the informal sector which had made them to be almost indispensable, particularly to small farmers. The results of the study

was supported by Hussein (2007) who indicated that farm households are more likely to prefer the informal sector to the formal sector with respect to flexibility in rescheduling loan repayments in times of unexpected income shocks.

Hussein (2007)' study on farm household economic behaviour in imperfect financial markets found out that the probability of choosing the formal credit sector was positively affected by gender, educational level, household labour and farm size. The results of the study further revealed that education, credit information and extension visit were more likely to increase the information base and decision making abilities of the farm households including the ability to compare *pros* and *cons* of choosing appropriate credit and production technology.

Mohieldin and Write (2000) employed a Probit model analysis of the formal credit sector to determine the impact of independent variables on the outcome of whether a person has access to a loan or not. The results of the study indicated that both the requirements of the individual (demand side) and of the lending institution (supply side) determined whether a loan is extant. The results further indicated that educational level, ownership of land, total assets, and household size was significant variables that explain whether or not a person has access to a loan.

According to Okurut (2006), household access to financial service (in both formal and informal sectors) is influenced by institutional factors, product features and household socio-economic characteristics. From the institutional perspective, the location of the financial service providers and their conditions greatly influence the probability of access. Porteous (2003) observed that access to formal financial services in South Africa tends to be limited to salaried workers, hence excluding the poor, the unemployed, self-employed and informally employed. Dallimore and Mgimeti (2003) also contended that the long distances and high transport cost constrains the rural poor's access to formal financial services mainly located in urban areas.

Zeller *et al.* (1994) suggested that access to credit from the Gambian co-operative was positively and significantly influenced by age and household income, while being female had a negative and significant effect. The results of the study further

suggested that older persons who control household resources are considered to be more credit-worthy, while women are discriminated against in the credit market.

The financial product features that influence access include interest rates and collateral requirements (Okurut, 2006). Kochar (1997) examined the effect of formal sector interest rates and choice of informal credit. Empirical evidence suggested a positive and significant relationship between the formal sector interest rate and the probability of access to informal credit (at the 5% significance level). This result can be interpreted in the context of those households that participate in both the formal and informal financial markets, where borrowers considers not only the formal sector interest rates, but also the associated transaction costs (financial and non-financial). This may explain the positive relationship between formal sector interest rates and informal credit demand (Okurut, 2006).

The specific borrowers' characteristics that influence the household access to credit markets include; the strength of previous business relationships, borrowers' reputation in the market, borrower' acceptance of interlinked credit contracts, borrowers' debt-service capacity and wealth status (Okurut, 2006). Aleem (1990), in a study of informal market lenders and their clients in Chambar, Pakistan, argued that informal lenders mainly used their established relationship with borrowers as a screening mechanism. Lenders did not generally entertain loan requests from people who had not had previous dealings with them either in the form of the sale of harvested output through them or purchase of farm inputs. The longer the period of the previous business relationship, the higher would be the probability of the borrower having credit access.

Hussein (2007), in his study also found out that the use of extension package, in effect, requires adequate labour supply, thus a positive effect of household labour on the choice of formal credit for the farm input. The results of the study indicated that the choice of the formal sector increases with the number of productive members of the farm households. The results also revealed that low level of education of the farm households may have contributed for limited use of formal sector credit by farm households. Furthermore, the results revealed that men tend to borrow more from the formal and semi-formal sources than women do. The implication for this is that

being a female reduces the likelihood of borrowing from the formal and semiformal credit sectors where it increases the probability of borrowing from the informal credit sources.

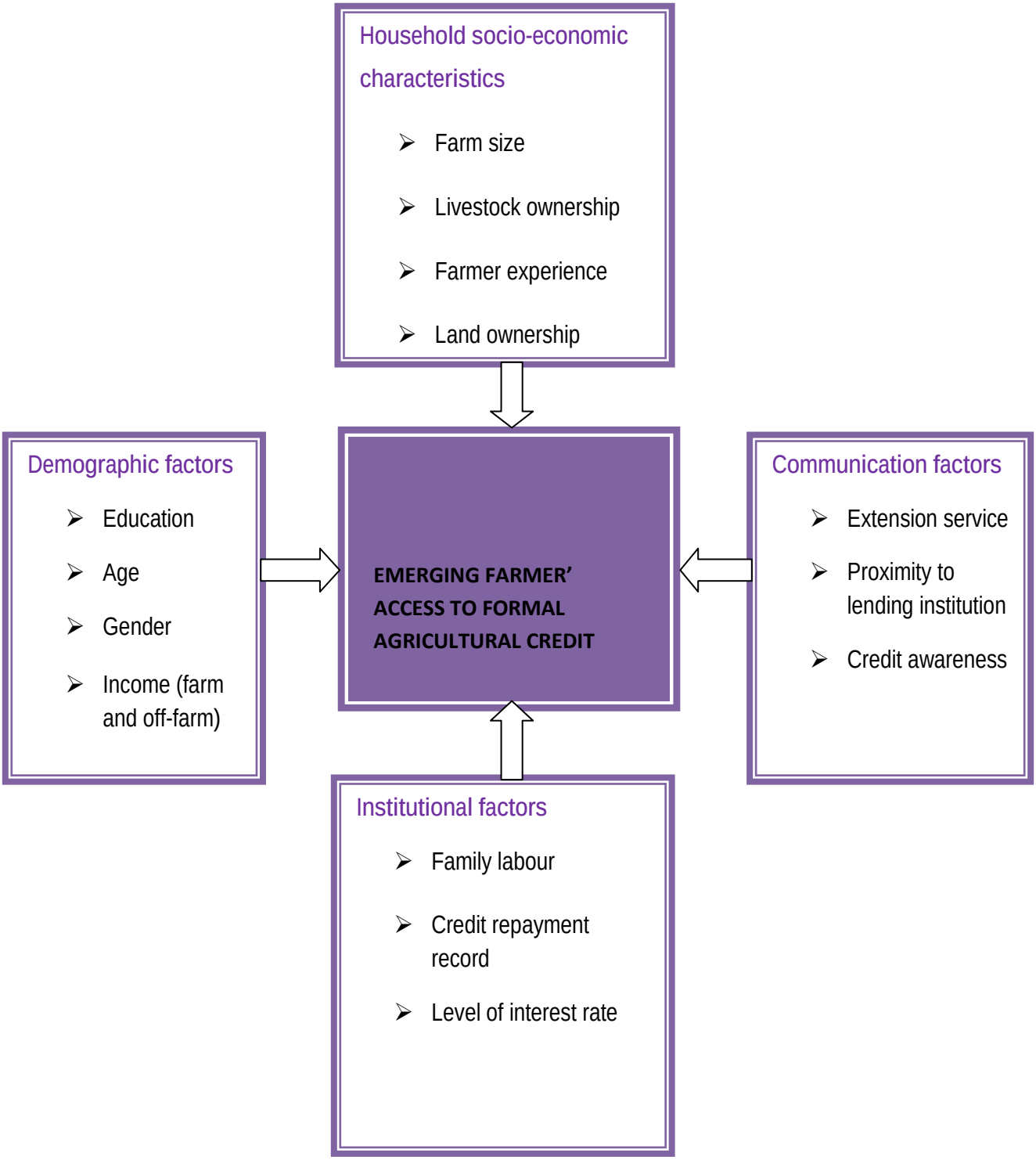
In view of the above studies on determinants of credit access, this study employed Probit regression analysis to a set of household socio-economic characteristics, demographic, institutional and communication factors differentiating between borrowers and non-borrowers only. Some of the factors which were considered in the study by Miller and Ladman (1983) such as farm size, level of education, distance, interest rate and livestock were also considered as factors that might influence credit access in the study area. Different studies focused on different types of financial credit institutions, for example Aleem (1990) focused on informal credit markets while a study by Mohieldin and Write (2000) focused on the formal credit market. Other studies focused on both formal and informal credit markets, for example Kochar (1997). This study focused only on formal agricultural credit since it is offered specifically for the purchase of agricultural inputs including seed, fertiliser, water charges, pesticides et cetera.

Based on the literature review on determinants of credit access presented above, the following conceptual frame work has been adopted, depicting most important factors expected to influence emerging farmers' access to formal agricultural credit in the study area.

2.11.1 Conceptual framework on determinants of credit access

According to the above framework, emerging farmers' access to formal agricultural credit was expected to be influenced by a number of factors which included households' socio-economic characteristics as well as demographic, communication and institutional factors. The relationship between emerging farmers' access to formal agricultural credit and each of the variables as proposed by the framework is discussed below.

Figure 1: Conceptual framework on determinants of credit access



Source: Yehuala (2008)

2.11.2 Household socio-economic characteristics

Farm size: This refers to the size of the farm of the household measured in hectares. The larger the size of the farm, the larger the amount of inputs needed to operate the farm. Farmers with relatively larger farm sizes might not be able to purchase amount of inputs needed and thus increase the demand for credit. It was therefore hypothesised that larger farm size would have a positive influence on emerging farmers' access to formal agricultural credit.

Farmer experience: This refers to the number of years the farmer has been involved in farming. A farmer having more years in farming is more likely to have knowledge on agricultural credit institutions since credit is an indirect factor of production. Therefore, a farmer having relatively more knowledge on agricultural credit institutions is more likely to use such information to his/her advantage. It was on this basis that it was hypothesised that, the more the number of years of farming, the higher the probability access to formal agricultural credit.

Livestock ownership: This refers to the total number of animals owned by a household. Livestock has long been considered to be an important asset which acts as a form of wealth for the household. The more livestock the household possesses, the less likely the household would demand credit. The reason for this is that when livestock is sold, it increases the income of the household. The implication for this is that more money would become available for the household which could be used to purchase inputs and thus reduce the demand for credit. Therefore, more livestock would have a negative influence on emerging farmers' access to formal agricultural credit.

2.11.3 Demographic factors

The level of education: Education plays an important role in household decision making. Emerging farmers who are educated are able to read, write, interpret information provided by financial institutions, calculate the risk involved, and make informed decisions as to whether or not to take credit. In this study, it was

hypothesised that education would have a positive influence on emerging farmers' access to formal agricultural credit.

Age: This refers to the number of years of the household head at the time of the interview. It is usually used by many formal credit institutions to determine whether or not an individual (applicant) is credit worthy. As the number of years of the farmer increases, the ability to perform certain tasks decreases. Older farmers are very risk averse such that even when credit becomes available, they would not like to take it. It was on this basis that it was hypothesised that access to credit from formal agricultural institutions would decrease as the farmer‘s age increases.

Gender: This refers to the sex of the household head. Traditionally, women had limited control over economic resources and activities. Male-headed households had greater participation and control over economic resources such as credit information although that has changed over the years. Therefore, it was hypothesised that being a male increases the chances of accessing formal agricultural credit.

Off-farm income**:** This refers to a situation where income generated outside the farming business results in more household resources that can be used to purchase farm inputs. The higher the off-farm income, the less likely the farmer would demand credit from formal agricultural credit institutions.

2.11.4 Institutional factors

Family labour: This includes all members of the household who assist in farming and other activities related to production on the farm. Farmers often use family labour as a substitute for hired labour due to limited farm income to cover the cost of hired labour. Therefore, family labour would reduce the demand for credit from formal agricultural credit institutions.

Credit repayment record: This applies to farmers who would have repaid their previous loans and are usually considered to be credit worthy and have a good relationship with financial credit institutions. Therefore, it was hypothesised that better a credit repayment record would positively influence emerging farmers' access to credit from formal agricultural sources.

Level Interest rate**:** Interest rate refers to the rate at which interest is paid by emerging farmers for the use of money borrowed from formal agricultural credit institutions. Since there are several formal credit institutions charging different interest rates, the level of interest rate refers to whether or not farmers would demand credit if the level of interest rate increases. Therefore, emerging farmers who will demand credit even if the level of interest rate increases are more likely to access credit from formal agricultural credit institutions.

2.11.5 Communication factors

Extension service: Extension officers play an important role in transferring information to farmers. Farmers who are visited frequently by extension officers would have more information which might influence their demand for credit. This information includes credit providers, application processes, period of payment, terms of credit and other credit related information. Therefore, it was hypothesised that extension services would have a positive influence on emerging farmers' access to credit.

Proximity to lending institutions (Distance): Farmers located close to credit institutions usually have easier access to information and travel less distances than those who live remote locations. Therefore, it was expected that longer distances travelled by farmers to formal agricultural credit institutions would negatively influence emerging farmers to access formal agricultural credit.

Credit awareness: This refers to awareness of the formal agricultural credit institutions available to emerging farmers in their area and information on application requirements, credit repayment period, terms and conditions of the loan among other things. Farmers who are aware of this information have a better chance of accessing credit than those without this kind of information. Therefore, credit awareness would have a positive influence on emerging farmers' access to formal agricultural credit.

CHAPTER 3: RESEARCH METHODOLOGY

3.1 Introduction

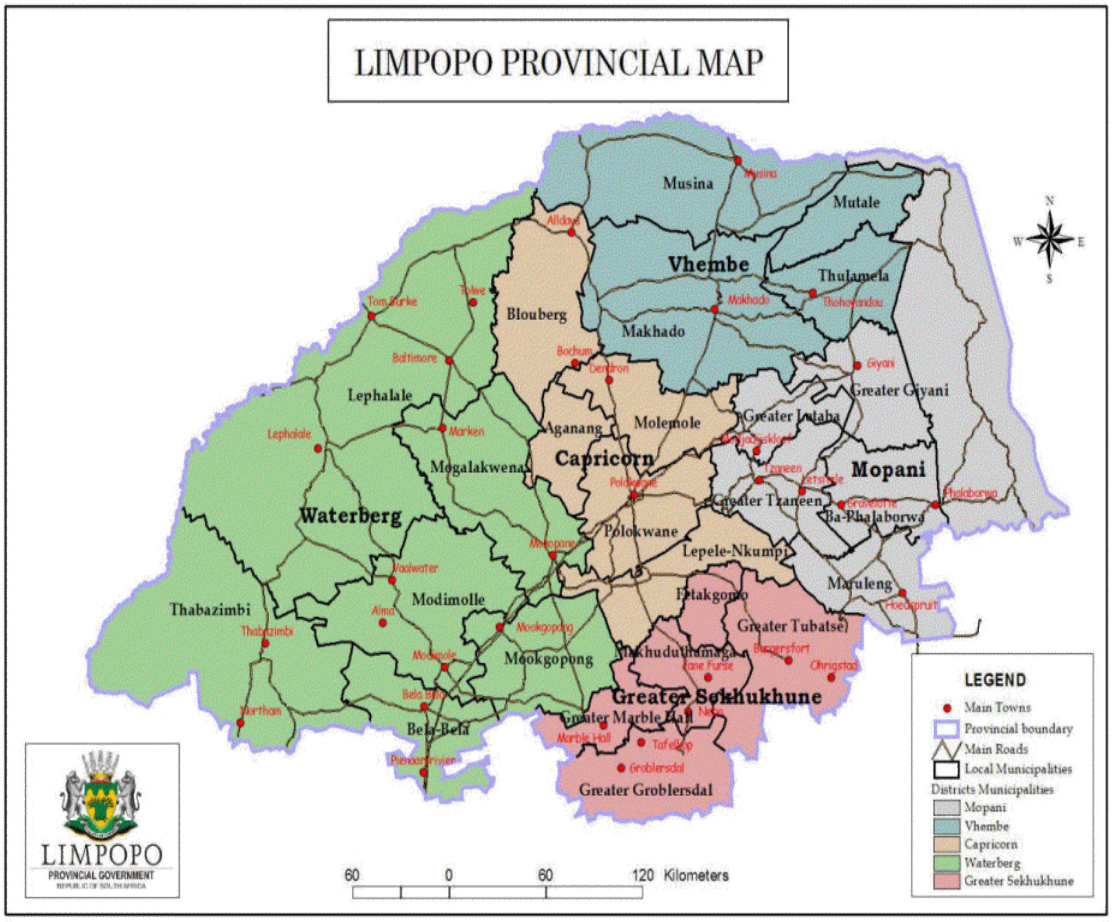
The aim of this chapter is to describe the study area and to explain the methods used in the data collection phase as well as the research techniques used to analyse data. The main research techniques used are the Cobb-Douglas production function and Probit analysis. Since the aim of the study was to compare technical efficiency levels of emerging maize and green beans farmers with and without access to formal agricultural credit, the Cobb-Douglas production function analyses were run separately for borrowers and non-borrowers of credit and then a comparison was made. Through interviews, the study was also able to map the value chain for maize and green beans in the study area.

3.2 Study area

Limpopo Province is one of the nine Provinces of South Africa and is situated in the Northern part of the country. The capital of Limpopo Province is Polokwane, formerly called Pietersburg. The Province was formed from the region of Transvaal Province in 1994 and initially named Northern Transvaal. In 1995, it was renamed Northern Province, which remained until June 2003, when the name of the Province was formally changed to Limpopo Province.

The Province covers an area of 125 754 km^2 which represents 10.3% of the country's total area (Stats SA, 2010). This makes it the fifth largest province of the countries nine Provinces in terms of area. Limpopo borders Zimbabwe to the north, Mozambique to the east and Botswana to the west. It is divided into five municipal districts (Capricorn, Mopani, Sekhukhune, Vhembe and Waterberg Districts), and sub-divided in 25 local municipalities. Mopani District Municipality comprises five local municipalities: Ba-Phalaborwa, Greater Giyani, Greater Letaba, Maruleng, and Greater Tzaneen.

Figure 2: Limpopo Provincial Map



Source: LDA- GIS (2011)

The study was conducted in Maruleng Local Municipality in the Mopani District of Limpopo Province, South Africa. Maruleng Municipality was first established in 1997 under the name Hoedspruit / Makhutswe Transitional Local Council. Maruleng is a Sepedi word derived from the name of the fruit “Marula” which is indigenous in Limpopo Province, which means place of Marula. Traditionally, Maruleng was made up of the Eastern Transvaal as well as the former apartheid homeland of Lebowa which was established for Pedi/Northern Sotho speaking people.

In terms of its location, Maruleng Municipality is situated in the South Eastern quadrant of the Limpopo Province within the Mopani District Municipality. The Municipality borders the Greater Tzaneen and Ba-Phalaborwa Municipalities in the north area and Bushbuckridge in the south. It also borders Blyde River Canyon in the

west, Timbavati Private Reserve and Kruger National Park in the east. Hoedspruit Town is the political and economic hub of Maruleng Local Municipality and is the main urban area in terms of business, infrastructure and institutional functions. Due to many land claims which have hampered investment in the area, the Municipality has limited economic development (MLM, 2010).

According to MLM (2010), it is estimated that Maruleng local Municipality has a population of approximately 106, 247, residing in a total of 33 rural settlements (98%) and three urban settlements (2%). The Municipality consists of up to 36 communities: 33 rural villages, one urban area (Hoedspruit) and two smaller urban areas. The Municipality is characterised as a predominantly rural area with two residential features: urban residential which is well established, with formal housing and good service particularly access to water and rural residential area in the former homeland which is still facing service delivery problems. It is estimated that approximately 5% of the population is white, with 95 % being black (MLM, 2010).

Land ownership patterns in Maruleng are diverse due to the scattered location of communal villages, conservation areas and commercial farms. Considerable land is owned by the State and falls under custodianship of traditional authorities which accommodate some 90% of the residents of the municipal area. Large areas of land in private ownership are also used for Conservation/Tourism/game farming and commercial hunting (MLM, 2010).

Ownership patterns are expected to change in the future, as the Sekororo Land Claim is settled and ownership of some of the land was successfully transferred to the Sekororo community (MLM, 2010). According to the Maruleng Local Municipality IDP Plan 2010-2015, 18.5% of the municipal area is subjected to 21 registered land claims (MLM, 2010). Most areas of the former Lebowa homeland are under communal land tenure with an active authority system in place. Other areas of privately owned commercial farmland that is mostly used by white commercial farmers will also be transferred to the Sekororo people as part of the land restitution process of land reform (Jacobs *et al*. 2011).

The Municipality has a firm economic base centered on agriculture and tourism, which are key sectors with significant potential for future growth. Currently, agriculture remains the leading employment generator and economic sector in Maruleng Municipality. Agriculture in Maruleng Municipality is characterised by commercial production of mangoes and citrus, and subsistence and small-scale farming of staple food crops such as maize, and a variety of crops such as green beans, potatoes, spinach, sweet potatoes, cabbage, pepper, tomatoes among others. Other agricultural activities taking place in the area include game farming, Marula production and livestock production with a focus on cattle, goats, sheep and poultry (MLM, 2008).

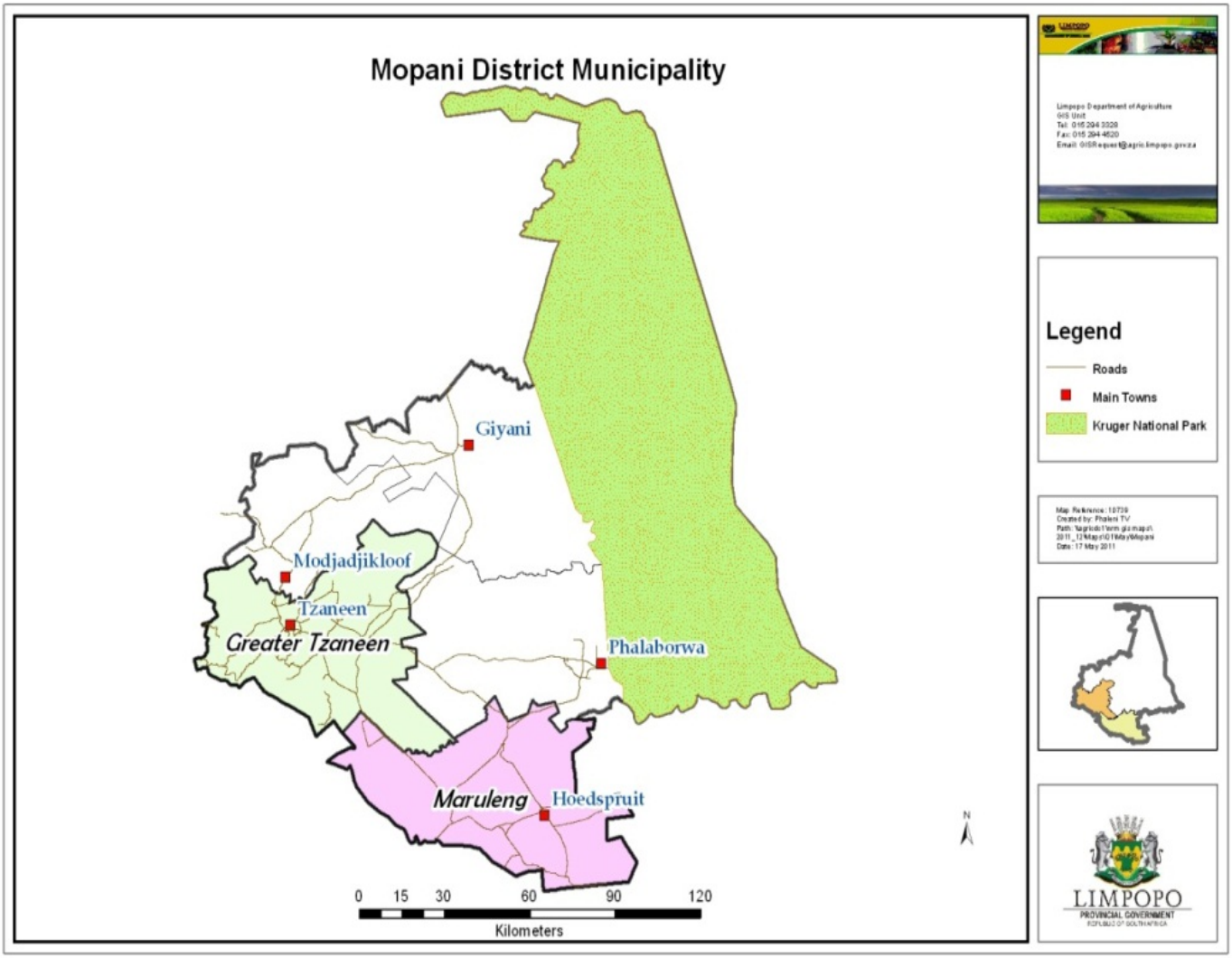
Maruleng is also the leading mango exporter and one of South Africa's largest exporters of citrus. Successful citrus and mango production require significant production efficiency levels in order for emerging farmers to be profitable and there are concerns in Maruleng Municipality that these are not viable options for small emerging farmers unless structured through co-operatives (MLM, 2008). There is also a potential to start sugar cane production, which offers an alternative for emerging farmers in the area (MLM, 2010). The Municipality also has a comparative advantage in irrigated agriculture since there is large amount of water reserves along the banks of the Blyde River. However, according to the Maruleng Local Economic Development Strategy (2009), agriculture in Maruleng under-performs relative to their potential, due to large amount of agricultural land that is under claims, and the lack of support services to farmers in the Municipality (Jacobs *et al*. 2011).

The Maruleng Municipality is characterised by low rainfall climate conditions. This results in limited water resources culminating in severe water shortages and drought condition. There is also severe competition for water between the Agricultural, Tourism, Industrial and Domestic users. Water in Maruleng is supplied by one of three sources: the Lepelle Northern Water Board (LNWB), the Department of Public Works and/or the Blyde River. LNWB supply almost all of the water needed for industrial and domestic use from the Phalaborwa Barrage, located on the Olifants River. Additional water is released from the Blydepoort Dam, located on the Blyde River in case, the area experience a decrease in water levels in the Phalaborwa Barrage, (MLM, 2010).

While the Maruleng Municipality has significant water resources from Blyde River Canton and Olifants River, water distribution is however unequal across different areas and more expensive for the poor households (MLM, 2010). Water for domestic use is rated as the first priority by Maruleng communities, particularly in the densely populated areas of Sekororo and Metz. Maruleng communities rely almost entirely on poor quality boreholes for water supply due to inadequate and poor infrastructure (Business Trust and DPLG, 2007).

Many subsistence farmers in the Municipality depend on seasonal rainfall for crop production. In the Oaks area, a former homeland irrigation scheme exists that supports emerging farmers. A commercial irrigation exists in the northern areas of Trichardtsdal and Hoedspruit. A new pipeline funded by RMB (R150 million) was established in 2003 to supply water from Blyde river dam to Hoedspruit town and the surrounding areas and 800 ha of irrigated land was reserved to support irrigation for small emerging farmers (MLM, 2010).

Figure 3: Mopani District map showing the study area



Source: LDA-GIS (2011)

Most of the financial institutions operating in the study area are involved in lending, providing technical assistance and advisory services. Some of the prominent ones include the Land Bank, commercial banks (Standard Bank, ABSA, African Bank, Capitec Bank, FNB), Micro Agricultural Financial Institutions of South Africa (MAFISA), co-operatives, small loan industry, Non-Governmental Organisations (NGO's), and informal financial institutions.

3.3 Data collection

The study used primary data, which was collected through a field survey. The main method used to collect information was face-to-face interviews using structured questionnaires. The structured questionnaire was administered on individual farmers or their proxies. The questionnaire comprised information about household socio-economic characteristics, land operation, livestock production, credit access, extension service, crop production, and food value chain analysis amongst others. Data on farming inputs included the use of land, seed, fertilizer, pesticides, irrigated land, labour and capital.

3.3.1 Sampling procedure

A sample of 62 emerging farmers was used in this study. According to Battese (1998), it may not be feasible to attempt to collect data on all possible crops grown by the farmers. This is especially the case where farmers in the region grow a wide variety of crops. Hence, it was necessary for the study to target the analysis of two of the most important crops (maize and green beans) produced in the study area.

Emerging farmers were identified first with the assistance of the Limpopo Department of Agriculture (Maruleng Local Municipality) and the Council for Scientific and Industrial Research (CSIR) through a WRC-solicited and funded project. The study used the stratified random sampling technique due to the fact that some emerging farmers have access to formal agricultural credit while others do not have access. Emerging farmers were classified as borrowers and non-borrowers of formal agricultural credit. Participant farmers were also stratified according to gender. The number of emerging farmers interviewed in each village is listed in the table below:

Table 1: List of villages and number of respondents

Name of the village	Frequency	Percent
Sofaya	6	9.7
Metz	17	27.4
Madeira	4	6.5
Ballon	3	4.8
Lorraine	6	9.7
Makhutshwe	6	9.7
Calais	3	4.8
Paris	7	11.3
Nasional	2	3.2
The oaks	4	6.5
The willows	2	3.2
Turkey	2	3.2
Total	62	100.0 %

Source: Survey data (2011)

3.3.2 Data analysis

Data was captured into the Statistical Package for Social Sciences (SPSS 17.0) for windows, and then a regression analysis was carried out. For descriptive purposes, frequencies, and the mean or average of the sampled farmers were calculated. A probit regression analysis was carried out with the aim of grouping farmers according their credit access status that is; borrowers and non-borrowers.

After carrying out the Probit regression analysis, Cobb-Douglas regression analysis for borrowers and non-borrowers producing each of the targeted crops (maize and green beans) was then applied. This provided the empirical information on the

differential technical efficiency levels of emerging farmers with and without access to credit in Maruleng Municipality.

3.4 Analytical methods

The study used two models: the Probit regression model and the Cobb-Douglas production function. The Probit model was used to determine socio-economic factors and characteristics influencing emerging farmers to access credit. The Cobb-Douglas production function was then used to compare levels of technical efficiency of emerging farmers with and without access to credit.

3.4.1 Probit regression model

The probit model was used in order to determine socio-economic characteristics and factors that influence emerging farmers to access credit. According to Nagler (2002), Probit model constrains the estimated probabilities to be between 0 and 1 and relaxes the constraint that the effect of the independent variable is constant across different predicted values of the dependent variable. The Probit model assumes that while we only observe the values of 0 and 1 for the variable Y, there is a latent, unobserved continuous variable Y* that determines the value of Y. The other advantages of the Probit model include believable error term distribution as well as realistic probabilities (Nagler, 1994).

While the Probit model is more appealing than other linear probability models, it generally involves non-linear estimation and thus added computational costs. In addition, the theoretical justification for employing the Probit model is often rather limited.

The model has been selected because it is best suited to analyse the relationship between categorical variable and set of both categorical and continous independent variables (Uchezuba *et al*. 2009). It includes farmers who are borrowers and non-borrowers. Selecting farmers who have access to credit and neglecting those who do not have access to credit could result in problem of selectivity bias, which may result

in the omission of other important variables and loss of valuable information. Therefore, there was a need to use the appropriate analytical techniques that incorporated observations on both borrowers and non-borrowers to overcome the problem of selectivity bias; hence the Probit model was employed in this study.

The model can be specified as follows:

$Y_i = \beta_0 + \beta x_i + U_i$

Where:

Y_i = 1 if a farmer had access to formal agricultural credit 0, otherwise

X_i = vector of socio-economic characteristics

β = vector of unknown parameter.

U_i= an independently distributed error term.

The Probit model specified in this study to determine socio economic characteristics and factors influencing emerging farmer access to credit can be expressed as follows:

$$Y_i = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \beta_4 x_4 + \beta_5 x_5 + \beta_6 x_6 + \beta_7 x_7 + \beta_8 x_8 + \beta_9 x_9 + \beta_{10} x_{10} + \beta_{11} x_{11} + \beta_{12} x_{12} + \beta_{13} x_{13} + \beta_{13} x_1 + \beta_{14} x_{14} + U_i$$

Table 2: Definition of variables

Variables	Description	Units of measurement
Dependent variable		
Y_i = 1, if the farmer had access to formal agricultural credit, 0 otherwise		
Independent variables		
Demographic factors		
x_1	Age of the household head	Years
x_2	Gender; 1 if a farmer is a male, 0 otherwise	Dummy
x_3	1, If a farmer completed secondary education, 0 otherwise	Dummy
x_4	Off-farm income in rand per month	Rand/month
Household socio-economic characteristics		
x_5	Size of the farm	Hectares
x_6	Total livestock of the household	Numbers
x_7	Number of years in farming	Years
x_8	1, if a farmer owns land, 0 otherwise	Dummy
Institutional factors		
x_9	1, If a farmer will demand credit when the level of interest rate increases, 0 otherwise	Dummy
x_{10}	1, If a farmer has a good credit repayment record, 0 otherwise	Dummy
x_{11}	Family members who assist in farming	Numbers
Communication factors		
x_{12}	1, If a farmer received extension service, 0 otherwise	Dummy
x_{13}	1, If a farmer is aware of financial credit institutions, 0 otherwise	Dummy
x_{14}	Total distance travelled to financial institutions	Hours

3.4.2 Cobb-Douglas production function

The Cobb-Douglas production function model was used to compare technical efficiency of the level of emerging maize/green beans farmers with and without access to credit. Emerging farmers were classified as borrowers and non-borrowers of credit. Cobb-Douglas production function was then used to compare levels of technical efficiency between these groups. The model assisted the study to assess the technical efficiency because its measurement was very important since it was a factor of productivity growth. The model was selected because it measure the effect of inputs on output as inputs are applied to produce output and the quantity and quality of inputs used influences the nature of output. The other reason was the ease with which the returns to scale could be interpreted.

The theoretical 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 / error term

For constant returns to scale, the sum of the technical coefficients, β must be equal to one (1). For increasing returns to scale, the sum must be greater than one, and for decreasing returns to scale the sum must be less than one.

The two important properties of Cobb-Douglas production function (Coudere and Marijse, 1991) are:

a. α and β are elasticities of production with respect to labour and capital

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

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

b. The function is homogenous of degree, α + β. If α + β > 1; there are increasing returns to scale, α + β = 1, indicates constant returns to scale and α + β < 1, indicates diminishing returns to scale.

However, the Cobb-Douglas production function has a number of weaknesses or limitations. The major criticism of the Cobb-Douglas function is that it cannot represent all the three stages of Neo-classical production function; it represents only one stage at a time. The elasticities of this type of a function are constant irrespective of the amount of input used. However, regardless of these limitations the Cobb-Douglas production function was used because of its mathematical simplicity and that its functional forms had a limited effect on empirical efficiency measurement. In addition, the model has been widely used to assess technical efficiency studies.

The operational model for maize/green beans relating to the production of Y, to a given set of resources X and other conditioning factors is given as follows:

$$Y = aX_1^{\beta 1} X_2^{\beta 2} X_3^{\beta 3} X_4^{\beta 4} X_5^{\beta 5} X_6^{\beta 6} X_7^{\beta 7} u$$

Where: Y = total amount of maize/green beans produced (kg)

: X_1 = Land devoted to maize/green beans production (hectares)

: X_2 = Family and hired worker days used in production of crops (Man days).

: X_3= Capital (tractor cost per ha).

: X_4 = Fertilizer used (in kg).

: X_5 = Pesticides (cost of pesticides in Rands).

: X_6 = Seed used (in kg).

: X_7 = Amount of water used for maize/green beans irrigation

measured in mm/ha.

: u = Disturbance term.

: b_1, b_2, b_3, b_4, b_5, b_6 and b_7 are elasticities to be estimated.

Model specification

In order to be able to use the OLS (Ordinary Least Squares) procedure for estimating, the function is linearised using logarithm and gives the following regression specification

$$lnY = b_o + b_1 lnX_1 + b_2 lnX_2 + b_3 lnX_3 + b_4 lnX_4 + b_5 lnX_5 + b_6 lnX_6 + b_7 lnX_7 + u$$

Description of variable included in the model

Output (Y) is the total quantity of maize/green beans produced per hectare; it is measured in kg per hectare.

Land (X_1) is the total area of the farm(s) devoted to the production of maize/green beans. It is measured in hectares.

Labour (X_2) is the total amount of labour used in the production of maize/green beans. It is expressed in adult equivalent days per hectare and is the sum of family labour and hired labour. Male and female labours were counted equally. Family members who do not spend most of their holidays on the farm were not considered.

Capital (X_3) is used to present capital, tractor cost per ha was used.

Fertilizer (X_4) includes both basal and top dressing fertilizers. Although some farmers use animal manure, this has been also included (it is measured in kilograms).

Pesticides (X_5) refers is pesticides cost, measured in Rands.

Seed (X_6) both certified and home produced (recycled seeds) were considered and measured in kilograms.

Irrigation water (X_7) is the amount of water used for irrigation. However, irrigated land, was used as a proxy for the amount of water used for irrigation. The reason for this was due to shortage, unreliable and inconsistent information which resulted in the failure to quantify the amount of water used for irrigation.

CHAPTER 4: RESULTS AND DISCUSSION

4.1 Introduction

The aim of this chapter is to present the results of the descriptive analysis. The chapter specifically describes the nature of the data used in the study and also provides brief summaries of the variables which were considered and their measures. The results are presented in tabular form and charts and then interpreted individually.

Table 3: Average of some of the socio-economic characteristics and factors of the sampled farmers

Variables	Total (62)	Borrowers (11)	Non-borrowers (51)
Age in years	38	52	36
Family labour	3	1	2
Size of the farm in Ha	60.34	61	60
Total number of livestock in unit	2	4	1
Farming experience in years	7	3	7
Extension service	Yes (64%)	73%	62%
	No (36%)	27%	38%
Credit awareness	Aware 24%	90%	10%
	Unaware 76%	10%	90%
Credit repayment record	Yes (76)	85%	15%
	No (34)	15%	85%
Total distance	0.45 hr	0.40hr	0.5hr
Level of interest rate	Yes 19=31%	7=64%	12=24%
	No 43=69%	4=36%	29=76%

Source: Survey data (2011)

4.2 Descriptive statistics

4.2.1 Age of the household head

Age of the household head was regarded as one of the crucial socio-economic factors influencing credit access in the study. As indicated on table 3 above, the average age of the household head in the sample was 38 years, with that borrowers and non-borrowers being 36 and 52 years respectively. The results show that emerging farmers who were borrowers of formal agricultural credit were relatively younger as compared to their non-borrowers counterparts.

4.2.2 Family labour

Family labour is mostly used in small-scale farming sub-sector as a substitute for hired labour due to limited farm income to cover the cost of hired labour. As shown on table 3, the average family labour in the sample was 3 labourers, with that of borrowers and non-borrowers being 1 and 2 labourers respectively. The results indicate that emerging famers who were borrowers of formal agricultural credit had fewer family labourers as compared to their non-borrowers counterparts.

4.2.3 Size of the farm

Land is the main collateral that farmers can offer formal credit institutions and as such it is considered as one of the factors that can influence credit accessibility among emerging farmers. The average size of the farms in the sample was 60 hectares with that of borrowers being 61 and 62 hectares respectively. This is also indicated on table 3 above. The results indicate that emerging farmers who were borrowers had one hectare of land more than their non-borrower counterparts.

4.2.4 Total number of livestock

Apart from crop production, emerging farmers in the study area were also involved in livestock production. Livestock ownership had long been considered as a symbol of

wealth and status and was the most important asset in rural areas. As indicated on table 3 above, on average, emerging farmers in the sample own two (2) livestock, with borrowers owning four (4) livestock, and non-borrowers owning one (1) as indicated on table 3 above. The result shows that emerging farmers in the study area had relatively fewer livestock and that, borrowers of formal agricultural credit had relatively more livestock than non-borrowers.

4.2.5 Farmer experience

The number of years the farmer has been involved in farming is regarded as the managerial ability of emerging farmers. An increase in the number of farming years is more likely to enable the farmer to effectively plan and improve his/her managerial abilities. On average, farming experience among the study participants was seven (7) years, with that of borrowers and non-borrowers' experience being three (3) and seven (7) years respectively as indicated on table 3 above. These results indicate that farmers who were borrowers of formal agricultural credit had relatively fewer years in farming than their non-borrowers counterparts.

4.2.6 Extension service

Extension officers have long been considered to be the transferors of information from agricultural institutions to farmer and technology from the researchers and in enforcing the adoption innovation by farmers although their exact role has evolved over time. In addition they also play a crucial role in transmitting information about credit institutions that provide credit to farmers. On average, 64% of the sampled farmers get extension services, with 73% and 62% of borrowers and non-borrowers receiving extension services respectively. These results indicate that non-borrowers of formal credit seemed to receive more extension services than their non-borrower counterparts.

4.2.7 Credit awareness

Credit awareness enables farmers to be educated on credit issues such as interest rates, credit requirements, period of repayment, application processes that improve

farmers' credit management ability, increase of the information base and decision making abilities of the farmer. In order to determine this variable, farmers where asked whether or not they were aware of formal agricultural credit institutions operating in their area. The results of the study as presented on table 3 above indicate that 90% of emerging farmers responded that they are were aware of formal agricultural credit operating in their area while only 10% responded that they were aware of formal agricultural credit. Overall, 90% borrowers of formal agricultural credit tended to be aware of formal agricultural institutions while 10% of non-borrowers were unaware.

4.2.8 Credit repayment record

Whether a farmer is eligible for additional formal credit would depend on whether he/she has any outstanding loan that is overdue (Spio, 2002). In order to determine this variable, farmers were asked whether or not they were able to repay the amount of the loan previously borrowed from financial institutions. On average, 76% responded that they were able to repay their loans while 34% responded that they were unable to repay. The results further indicated that 85% of borrowers of formal agricultural credit were able to repay their loans while only 15% of non-borrowers were able to repay. These results indicate that farmers with access to credit had good credit repayment record while those without access had bad credit repayment record or that they feared that they would be unable to meet repayment requirements.

4.2.9 Total Distance

Long distances travelled to financial institutions result in high transportation costs that affect the rural poor's access to formal financial services mainly located in urban areas. In order to determine this variable, farmers were asked how far their home was from the nearest formal lending institution, in hours. On average, it took farmers in the sample 45 minutes to travel to their nearest financial institutions, with borrowers taking 40 minutes and non-borrowers 50 minutes as shown on table 3 above. The results of the study indicate that there is little difference in the total

distance travelled by borrowers and non-borrowers. This is due to the fact that some borrowers and non-borrowers were from the same locality and travelled the same distance to the nearest lending institutions.

4.2.10 Level of interest rate

In order to determine this variable farmers were asked whether or not they would demand credit if the level of interest rate increases. Table 3 indicates that 31% of emerging farmers indicated that they would demand credit if the level of interest rate increased while 69% indicated that they would not demand credit if the level of interest rate increased. Overall, 64% of borrowers of formal agricultural credit indicated that they would demand credit while 76% of non-borrowers indicated that they would not demand credit.

4.2.11 Gender of the household head

The South African government has initiated women empowerment programmes to achieve gender equality and encourage women participation in agriculture and rural development. Figure 4 presents gender of the household head per credit status groups. The results indicate that 55% of male farmers had access to credit while 55% of females did not have access. Overall, a large number of male emerging farmers had access to formal agricultural credit compared to their female counterparts.

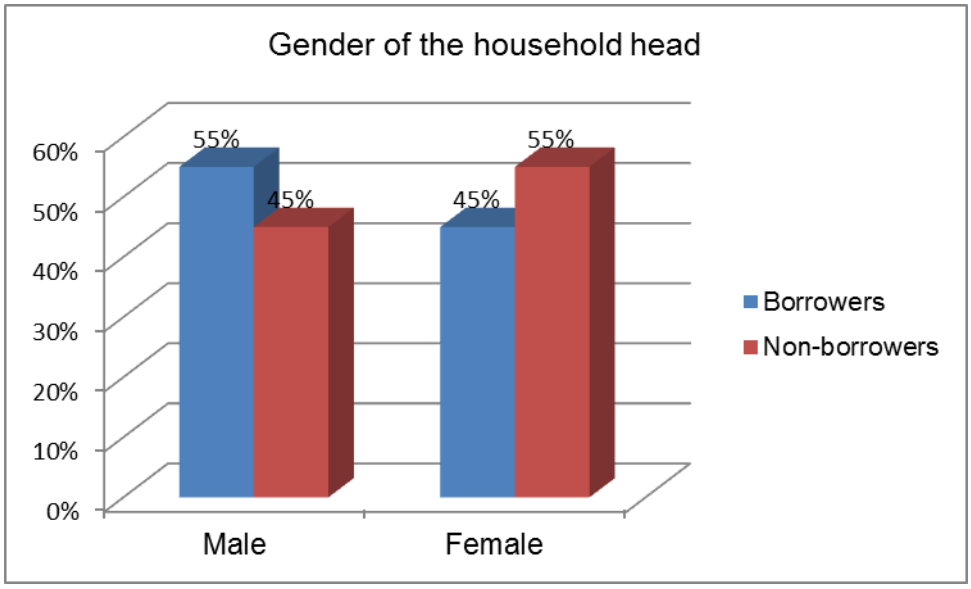


Figure 4: Gender of the household head

4.2.12 Level of education of the household head

Level of education variable was divided into four categories, namely, emerging farmers who never went to school, the ones who completed secondary, ABET and tertiary education. Figure 5 below, shows the average level of education of the household head per credit access status groups. The results show that 32% of emerging farmers never went to school, 50% completed primary education, 10% completed secondary education, 6% completed tertiary education and 2% completed ABET. Overall, borrowers had higher education level than their non-borrower counterparts.

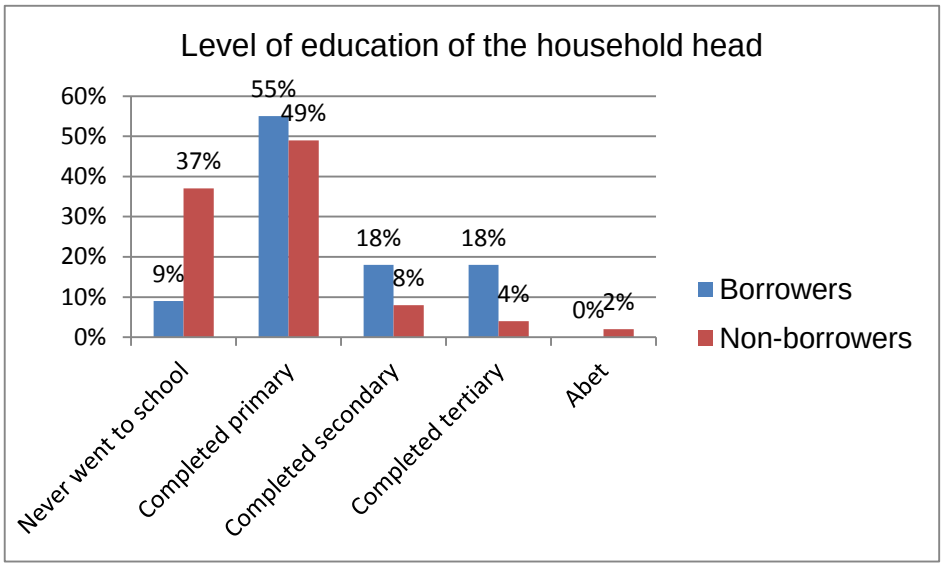


Figure 5: Level of education of the household head

4.2.13 Off-farm income

Off-farm income variable was divided into four categories, namely, off-farm income of less than R1 000 per month, off-farm income ranging from R1 000-R5 000 per month, off-farm income ranging from R5 000-R10 000 per month and off-farm income of more than R10 000 per month as presented in figure 6 below. The results show that 26% of emerging farmers had off-farm income of less than R1 000 per month, 69% of emerging farmers had off-farm income ranging from R1 000-R5 000 per month, 3% of emerging farmers had an off- farm income ranging from R5 000-R10 000, and 2% of emerging farmers had an off-farm income of more than R10 000 per month. Overall, borrowers had higher off-farm income than their non-borrowers counterparts.

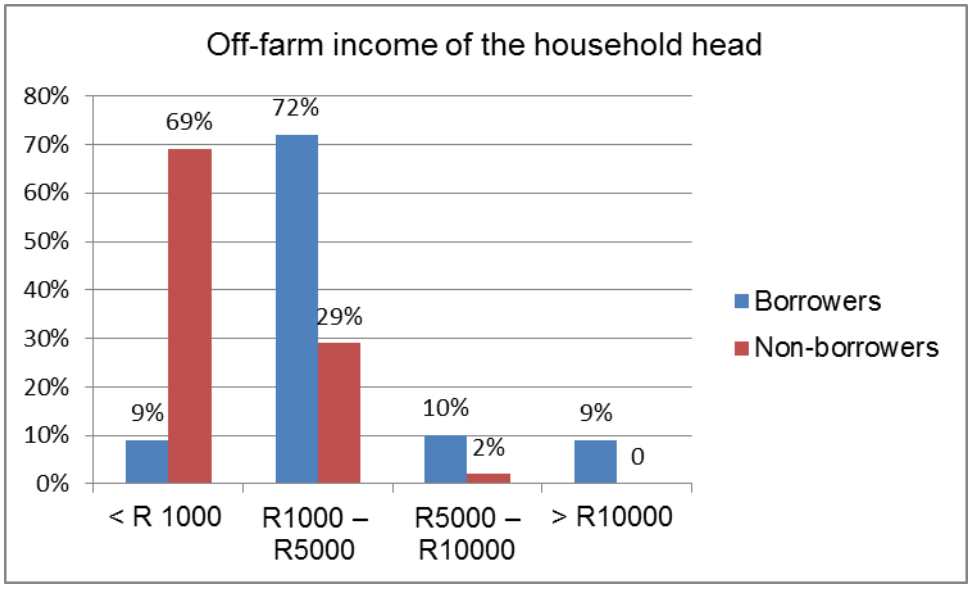


Figure 6: Off-farm income of the household head

4.2.14 Land ownership status

The land ownership variable was divided into four categories, namely; title deed, inherited land, communal and leased land and was used to indicate type of land ownership. Figure 7 below, shows the land ownership per credit access status. On average, 55% of the sampled farmers had title deeds, 18% used inherited land, 15% used leased land, and 12% used communal land. The results further indicated that 50% of borrowers had title deed while 45% of non-borrowers had the same ownership title. The results show that borrowers of formal agricultural credit owned land as evident by the presence of title deed.

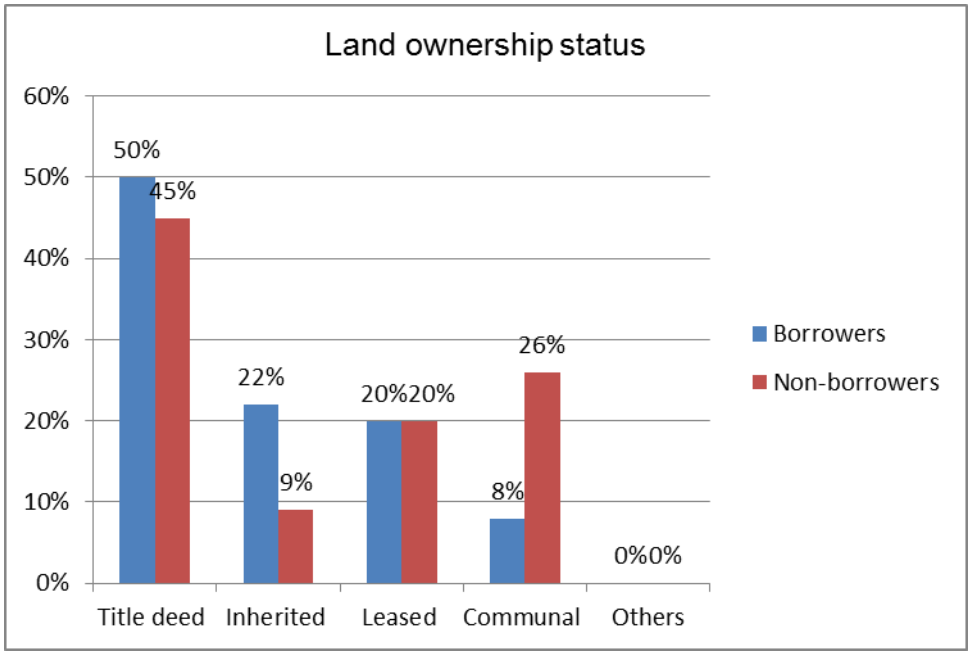


Figure 7: Land ownership status

CHAPTER 5: EMPIRICAL RESULTS

5.1 Probit regression results

This section presents the empirical results from probit regression analyses. The section specifically focuses on discussing the factors influencing credit access among emerging farmers. The main question had to do with establishing which specific variables influence emerging farmer to access credit. There are various economic, demographic, socio-economic, physical, institutional and communicational factors that limit emerging farmers to obtain credit from formal credit sources. In this study, it is argued that to assess all the factors influencing credit access of the individual farmer would be possible. However, only the variables which were considered as the most important influencing factors in the study area would be measured. The Probit regression analyses were used to explain the various factors that influence emerging farmers to have access to credit. The results are presented on Table 4 below.

Table 4: Binary Probit regression coefficients of factors influencing emerging farmers to access formal agricultural credit.

Variable	**Estimated coefficient**	**Standard error**	**t-ratios**	**Probability**
x_1	-0.007**	0.0407	-4.624	0.289
x_2	0.055	0.037	1.493	0.142
x_3	0.347*	0.629	0.230	0.840
x_4	-0.285*	0.118	-2.578	0.137
x_5	0.315*	0.746	0.421	0.674
x_6	0.625*	0.154	1.680	0.080
x_7	0.003	0.043	1.023	0.312
x_8	0.835**	0.438	1.143	0.735
x_9	0.001	0.147	1.380	0.174
x_{10}	0.312	0.742	0.420	0.674
x_{11}	0.028	0.033	0.845	0.380
x_{12}	0.771*	0.524	1.683	0.754
x_{13}	0.23	0.20	1.124	0.267
x_{14}	-0.109*	0.514	-2.126	0.390
Number of observations at one:			11	
Number of observations at zero			51	
Log likelihood			-22.0750	
Cases correctly predicted (%)			82.84	
** Significant at 10 %				
* Significant at 5%				

Source: Survey data (2011)

Overall, the model accurately predicted 82.84 per cent of the sample. A positive sign of the variable coefficient indicated that a higher value of the variable increased the likelihood of emerging farmers to access formal agricultural credit and vice versa. The results show that level of education of the household head, land ownership, size of the farm, off-farm income, and credit repayment record had a significant positive influence on the probability of accessing formal agricultural credit. Gender of the household head, total livestock of the household, credit awareness and farming experience had insignificant positive influence. This implies that targeting emerging farmers with high income, good credit record, large farm size and farmers who are educated and own land would most likely improve the probability of accessing credit and thus providing an opportunity for training of the uneducated farmers.

Conversely, age of the household head, family labour and level of interest rate had significant negative influence on the probability of accessing credit and whereas extension service had an insignificant negative influence. The implication for this is that chances of emerging farmers accessing credit decreases with age, family labour and the level of interest rate.

According to Battese (1984), probabilities are numbers associated with event of random experiments and are between zero and one. If for a given situation, probabilities do not fall between zero and one, therefore, the values are not true probabilities. The probabilities in table 4 are between the value of zero and one which indicate that all values are true probabilities.

5.1.1 Age of the household head

The age of the household head was statistically significant at 10% and was found to have a negative influence on the probability of accessing credit. The probability that age of the farmer would influence credit access was 0.289. This result indicates that if age of emerging farmers in the study area increases by 1, the likelihood of accessing formal agricultural credit would decrease by 0.29%. The negative sign of the coefficients implies that when the farmer's age increases, the probability of accessing formal agricultural credit decreases. The implication of negative influence of age on the probability of credit access is that aging farmers might be partly

unwilling to undergo long credit application processes which also indicate risk aversion of older farmers. The results of the study concur with Boehlje (1973); Ziemer and White, (1981) who indicated that younger farmers entering into farming have to purchase a "critical mass" of land, machinery, and equipment to establish a viable enterprise and as such the demand for credit increases.

5.1.2 Level of education of the household head

Level of education of household head was significant at 5% level and was found to have a positive influence on the probability of accessing credit from formal financial sources. The results also indicated that probability of accessing formal agricultural credit would increase with the level of education by 0.840. This implies that access to credit increases with the level of education of the farmer. Farmers who are educated have the ability to analyse costs and benefits of borrowing money and therefore are more likely to access credit than their uneducated counterparts. This assertion is supported by Musebe *et al*. (1993) who found out that as the household gets more formal education, the probability of obtaining credit increases. However, results from this study contradict with those of Sebopetjie and Belete (2009) which concluded that the chances of farmers taking credit decreases with the number of years of formal education as a highly educated farmer would have enough money to finance production requisites.

5.1.3 Family labour

Family labour was statistically significant at 5% and had a negative influence on the probability of accessing credit from formal agricultural sources. The results showed that the probability of accessing formal agricultural credit decreases with more family labourers by 0.380. This indicates that if family labourers were to be increased by 1%, the likelihood of accessing formal agricultural credit would decrease by 0.38%. The results also indicate that farmers who had large family members who assisted them in farming were less likely to borrow money as compared to families with fewer labourers. The implication for this is that more family labourers reduce the demand for hired labour while reducing the cost of hiring labour and in turn reducing the

demand for credit for labour payment. These results concur with those of Yehuala (2008), who indicated that the more the work force available for production purpose, the lesser the demand for credit.

5.1.4 Size of the farm

The size of a farm was statistically significant at 5% and had a positive influence on the probability of accessing credit. The probability of accessing credit from agricultural sources was 0.674 which indicates that if the size of the farm were to be increased by one hectare, emerging farmers' access to credit would increase by 0.84% holding other factors constant. The implication for this is that chances of emerging farmers accessing credit increases with the size of the farm. A study by Bagi (1983) confirms the results of the study that indicated that, the larger the farm size, the larger the amount of inputs needed to operate the farm and therefore, an operator of a relatively larger farm may use credit in order to purchase an adequate amount of inputs. Land is also the main collateral that emerging farmers can offer formal credit institutions and as such, the probability of emerging farmers accessing credit was influenced by the size of their farm.

5.1.5 Off-farm income

The results of the study indicate that off-farm income was statistically significant at 5% and had a positive influence on the probability of accessing formal agricultural credit. The results further indicate that probability of accessing formal agricultural credit was 0.13. This implies that if off-farm income were to be increased by 1%, chances that emerging farmers would access credit would increase by 0.13%. The positive sign implies that the probability of farmers accessing credit from formal agricultural sources increases with off-farm income. The implication for this is that off-farm income provides emerging farmers with sufficient financial needs and relatively stable flow of funds into the farm and thus put farmers in a better position to repay the loan requested.

5.1.6 Land ownership status

Land ownership was found to have a positive influence on the probability of accessing formal agricultural credit and had a statistical significance of 5%. The probability of accessing credit was 0.735 which implies that if the number of emerging farmers with tittle deeds were to be increased by 1%, the likelihood of emerging farmer access to credit would increase by 0.73% holding other variables constant. This also implies that farmers who own land were more likely to access credit compared with farmers that used inherited or leased land. Thus, land ownership increases the probability of accessing credit from formal agricultural sources.

The implication for this is that farmers with land ownership have a stronger incentive to make long run investment since their tenure is secured. Therefore, financial institutions find it easier to finance them because they have relatively higher collateral value to lenders and much higher probability of gaining benefits from such investments as opposed to their counterparts who use leased or inherited land. This assertion is supported by Spio (2002) who found out that farm ownership gives a farmer the freedom to produce on the land and is one of the factors that have an influence on access to credit and the amount of credit the farmer may receive.

5.1.7 Credit repayment record

Credit repayment record was found to have a positive influence on the probability of accessing credit and was statistically significant at 5%. The probability of accessing credit with respect to a good credit record was 0.674. This result implies that if the number of emerging farmers with good credit record increases by 1%, chances of emerging farmers to access credit would increase by 0.67%. The result also implies that, the chance of emerging farmers accessing credit increases with a good credit repayment record and that whether or not a farmer is credit worthy would depend on his or her ability to repay the amount of money previously borrowed from formal financial sources.

5.1.8 Level of interest rate

The level of interest rate was found to have a negative influence on the probability of accessing formal agricultural credit and had 5% level of statistical significance. The probability of accessing credit with respect to the level of interest rate was 0.174. This implies that if the level of interest rate was to be increased by 1%, emerging farmer access to credit would decrease by 0.17%. The implication for this is that chance of emerging farmers accessing credit decreases with an increase in the level of interest rate. This finding concurs with the study by Atieno (2001) who asserted that, as the interest rate increases, the level of risk of those who borrow also increases. Therefore, when the level of interest rate increases, the probability of emerging farmers accessing credit from formal sources decreases.

5.2 Cobb-Douglas regression results

This section presents empirical results of differential technical efficiency levels of emerging maize farmers. The study was to compare technical efficiency level of emerging maize and green beans farmers with and without access to formal agricultural credit. As a result, Cobb Douglas analyses were run separately for borrowers and non-borrowers of credit and then a comparison was made. The results are presented on Table 5 below.

Table 5: Production function estimates by credit status group

Emerging farmers	Constant	Land (Ha)	Labour (Man/days)	Capital (R)	Fertiliser (Kg)	Pesticides (R)	Seed (Kg)	Irrigation water	Sum of b's	Adjusted R^2
Borrowers: Maize	0.686** [0.481] (1.822)	0.836** [0.35] (1.82)	0.425** [0.11] (0.75)	0.693** [0.491] (1.798)	0.748** [0.392] (1.843)	0.465 [0.204] 2.2.83	-0.156* [0.746] (0.195)	-0.039 [0.15] -(0.203)	3.658	0.72
Non-Borrowers: Maize	0.145* [0.543] (0.332)	0.726** [0.489] (0.536)	0.435* [0.12] (1.76)	-0.453* [0.243] -(0.278)	-0.165 [0.791] -(0.195)	0.023 [0.020] (1.124)	-0.128* [0.22] (0.163)	-0.07 [0.09] -(0.77)	0.513	0.452
Borrowers: Green beans	0.628** [0.358] (1.688)	0.589** [0.32] (1.36)	0.513** [0.22] (1.58)	0.566** [0.292] (1.601)	0.806** [0.496] (1.899)	0.691** [0.452] (1.826	0.638** [0.389] (1.762	-0.462 [0.15] -(4.890)	3.969	0.78
Non-Borrowers: Green beans	0.576* [0.199] (1.455)	0.498** [0.19] (1.87)	0.425* [0.21] (1.48)	-0.499* [0.255] -(1.221)	-(0.098)* [0.84] -(0.056)	-0.134* [0.031] 44.367	0.521** [0.123] (1.674)	-0.366* [0.036] -(3.056)	0.923	0.64

Source: Survey data (2011)

Figures in brackets [ ] are the standard error of estimates

Figures in the parenthesis ( ) are the t-ratios of the coefficient

** Significant at 10%

* Significant at 5%

Table 5 shows the estimation of the four production function and resulted in the adjusted R^2 values of between 0.45 and 0.78. This implies that inputs used in the model were able to explain between 45% and 78% of the variation in maize and green beans production respectively by borrowers and non-borrowers of agricultural credit while the other percentage is due to other factors that were not considered in the study. The adjusted R^2 for maize was found to be relatively lower than that of green beans farmers. The reason for this is that irrigated land variables were found to be insignificant for maize farmers. The insignificance of irrigated land input was due to the fact that farmers in the study area usually cultivate maize under dry land conditions.

5.3 Elasticities of production

According to Truran and Fox (1979), an elasticity of production co-efficient for an individual input indicates the percentage increase or decrease in output that would result if the particular input is increased or decreased by one percent, holding all other inputs constant. The results of the study revealed that the output elasticities of land, fertiliser, labour, seed, pesticides and irrigated land were significant. However, the results indicated that, only land and labour inputs were positive for both maize and green beans borrowers and non-borrowers. Pesticides and irrigated land inputs were not significant for both borrowers and non-borrowers producing maize. In addition, capital and fertiliser inputs were found to be positive for borrowers and negative for non-borrowers. Seed was negative for maize borrowers and non-borrowers but was positive for green beans borrowers and non-borrowers.

5.3.1 Land

Land is a very important resource in both subsistence and smallholder farming. However, it is the arable land rather than the land itself that hinders crop production and efficiency (Iheanacho, 2001). Since output of farmers operating on more land might be more than that of farmers operating on little land, only one hectare of land was considered. The results of the study revealed that, the estimated coefficient for both borrowers and non-borrowers of credit were statistically significant at 10% and positive. The implication for this was that, if emerging farmers in the sample were able to expand their farm size with one hectare of arable land, then the total output for green beans and maize would have an estimate increase from 49% to 83% for both borrowers and non-borrowers.

5.3.2 Labour

Labour is the second most important resource after land in the small-scale farm sector since it is where man power in the production process resides (Upton, 1987; Nwaru and Ekumakama, 1999). The elasticities of output with respect to labour input were found to be positive and statistically significant at 10% and 5% for borrowers and non-borrowers respectively. This implied that one percent increase in labour would result in an increased total output. This indicates that labour is critical in the production of maize and green beans production for both borrowers and non-borrowers. Since labour input includes both family and hired labour, it could be deduced that credit enabled borrowers to hire labour while their non-borrowers counterparts relied more on family labour.

5.3.3 Capital

Cost of tractor (per hectare) was used as a proxy for capital. The estimated coefficient for capital was found to be statistically significant at 10% and positive for borrowers and statistically significant at 5% but negative for non-borrowers. The results also indicate that, the elasticity of output with respect to capital was the largest for maize borrowers with a value of 0.69. This indicates that if the amount of

money spent on capital were to be increased by 1%, the total production of maize would have an estimate of 0.69%, holding other factors constant.

The implication for this is that, as more capital is used in the production of maize, output would increase. This further indicates that, credit would have assisted borrowers to pay for cost of tractors. Thus capital is an important factor that can increase farm output. As indicated by Bonti-Ankomah and Mhlambo (2000), maize production is highly capital intensive and due to rising inputs cost, farmers increasingly become tied to credit, input suppliers and marketing agents.

5.3.4 Fertilizer

Fertilizer is a major and common soil augmenting input in the sense that it improves productivity by increasing crop yields per hectare (Nwaru *et al.* 2006). It plays an important role in increasing crop productivity since it increases crop yield without cultivating more land. Fertiliser was found to be statistically significant and positive for borrowers and statically significant but negative for non-borrowers. The elasticity for fertilizer was the largest for green beans borrowers, with a value of 0.80. This indicates that if the amount of money spends on fertilizer was to be increased by one percent; the total production of green beans would increase by 0.80% holding other factors constant.

The implication for this is that, the use of more fertilizer in the production process would lead to an increase in output. This perhaps indicates that access to credit could assist emerging farmers to acquire fertilizer needed in the production process. The results of the study is supported by Nwaru *et al*. (2006), who indicated that credit use helps farmers to participate more actively in the farm inputs market and as more farm inputs are used, output of arable crops increases.

5.3.5 Pesticides

Pesticides are used for spraying crops in order to enhance crop output. In this study, the cost of pesticides was used and measured in Rands. Pesticides input were found to be statistically significant at 10% and positive for green beans borrowers and

statistically significant at 5% but negative for non-borrowers. The results also revealed that pesticides input were not significant for both borrowers and non-borrowers of maize farmers. The non-significance of pesticides indicates the fact that farmers in the sample did not use pesticides to spray maize.

The elasticity for pesticides was the largest for green beans borrowers, with a value of 0.69. This implies that if the amount of money spent on pesticides were to be increased by one percent, then the total green beans production would have an estimate increase of 0.69%, holding all other factors constant. This further indicates that access to credit could have assisted borrowers to purchase pesticides for spraying green beans to enhance output.

5.3.6 Seed

Certified seeds and home produced or recycled seeds were considered in the study and measured in kilograms. The results indicated that the estimated coefficient for seed was found to be negative at 5% for both borrowers and non-borrowers producing maize but positive at 10% for both borrowers and non-borrowers producing green beans. The negative elasticity estimate for seed implies that as the quantity of seed used by the sampled farmers increases, output tends to decrease. These results are in accordance with the fact that farmers in the study area usually did not buy maize seed but use recycled seed and as such they tend to over-utilize the seed input. On the other hand, they did not recycle green beans seed but bought it from inputs suppliers. The results also indicated that the elasticity of production for green beans is higher among borrowers with a value of 0.63 than 0.52 values of their non-borrower counterparts.

5.3.7 Irrigation water

Irrigated land was used as a proxy for irrigation water. Irrigated land refers to the land under irrigation for production of both maize and green beans and was measured in hectares. The irrigation water was not significant for both borrowers and non-borrowers maize producers and was found to be negative but statistically significant for both borrowers and non-borrowers producing green beans. The non-

significant result for maize is true since farmers in the sample produce maize under dry land condition. The negative elasticity of estimates for irrigation water implies that as more and more hectares of land is being irrigated, output tends to decline. These results are in accordance with the fact that majority of farmers in the sample size share water from the irrigation schemes. As such, they tend to compete amongst each other for water, resulting in over-utilization of water.

5.4 Returns to scale

Returns to scale for each borrower and non-borrower were calculated by adding up the coefficient for elasticity of each group. The sum was then used as an indicator of whether or not farmers exhibit constant, decreasing or increasing returns to scale. According to Cornia (1985), as quoted by Mushunje and Belete (2001), constant returns to scale are assumed to occur when the sum of the coefficient falls within the interval 0,95 to 1,05 and below 0,95 or above 1,05 for decreasing and increasing returns to scale respectively.

The results on Table 5 indicate that maize and green beans borrowers exhibit an increasing returns to scale with value of 3.658 and 3.969 respectively. This indicates efficiency as they are producing more output using fewer inputs. These results are not surprising since borrowers would like to maximise profit by producing more at low cost and be able to pay the amount of money borrowed. It is also noted that the returns to scale of green beans borrowers was relatively higher than that of maize borrowers. The reason for this might be due to the fact that green beans farmers in the sample size were more profit oriented than maize farmers, that is; green beans farmers produce for income generation or commercial purpose while maize farmers tended to produce for subsistence purposes and sold only a small part of their produce.

Maize non-borrowers exhibited decreasing returns to scale (0.513). The results are in accordance with the fact that farmers in the study area produce maize for subsistence purposes and only sold surplus maize whereas non-borrowers usually did not apply fertilizer, pesticides and only plant maize under dry land conditions.

Non-borrowers producing green beans exhibited a decreasing return to scale (0.923). This indicated inefficiency in production since they were producing less output. The implication for this is that, non-borrowers might not have had enough funds to purchase fertilizer and pesticides, which are crucial in green beans production. As a result they were under-utilising this resources with the assumption that they could maximize output.

5.5 Technical efficiency analysis

According to LIewelyn and William (1996), in economic returns, technical inefficiency refers to failure or inability to operate on the production frontier and generally is assumed to reflect inefficiency caused by timing and method of application of production inputs.

A number of studies have employed different analytical techniques in an attempt to measure technical efficiency. These vary from the use of mathematical programming methods to use of stochastic production frontiers. Aigner *et al*. (1977*);* Meesusen and Van den Broeck (1977) proposed stochastic frontier modeling, which is a deterministic measure of efficiency. Other researchers such Panda (1996); Bagi and Huagi (1983) adopted Greene‘s use of the correlated least square (COLS) method of estimating the frontier production.

Since the aim of the study was to compare technical efficiency levels of borrowers and non-borrowers of agricultural credit, the study employed Saleem’s (1988) approach. This method was developed by Lau-Yotopoulos. The method uses Cobb-Douglas production function which is specific to have variables and one fixed input.

From the Cobb-Douglas function $Y= AL^{\alpha}K^{\beta}$, A (intercept) indicates the technology of the group that generated the observation upon which the parameters of the function were to be estimated. The higher value of the intercept, the more positively it affects the yield. As a result, the farm with higher intercept value is more technically efficient.

The Cobb- Douglas production function is specified to have a set of variable inputs and a set of fixed inputs. Since, in this study two credit status groups were considered, that is; borrowers and non-borrowers. Borrowers were denoted by superscript 1 and non-borrowers where denoted by superscript 2.

The following production functions are developed:

$Y^1 = A^1F(X^1, Z^1)$ and $Y^2 = A^2 F(X^2, Z^2)$

Where:

Y^1, Y^2	is the output of maize and green beans respectively.
A	is a constant, the technical efficiency parameter which incorporates other factors such as managerial capacity and environmental factors.
F	is the (same) functional relationship between inputs and outputs.
X	is the set of variable inputs.
Z	is the set of fixed inputs.
1, 2	are superscripts denoting the borrowers and non-borrowers respectively.

As a result, relative technical efficiency measure for the study is thus shown by the intercept in the model. The technical efficiency estimates of borrowers and non-borrowers were derived, summarised and presented on the table below.

Table 6: Relative technical efficiencies of borrowers and non-borrowers

Credit status group	**Maize production**	**Green beans production**
Borrowers	6.776	9.843
Non-borrowers	2.892	3.567

Source: Survey data (2011).

The results of the study revealed that the level of technical efficiencies varies widely; being 9.843 for green beans borrowers of formal agricultural credit farmers and 2.892 for maize non-borrowers of formal agricultural credit. The results also revealed that technical efficiency levels of borrowers and non-borrowers was too wide and

that technical efficiency level of green beans and maize borrowers was significantly higher than those of their non-borrower counterparts.

From the results, it is clear that the technical efficiency level of borrowers of formal agricultural credit was significantly higher than those of non-borrowers. This indicates that borrowers of formal agricultural credit were more technically efficient than their non-borrowers counterparts. The implication for this is that, the odds of emerging farmers being efficient increases with credit access. The results of the study is consistent with those of Nwaru *et al*. (2006) who found out that the mean technical efficiency of 10 best performing credit-using farmers was significantly higher than those of 10 best performing non-credit using farmers.

These results should however not be overstated due to the fact that there are other factors that explain technical efficiency but were not considered due to the scope of the study. All unexplained factors which were not considered in the study might also contribute to measured inefficiency. It should also be noted that there are number of crops that emerging farmers in the study area produce, but only maize and green beans were looked at. If the value of all crops had been pooled together for estimation, different values of technical efficiency might have been observed.

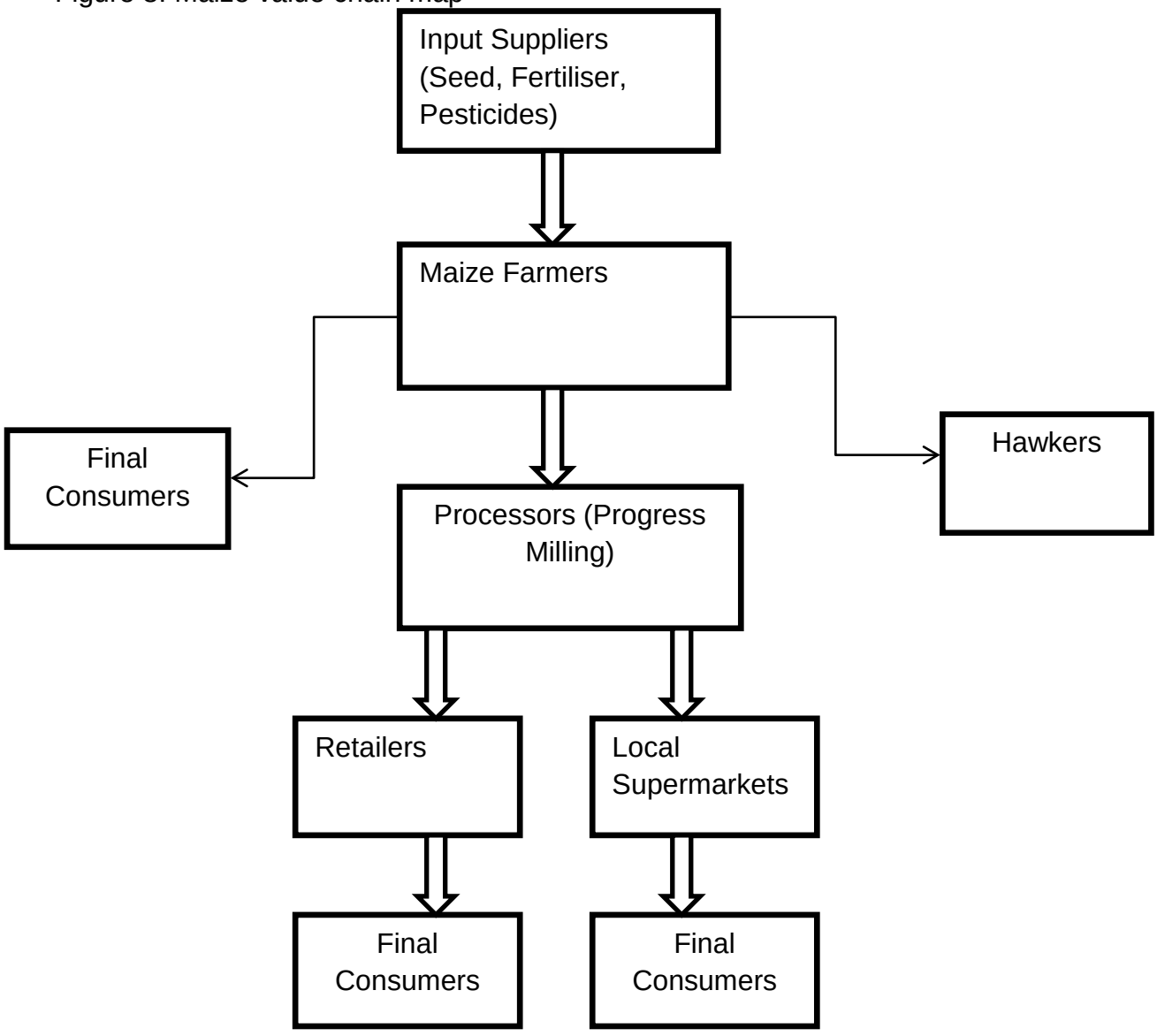
Despite the above, this results of the study is further supported by Desai and Mellor (1993) and Nwagbo (1989) who stated that farm level credit when used properly encourages agricultural diversification which stabilises and increases resource productivity, agricultural production, value added, net farm income. Therefore, credit facilitates adoption of innovation in farming, encourage capital formation and market efficiency.

It is interesting to observe higher technical efficiency in green beans production. The implication for this is that green beans producers were relatively more technically efficient than maize producers. This is due to the fact that emerging farmers in the study area generally produced green beans for income generation and produced maize for home consumption and only sold surplus maize.

5.6 Value chain results for maize and green beans

Through interviews, the study was able to map the value chain for maize and green beans in Maruleng Municipality as shown in Figure 3 and 4 below. The value chain shows the current maize and green beans value chain system and the different role players therein. All of the players who fulfill specific functions are shown in the map, with lines and arrows to demonstrate the linkages and relationships thereof. At the bottom of the map are the final product markets, that is; final consumers. One of the main questions that a value chain map can help answer is how products move along supply chains and flow through various channels to final consumers.

Figure 8: Maize value chain map



Source: Survey data (2011)

Figure 3 shows the different food value chain system for maize in Maruleng Municipality. Emerging farmers in Maruleng municipality produce maize during the summer period primarily for home consumption. However, it should be noted that if the farmers manage to produce surplus, they try to dispose the surplus product through different marketing channels or exchange maize for maize meal with processors.

Maize producers

Emerging farmers in Maruleng Municipality farm on relatively small land size and family members are usually the main source of labour for their farms. They usually use family labourers during off-peak season and employ few temporary labourers during peak seasons.

Traders

Traders in the study area were local individuals who acted as middlemen between the emerging farmers and local villagers. These traders purchase maize directly from the farmers. In this channel traders are able to obtain maize at relatively low prices, and avoid paying the brokerage fee. This channel is commonly used by local individual traders because they are familiar with the emerging farmers in the area.

Transporters

Transportation is a very important logistics issue for farmers since they need to carry their produce from the farm gate to different markets or to their home for household consumption. Emerging farmers in Maruleng Municipality hire transport from local transporters to carry their produce from the farm to designed markets. However, farmers with transport do transportation by themselves and thus lowering the cost of transportation that could have otherwise been charged. Those who use contract farming often do not incur transport since the buyers come directly to the farm depending on the terms of contract. Other farmers use collective transport in the case where common markets are used, especially those in Communal Property Associations (CPA's) or in the same neighbourhood.

Processors

Processors buy maize form producers and convert it to either maize-meal for human consumption, for animal feed or for maize starch. After conversion, maize meal is then graded and packaged into different forms for example 5 kg, 10 kg, 25 kg, 50 kg & 80 kg). Since farmers do not sell all of their maize, they sometimes exchange maize for maize meal with processors at an agreed price.

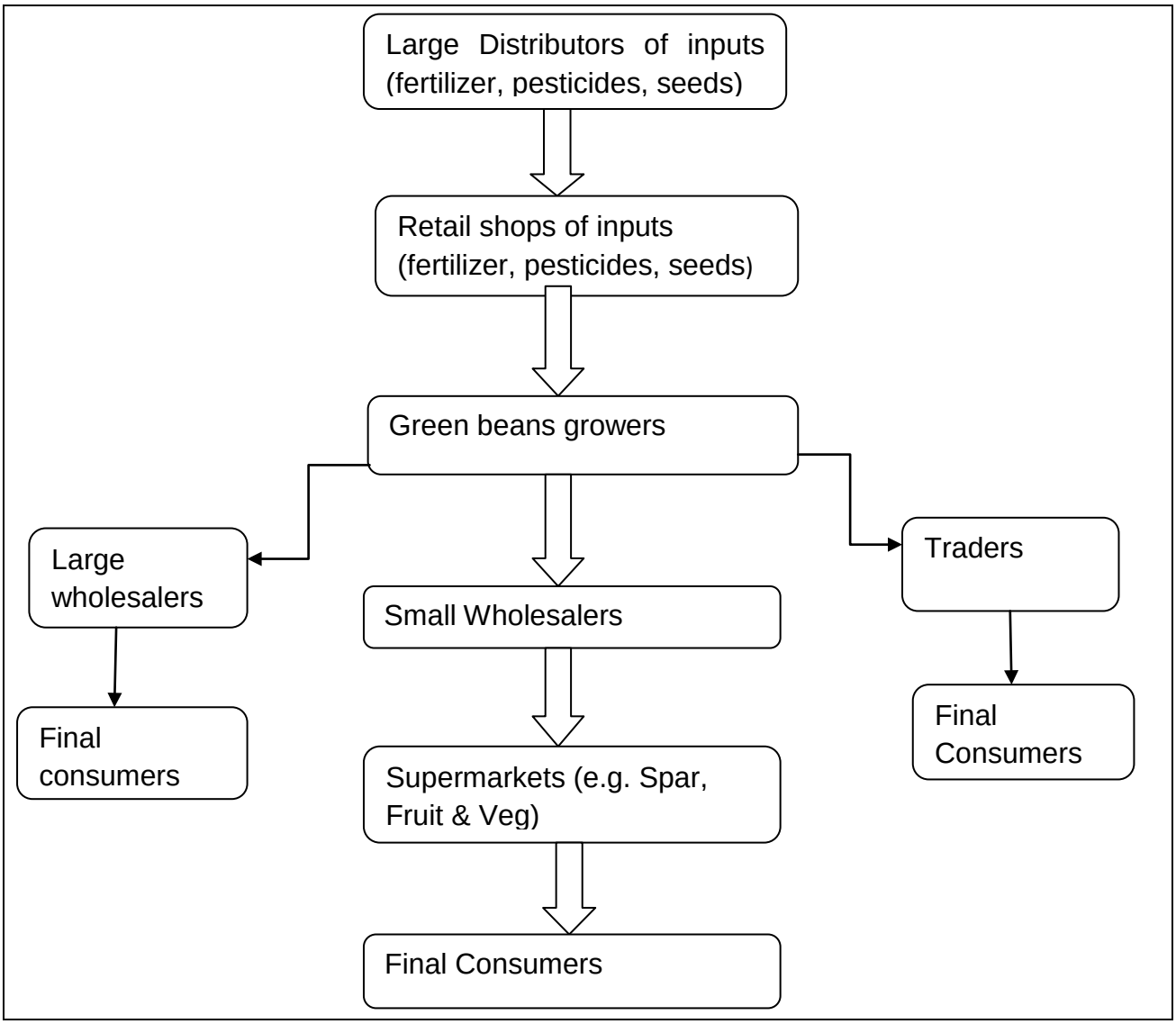
Retailers

Retailers include retail shops such as Pick n Pay, Spar, Shoprite and other retail shops that either buy maize from processors or sell directly to households or final consumers. In this case, the role of retailers is to pack and store maize meal before it is purchased by consumers for household use.

Local supermarkets

Local supermarkets in the study area operate in local villages. This channel is commonly used because of its proximity to the final consumers. The role of local supermarkets in this channel is similar to that of retailers. The final consumers are able to obtain maize meal at relatively low prices since they do not incur transport cost compared to purchases made from retailers who operate in the nearest town.

Figure 9: Green beans value chain map



Source: Survey data (2011)

Figure 4, shows the different food value chain system for green beans in the study area. In Maruleng Municipality, emerging farmers rely primarily upon the irregular income from the sale of a few staple crops such as green beans. This does not mean that emerging farmers do not consume green beans. With respect to marketing, the small green beans growers sell their product to retail trade kiosks, road side stalls, small wholesalers, and to different forms of informal markets. Small green beans growers have little chance to sell green beans directly to large wholesalers, distributors and major exporters. In addition, collective marketing could play a very important role in establishing a link between small scale green beans growers and large wholesale exporters or large distributors.

Green beans growers

Emerging farmers in Maruleng Municipality grow green beans on relatively small sizes of land and rely on this crop for additional income. Due to the fact that emerging farmers in Maruleng produce maize during the summer season, they also grow green beans widely in winter as a means of diversifying their agricultural production and income. Emerging farmers hire labour in addition to family labour or as a result of limited family labour. Additional labourers for green beans production is often required during cultivation and hoeing periods, and is done primarily to keep down and destroy weed. Given appropriate government support these growers could improve their productivity and increase incomes.

Small wholesalers

Small wholesalers usually possess their own transport vehicles and are the major buyers at the farm level as the source of the largest volumes arriving in wholesale markets. These small traders have no fixed warehouses or depots, and are often based in major urban centres. The principal marketing function for the small wholesalers is to serve as the main locus for assembly and transport of the crops from the farm level to the wholesale markets. However, they are sometimes in competition with farmers who may perform the same function if they have access to transport.

Large wholesalers

Large wholesalers are generally registered businesses that have a fixed warehouse in wholesale markets. These actors buy exportable agricultural products from small, medium and large farmers and use their own transport vehicles, generally trucks, with a capacity of over 5 tons. These actors could be small or medium enterprises. It is possible that these actors may have other activities (for example agribusiness, construction, real estate) as sources of income. They usually sell agricultural products to distributors in the wholesale market or sometimes to processors and retailers.

Small retail traders

Emerging farmers also sell their green beans to traders who then sell directly to final consumers for the edible markets. These traders buy agricultural products from different sources and earn a living out of this business. The quality of green beans is measured in terms of physical attributes such as spotlessness.

Retailers

This includes local supermarkets such as Spar, Fruit and Veg, and other supermarkets that buy either directly from the farmers or from the various role players. The role of supermarkets is to pack, store and help consumers to access food.

CHAPTER 6: SUMMARY, CONCLUSION AND RECOMMENDATIONS

6.1 Introduction

This chapter presents the main findings of the study and discusses the conclusion derived from the empirical results. The chapter specifically discusses the extent to which the hypotheses together with the research questions have been addressed through analysis. The chapter further suggests practical recommendations for policy makers to develop appropriate credit policy that will take into account the environment, socio-economic and challenges faced by emerging farmers. It also makes recommendations for strategies to increase emerging farmer participation in food value chains. In the end, the chapter further makes recommendations for future research.

6.2 Summary

The main aim of the study was to compare technical efficiency levels of emerging farmers with and without access to credit in Maruleng Municipality. The objectives of the study were to determine socio-economic characteristics and factors influencing emerging farmer access to formal agricultural credit, to compare technical efficiency levels of emerging maize and green beans farmers with and without access to credit and to map the current maize and green beans value chains in Maruleng Municipality.

The following hypotheses were stated;

Hypothesis 1- Socio-economic characteristics and factors do not influence emerging farmers to access formal agricultural credit in Maruleng Municipality. This hypothesis is therefore rejected since the Probit regression results indicated that level of education of the household head, land ownership, size of the farm, off-farm income, and credit repayment record have a significant positive influence on the probability of accessing formal agricultural credit. It was also observed that gender of the household head, total livestock of the household, credit awareness and farming

experience had insignificant positive influence on the probability of accessing formal agricultural credit.

Hypothesis 2- There is no difference in technical efficiency levels of emerging maize and green beans farmers with and without access to formal agricultural credit in Maruleng Municipality. This hypothesis is also rejected since the Cobb-Douglas regression results revealed that the level of technical efficiencies of emerging farmers vary widely, being 9.843 for green beans borrowers of formal agricultural credit farmers and 2.892 for maize non-borrowers of formal agricultural credit. The results further indicated that overall, technical efficiency level of green beans and maize borrowers was higher than their non-borrowers counterparts.

Hypothesis 3-An alternative maize and green bean food value chain in Maruleng Municipality for emerging farmers does not differ from conventional food value chains for these commodities in commercial settings. This hypothesis was also rejected, since the study revealed that an alternative food value chain had emerged that differed considerably to that of commercially derived food value chains for maize and green beans in Maruleng Municipality.

6.3 Conclusion

Probit regression results indicated that the level of education of the household head, land ownership, size of the farm, off-farm income and credit repayment record have a significant positive influence on the probability of accessing formal agricultural credit. In addition, it was noted that gender of the household head, total livestock of the household, credit awareness and farming experience had insignificant positive influence. This implies that targeting emerging farmers with high income, good credit record, large farm size and farmers who are educated and owns land would most likely improve the probability of accessing credit and thus provides an opportunity for training of the uneducated farmers.

Conversely, age of the household head, family labour and level of interest rate had a significant negative influence on the probability of accessing credit. Extension services had insignificant negative influence. The implication for this is that chances

of emerging farmers accessing credit decreases with age, family labour and the level of interest rate.

Cobb-Douglas results on relative technical efficiencies revealed that the level of technical efficiencies varied widely, being 9.843 for green beans borrowers of formal agricultural credit farmers and 2.892 for maize non-borrowers of formal agricultural credit. The results also revealed that technical efficiency levels of borrowers and non-borrowers was too wide and that technical efficiency level of green beans and maize borrowers was significantly higher than that of their non-borrower counterparts. These results suggest that the odds of emerging farmers being efficient increases with their credit access.

Cobb-Douglas regression results on elasticity of production indicated that, land, fertilizer, pesticides, labour and seed and irrigation water significantly influenced output. In addition, only land and labour inputs were positive for both maize and green beans borrowers and non-borrowers. These results suggest that an efficient use of this input would result in greater production of maize and green beans.

The coefficient elasticity of fertilizer and pesticides was found to be significant but negative for green beans non-borrowers. From these results, it could be deduced that non-borrowers were unable to purchase these inputs needed to enhance crop output and as a result their output was low.

6.4 Recommendations

Based on the empirical results of the study, policy recommendations regarding improvement of emerging farmers' access to formal agricultural credit are made. Based on the food value chains for maize and green beans, it is evident that Maruleng Municipality had a number of features that could be beneficial standing to investment. Therefore, the study made policy recommendations relating to encouragement of emerging farmers' participation in food value chains.

Reviewing existing credit programmes

The results of the study revealed that most of the emerging farmers in the study area do not have access to formal agricultural credit. The situation is likely to remain unchanged unless a decision is made to make agricultural credit available to emerging farmers. This also applies to other policy changes. The South African policy makers have to make a major assessment or critical review of credit programmes in order to improve emerging farmers' access to credit. This could be made possible by determining credit needs of emerging farmers. By determining this information, the government and other institutions could design credit programmes that are promptly responsive to the needs of emerging farmers.

The study suggests that existing agricultural credit programmes be reviewed to accommodate the needs of emerging farmers and should be refocused and be more youth friendly. Such policies should enhance education through sustained capacity building for farmers to improve their ability to read, analyse and interpret information. It is also recommended for agricultural credit institutions to offer special monitoring programme for emerging farmers and the interest rates charged be lowered and the turnaround time revised.

Encouraging collective action among emerging farmers

Evidence from the study showed that emerging farmers in the study area seldom sold their maize or green beans directly to distributors, large wholesalers, retailers, and major exporters. Collective marketing could play a very important role in establishing a link between small scale green beans growers and large wholesale exporters or large distributors. Acting collectively, emerging farmers would be better positioned to reduce transaction costs for their market exchanges, obtain necessary market information, secure access to new technologies, and tap into higher-value markets allowing them to compete more effectively with large farmers and agri-businesses.

Encouraging value chain relationships to create new opportunities for emerging farmers

For farmers who are new to agriculture (emerging farmers), surplus crop production typically occurs in small quantities. This limits the potential to market small quantities of surplus produced. There is a need to encourage value chain relationships that can create new market opportunities for these farmers to be involved food value chains. Typically, this could involve a value chain project that focuses on linking farmers with transporters, processors, wholesalers, retailers and final consumers and training farmers to pool would create more income and thereby encourage farmers to participate fully along in food chain.

Establishing a ware house receipt system

Access to storage facilities by emerging farmers usually reduces post-harvest loss. Therefore, there is a need to establish a warehouse receipt systems that would enable farmers to store and package crops (thereby adding value) as opposed to unwillingly selling their produce. Such system would support income smoothing and assist farmers to manage risk of high food crops during off-peak season.

Improving rural infrastructure

Inadequate infrastructure and incomplete markets in rural areas are often the reasons for high food prices. Poor road infrastructure may raise transport cost. In cases processing takes place outside Maruleng Municipality, food would then be brought back to the area at a high cost. Therefore, there is a need to upgrade and improve existing market infrastructure, and roads in the area to increase emerging farmers' participation along the food value chain. These projects should involve paving of roads to and from different farms to assist farmers or buyers to have access to the markets, thereby increasing farmer participation in food value chain.

6.5 Recommendations for future research

Due to time constraints and limited nature of the scope, the study used cross-sectional data from selected emerging farmers in Maruleng Municipality of Mopani District. It would be interesting if a similar study could be carried out across all five Districts of Limpopo to provide a broader overview of behavioural analysis in the Province. Although the study was conducted in relatively a smaller area, the results could be applicable to other emerging farmers with similar socio-economic characteristics. The opportunity exists for future researchers to determine the elasticity of the amount of loans requested with respect to farm output.

The importance of developing emerging farmers' knowledge with regard to interest rates was noted. Whilst the knowledge of emerging farmers with regard to interest rates may matter, their knowledge to dynamic change of credit environment may be as, or even more, important. It is on this basis that the study recommends that further research in the development of credit policy and institutional environment conducive for credit accessibility by emerging farmers be explored.

Credit access process involves two distinct stages; demand and supply side. The study looked only at the demand side of credit in which borrowers decided how much funds to apply for and from which financial institutions. Future studies could focus on the supply side of credit by finding out how credit institutions determine who accesses credit and at what amount.

This study only focused on the technical efficiency of the maize and green beans and as such, there are a number of directions in which the study could be extended. This includes analysing technical efficiency of all the crops of a farm business. In addition, the study focused on comparing technical efficiency of borrowers and non-borrowers of formal agricultural credit. A study which also focuses on comparing allocative efficiency would probably give more insight into the possibility of increasing efficiency levels by highlighting the direction of input use adjustment and efficient resource allocation.

However, the above could be possible by evaluating both technical and allocative efficiency using panel data across Maruleng Municipality to determine how technical efficiency levels had changed over time. An efficient allocation of resources could be attained through sound financial support structure, which must be properly regulated, supervised and controlled by appropriate institutions that are committed to serve the special needs of borrowers at sound interest rates.

Based on the food value chain maps for maize and green beans in Maruleng Municipality, it is recommended that future researchers focus on determining margin share for each of the role players in the food value chain. In addition, future researchers should also determine how much value is added at each stage of the food value chain.

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UNIVERSITY OF LIMPOPO

Turfloop Campus

Faculty of Science and Agriculture

School of Agricultural and Environmental Science

APPENDIX: QUESTIONNAIRE

Title: Comparative analysis of technical efficiency levels of emerging maize and green beans farmers with and without access to formal agricultural credit along food value chain in Maruleng Municipality, Limpopo province of South Africa.

Department of Agricultural Economics and Animal Production

University of Limpopo

Turfloop campus

Researcher: Mapula Hildah Lefophane

Name of Enumerator……

Date of interview ……

Name of municipality……

Name of Village……

Questionnaire no……

INTERVIEW CONSENT FORM

Agreement:

1. I agree to be interviewed for the purposes of the research project named above.
2. The purpose and nature of the interview has been explained to me.
3. I agree that the electronic interview may be recorded for research purposes.
4. Choose a), b) or c):

a). I agree that my name, and affiliation to _____ may be used for the purposes of the assignment only and not for publication.

OR

b). I understand that the researcher may wish to pursue publication at a later date and my name and affiliation to _____may be used.

OR

c) I do not wish my name to be used or cited, or my identity otherwise disclosed, in this research project or related articles.

Name of interviewee**……..**

Signature of interviewee**……..**

Date**……..**

SECTION A: SOCIO-ECONOMIC CHARACTERISTICS

1. Name (or pseudonym) of household head**……**

2. Age of the household head**……**

3. Gender of household head 1. **Male** 2**. Female** (Circle the right answer)

4. Level of education of household head

1	2	3	4	5
Never went to school	Completed primary school	Completed secondary school	Completed tertiary school (degree and above)	ABET

5. What is the main occupation of the household head?

1	2	3	4	5	6	7
Full time farmer	Part-time farmer	Government Employee	Employed-company	Pensioner	Unemployed	Self-employed

6. What is the source of income of the household head?

1	2	3	4	5	6
Salary	Farming	Pension	Grant	Remittance	Other

7. If other, please specify**……**

8. What is the income of the household head per month (In rands)?

1	2	3	4
<1000	1000-5000	5000-10000	>10000

SECTION B: DETAILS OF LABOUR

9. How many people live with you including head of household?

No	**Age group**	**Number**
1	Children <10 years	
2	Boys (10-17 years)	
3	Girls (10-17 years)	
4	Adults male(18 and above)	
5	Adult female (18 and above)	
TOTAL		

10. How many family members assist in farming?**.....**

11. Which of the following sources of labour have you used for your farming operation in the last 12 months?

1	2	3	4
Family labour	Hired labour	Friends and relatives	Other

12. If other, please specify**……..**

13. If hired indicates method of payment

1	2	3	4
Own cash	Credit	farm income	Other

14. If other please specify……

15. Did you face labour shortage during the year? 1. YES 2. NO (circle the right answer).

SECTION C: LAND HOLDING INFORMATION

16. Do you own land? 1. YES 2. NO (circle the right answer).

17. If yes, how far is your farm from your home (in hours)?**.....**

18. What is the size of your farm in hectares?**……**

19. What is your tenure status?

1	2	3	4	5	6
Own	Inherited	Leased	Share cropped in	Bought	Others

20. If other, please specify**……**

SECTION D: ANIMAL PRODUCTION INFORMATION

21. Livestock holding of the household during the last 12 months

Species	**Number owned**	**Number sold**
Cattle		
Goats		
Donkeys		
Chickens		
Sheep		
Pigs		
Others (specify)		
Total		

22. What was the purpose of the income from animals sold?

1	2	3	4	5
Purchase of farm inputs	Hiring labour	Household expenses(food, clothes etc)	For loan repayment	Other

23. If others, please specify**……**

SECTION E: EXTENSION INFORMATION

24. Do you get extension services? 1. YES 2. NO (**Circle the right answer). If NO, please skip to Q 29.**

25. If YES, for how long have you been getting the service? ____Years

26. Who provides the extension service?

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

27. If others please specify**……..**

28. How many times were you visited by extension officer in the last 12 months?**.....**

SECTION E: CREDIT ACCESS INFORMATION

29. Do you have access to formal agricultural credit? 1. YES 2. NO **(Circle the right answer). If NO, please skip to Q 39.**

30. If yes, what was the main purpose of borrowing?

1	2	3	4	5	6	7	8	
Purchase of farm fertilizer, seed, pesticides	Purchase of farm implements	Purchase of land	Payments of rented tractor	Purchase of livestock	Purchase household goods	Debt repayment	Education expenses	9

(Note: farm implements may include tractor, spade,……..etcetera.

31. If other, please specify**……**

32. What is your source of credit?

1	**2**	**3**	**4**	**5**	**6**	**7**
Commercial banks	Government	Money lender	Relative or friend	Neighbour	Cooperatives	Other, specify

33. If others please specify**……**

34. How much did you borrow in Rands?**.....**

35. Was the amount borrowed sufficient? 1. YES 2.NO **(circle the right answer).**

36. For how many years did you use credit?**.....**

37. Were you able to repay the loan? 1. YES 2.NO **(Circle the right answer)**

38. If no, what was the reason for non-payment?

……
……
……

39. How far is your home from the nearest lending institution? In hours**……..**

40. In your view, is borrowing from formal financial sources risky? 1. YES 2. NO **(Circle the right answer)**

41. What is your view on the constraints and difficulties to access credit from the formal financial services sources?

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

42. Will you demand credit if the level interest rate increases? 1. YES 2. NO **(Circle right answer)**

SECTION F: CROP PRODUCTION INFORMATION

43. How long have you been involved in crop farming (years)?**.....**

44. What kinds or variety of crops do you produce currently?

1	2	3	4	5	6	7
Maize	Tomatoes	Green beans	Cabbages	Butternut	Chillies	Spinach
8	9	10				
Mangoes	Citrus	Other				

45. If other, please specify**……**

46. How many hectares do you use to produce crops?

……

47. What was the motive for crop production?

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

48. If other, please specify**……**

Maize Production only

49. How many hectares do you use to produce maize?.**.....**

50. How many kilograms (kg) of maize do you normally produce per hectare?**.....**

51. Do you hire labour for maize production? 1. YES 2. NO **(Circle the right answer). If NO, please skip to Q55.**

52. If YES, how many labourers do you normally hire?**……**

53. How much do you pay them per month?.**.....**

54. How many bags of maize did one labourer harvest per year?**.....**

55. Do you normally hire a tractor for maize production? 1. YES 2. NO **(circle the right answer). If NO, skip to Question 58.**

56. If YES, how much does it cost per ha?**.....**

57. If NO, how do you compensate for the tractor**?.....**

58. Do you apply fertilizer for maize production? 1. YES 2. NO **(circle the right answer). If NO, please skip to Q 62.**

59. If YES, how many kg do you apply per ha?**.....**

60. How much do you spend on fertiliser?**.....**

61. If no, how do you compensate for the fertilizer?**.....**

62. Do you normally use any type of pesticides for maize production? 1. YES 2. NO **(circle the right answer). If NO, please skip to Q 65.**

63. If YES, how much does it cost per ha?**.....**

64**.** If NO, do you compensate for the pesticides?**.....**

65. How many kilograms of seed do you normally use per hectare of maize?**.....**

66. Do you purchase hybrid seed? 1. YES 2. NO **(circle the right answer). If NO, please skip to Q 68.**

67. If YES, how much does it cost per kg?**.....**

Green beans production only

68. How many hectares do you use to produce green beans?**.....**

69. How many kilograms of green beans do you normally produce per hectare?**.....**

70. Do you hire labour for green beans production? 1. YES 2.NO **(Circle right the answer). If NO, please skip to Q 74.**

71. If YES, how many labours do you normally hire?**……**

72. How much do you pay them per month (in rands)?**.....**

73. How many bags of green beans did one labourer harvest per year?**.....**

74. Do you normally hire a tractor for green beans? 1. YES 2. NO **(circle the right answer). If NO, skip to Q 77.**

75. If Yes, how much does it cost per ha?**.....**

76. If NO, how do you compensate for the tractor?**.....**

77. Do you apply fertilizer for green beans? 1. YES 2. NO **(circle the right answer). If NO, please skip to Q 81.**

78. If YES, how many kilograms do you apply per hectare?**.....**

79. How much do you spend on fertiliser (in rands)?**.....**

80. If no, how do you compensate for the fertilizer?**.....**

81. Do you normally use any type of pesticides for green beans production? 1. YES 2. NO **(circle the right answer). If NO, please skip to Q 84.**

82. If YES, how much does it cost per ha?**.....**

83**.** If NO, do you compensate for the pesticides?**.....**

84. How many kilograms of seed do you normally use per hectare of green beans?

……..

85. Do you purchase hybrid seed? 1. YES 2. NO (circle the right answer). **If NO, please skip to Q 86.**

86. What problems do you have with crop production in the area?

……
……
……
……

SECTION G: WATER USE INFORMATION

87. What is your main source of water for crop irrigation?

1	2	3	4	5	6
River	Dams	Taps	Boreholes	Rain	other

88. If other, please specify**……**

89. How many hectares of crops are under irrigation?

Maize	Green beans

90. How much water do you use to irrigate one hectare of crops in litres?**.....**

91. Do you produce more crops with less water?**……..**

92. Does water affect your productivity as a farmer?**……**

93. If you had more water what would you do with it?

1	2	3	4	5
Plant more crops	Store it for future use	Use more of it	Use it like before	Other

94. If other, please specify**……**

SECTION G: VALUE CHAIN INFORMATION

95. Where do you sell your produce?

1	2	3	4	5	6	6	7	8	9
Hawkers	Factory	Wholesaler	Middlemen	Retailer	Local supermarket	Directly to final consumers	International market	Traders	Other
10	11	12	13	14					
Small retailers traders	Larger retailers	Small wholesalers	Larger wholesalers	Supermarket					

NB: More than one answer is possible.

96. If other, please specify**……**

97. How do you sell your produce?

1	2	3	4
Contract	Salesmen	Buyers coming by themselves	Other

98. If others, please specify**……**

99. Who transports the products from the farm to the final destination?

1	2	3	4	5	6
Processor	Transporter	Self-transport	Buyer transport for themselves	Co-operate/collective transport	Other

100. If other, please specify**……**

101. In case of surplus, what do you do with the products?

1	2	3	4	5
Store	Sell at low price	Dump	Give-away	Others

102. If others, please specify**……**

103. Is there any government driven agricultural project in your area that helps farmers in the production and marketing of products? 1. YES 2. NO. **(Circle the right answer).**

104. If YES, what is the name of the project?**.....**

105. When was it formed?**.....**

106. How did the project help you in marketing your products?

……

……

……

……

THE END

Thank you very much for your patience, time and effort in answering this questionnaire.