DETERMINANTS OF PRODUCTIVITY AND MARKET ACCESS OF SMALLHOLDER VEGETABLE FARMERS: A CASE STUDY OF SPINACH PRODUCERS IN POLOKWANE LOCAL MUNICIPALITY, LIMPOPO PROVINCE, SOUTH AFRICA

BY

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DECLARATION

I, Mashaphu Lepharo Solly, declare that the mini-dissertation entitled **"Determinants of productivity and market access of smallholder vegetable farmers: A case study of spinach producers in Polokwane Local Municipality, Limpopo Province, South Africa"**, hereby submitted to the University of Limpopo, for the degree of Master of Science in Agriculture (Agricultural Economics) is my own work in design and execution, that this work has not previously been submitted by me for the degree at this or any other university and that all material contained herein has been duly acknowledged.

Mashaphu LS _____ 29/04/2022

Surname, Initials (title) **Date**

DEDICATION

This dissertation is dedicated to my late grandmother, Mapula Mmina Mashaphu; my late mother, Motanti Julia Mashaphu and my entire family. To my late grandmother and mother, you will always be remembered.

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ABSTRACT

Spinach (*Spinacia oleracea)* is an important cash crop, which remains one of the largest sources of income and a way of sustaining livelihoods for rural households in South Africa. Smallholder farming in most rural areas of the Limpopo Province contributes to food security. However, the majority of smallholder farmers experience low agricultural productivity, low quantities and poor quality produce which reduce their chances of accessing markets. Hence, this study focused on identifying and analysing factors that determine productivity and market access by smallholder spinach farmers in the Polokwane Local Municipality, Limpopo Province. This area of research is important towards the development of smallholder farming where resources are limited, but high population growth is very common.

The overall objective of the study was to examine farm and farmer characteristics that determine the productivity and market access of the smallholder vegetable farmers. In order to achieve the aim and objectives of this study, a multi-stage sampling technique was used to select 80 smallholder spinach farmers to collect primary data from them using structured questionnaires. Cobb-Douglas production function was used to examine factors that determine productivity level and the Two-limit Tobit Model was also used to analyse factors that influence market access.

The results from the Cobb-Douglas production function indicated that smallholder farmers in the study area are experiencing a decreasing return to scale, which suggests that they are over-utilising factors of production. Two-limit Tobit Model results on the socioeconomic factors that influence market access indicated that household size was statistically significant at 10%, distance to the market, extension contact and farming experience were statistically significant at 5% and educational level, quantity produced and market information was statistically significant at 1%.

Based on the findings, several policy suggestions were made. These include strengthening of farmers' organisation, provision of market information, regular extension visits and provision of training to the farmers.

Keywords: *smallholder farmers, productivity, market access*

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LIST OF ACRONYMS AND ABBREVIATIONS

CIAT	Centro International De Agricultural Tropical
COVID-19	Corona Virus Disease of 2019
DAFF	Department of Agriculture, Forestry and Fisheries
FAO	Food and Agriculture Organization
HODET	Horticulture Development Council of Tanzania
IDP	Integrated Development Plan
IFAD	International Fund for Agricultural Development
IFAD	International Fund for Agricultural Development
SPSS	Statistical Package for the Social Sciences
TREC	Turfloop Research Ethics Committee

CHAPTER ONE: INTRODUCTION

1.1 Introduction and background

The production of vegetables within the Limpopo Province contributes an average of about 22% to the gross income from agriculture and about 18% to the total gross income of vegetables in the country (DAFF, 2015). Horticultural production, especially vegetables, is an important source of income for smallholder farmers (McCulloch and Ota, 2002). It has higher returns than most other cash crops and is suitable for production on the currently declining farm sizes in varying agro-ecological zones (Minot and Ngigi, 2003). However, it is likely to remain the major engine for rural growth and livelihood improvement for some time in most parts of sub-Saharan Africa (Poulton *et al.,* 1998).

Dolan and Humphrey (2000) indicated that the horticultural subsector is one of the upcoming subsectors in South Africa. The growth of this subsector is a result of the increased health awareness of the populace in terms of the benefits of eating fruits and vegetables. Consequently, there is an increased demand and market opportunity for horticultural produce in urban centres of both developing and developed countries. Due to this, smallholder vegetable farmers have an enormous opportunity to invest more in sustaining the horticultural production system, especially vegetables such as spinach. According to Aku *et al.* (2018), vegetable production has received considerable attention in recent times. Vegetables are of great importance in terms of nutrition improvement, income generation, food security, and improving resource use efficiency in agriculture (Ebert, 2014). Despite the importance of vegetables, their production is associated with high risk and uncertainty owing to their highly perishable characteristics. The perishable nature of vegetables necessitates effective marketing channels (Xaba and Masuku, 2012). According to Antwi and Seahlodi (2011), the success of vegetable growers in terms of operation and decision depends on market availability, accessibility, affordability and increased productivity.

Dorward *et al.* (2004) asserted that a smallholder-led economy is obstructed by a lack of market access and a low level of productivity. Market access and increasing production are crucial in smallholder farmers' development because they create the necessary demand and offer remunerative prices, thereby increasing smallholder incomes (Al–Hassan *et al.,* 2006). The proponents of this thought strongly argue that effective market access can lead to sustainable increases in household incomes and

food security, increased rural employment, and sustained agricultural growth. Another study by Hugo *et al.* (2006) supports the enhancement of market access by maintaining that greater agricultural markets mean increased trade and ultimately increased income growth. Hence, there is an urgent need to improve market access of perishable crops, particularly, horticultural produce such as vegetable production to ensure sustainability.

According to HODECT (2010), one such option of enhancing productivity and market access involves the provision of market information to smallholder vegetable producers through the formation of farmer organisations. Mobilising producers into groups and establishment of contractual arrangements between farmers and buyers can be an important entry point to link farmers with buyers. By so doing, there will be market assurance to farmers and sufficient supply to buyers. Currently, most developing countries are struggling to secure an adequate and nutritious food supply to match rising demand through various strategies of increasing agricultural production capacity and enhancing the market access of farm produce (Zuwarimwe and Mbaai 2015).

1.2 Problem statement

The contributions of smallholder spinach farmers to the economic development of Polokwane Municipality can be realised if the spinach farmers can access the formal market. According to Jalang'o *et al.* (2016), smallholders' access to formal markets would be an incentive to shift from subsistence to commercial. However, accessing such markets and a low level of productivity, which are evidenced by low farm-gate prices, as they sell in informal local markets, through speculating and hawking has been a challenge to many smallholder farmers in the area. Moreover, these low prices often received by smallholder spinach farmers have led to low household income (Goerdeler, 2012). However, they are some of smallholder farmers who are located in remote areas with poor transport and market infrastructures, and all these contribute to the high transaction costs they are facing. Transaction costs have been noted to be the key reasons for smallholder farmers' failure to access the formal markets while increasing production (Makhura *et al*., 2001). These transaction costs include costs of searching for trading partners, as well as costs of bargaining, monitoring, enforcement and eventually, transferring the product to its destination (Baraka, 2019).

According to Delgado *et al.* (1998), smallholder vegetable farmers are being undermined in most African countries because smallholder farmers operate in small

areas of land, lacking investments and institutional supports. Although financial institutions have been established to assist farmers, smallholder vegetable farmers are still facing the challenge of accessing credit. According to Hazell (2005), smallholder farmers have low income which results in lower productivity. They also face challenges of accessing markets and having access to resources that will improve their agricultural productivity. In order for smallholder vegetable farmers to have access to improved markets, there is a need to improve the competitiveness of their produce (Mpandeli and Maponya, 2014). For these reasons, the study strives to examine determinants of productivity and market access of smallholder spinach farmers in Polokwane Local Municipality.

1.3 Rationale

According to Barret (2009), smallholder vegetable farmers who have engaged in semi-subsistence agriculture have a lower marketable surplus (low return) causing them to be in a low equilibrium poverty trap. A leap that smallholder vegetable farmers need to make to reduce poverty and hunger is to transform from low marketability semi-subsistence farming to high-level market-oriented farming. Furthermore, Ngqangweni (2000) indicated that market access and increased productivity of agricultural produce is important amongst smallholder farmers because they derive benefits such as income and rural employment through it. High productivity among vegetable farmers has been recognised for its potential to unlock economic growth and development in rural areas. According to Barret *et al.* (2008), market access has been identified as one of the critical factors influencing the performance of smallholder agriculture in developing countries and in particular, least developing countries. Enhancing returns from increased agricultural productivity through improved access to the market can therefore, be a vital element of poverty alleviation strategies and livelihood improvement.

Reardon (2000) argued that a market-oriented production of vegetable farmers could achieve welfare gain through specialisation and comparative advantage, economies of scale and regular interaction and exchange of ideas. Unfortunately, most smallholder farmers who need this kind of welfare boost have been constrained by several factors in their quest to increase productivity and access the market for their goods and services. Altshul (1998) stated that analysing factors influencing productivity and market access play a critical role in meeting the overall goals for food security, poverty alleviation, and sustainable agriculture, particularly among smallholder vegetable farmers in developing countries. This study, therefore,

intended to contribute to insights on these narratives and to enrich the stock of knowledge regarding productivity and market access of smallholder spinach farmers in order to serve as an input for policy makers and researchers who wish to work in this area.

1.4 Purpose of the study

1.4.1 Aim of the study

The aim of the study was to examine the determinants of productivity and market access of smallholder spinach farmers in the Polokwane Local Municipality, Limpopo Province.

1.4.2 Research objectives

The overall objective of the study was to examine farm and farmer characteristics that determine productivity and market access of the smallholder vegetable farmers. The study had the following specific objectives:

i. To identify the socio-economic characteristics of smallholder spinach farmers in Polokwane Local Municipality of Limpopo Province.
ii. To examine the determinants of productivity among smallholder spinach farmers in the study area.
iii. To analyse the effect of socio-economic characteristics of smallholder spinach farmers on market access in the study area.

1.5 Research hypotheses

The main hypothesis of the study was that farm characteristics and farmer characteristics influence the productivity and market access of smallholder vegetable farmers. Specific hypotheses that were tested are:

i. Socio-economic determinants of smallholder spinach farmers do not have an effect on their productivity level in Polokwane Local Municipality of Limpopo Province.
ii. Socio-economic characteristics of smallholder spinach farmers do not have an effect on their market access in Polokwane Local Municipality of Limpopo Province.

1.6 Organisational structure

Chapter 1: Discussed the introduction and the background of the research at large. An outline of the problem statement, rationale, aim, and research objectives and research hypotheses guiding this study were also presented in this chapter.

Chapter 2: Discusses the literature review conducted by other researchers in South Africa and abroad concerning smallholder farmers' productivity and market access.

Chapter 3: Explains the research design and the methodology implemented in this study. This chapter elaborates on the chosen samples, methods used in data collection and data analysis techniques.

Chapter 4: Presents the results obtained from the analysis and discussion of the findings in relation to the literature.

Chapter 5: Outlines the summary, conclusion and recommendations drawn from the results of the study.

CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

This chapter presents an overview of literature conducted in South Africa and abroad on aspects related to the topic of this study. It further discusses the contribution of smallholder farmers to the agricultural economy of South Africa, and it highlights the environment in which smallholder farmers in South Africa operate, with a view of identifying and analysing the most important socio-economic factors that affect smallholder vegetable farmer's productivity and access to the market, especially formal market.

2.2 Definition of concepts

2.2.1 Smallholder farmers

According to Mashaya (2021), the definition of a smallholder farmer varies and remains a contentious issue, since there are different ways used to define smallholder farmers. Most scholars defined smallholder farmers looking at farm size, consequently perceiving smallholder farmers as those who have less than two hectares of land for cultivation (Berdegue and Fuentealba, 2011; Nagayets, 2005). For instance, Nagayets (2005) defines a smallholder farmer based on the magnitude of landholding or land size used for the production and indicates that a smallholder farm has two hectares and below in size. Berdegue and Fuentealba (2011) stated that smallholder agriculture comprises farms that are operated by families and whose labour is mainly from these families. Moreover, these smallholder farmers can be further divided into two subgroups. The first and coincidentally the larger subgroup are referred to as subsistence farmers. These farmers derive a large fraction of their household income from nonfarm sources, which include providing labour for non-farming activities, remittances, as well as social support services. The second subgroup is the commercial family farmers, which, at times, hire a handful of permanent labour to work on their farms.

Kirsten and Van Zyl (1998) acknowledged that size is not a good criterion for defining small farms. For example, one hectare of irrigated peri-urban land, suitable for vegetable farming or herb gardening, has a higher profit potential than 500 hectares of low quality land in the Karoo. For this reason, turnover, or rather the level of net farm income, determines the farm size category, not the land size. Furthermore, Kirsten and Van Zyl (1998) defines a smallholder farmer as a small farmer in which the scale of operation is too small to attract the provision of the services he/she needs to be able to significantly increase his/her productivity.

Dixon (2005) supported the notion that smallholder farmers are characterised by the limited resource endowed relative to other farmers in different sectors. According to Ellis and Biggs (2001), a smallholder farmer is a farmer who has access to means of his or her livelihood relying on land owned and farm labour for farm production to produce for own consumption and sometimes for the market given that they will be having a surplus to dispose. Todaro (2003) also defined a smallholder farmer as a farmer who owns a small piece of land on which he or she grows crops for own consumption and a few cash crops given that they have the necessary resources to produce them. Following from the lessons from the literature on the concept of smallholder farmers, this study principally defined a smallholder farmer based on landholding or size. In this study, a smallholder farmer was considered to be a farmer with a land size ranging from one hectare to two hectares.

2.2.2 Agricultural productivity

Many scholars have suggested various definitions for agricultural productivity. Nwaiwu *et al.* (2012) citing Olayide and Heady (1982) defined agricultural productivity as the index of the ratio of farm output to the value of the total input used in producing the output. However, Ehui and Spencer (1990) went further to identify partial productivity as the ratio of total output to a single input. The word 'productivity' usually denotes the ratio of economic output to any or all associated inputs (in real terms), or output per unit of productive input. Increasing productivity means that the amount of goods and services available per capita is growing, assuming a constant population. However, for this study agricultural productivity refers to the ratio of quantity of output produced from a given quantity of inputs.

2.2.3 Market access

According to Killick *et al.* (2000), market access in the context of smallholder farmers, is the process by which farmers access markets in relation to the nature, efficiency and costs of these processes as well as their ability to seize available market opportunities. The above definition is close to the IFAD (2004) definition, where market access is related to three dimensions, which include physical access to markets (distances, costs, etc.); structure of the markets (asymmetry of power relations between farmers, market intermediaries and consumers); and the level of producers' human capital (e.g. understanding of market forces, prices, bargaining, etc.). However, for this study, market access is defined in light of Ngqangweni *et al.* (2018)'s definition which regards market access as the ability of smallholder farmers to seize available market opportunities.

2.3 The role of smallholder farming in South Africa

According to Vink and Kirsten (2003), the agricultural sector in South Africa is dualistic. The smallholder sector consists of around 4 million black farmers farming in the former homeland areas on 13% of the agricultural land of South Africa compared to commercial farmers who are well integrated and highly capitalised with approximately 35 000 farmers, producing around 95% of agricultural output on 87% of total agricultural land (Aliber and Hart, 2009). This dualistic nature and division between the commercial, large-scale farming sector and the comparatively low productive, struggling smallholder sector is a direct result of historical patterns of dispossession and impoverishment, which systematically eroded historically successful land-based production systems and livelihoods in South Africa (Neves and Du Toit, 2013).

Smallholder farmers are believed to be the key drivers of many African economies (Mutero *et al*., 2016). However, in South Africa, the potential contribution of smallholder farmers to economic growth remains locked. The major challenges facing smallholder agricultural growth are closely associated with a lack of marketing knowledge and opportunities, calling for market-oriented interventions. In marketing, the smallholder agricultural sector still resembles the past apartheid legacy, where the sector has difficulties in marketing produce through formal channels (Carter and May, 1999). Furthermore, Jacobs (2008) indicated that socio-economically, most smallholder farmers in South Africa are poor, less educated and reside in rural communities with less developed infrastructure, which locate them in the so called second economy.

Statistics South Africa (2012), reliant on its multiple-year data, revealed the total number of people participating in smallholder farming as well as how these are among the poorest population in South Africa, characterised by weak livelihood assets and vulnerability to household food insecurity. Despite this fact, the smallholder (which includes subsistence) farmers who are largely located in former homelands have not experienced effective support from policy makers (Jacobs, 2008). Farmers participating in smallholder farming activities warrants the need to understand their farming contexts because this might inform the appropriate strategies required to support their livelihoods more effectively and sustainably (Statistics South Africa, 2012).

Dorward and Kydd (2006) indicated that the importance of smallholder agriculture in developing countries is being recognised and this is the reason why there are countries where land is transferred to smallholders and development programmes are redirected towards empowering these farmers. The proponents of smallholder farming argue that, with enhanced market access, smallholder agriculture has the potential to commercialise and contribute towards food security and poverty alleviation through food price reduction and employment creation. In addition, efficient smallholder agriculture leads to increased incomes and promotes equitable distribution of income, creates backward and forward linkages necessary for economic growth (Magingxa and Kamara, 2003). In this way, the smallholder agriculture sector is not only important for the revitalisation of the agricultural sector, but for the economy at large.

Furthermore, Hazell (2005) states that smallholder farming in developing countries is a force to reckon with, as it is the main source of employment, income, food security, as well as a source of food security in rural communities. According to Baiphethi and Jacobs (2009), there is a significant need to increase the productivity of smallholder farmers to ensure long-term food security, as smallholder production increases the food supply within households and therefore stifles the effect of commodity and food prices on these households while at the same time improving food security. Page and Slate (2003) point out that evidence shows that an effectively producing smallholder farmer is seen as an essential route out of poverty.

Aliber and Hart (2009) acknowledged that the majority of smallholder farmers had recourse to engage in subsistence farming, which involves merely selling of surplus produce as an additional survival strategy to meet their daily basic needs. According to DAFF (2015), smallholder farmers engage in subsistence agriculture to obtain extra food while ensuring household food security. Landesa (2014) also claims that smallholder farmers can be the driving force behind rural development, which is equitable, sustainable and productive. Moreover, Altieri *et al.* (2012) noted that smallholder agricultural production is a contributor to national food security.

2.4 Market access by smallholder farmers in South Africa

Thamaga-Chitja and Morojele (2014) pointed out researchers believe that most smallholder farmers aim to reap economic benefits alongside the fulfillment of subsistence goals. However, for smallholder farmers, the environment for economic growth is constrained by challenges of production, lack of infrastructure and lack of access to the markets. The need to tackle these constraints stems from the fact that

despite the advent of the democratic dispensation, poverty remains deep-rooted and smallholder farmers withstand the worst of this as they remain constrained from accessing the market. Although market access and its constraints for small producers in the world is not a new phenomenon, the deep poverty and inequality in South Africa make this an urgent issue that requires immediate attention.

Nossal and Gooday (2009) indicated that market conditions offer a farmer encouragement for production improvement. Furthermore, these researchers additionally indicated that since crop production responds to changing product prices, the forces of demand and supply and competition can encourage development in performance through activities such as changes in input mix. Particularly, for the agricultural nature of most economies of the African region, agricultural production remains to be an important determinant of both food security and economic growth (Funk and Brown, 2009).

Given that the integration of markets is a challenge for smallholder farmers, some farmers try to learn new techniques in their production to integrate well in their cooperatives. Most of them strive for higher benefits through the control of quality, quantity, inputs and consumers. It means that their focus will be broader when they start integrating their production, community and markets (Berdegue *et al.*, 2008). Unfavourable market access is the major hindrance to the farmers when it comes selling their produce in the market place due to infrastructural challenges as well as the competition posed by commercial farmers. Furthermore, it is not possible for farmers to access markets because of the resources that are needed to make that possible. For example, farmers would need to be able to buy seeds, correct amounts of fertilizers and they would need transport to get their products to the market place. The latter is necessary, as it is not possible for farmers to buy their goods without support. The ageing of farming communities is another constraint on the future of vegetable crop production (Boys and Fraser, 2019).

Altshul (1998) stated that market access plays a serious part in meeting the overall goal of food security, poverty alleviation and sustainable agriculture mainly among smallholder farmers in emerging countries. The pressure that smallholder farmers get from market liberalisation makes it difficult for the farmers to partake in markets. Kirsten *et al.* (2008) argued that smallholder farmers are not able to meet the standards and requirements that are set by the formal sector, and are therefore excluded from the formal market. For example, to meet their quantity size and quality, supermarkets may be forced to transact with a number of smallholder

farmers. However, because of the high transaction costs incurred in coordinating many smallholder farmers, supermarkets often reject these smallholder farmers. The solution may be in the formation of co-operatives which could strengthen smallholder farmers' bargaining power and negotiations with large buyers and reduce transaction costs (Ortmann and King, 2007).

Machethe (2004) noted that one of the key factors to the success of smallholder farmers is access to lucrative markets. However, improving market access for smallholder farmers and to obtain much needed resources, farmers require suitable and an enabling institutional environment to become successful. Therefore, there is a common argument that reducing barriers to market access may accommodate smallholder farmers into the mainstream economy, thus, improving household food security, reducing poverty, enhancing agricultural development and improving economy-wide growth. Jari and Fraser (2012) acknowledged that the system of lucrative markets requires market information, market intelligence and effective farmer organisations that are responsive to the farmers' needs. However, in most developing economies smallholder farmers find it difficult to participate in markets because of numerous constraints and barriers.

Van Renen (1997) explained that smallholder farmers usually consume a larger proportion of their produce and/or sell the surplus to the local communities. This researcher indicated that there is potential for these farmers to break through the market opportunities used by commercial farmers. However, the extent to which they could penetrate varies across provinces and depends on the availability of infrastructure and market information. Furthermore, most of these smallholder farmers are excluded from one of the most lucrative channels such as direct sales to supermarkets and exports mainly due to lack of management skills, small quantities produced, low quality of the produce, lack of suitable storage facilities, little value addition to their products, transport constraints and ineffective dissemination of information.

2.5 Overview of challenges faced by smallholder farmers in accessing formal markets

According to Fred *et al.* (2020), the opportunity for smallholder farmers to increase their incomes from agricultural undertakings, natural resource management and other enterprises largely depends on their ability to fully participate in the marketplace exchanges. However, several internal and external challenges are encountered by smallholder farmers making it complicated for them to participate in

these market place exchanges. Makhura (2001) also supported the notion that smallholder farmers face difficulties in accessing markets and as a result, markets do not serve the interests of smallholder and emerging farmers. South Africa, which is characterised by less developed rural areas, smallholder and emerging farmers find it difficult to participate in commercial markets due to a range of technical and institutional constraints. Factors such as poor infrastructure, lack of market transport, dearth of market information, insufficient expertise on, and use of grades and standards, inability to conclude contractual agreements and poor organisational support have led to inefficient use of markets. All these result in commercialisation bottlenecks.

Smallholder farmers lack vertical linkages in the marketing channels, which results in their exclusion from the use of formal markets. Smallholder farmers have weak financial and social capital as well as limited access to legal recourse, implying that it is difficult to change these negative market factors individually. As a result, they are trapped and continue to operate within the given market constraints and they do not receive rewarding incomes from their agricultural activities (Fenwick and Lyne, 1999). However, Markelova and Meinzen (2006) indicated that these challenges could be addressed by the use of collective action in agricultural markets by helping these farmers reduce transaction costs for their market exchanges, obtain necessary market information, secure access to new technologies and tap into high value markets that would offer them a competitive advantage over large farmers and agribusinesses. According to Mango *et al.* (2017), collective action offers a practical solution to smallholder farmers' marketing challenges. If well-coordinated, collective action would help smallholder farmers to meet quality and quantity requirements in modern markets through effective use of post-harvest technologies and mobilisation of the majority of these farmers to participate, thus, enhancing access to better markets.

Furthermore, Montshwe (2006) explained that most of the smallholder farmers have difficulties in accessing market information and increasing productivity, exposing them to a marketing disadvantage. Smallholder farmers normally rely on informal networks such as traders, friends and relatives for market information due to weak public information systems (FAO, 2004). However, such individuals may not have up to date and reliable market information, making the usefulness of the information doubtful. Additionally, farmers relying on informal networks for market information are at risk of getting biased information due to the opportunistic behaviour of the

more informed group. For instance, Mangisoni (2006) explained that smallholder farmers usually accept low prices for their crops when the broker informs them that their produce is of poor quality. This author noted that smallholder farmers accept these low prices mainly because they are unable to negotiate from a well-informed position.

Consumers demand high quality for the goods they buy. In addition, they will not buy food products unless there is a guarantee that they are safe to eat (Kherallah and Kirsten, 2001). In other words, consumers make purchasing decisions depending on the packaging, consistency as well as uniformity of goods. Most smallholder vegetable farmers have no clearly defined grades and standards, and therefore, cannot meet the consumers' demands (Reardon and Barrett, 2000). Produce from smallholder farmers do not meet certain market grades and standards because the farmers lack the knowledge and resources to ascertain such requirements. In addition, institutions for determining market standards and grades tend to be poorly developed in smallholder farmers' environments. Due to uncertainty on the reliability and quality of their goods, smallholder farmers usually cannot get contracts to supply formal intermediaries such as shops and processors. This indicates that only well organised farmers can benefit from trade liberalisation by adopting strict quality control measures and obtaining the necessary certification for their goods (Benfica *et al.*, 2002).

Machethe (2004) pointed out that most small producers in South Africa lack appropriate transportation facilities and road infrastructure, communication links and storage infrastructure resulting in high transaction costs. Further, smallholder farmers have limited ability to add value to their produce. Lack of such facilities usually constrains farmers' supply response to any incentives in both agricultural production and marketing (Dorward *et al.*, 2003). Sometimes, transaction costs are too high for farmers and traders to get any meaningful benefits from potential trading activities, discouraging farmers to participate in marketing activities.

Eggertson (1990) cited by Jari and Fraser (2012) indicated that transaction costs are found to be observable and non-observable costs associated with enforcing and transferring property rights from one person to another. These include the costs of searching for a trading partner with whom to exchange, the costs of screening partners, bargaining, monitoring, enforcement and, eventually, transferring the product to its destination (Hobbs, 1997). Delgado (1999) identified high transaction costs as the embodiment of market access barriers among resource poor

smallholders. These high transaction costs result from individual produce transportation and selling, difficulties in getting trading partners and poor bargaining power. When transaction costs are high, smallholder farmers may cease to market their produce. In other words, with high transaction costs, markets fail in their role of allocating scarce resources to alternative ends. For South Africa, Makhura (2001) explained that high transaction costs prevail among the smallholder farmers.

2.6 Agricultural productivity

According to Conning and Udry (2005), agricultural productivity is strongly conditioned by the fact that inputs are transformed into outputs with considerable time lags. Because of the reduction of land size per farm due to increased population pressure, the traditional system of generating soil fertility using fallow has decreased. Intercropping and crop rotation have become common among smallholder farmers. If farm households are to feed themselves and produce a marketable surplus with less land per capita, they need to adopt new farming practices and increase their efficiency in using the available technologies. The ability of a country to achieve growth in agricultural productivity and output depends on its ability to use the available resources efficiently and make an efficient choice among alternative paths of technical changes (Xu and Jeffrey, 1998).

Despite considerable attempts to introduce improved technologies and extension activities among smallholder farmers, low productivity of the agricultural sector remains a challenge in the road towards agriculture based economic growth. The government's attempt to increase agricultural production through increased use of improved technologies has proved not to bring about the expected productivity gains, and this is due to a lack of the necessary technical skills and knowledge in using these technologies, poor extension and credit services, and poor infrastructure, among others (Arega and Rashid, 2005).

Hughes (1998) indicated that empirical studies have shown that productivity arises from improvement in efficiency brought about by advancement in technology. Advancement in agricultural productivity has led to abundant and affordable food and fibre throughout most of the developed world. Moreover, Fan *et al.* (2000) assert that agricultural productivity is desirable as it implies higher output from the application of technology, better utilisation of resources, and a reduction in poverty in rural areas. Furthermore, Nkamleu *et al.* (2003) indicated that many African farmers are still using low yielding agricultural technologies, which lead to low productivity. In addition, it is always argued that, the relevant question for agricultural policy makers,

is whether the agricultural sector can be made more efficient, by achieving more output with the current input level, or achieving the current output with less input usage than is currently observed.

According to Awoyemi *et al.* (2003), the issue of determining the pattern and the efficiency of resource use in traditional farming particularly on smallholder farmers, arises in the context of formulating development strategies. Thus, the designed strategies will not only raise the productivity of resources already committed to farming, but, will also ensure that the newly created resources in the agricultural development efforts are allocated to areas and enterprises in which their productivities are higher. Ahmad *et al.* (2002) stated that variations in productivity are due to management factors or in other words inefficiency gaps. Therefore, in order to accomplish sustained growth in agriculture, efficiency and productivity differentials have to be reduced. This can be achieved by having adequate knowledge and understanding of determinants of the smallholder farmers' productivity variations.

Tsinigo *et al.* (2017) carried out a study on the impact of improved rice variety on productivity among smallholder farmers in Ghana. The study found that the technical change associated with the introduction of the improved rice variety was of the non-neutral type. Further, the adoption of the improved rice variety has increased rice productivity by about 46% for the adopters. The main determinants of productivity for the adopters were seed, land, fertiliser, herbicide, and education. Productivity among the non-adopters was positively influenced by seed, land, herbicide, and fertiliser. The study concluded that the improved rice variety has a superior yield advantage. Poulton *et al.* (2006) reached a similar conclusion that the most important source of agricultural productivity increases is technical change and improved varieties.

A study conducted by Obasi *et al.* (2013) used Ordinary Least Squares Multiple Regression Analysis to analyse factors affecting agricultural productivity among arable crop farmers in Imo state, Nigeria. The results showed that the farmers are highly efficient in the use of planting materials but highly inefficient in the use of land and chemical fertilizer. Furthermore, the results of the Multiple Linear Regression Analysis on the determinants of agricultural productivity show that age, level of education, years of farming experience, farm size, extension contact, fertilizer use, planting materials and labour use are the main determinants of agricultural productivity in the state (Obasi *et al.,* 2013). El-Kader *et al.* (2010) indicated that access to fertilizer, agro-chemicals and improved seeds or planting materials has

been proven as an important driver of agricultural production and productivity among farmers.

2.7 Review of market access and agricultural productivity on smallholder farmers

According to Barrett (2009), the poorest people in the world are smallholder farmers with low agricultural productivity and low rates of market access. Increasing either one could help to improve the other, and both could boost their living standards. The researcher further indicated that higher market participation could drive productivity by providing incentives, information and cash flow for working capital. Furthermore, higher productivity could drive market participation since households with higher productivity are more likely to have crop surpluses above their immediate consumption needs. Many studies address the impact of either market participation or productivity on farmers' income, and some studies relate them to each other. According to Martin (1992) cited by Haji (2008), studies on farm productivity have long been recognised in the literature in developing countries. Recently, economic theories have shown that productivity is the viable engine for sustainable long-term economic growth. However, more is known about the productivity of vegetable farming and the factors influencing it in Africa (Maseko *et al.,* 2018)

Several studies have identified the role of productivity in stimulating the market access of farmers. For example, according to Rios *et al.* (2009), households with higher productivity tend to have more access to markets. There is evidence of a reverse causal linkage where market access would lead to higher productivity. Moreover, the investments in market access infrastructure provide only minimal, if any, improvements in agricultural productivity. Enhancements in farm structure and capital, on the other hand, have the potential to increase productivity and market access. Similarly, Rao *et al*. (2004) indicated that since many of the determinants of agricultural productivity are relatively fixed, such as the quantity of land and labour, distance to core markets, and climate, continued development in productivity comes from increases in the quality of land and labour and through decreasing transport costs via improvements in infrastructure such as roads and ports.

Hau and von Oppen (1999) studied rural market structures and the impact of market access on agricultural productivity in Northern Thailand. The results of their study have shown that market access has a positive impact on agricultural productivity directly through specialisation and indirectly through intensification. Furthermore, their study indicate that better market access can promote a more efficient allocation

and use of resources, leading to increased productivity. This is in line with the study by Kamara (2004) who found that through intensification of input use the aggregate physical productivity increases with improvement in market access. Moreover, there is a disparity in the distribution of market-generated efficiency gains between small and large farmers (large farmers benefit more than small farmers), and between farmers with different access options to markets. Thus, farmers who easily access markets benefit more than farmers who find it difficult to access markets.

Katungi *et al*. (2011) used a Macroeconomic Analysis Approach to analyse market access, intensification and productivity of common bean in Ethiopia. Drawing from the survey conducted among common bean producers in Ethiopia in 2008, a two stage econometric method was used to investigate the contribution of market access and other micro-level factors in facilitating crop intensification and productivity. The results of the study indicate that an increase in the intensity of fertilizer and seed use produces an increase in yield and so does market access. Market access has intensification and specialisation effects on common bean yield. The study further confirms poor market access and labour constraints as key factors constraining fertilizer use, and indirectly inhibiting productivity growth in common bean in Ethiopia.

Rios *et al*. (2008) employed two-stage least squares approach in the analysis of linkages between market participation and productivity on multi-county farm households. The results indicated that regardless of market access factors, households with high productivity tend to participate in agricultural markets. In contrast, having access to better markets does not actually lead to increased productivity. The finding implies that investment in market access and infrastructure provides less advancement in agricultural productivity, whereas programmes targeted on enhancements in farm structure and capital have the potential to increase both productivity and market participation.

According to CIAT (2004), improved productivity level and marketing facility enables farmers to plan their production more in line with market demand, to schedule their harvest at the most profitable time, to decide which market to sell their produce, and negotiate on a more even footing with traders. Enhancing poor smallholder farmers' ability to reach markets and actively engaging them is the most pressing development challenge. Without having convenient market access, the possible increment in output, rural incomes, and foreign exchange resulting from the introduction of improved production technologies could not be effective (MoA and

ILRI, 2013). In addition, Abu *et al.* (2016) found that maize and groundnut farmers who have higher land productivity access the markets more than farmers with low productivity. However, Mekonnen (2017) provided evidence to show that the use of improved agricultural production technologies has higher marketable surplus ratios.

2.8 The importance of household characteristics in the agricultural sector

According to Adomi *et al.* (2003), market access and agricultural productivity are influenced by other household characteristics such as the farm operator's age, family size, education level, income and landholding size. Gasperini (2000) suggested that education is one of the most important factors, which may contribute to a better livelihood of an individual or community. Furthermore, the researcher pointed out that education is a fundamental human right and it is essential for reducing poverty and improving the living conditions for rural people (Gasperini, 2003). The researcher further indicates that from a perspective of agricultural improvements, basic education improves farmer productivity and business management. It is further noted that South Africa, like other developing countries, will not develop without well-educated people with a strong agricultural base among all population groups to provide food security for improved nutrition and health (DAFF, 2015).

Collett and Gale (2009) supported the notion that education could be the key to equipping rural farmers to manage their businesses profitably and sustainably. Moreover, Mdlalose (2016) acknowledged that through education and training, human resource development can be achieved. Smallholder farmers themselves understand that there is a need for education and training for them to improve productivity and business management. According to Lindley *et al.* (1996), in order to meet the challenges of agricultural production and food security facing African countries, improvement of a country's human resource capacity for productivity is a pre-requisite. Okoye *et al. (*2008) also concluded that human resources development enhances the skills, knowledge and abilities of individuals, allowing them to reach their full potential thereby improving on their productivity.

Mathenge and Tschirley (2008) indicated that the source of income influences the farming decisions by the farmer because farm practices depend on capital investment, especially when the capital is dependent on the existing sources of income. Masunga (2014) proffered that it is plausible that earnings from off the farm may often be used to compensate for the missing and imperfect credit markets by providing ready cash for input purchases as well as other household needs. In addition, off and on-farm earnings could be used to spread the risk of using these

modern farm inputs to the extent that smallholder farmers choose traditional over modern inputs in order to lower their risk. Thus, any mechanism that allows farmers to smoothen consumption will raise the use of modern inputs and increase farm productivity.

Makhura (2001) stated that the age of the head of the household is considered a crucial factor since it determines whether the household benefits from the experience of an older person, or has to base its decisions on the risk-taking attitude of a younger farmer. According to Adomi *et al.* (2003), the age of the household head is a proxy variable for the farming experience of farm operators. Farmers are highly dependent on their previous knowledge of farm practices in cultivating different crops. Hence, experienced farmers are expected to enhance the productivity of their holdings.

Gender is one important factor when coming to participating in vegetable farming. However, Mollel and Mtenga (2000) indicated that gender relates to socially assigned roles and behaviours attributable to men and women; it refers to the social meaning of biological sex differences. Gender roles are roles that are played by both women and men and which are not determined by biological factors but by the socioeconomic and cultural environment or situation. Furthermore, Kabeer (2003) indicated that women from poor households engage in a variety of income-generating and expenditure-saving activities. In some cases, these activities supplement the contribution of males while in others they are the primary or the sole source of household livelihoods. Women are twice as likely as men to be involved in agriculture related activities (Odame *et al.,* 2002). However, most male smallholder farmers participate more in the market compared to female smallholder farmers (Rabbi *et al.,* 2019).

Ugwu (2019) based on a project report of African women in agriculture, revealed that more women than men in cultivator families did agricultural work and that women were usually working more hours than men. Furthermore, it has been noticed that female labour in production tends to be less important in societies where intensive agricultural systems are more dominant than extensive systems. However, Ogunlela and Mukhtar (2009) acknowledged that women are a driving force for the maintenance, conservation and development of rural areas, both in cultural and economic terms. They also represent a considerable proportion of the workforce in agriculture and contribute to the development of the rural sector in the face of

constant depopulation. Therefore, the South African government is currently promoting and advocating the participation and involvement of women in all economic spheres, including agriculture.

Household size may determine the household's family labour supply for production activities. However, Ijatuyi *et al.* (2017) stated that as household size increases in a family or rural household, it is a greater contributor to the level of productivity because a farmer will incur a lesser cost of labour whilst producing more total output, especially considering that smallholder farmers may use household labour due to financial constraints. Mathonzi (2000) studied the effects of market orientation on income and food security of small-scale farmers and found that a large household size that is actively involved in farming is useful to provide farm labour. However, if the household size is big and most members are just dependants it brings a negative impact on farm income.

2.9 Chapter summary

This chapter reviewed challenges faced by smallholder farmers in accessing markets. Based on the literature reviewed, smallholder farmers were defined as those with less than two hectares, with limited resources and needs external support so that they can farm successfully. The chapter has outlined the role of smallholder farming by highlighting its contribution to poverty alleviation, job creation and food security. The importance of household characteristics in agriculture was also discussed. The study on agricultural productivity and market access that were conducted locally and abroad were also discussed. The literature also found that in order for a smallholder farmer to increase productivity and access the markets, production resources such as land, capital access, market information and water availability are required. Thus, smallholder farmers are constrained by high transaction costs and poor organisational support.

CHAPTER THREE: RESEARCH METHODOLOGY

3.1 Introduction

This chapter presents the research methods of data collection and analysis used in the study. The aim of this chapter is to show how the study was conducted and explain research tools that were employed. It starts by describing the study area, data collection and data analysis. Furthermore, the analytical framework, outlining descriptive statistics and data processing models as well as the justification of selected models have been outlined in this chapter.

3.2 Description of the study area

The study was conducted in Polokwane Municipality, which is located within the Capricorn District in the Limpopo Province. The municipality covers a surface area of 3775 km and accounts for 3% of the Province's total surface area of ±124 000 km^2. In terms of its physical composition, Polokwane Municipality is 23% urbanised and 71% still rural (Polokwane IDP document,2019). The remaining area (6%) comprises smallholdings and institutional, industrial and recreational land. At the centre of the area is the Polokwane economic hub, which comprises the central business district, industrial area, and a range of social services and well-established formal urban areas servicing the more affluent residents of Polokwane (Polokwane IDP document, 2019).

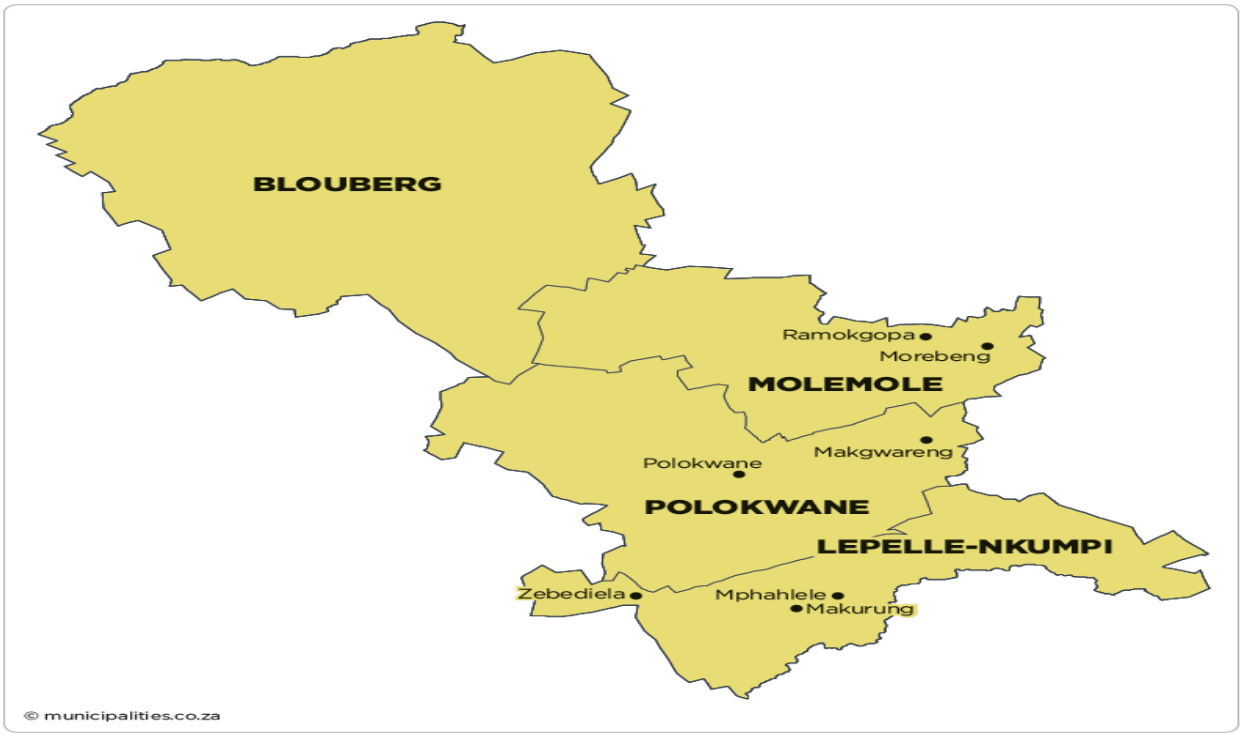

Figure 3.1: Capricorn district map (Polokwane local Municipality)

Source: www.municipalities.co.za, 2020

3.2.1 Topography

The Municipal area is divided into two rough topographical units, namely; 'Moderately Undulating Plains' (mainly the eastern half of the municipal area) and 'Strongly Undulating Plains' in the west. The Polokwane Municipal area is situated on the so-called 'Pietersburg Plateau', which is bordered in the south by the Strydpoort Mountains, in the west and north by the Waterberg Mountains and in the east by the Great Escarpment. The highest part of the Plateau lies in the south near the Strydpoort Mountains, which forms the watershed between the Olifants and Sand River systems. There are a number of ridges that form constraints on development due to their visual exposure, potential as recreation or educational sites, former importance as sacred sites (likelihood of heritage sites) and the likelihood of supporting sensitive plant communities (Polokwane IDP document, 2020).

3.2.2 Climate

Polokwane Municipality lies in the summer rainfall region and has a warm climate. Frost is rare. The highest temperatures occur during December and January. The daily average high temperature is 28.1 degrees Celsius in January and the highest recorded temperature is 36.8 degrees Celsius. The average minimum winter temperature is 4.4 degrees Celsius in July with a record low of -3.5 degrees Celsius in 1964. The mean annual daily variation is 15 degrees Celsius. The mean annual precipitation for the region is 478mm. Most precipitation falls between October and March with the peak period being December/January. Rainfall between the months of May and September is generally low with the average precipitation rate for the period June to August being 4,6mm. Large-scale surface airflow over the region is dominated throughout the year by easterly and north-easterly winds. October and November are typically windy with wind speed up to 13.8m/s. The frequency of southerly winds increases during June and July (Polokwane city, history of Limpopo. 2020).

Figure 3.2: A picture that illustrates a farmer holding harvested spinach from the farm

Source: Picture taken by the researcher during survey (2021)

3.3 Data source and sampling method

Primary data was used in this study and cross-sectional data was collected through interviews from a sample of 80 smallholder farmers who are producing spinach, using structured questionnaires to achieve the objectives. A multi-stage sampling technique was used in the study because larger clusters were subdivided into smaller, more targeted groupings for surveying. In the first stage, it involved a purposive selection of Polokwane Municipality from Capricorn District due to agro-ecological conditions that favour production of a diverse number of crops, including spinach. In the second stage, three villages, namely; Ga-Mamabolo, Ga-Molepo and Dikgale were purposely selected as there is a high number of smallholder farmers who actively engage in spinach production. On average, each village had a population of 35 smallholder spinach farmers, of which were actively producing spinach. The third stage involved the random selection of 27 smallholder spinach farmers from each village to enhance fair distribution of respondents in all the villages.

3.4 Analytical techniques

The data collected for the study were analysed using the Descriptive Statistics, Tobit Model and the Cobb Douglas Production Function Model.

3.4.1 Descriptive Statistics

The first objective of analysing the smallholder spinach farmers' socioeconomic characteristics was analysed using Descriptive Statistics in the form of tables, means, and percentages. Thus, tables, charts and percentages were used to describe characteristics and the constraints that are faced by smallholder vegetable farmers. Descriptive Statistics provided a simple summary of the sample and the measurement used to describe the basic features of the data in a study. Descriptive Statistics produced simple graphics analysis, consequently forming the data of the basis virtually of every quantitative analysis. For this reason, data for this study were analysed using the Statistical Package for Social Sciences (SPSS) version 26 and subjected to statistical analysis to generate descriptive statistics.

3.4.2 Cobb Douglas Regression Model

The Cobb Douglas Production Function was used to examine the factors affecting productivity among smallholder spinach farmers in Polokwane Municipality. According to Coelli *et al.* (2005), productivity is the quantity of output produced per production input in a unit of time and is a measure of how efficiently the input is used. Productivity reflects improvements in the ability to transform inputs into outputs (Fuglie *et al*., 2007). The general Cobb Douglas Production Function is expressed as follows:

$Y= AL^{\alpha} K^{\beta}u$

Where: Y= Output, A= Constant, L= Labour, K= Capital and U= Disturbance term, α and β are elasticities of production with respect to labour and capital. Therefore, the general models for this study, Y, to a given set of resources, X and other conditioning factors are given as follows:

$$Y = \alpha X_1^{B_1} + \alpha X_2^{B_2} + \alpha X_3^{B_3} + \alpha X_4^{B_4} + \alpha X_5^{B_5} + \alpha X_6^{B_6} + \alpha X_7^{B_7} + U_i$$

α is a constant, β1, β2, β3, β4, β5, β6 and β7 are elasticities to be estimated.

3.4.2.1 Model specification

For ease of estimation, the linearised form of the Cobb Douglas Function was used in the form of a double logarithm in which variables were transformed using the

natural logarithm. Double log means the dependent and all independent variables are all logged. The model gives the following specification:

$$\text{Ln } Yi = b_0 + b_1 \text{ Ln FARMSIZ} + b_2 \text{ Ln SEED} + b_3 \text{ Ln TRACTCOST} + b_4 \text{ Ln FERT} + b_5 \text{ Ln LABO} + b_6 \text{ Ln PESTI} + b_7 \text{ Ln IRRWATER} + U_i$$

3.4.2.2 Definition of variables

3.4.2.2.1 Land

This was the area of the farm that is devoted to the cultivation and this variable was captured in hectares. The estimated coefficient of land was expected to have a positive influence on smallholder farmers' productivity, given that larger farmers are expected to portray economies of scale in their farming operations compared to smaller farms. This implies that, a unit increase in the land will bring about an increase in productivity.

3.4.2.2.2 Quantity of seeds

This was captured in kilograms (kg). It is included in the model to examine the actual kilograms of the spinach seed. The coefficient for the quantity of seed is expected to be positive. This implies that, a unit increase in the quantity of seed will bring about an increase in output produced.

3.4.2.2.3 Tractor hiring cost

This variable is captured in South African Rands. It is included in the analysis of the model to estimate the cost of hiring tractor services. The sign for the cost of hiring tractor services is expected to be positive. This implies that a rand increase in the cost of hiring tractor services will bring about an increase in output.

3.4.2.2.4 Quantity of fertilizer

This was captured in kilograms (kg). It was included in the model to examine the actual kilograms of the fertilizer used which affect output. The sign for the quantity of fertilizer is expected to be positive. This implies that, a unit increase in the quantity of fertilizer will bring about an increase in output produced.

3.4.2.2.5 Labour days

This consists of family and hired labour, it was included in the model to examine how variability in labour used affects output. Labour was captured in man-days. The sign for a quantity of labour is expected to be positive. This implies that, a unit increase in the quantity of labour will bring about an increase in output.

3.4.2.2.6 Quantity of pesticides

This was captured in litres. It was included in the model to examine the actual litres of the pesticides used during the production period. The sign for the quantity of pesticides is expected to be positive. This implies that, a unit increase in the quantity of pesticides used during the production period will bring about an increase in output.

3.4.2.2.7 Irrigation water

This refers to the amount of water used during the production period. This variable was captured in litres. The sign for irrigation water is expected to be positive. By implication, a unit increase in litres of irrigation water will increase output.

Table 3.1: Description of variables used in the Cobb Douglas Production Function Model

Variables	Description of variables	Measurements	Expected sign
Dependent variable			
Total output of spinach	Total quantity of spinach produced per hectare	Kg	
Independent variable			
FARMSIZ	Total size of land used to plant spinach	Ha	+
SEED	Quantity of seed used per hectare	Kg	+
TRACTCOST	Tractor hiring cost per hectare	Rand	+
FERT	Quantity of fertiliser used per hectare	Kg	+
LABO	Man-days of labour used for arable crop production. Both hired and family labour	Days	+
PESTI	Quantity of pesticides used per hectare	Litres	+
IRRWATER	Amount of water used for irrigation	Litres	+

Source: Researcher's compilation, 2020

3.4.3 Two-limit Tobit model

The two-limit Tobit Model was used to analyse socioeconomic factors of smallholder spinach farmers that affect market access in Polokwane Local Municipality. This model is appropriate for the current study since the dependent variable is an index which takes values between 0 and 1 inclusive. Tobit model is able to provide

probability of accessing market in addition to estimating marginal effects of variables. The Two-limit Tobit model can be specified as:

$$\gamma^* = X_i\beta + \varepsilon_i \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots (1)$$

Where: γ^* is a latent variable (unobserved for values greater than 1 and smaller than 0), X_i is a vector of explanatory variables hypothesized to influence access to output market, β is the vector of coefficients and ε_i is an error term.

Denoting γ as the observed dependent variable (access to market), the two-limit Tobit model can be specified as:

$$\gamma_i = \{\gamma^* if\ 0 < {\gamma_i}^* < 1 \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots . (2)$$

3.4.3.1 Model specification

The specified Two-limit Tobit model that was used to analyse smallholder farmers' access to market can be as follows:

Y_i = B_0 + B_1HHZ+ B_2GEND + B_3AGE + B_4EDUC + B_5MARIST + B_6FARMSIZ + B_7MARKETINFO + B_8FARMEXP + B_9DISM +B_{10}EXTENCON + B_{11}QUANPROD+ B_{12}CRETACC + B_{13}COOPM + U_i

3.4.3.2 Definition of variables

3.4.3.2.1 Market access

This variable is a dependent variable for the Tobit Model and it is dichotomous in nature. This variable differentiates smallholder farmers who have access to the market and those who do not have market access. This dependent variable is a dummy variable, which assumes the value of one if a farmer has access to the market or the value of zero if a smallholder farmer does not have market access.

3.4.3.2.2 Household size

This variable refers to the total number of people who live together under the same roof which includes household head and dependents. This implies that an increase in the household size of the smallholder farmers would likely increase their probability to access the market. According to Alene *et al.* (2008), larger households are expected to produce higher levels of output since farm labour in rural settings is provided by the household members. The higher output levels will therefore induce the household to access agricultural markets. The sign for household size is expected to be positive.

3.4.3.2.3 Gender

This refers to the gender of smallholder farmers and it is captured as a dummy variable that assumes the value of one, if the household head is a male and zero, otherwise. The gender of the household head is hypothesised to influence market access positively because male households might have more information on the market than their female counterparts. Melese *et al.* (2018) found that male-headed households could also be wealthier than their female-headed counterparts and this could allow the farmer to own more productive assets which increases their chances of assessing the markets. Therefore, the study hypothesised that male-headed households will have a positive influence on the market access.

3.4.3.2.4 Age

This refers to the number of years an individual attained from birth. It was captured in years. An increase in the age of the household head is likely to increase the probability of the farmer to access the market. This means that older smallholder farmers have a propensity to access market because age is usually associated with experience. This means that they have lived long enough to accumulate more knowledge, understanding and experience about the market. The sign for age is expected to be positive.

3.4.3.2.5 Education level

This refers to the acquisition of knowledge through formal schooling. It is a dummy variable which assumes the value of one, if the household head has attained formal education and zero, otherwise. It is believed that if a household head attained formal education of any level there is a possibility that he/she is likely to access the market. Therefore, the farmer's level of education was thought to influence market access. The study by Randela *et al.* (2008) indicated that the ability to speak or understand English was found to have a positive effect on the level of commercialisation. The sign expected for education is positive.

3.4.3.2.6 Marital status

Marital status was captured as a dummy variable which takes the value of one, if a smallholder farmer is married and the value of zero, otherwise. The sign for marital status is expected to have either a positive or negative effect on market access. According to Mwangi *et al.* (2015), a married household head is expected to have a higher probability of accessing market than a single household head. This is because duties can be easily shared where one can deal with production activity and the other with marketing.

3.4.3.2.7 Farm size

This refers to the land owned by a farmer and is in hectares. The land is an important factor in production and ownership of land is crucial for farmers to access the agricultural markets. According to Jagwe (2011), size of the land owned by a household positively influenced the probability to access the market among banana producers in East Africa. In this study, it is hypothesised that farm size will influence market access positively. The sign is expected to be positive.

3.4.3.2.8 Market information

This refers to access to information on available markets and prices for the commodity produced because it enables farmers to make informed decisions. It is a dummy variable, which takes the value of one, if a smallholder farmer has access to market information and zero, otherwise. Siziba *et al.* (2010) found that access to market information positively influenced both the probability and intensity of market access among cereal producers in sub-Saharan Africa. Thus, market information is expected to positively influence market access by smallholder farmers.

3.4.3.2.9 Farming experience

This refers to the skill or knowledge acquired over a length of time during farming activities. It was captured in years. Farmers with more experience in farming may have more experience in accessing the market. Experienced farmers may have a better ability of understanding the needs of the market. Pote (2008) found that farming experience was very important in market access because farmers adapt to information regarding markets. Therefore, a sign for the number of years of farming experience is expected to be positive.

3.4.3.2.10 Distance to market

Distance to market indicates the transportation cost associated with moving the produced product to formal market. It was captured in kilometres. The longer the distance the farmer is located, the less likely the farmer would access the market because of higher transportation cost. Hence, it is expected that as market distance increases the probability of accessing the markets decreases. Omiti *et al*. (2009) found that households that were in urban centres have market access than those that were in rural areas because the farmer could access markets at lower transportation and transaction costs. The sign for distance to market is expected to be negative.

3.4.3.2.11 Extension service

This refers to access to the government extension services by the farmers in the production period. It is a dummy variable, which takes the value of one, if a smallholder farmer has access to extension service and zero, otherwise. The sign for extension service is expected to be positive, this implies that smallholder farmers who receive extension services have high chances of accessing the market due to the pool of knowledge they receive, and this makes them to make informed decision when it comes to accessing markets.

3.4.3.2.12 Quantity of output produced

This indicates the total amount of output produced during the production process. It was captured in kilograms. Therefore, a marginal increase in output produced will have a significant effect on farmers' access to markets. Thus, this variable is expected to have a positive effect on market access. Astewel (2010) found that the quantity of paddy produced influenced the probability of market access and volume of supply.

3.4.3.2.13 Credit access

This refers to the amount of money received from both formal and informal sources. This is a dummy variable, which assumes the value of one, if a smallholder farmer has access to formal credit and zero, otherwise. Access to credit would enhance the financial capacity of the farmer to purchase the inputs, thereby increasing spinach production and market access. Furthermore, farmers who have access to credit produce more production which will push them to access the market. Therefore, it was hypothesised that the sign for access to credit is expected to be positive, indicating a positive influence on market access.

3.4.3.2.14 Cooperative membership

This variable was captured as a dummy variable taking the value one, if a farmer is a member of a cooperative and zero, otherwise. This refers to the coming together of individuals into a group of farmers for interaction and sharing of ideas for common goal attainment. Thus, it influences the attitude of members towards community developmental projects. This variable was used to characterise farmers based on particular involvement in production and/or marketing organisation at the time of data collection. The expected sign for cooperative membership is positive, implying that farmers who form part of the cooperative are likely to the access market than those who are not.

Table 3.2: Description of variables used in the Tobit Regression analysis

Variables	Description of variables	Measurements	Expected sign
Dependent variable			
Smallholder spinach farmers market access	1 if the farmer has market access, 0 otherwise	Dummy	
Independent variable			
HHSIZ	Number of members in the household	Number	+
GEND	1 if the farmer is male, 0 otherwise	Dummy	+
AGE	Age of the farmer	Years	+
EDUC	1 if the farmer has formal education, 0 otherwise	Dummy	+
MARIST	1 if the farmer is married, 0 otherwise	Dummy	+/-
FARMSIZ	Farm size	Hectares	+
MARKETINFO	1 If the farmer has market information, 0 otherwise	Dummy	+
FARMEXP	Years of farming experience	Years	+
DISM	Distance to the nearest market	km	-
EXTENSER	1 if farmer have access to extension services, 0 otherwise	Dummy	+
QUANPROD	Quantity of output produced	Kg	+
CRETACC	1 if farmer has credit access, 0 otherwise	Dummy	+
COOPM	1 if farmer is member of a cooperative, 0 otherwise	Dummy	+

Source: Researcher's compilation, 2020

Table 3.3: Analysis of objectives

Objectives	Data source	Analytical tool
Identify and describe the socio-economic characteristics of smallholder spinach farmers in the Polokwane municipality of Limpopo province.	Primary data	Descriptive statistics
Examine the determinants of productivity among smallholder spinach farmers in the Polokwane municipality of Limpopo Province.	Primary data	Ordinary least squares regression of Cobb Douglas Production Model
Analyse the effect of socio-economic characteristics of smallholder spinach farmers on market access in the Polokwane Municipality of Limpopo Province.	Primary data	Two-limit Tobit Model

Source: Researcher's compilation, 2020

3.5 Ethical considerations

3.5.1 Permission

The official permission or the ethical clearance certificate to carry out the study was obtained from Turfloop Research Ethics Committee (TREC) of the University of Limpopo prior to the commencement of the study.

3.5.2 Informed consent

The researcher informed the smallholder farmers that the questions to be asked were not intended to harm them and invade their privacy. Participation in this study was on a voluntary basis and the respondents were informed that they were free to withdraw from participating at any time without justifying their decision.

3.5.3 Confidentiality and anonymity

In this study, the confidentiality and anonymity of smallholder farmers were taken into consideration. The information they provided in the study was kept confidential and used only for the research purposes. The researcher fully informed the smallholder farmers about the topic, aim and objectives of the study before they agreed to participate in the study.

3.5.4 Protection from harm

The researcher protected the identities of the smallholder farmers and their privacy was also protected through anonymity. The study was not harmful to the well-being of the participants.

3.6 Limitations of the study

Most of the smallholder farmers in the study area were not keeping records of their information and it was very difficult for them to recall some of the information needed for the survey. For example, some of them were not able to recall the quantity of the spinach harvested and sold to the market. Furthermore, the sample size of surveyed smallholder spinach farmers was relatively lower due to financial shortage, as the transport to move from one area to another is costly and some farmers were fearful of contracting the Corona Virus Disease of 2019 (Covid-19). Nonetheless, the sampled number was still adequate to provide indications of the socio-economic characteristics, which are affecting productivity and market access as those farmers also were coming from different villages.

3.7 Summary of the chapter

The aim of this chapter was to provide an overview of the study area, data collection methods, analytical procedures and the models that were used in the study. The data was analysed using the Cobb Douglas Production Function to examine determinants of productivity and the Two-limit Tobit Model was used to examine smallholder farmer's market access in the study area.

CHAPTER FOUR: RESULTS AND DISCUSSION

4.1 Introduction

The aim of this chapter is to provide some insights into the socio-economic characteristics on the determinants of productivity and market access of smallholder farmers in Polokwane Local Municipality. The chapter presents the results of the empirical models and descriptive analysis. The information given below is derived from the descriptive analyses of the data collected, as described in Chapter 3. In this chapter, basic socio-economic and demographic characteristics of farmers are discussed in the context of productivity and market access. Within the chapter, descriptive statistics such as mean, maximum and minimum values, frequencies and standard deviation are presented. The empirical results of the Cobb Douglas Production and Two-limit Tobit Model in accordance with the research objectives are also presented.

4.2 Results from descriptive statistics

Table 4.1: Market access by smallholder farmers

Market	Frequency	Percentage (%)
Access to the market	52	65%
Do not have access to the market	28	35%
Total	**80**	**100**

Source: Results generated from field survey, 2021

Table 4.1 above shows the proportion of smallholder spinach farmers who have access to the markets and those that do not have access using frequencies and percentages. According to Table 4.1, 65% (52) have access to the market while 35 (28) do not have access to the market.

Table 4.2: Smallholder farmers' market access by age, household size, farming experience and land size

Variable		Freq	Per (%)	Market access (n=52)				No market access (n=28)			
				Min	Max	mean	Std	Min	Max	mean	Std
Age (years)	< 30	18	22	27	57	35	7.74	28	66	46	9.84
	30–39	29	36								
	40–49	15	19								
	50-59	11	14								
	> 60	7	9								
Household size (numbers)	<5	20	25	3	11	9	4.57	2	14	8	8.96
	5-10	49	61								
	11-15	9	11								

	>16	2	3								
Farming experience (years)	<5	18	23	3	21	12	5.44	1	14	7	8.86
	5-10	27	34								
	11-15	24	30								
	16-20	9	11								
	>20	2	2								
Land size (hectares)	<0.5	23	29	1	3	2	1.63	1	2	2	4.38
	0.5-1	32	40								
	1.5-2	19	24								
	>2	6	7								

Source: Results generated from field survey, 2021

Age of the household

According to Mdlalose (2016), younger farmers were expected to be more active in farming than elderly farmers. The results in Table 4.2 revealed that the majority (36%) of the farmers were between the ages of 30-39 years, 19% were between 40-49 years, while 14% were between 50-59 years and 9% were about 60 and above years of age. About 22% of the farmers were less than 30 years. With regards to market access, smallholder farmers with market access had a minimum age of 27 years, maximum of 57 years and an average age of 35 years. Moreover, smallholder farmers with no market access had a minimum age of 28 years, maximum age of 66 years and the average age was 46 years. These results show that the majority of the farmers with market access in the study area are still young and in the active age group, implying that they can make a positive contribution to smallholder farming as well as serve as agents of innovation transfer in farming activities.

Household size

Table 4.2 also shows the distribution of the farmers by household size. A majority (61%) of the farmers had the household size that is between 5-10 members, followed by a household size with less than 5 members which constituted 25%. About 11% had household size, of between 11-15 members and 3% had the household size of more than 15 members. The household size of farmers with market access had a minimum of 3 members, and a maximum of 11 members and an average of 9 members. For farmers with no market access, the minimum household size is 1 member and maximum of 14 members with an average of 8 members. This implies that family labour would be readily available for farmers with market access when needed for farming activities. Hence, Martey *et al*. (2012) indicated that a larger household may have more family labour for production compared to a smaller one.

Farming experience

Pote (2008) indicated that farming experience is very important in market access because farmers with experience adapt easily to information regarding markets. This

implies that the more years of experience in farming, the more farmers will be able to make sound decisions that are technically feasible concerning resource allocation and management of their farming activities. The distribution of respondents by their farming experience in Table 4.2 revealed that 23% of farmers had less than 5 years of farming experience, 34% had 5-10 years and 30% had 11-15 years of farming experience, while only 2% had a farming experience of more than 20 years. Moreover, the minimum farming experience of smallholder farmers with market access was 3 years with a maximum of 21 years and an average of 12 years. The farmers who lack market access had an average of 7 years of farming experience with the minimum and maximum of 1 year and 14 years, respectively. This suggests that smallholder farmers who have access to the market are relatively more experienced than smallholder farmers who do not have access to the market.

Land size

Results indicate that the size of the land used for spinach production by the farmers in the study area differs from farmer to farmer. As displayed in Table 4.2, 29% of the respondents had a land size less than 0.5 hectares, 40% with a land size that is between 0.5-1 hectares, 24% with a range between 1.5-2 hectares and only 7% of the respondents had a land size above 2 hectares. The results further indicated that the average farm size of the farmers with market access is 2 hectares with the minimum and maximum of 1 hectare and 3 hectares, respectively. Furthermore, those with no market access had a minimum of about 1 hectare, a maximum of 2 hectares and the average of 2 hectares. The finding is consistent with Matungul *et al.* (2001) who found that smallholders are allocated quite small plots of arable land for farming.

Table 4.3: Smallholder farmers' market access by gender, marital status, education, main source of income and land size

Variable		Freq.	Per (%)	Market access (n=52)		No market access (n=28)	
				Freq.	%	Freq.	%
Gender	Male	33	41	23	44	10	36
	Female	47	59	29	56	18	64
Marital Status	Single	15	19	8	15	7	25
	Married	47	58	32	61	15	54
	Widowed	7	9	5	10	2	7
	Divorced	11	14	7	14	4	14
Education	No formal education	16	20	6	11	10	36
	Primary education	14	17	9	18	5	18
	Secondary education	44	55	31	59	13	46

	Tertiary education	6	8	6	12	0	0
Cooperative membership	Yes	44	55	42	81	2	7
	No	36	45	10	19	26	93
Main source of income	Salary	12	15	8	15	4	14
	Farming income	22	28	16	31	6	22
	Government social grants	37	46	24	46	13	46
	Other business income	9	11	4	8	5	18
Land ownership	own	55	69	38	73	17	61
	Inherited	11	14	5	10	6	21
	Leased	10	12	7	13	3	11
	other	4	5	2	4	2	7

Source: Results generated from field survey, 2021

Gender of the household head

Results presented in Table 4.3 show that 59% of the respondents are females. This indicates that female-headed households were more actively involved in growing spinach than males in the study area. All the male and female smallholder farmers who have access to markets were 44% and 56%, respectively, whereas their counterparts who lacked market access were 36% and 64%. Most women being officially unemployed in the study area, often become actively involved in growing spinach while their male counterparts seek jobs.

Marital status

Respondents (farmers) were assessed based on their marital status, which was classified into four categories, namely: single, married, widowed and divorced. Based on the results in Table 4.3, 19% of the respondents were single, 58% were married, 9% were widowed and 14% were divorced. Furthermore, the results revealed that the majority, that is, 62%(32) of the respondents with market access were married, 15% were single, 14% were divorced and 10% of the respondents were widowed. For their counterparts with no market access, it was found that 54%, 25%, 14% and 7% were married, single, divorced and 7% widowed, respectively. The results indicate that farmers involved in smallholder vegetable farming were mostly married. Since both single and married smallholder farmers were present in the study, it could be concluded that in the study area, the marital status of an individual did not necessarily influence farming decisions.

Education level

Education is an important demographic factor that influences farmers' decision-making because of its influence on farmers' awareness, perception and adoption of innovations. Educational level was divided into four categories, namely; no education, primary education, secondary education and tertiary education. The

results in Table 4.3 revealed that 20% of the respondents had no formal education while about 17% had primary education, 55% had secondary education and 8% had tertiary education. The results further showed that respondents with market access were 89% and 11% with formal education and no formal education, respectively, while those with no access to market 64% had formal education and 36% had no formal education. The majority (80%) of the farmers in the study area had one form of formal education or the other, implying that there is potential for increased spinach production since education will help them to have access to information on new agricultural innovation, which can be adopted to enhance their market access and productivity.

Cooperative membership

The results in Table 4.3 show that 55% of the farmers participate in cooperative association and 45% of the farmers did not participate in any cooperative association. About 81% of the farmers who are participating in cooperatives have market access and only 19% of them who are not participating in cooperatives have market access. Furthermore, 7% of the farmers who are participating in cooperatives have no market access while 93% of the farmers who are not participating have no market access. The results suggest that there is high number of membership in cooperatives by a significant proportion of the farmers in the area, which implies that farmers have more access to resources and information that will improve their production practices.

Main source of income

Sampled respondents were asked if they have any other source of income besides farming. As indicated in Table 4.3, larger portions (46%) of the farmers have a source of income from government social grants, and 15%, 28% and 11% were from salary, farming and other businesses, respectively. The results further indicated that 31% of the respondents with market access have farming income while 69% have sources of income besides farming. Moreover, 22% of the respondents with no market access have farming income whereas 78% of the respondents have sources of income besides farming. About 73% of the farmers have sources of income besides farming while 27% only receive farming income. This shows that most of the respondents in the study area are unemployed and rely on government social grants and other businesses for other income.

Land ownership

As indicated by the results in Table 4.3, a larger proportion of the sampled farmers (69%) practices their farming activities on owned land, implying that most smallholder farmers in the study had access to secured land for production purposes. Furthermore, 14%, 12% and 5% of the land was inherited, leased and acquired in other forms that include land being donated or being family owned land, respectively. About 73% of the respondents with market access own the land and 27% do not own the land whereas 61% of the respondents who do not have access to the market own the land and 39% of the respondents do not own the land; it was either inherited, leased or donated to them.

4.2.1 Descriptive statistics for market related variables

4.2.1.1 Number of extension visits

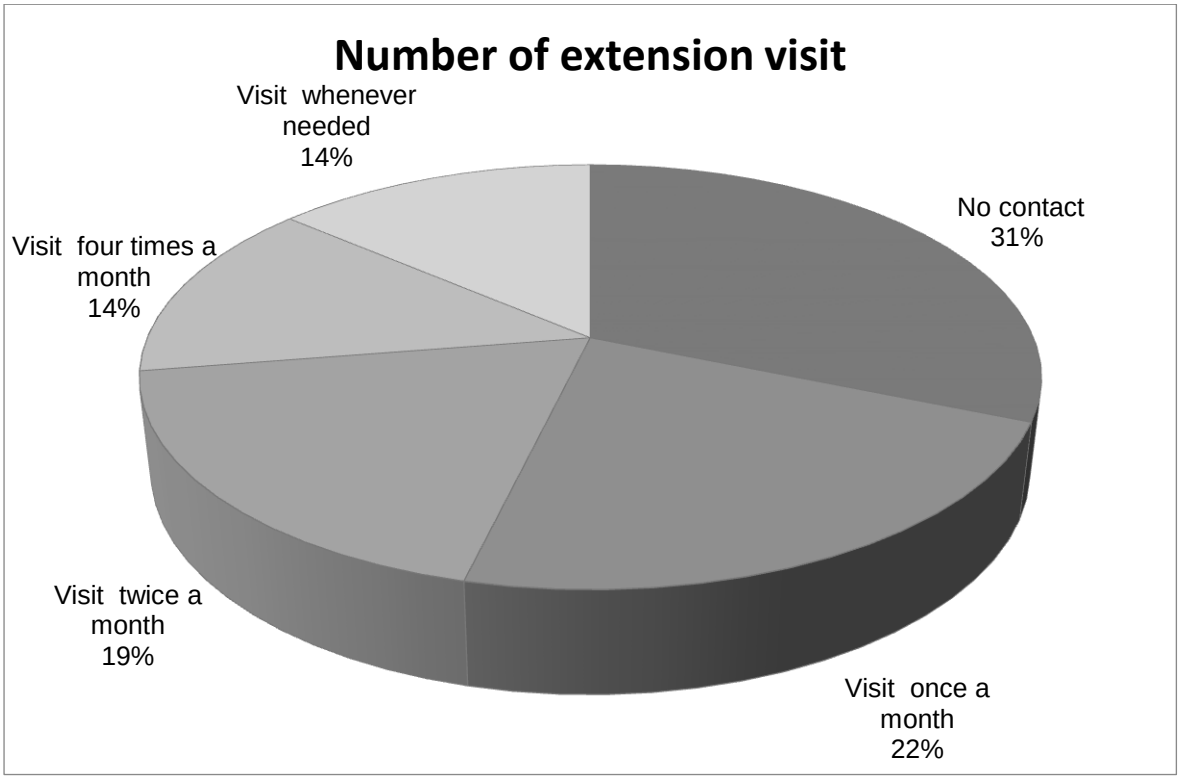

Figure 4.1: Number of extension visits

Source: Results generated from field survey, 2021

The study assessed the frequency of visits by extension officers. The ultimate aim of extension services is to enhance farmer's ability to efficiently utilise resources through the adoption of new and improved methods instead of using traditional methods, which are inefficient, resulting in low yield. The distribution of the respondents based on numbers of extension visits are shown in Figure 4.1. It was found that 31% of respondents do not have access to extension service at all. About 22% of the respondents indicated that extension officers visit them once a month

and 19% are visited twice a month. Furthermore, 14% of the respondents indicated that they are visited four times a month and only 14% mentioned that extension officers visit them whenever they are needed. Respondents pointed out that some of the extension officers do not have their own cars and have to share government vehicles to visit them. This suggests that the extension officer would fail to visit farmers if a government vehicle is not available or is being used by another extension officer.

4.2.1.2 Sources of market information

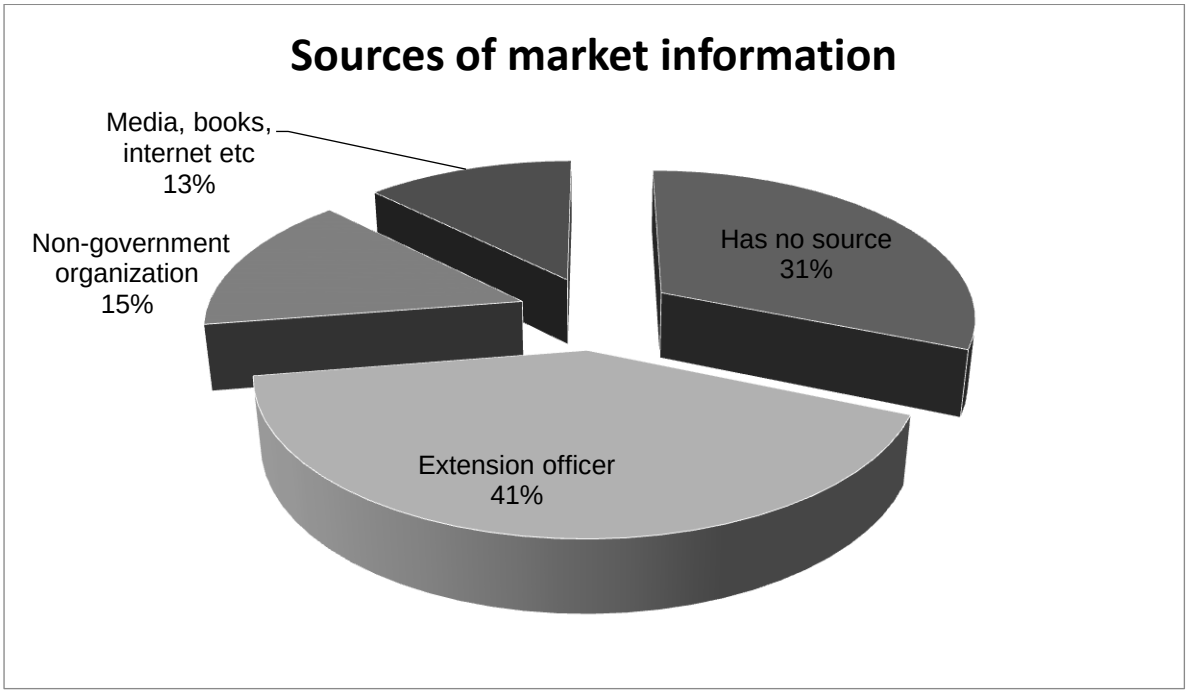

Figure 4.2: Sources of market information

Source: Results generated from field survey, 2021

Mdlalose (2016) indicated that it is important that market information should be obtained from reliable and trusted sources. The respondents were asked to disclose their sources of market information. As shown in Figure 4.2, about 41% of the respondents indicated that their source of market information is extension officers, 15% of the respondents receive their information through non-government organisations and 13% rely on media, books, internet and other sources for information. A concern is that 31% of the respondents had no market information. This suggests that these farmers do not know what the market needs or wants.

4.2.1.3 Distance to the market

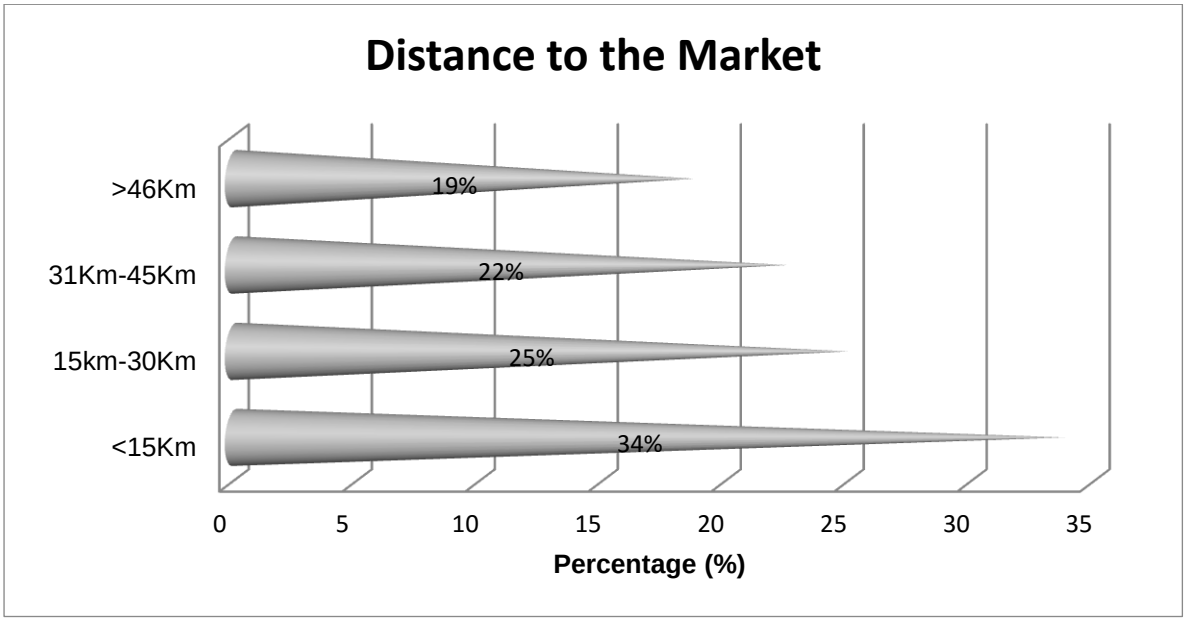

Figure 4.3: Distance to the market

Source: Results generated from field survey, 2021

Market distances also influence the extent to which smallholder farmers can access different types of markets. Results in Figure 4.3 show that 34% of the respondents transport their produce to the market for a distance less than 15Km, 25% of the farmers travel from 15Km to 30Km, 22% farmers transport their produce to the market distance of 31Km to 45Km and about 19% transport their produce to markets of distance above 46Km. According to Matoti *et al.* (2007), smallholder farmers in South Africa in general, are geographically dispersed and distant from markets and therefore reaching the markets is difficult for most of them.

4.2.1.4 Mode of transport

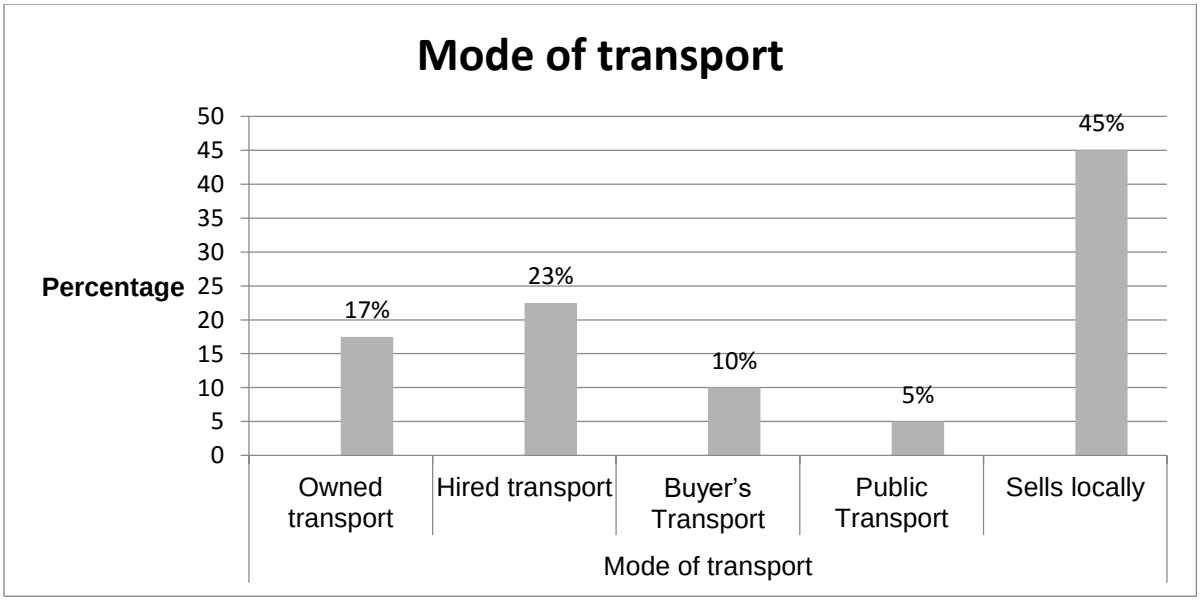

Figure 4.4: Mode of transport

Source: Results generated from field survey, 2021

The availability of reliable transport is important because unreliable transport can lead to delays (Mdlalose, 2016). As indicated in Figure 4.4, about 17% of the respondent farmers indicated that they use their own transport to take produce to the market. About 23% of the sampled farmers use hired transport, 5% use public transport, 10% use the buyer's transport and only 45% sells to locally to informal market. The respondent farmers indicated that when moving their produce, they face problems of high transportation costs and poor modes of transport. For instance, one of the farmers indicated that some 'bakkies' do not have a canopy to protect their spinach against the sun and dirt, posing threat to hygiene and quality of the produce.

4.2.1.5 Ease of finding markets

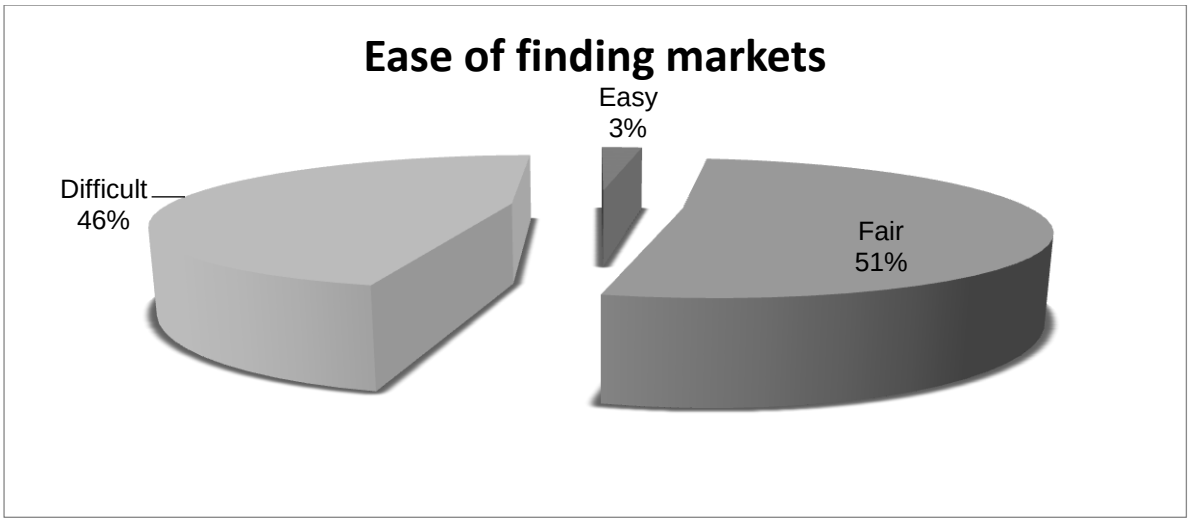

Figure 4.5: Ease of finding markets

Source: Results generated from field survey, 2021

The respondent farmers were also asked to indicate how difficult it is to find the markets. As shown in Figure 4.5, only 3% of the respondents find it easy to locate markets. About 51% believed that it is fair, meaning that they only face a few challenges when finding markets while the remaining 46% believed that it is difficult to find markets.

4.2.1.6 Timing of seeking markets

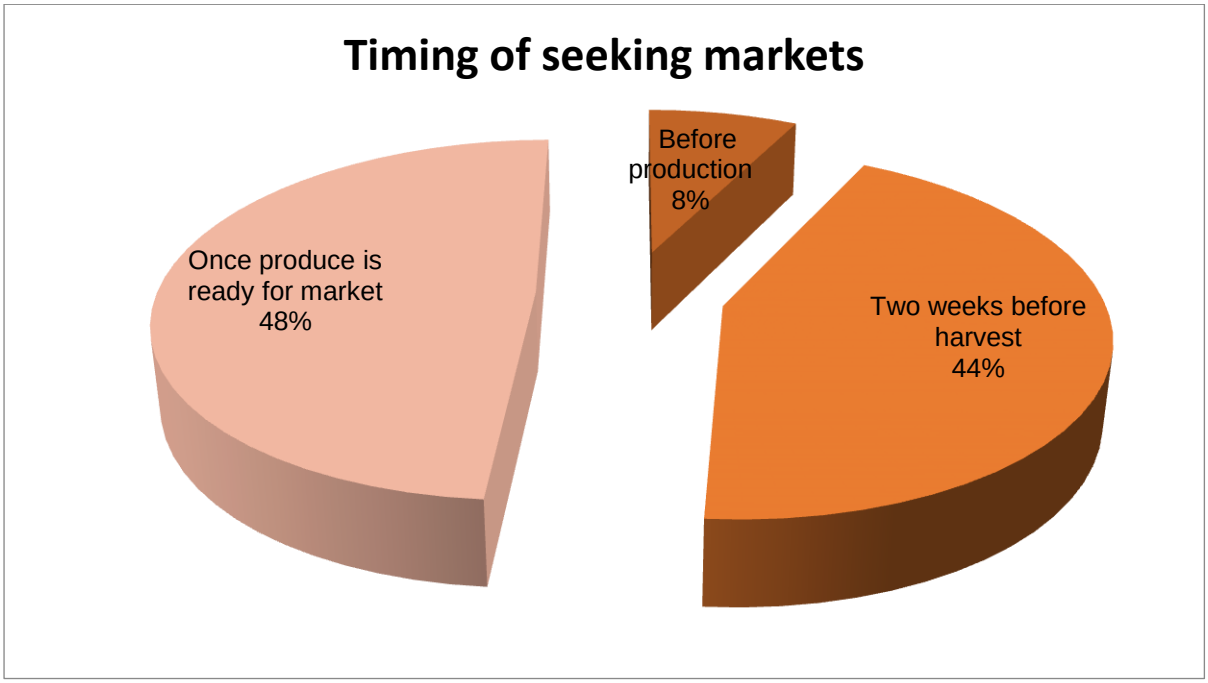

Figure 4.6: Timing of seeking markets

Source: Results generated from field survey, 2021

Furthermore, the farmers were asked when they looked for markets. As displayed in Figure 4.6, about 8% of the farmers indicated that they look for markets before production. Only 44% of the respondents indicated that they usually start to look for markets two weeks before the harvest time begins whereas the remaining 48% look for the market when their produce is ready. The farmers indicated that it is not possible to seek markets before production because their potential buyers require a sample produce. This shows that there is lack of trust between potential buyers and these farmers. Therefore, they are forced to look for markets once produce is available.

4.2.2 Descriptive statistics for productivity related variable

Table 4.4: Descriptive statistics for productivity related variables (n=80)

Productivity related variable		**Frequency**	**Percentage (%)**
Access to irrigation water	Yes	58	72.5
	No	22	27.5
Tractor cost	<R300	23	28.7
	R300-R500	32	40
	R500-R700	19	23.8
	>R700	6	7.5
Monthly household income	<R700	5	6.3
	R700-R1500	12	15

	R1500-R3000	32	40
	R3000-R5000	14	17.5
	>R5000	17	21.2
Labour	Hires labour	24	30
	Family labour	56	70
Credit access	Yes	33	41.3
	No	47	58.7
Off farm activities	Yes	58	72.5
	No	22	27.5
Fertilizer application	Yes	53	66.2
	No	27	33.7

Source: Results generated from field survey, 2021

Access to irrigation water

The availability of a reliable water supply for irrigation is important, especially in vegetable production because it enables the farmer to produce high quality output. As such, Table 4.4 displays that 72%, which is the majority of the farmers in the study area, have access to a water supply to irrigate their spinach while 28% of the farmers indicated that they rely on rivers for water.

Tractor cost

The cost of a tractor differs according to the farmers' farm size. Those with large farm sizes will have to pay more money than those with smaller farm sizes for tractor services. As displayed in Table 4.4, 29% of the farmers pay less than R300, 40% of the farmers pay between R300 and R500 for a tractor per hectare, 24% pay between R500 and R700 and only 7% of the farmers pay more than R700 for a tractor per hectare.

Monthly household income

The results in Table 4.4 show that 6% of the farmers receive less than R700 monthly, with the majority (40%) of farmers earning between R1500 and R3000 and 15% of the farmers earning between R700 and R1500 monthly, 18% were earning between R3000 and R5000 monthly while 21% of the farmers earned more than R5000. This suggests that since farming in the study area involves young people, it shows that most of them do not depend on farming income only, but also have other sources off-farm incomes, which enables them to buy necessary inputs, thereby increasing their productivity levels.

Labour

Most of the smallholder farmers in the study mainly depend on family labour but they still hire labour to add to the family labour. Usually, farmers with small household sizes are the ones who hire labour. Hired labour helps in accelerating production at various stages in farming. According to Table 4.4, 30% of the farmers hire labour while 70% of the farmers depend on family labour. Thus, family labour tends to influence the productivity level of smallholder spinach farmers as they have the best interest of the household to improve their livelihood, unlike hired labour.

Credit access

According to Kinde (2005), adequate funding is required by farmers to finance their production activities. In the study, farmers were asked if they have access to credit through formal or informal sources. As indicated in Table 4.4, about 41.3% of the farmers indicated that they do have access to credit while 58.7%% of the farmers do not have access to credit. This suggests that a large number of farmers in the study face a serious shortage of funds to finance their production activities, which in turn limits their level of productivity. Furthermore, Junge *et al.* (2009) noted that lack of accessibility to credit services has been reported in many parts of sub-Saharan Africa as well as other developing countries as the limiting factor of increased agricultural productivity.

Off-farm activities

Off-farm activities usually play a vital role in helping the farmer to have additional income, which will help in strengthening farm activities by acquiring other important farm inputs such as agrochemicals (pesticides, herbicides, etc.). The results in Table 4.4 indicate that about 72% of the farmers are involved in other ventures than farming whereas 28% are only involved in farming as a primary activity.

Fertilizer application

Fertilizer plays an important role in spinach production, as no matter how large and small the farm size may be, if applied properly, it will yield increase. The above results in Table 4.4 show that 66% of the farmers do apply fertilizers in their farming practices. This includes even farmers who are using kraal manure and ready-made fertilizers. However, about 34% of the farmers do not use fertilizers. This could be due to a lack of funds to purchase them. According to Ibitola *et al*. (2019), non-application of fertilizers in farming practice influences productivity level.

4.3 Empirical results and discussion from the Cobb Douglas Production Function

Table 4.4 below presents the estimates of the Cobb Douglas Production Function as described in Chapter 3. The model was used to examine the determinants of productivity among smallholder spinach farmers in the Polokwane Local Municipality. It is important to use a model that relates productivity to those variables for a better understanding of the functional relationships. The variables included in the analysis of the model are farm size, tractor cost, seed, water irrigation, pesticides, fertilizer, and labour. The results show that the estimation of the production function resulted in the adjusted R^2 of 0.614.

Table 4.5: Results from Cobb Douglas Production Function model

Variables	**Coefficient of elasticity**	**Standard error**	**T-ratios**	**Significance**
Constant	0.122	0.327	0.373	0.152
Ln LABO(man days)	0.041	0.015	2.733	0.031**
Ln TRACTCOST	-0.134	0.246	0.545	0.142
Ln FARMSIZ(hectares)	0.141	0.065	2.169	0.043*
Ln PESTI	0.278	0.457	0.608	0.344
Ln FERT	0.335	0.132	2.538	0.000***
Ln WATERIRR	0.109	0.566	0.193	0.159
Ln CERSEED	0.127	0.062	2.048	0.015**
Adjusted R^2		0.614		
R- squared		0.706		
n		80		

Note: ***, **, and * are significant at 1%, 5%, and 10% significant levels, respectively.

Source: Results generated from field survey, 2021

4.4.1 Elasticities of production

According to Fuglie *et al*. (2007), elasticities represent the percentage change in the total value of output with respect to the percentage change in each of the inputs. The elasticity represents the effects of additional units of input used which results in constant (E_P=1), increasing (E_P>1), or decreasing (E_p<1) marginal returns. The sum of all the elasticities yields the rate of return to production (that is, whether it is stage 1, 2 or 3 of the production function) at which farmers operate. The elasticities of production function estimates in Table 4.5 above indicate the relative importance of factors or inputs used in spinach production in this study. The estimates show that

labour, farm size, fertilizer and certified seeds are important factors of production with the coefficient of 0.041, 0.141, 0.335 and 0.127, respectively.

These estimates of the parameters of the model revealed that most of the estimated coefficients of the variables of the production function were positive except tractor cost, which is negative. The positive coefficients imply that as each of these variables are increased, the total output of spinach will also increase. This result of the analysis suggests that by increasing all these variables in the study, except tractor cost, an increase in output will be recorded in spinach production.

4.4.2 Return to scale

The return to scale analysis, which serves as a measure of total resource productivity. The return to scale parameter (0.897) was obtained by summing all the coefficients of these input elasticities. To determine the returns to scale, firstly the sum of the coefficients β and α must be greater than one ($\beta + \alpha > 1$), for increasing returns to scale and for decreasing returns to scale the sum of coefficients β and α must be less than one ($\beta + \alpha < 1$). The constant return to scale is denoted when the sum of coefficients β and α equal to one ($\beta + \alpha = 1$).

The results as shown in table 4.5 above indicate the return to scale of 0.897, which is less than one indicating a decreasing return to scale. This may be because smallholder spinach farmers in the study area are over-utilising the resources at their exposal. This implies that farmers are experiencing more cost during production period while the returns are lower.

4.4.3 Labour

The elasticity of labour is positive (0.041) and statistically significant at 5% level. This implies that 1% increase in man-days of labour used in production would increase the total output of spinach by 4.1%, all other inputs held constant. This simply indicates that an increase in labour should lead to an increase in spinach output as there will be more hands on the farm to work, especially when the labour type is family. According to Ibitola *et al*. (2019), family labour tends to contribute to low cost as labour is not hired, but in cases where the labour is hired, more cost incurs. Therefore, the farmer may not have a good yield as expected, because he or she will be spending more money on labour than on other farming activities. The sign is as expected and this work corresponds with the work of Asiribo *et al.* (2009).

4.4.4 Farm size

This refers to the total area used by the farmer for farming activities. Farm size as a variable has an elasticity of 0.141 and strongly influences spinach production at 10% significant level. The positive coefficient is an indication that the farm size has a direct relationship with farmers' productivity in the study area. According to the results, this implies that an increase in the plot size by 1% significantly increases the farmer's total output by 14.1%, all other inputs held constant. Furthermore, this finding agrees with Koc *et al*. (2011), who suggests that, the more the land is allocated to farming, the higher the yields obtained and argued that most smallholder farmers usually fail to maximise output due to underutilisation of the land.

4.4.5 Fertilizer

The variable fertilizer has a positive elasticity coefficient of 0.335 as hypothesised, and statistically significant at 1% level. The results imply that a 1% increase in the quantity of fertilizer applied would increase the total output of spinach output by 33.5%, all other inputs held constant. This simply suggests that increasing the amount of fertilizer would contribute to higher spinach yields in the study area. This finding of the study is in line with the findings presented by Tchale (2009) in Malawi where fertilizer was a key factor in the production of major crops grown by smallholder farmers. Reardon (1996) on the study of determinants of farm productivity in Africa also found a positive effect of fertilizer on productivity. From the results, it is evident that to achieve higher productivity, farmers in the study area need to increase their usage of fertilizer.

4.4.6 Certified seeds

The results showed a positive elasticity of 0.127 for seed as hypothesised was statistically significant at 5% level. This shows that 1% increase in the quantity of seeds used would increase the spinach output by 12.7%, all other inputs held constant. This suggests that planting more seeds will improve spinach productivity, which is attributed to the fact that the increased number of seeds per hole will help to reduce the risk of plants failing to grow and translated into higher production from a unit piece of land. The finding agrees with the findings by Nya *et al.* (2010) who established that improved planting materials like seeds significantly influence yields and profitability among vegetable farmers.

4.4.7 Tractor cost

The elasticity coefficient of tractor cost was found to be negative (-0.134) and was not statistically significant at any level. By implication, when tractor cost increases by the amount of 1%, the total output would decrease by 13.4%, all other inputs held

constant. The tractor cost influences the total output of spinach negatively and that the farmers in the study area were over utilising it in the production process. This indicates further that the farmers in the study area are operating on stage 3 of the neoclassical production function.

4.4.7 Pesticides

This variable was found to have positive elasticity of 0.278 and was not statistically significant. There is a positive relationship between total output and pesticides and the farmers in the study area are under-utilising this variable. This implies that 1% increase in the litres of pesticides, all other inputs held constant, will increase total output by 27.8%. These suggest that the variable is sensitive to the total output of spinach.

4.4.8 Irrigation water

The elasticity of water for irrigation was found to be 0.109 and not significant. Therefore, the input contributes positively to the production of spinach in the study area. The results show that 1% increase in the amount of litres used in the production process, holding all other inputs constant, the total output of spinach would increase by 10.9%. In other words, access to water for irrigation by smallholder farmers in the study area is more effective and efficient.

4.4 Empirical results and discussion from the Two-limit Tobit Model

This section contains the empirical results derived from the Two-limit Tobit Model. This model was used to analyse the effect of socio-economic characteristics of smallholder spinach farmers on market access in the Polokwane Local Municipality. Accordingly, thirteen(13) hypothesised socio-economic characteristics of smallholder spinach farmers who have the largest potential to influence market access were empirically tested. Only seven (7) variables were significantly associated with market access. These variables are education level, household size, extension contact, farming experience, distance to the market, quantity of output produced, and market information. Among all these variables, the variable distance to the market was found to have a significant negative influence.

As indicated in Table 4.6. The Pseudo R^2 is 0.682, and it is an acceptable level, implying that 68% of the variation in the dependent variable, which is the market access, is explained by the changes in the independent variables.

Table 4.6: Results for Binary Two-limit Tobit Model

Variables	Estimated coefficient	Marginal effect	Standard error	T-ratios	significance
Constant	3.179	0.850	1.749	1.818	0.366
AGE	-0.378	-0.17	0.229	1.651	0.395
GEND	2.867	0.97	1.765	1.624	0.279
EDUC	1.734	0.063	0.457	3.794	0.001***
CRETACC	0.198	0.202	0.154	1.286	0.489
HHSIZ	0.353	0.043	0.098	3.602	0.087*
COOPM	0.253	0.461	0.322	0.786	0.273
QUANPROD	0.001	0.071	0.0003	3.333	0.005***
MARKETINFO	0.287	0.678	0.122	2.352	0.001***
FARMSIZ	0.486	0.344	0.345	1.409	0.287
DISM	-2.267	-0.642	0.688	3.295	0.048**
MARIST	0.442	0.156	0.424	1.042	0.309
EXTENCON	0.673	0.052	0.219	3.073	0.036**
FARMEXP	4.981	0.392	2.143	2.324	0.019**
Number of observations		80			
LRChi^2		130.28			
Pseudo R^2		0.682			
Prob>chi^2		0.0000			

Note: ***, **, and * are significant at 1%, 5%, and 10% significant levels, respectively.

Source: Results generated from field survey, 2021

4.4.1 Education level of household head

The education level of the household was found to have a positive relationship with the market access and was statistically significant at 1% probability level. The results imply that one-year increase in the level of education by the household head increases the likelihood of accessing the agricultural markets by 6.3%, all other factors held constant. In other words, household heads with a higher level of education are more likely to access markets because with the increased level of education, utilisation of market opportunities tend to be higher. The finding is consistent with results found by Rao *et al.* (2012) in the case of vegetable farmers in Kenya, who observed that educated farmers are more likely to be willing to seek extension services because they are able to process the often abstract extension

packages and convert such information into practice, making them more likely to access markets.

4.4.2 Household size

The variable household size was statistically significant at 10% probability level and has a positive influence on market access. The implication is that an increase in the size of the household by one person increases the probability of accessing the spinach market by 4.3%, all other factors held constant. Furthermore, this implies that as vegetable farming is labour intensive, the larger family provides more labour to undertake vegetable production and management activities easily which in turn increases vegetable yield leading to increased market access. The results are consistent with those of Woldemichael (2008) who found that household size has a positive effect on the probability of dairy household milk with market access.

4.4.3 Quantity of output produced

The coefficient of quantity produced was found to be statistically significant at 1% probability level and has a positive effect on market access. This means that the relationship between the quantity produced and market access is positive. From the results, an increase in the spinach quantity produced by one kilogram increases the likelihood of market access by 7.1%, all other factors held constant. This is in line with the findings of Mussema and Dawit (2012) who found that when farmers produce more pepper, they are more likely to access the output market.

4.4.4 Market information

Market information was significant at 1% probability level and positively influenced market access by the smallholder farmers in the study. This means that the relationship between access to the market by the smallholder spinach farmer and the market information is positive. This implies that 1% increase in access to market information by smallholder farmers regarding market conditions will increase the probability of accessing the market by 67.8%, all other factors held constant. In other words, when market information is available and accessible to farmers, spinach farming becomes less risky and farmers are more likely to access the markets. This finding is consistent with that of Omiti *et al.* (2009) who observed that the use of formal market information channels contributed to an increased output market access in rural areas, choice of marketing channel and choice of facilitation to output market.

4.4.5 Distance to the market

The coefficient of distance to the market was statistically significant at 5% probability level and negatively influences the market access. This indicates that the relationship between distance to market and market access of the farmer is negative. The results show that an increase in the distance to the market by one kilometre will decrease the likelihood of market access by 64.2%, all other factors held constant. This can be explained by the fact that farmers who are far from the market are less likely to produce spinach for sale and more likely to produce for their own consumption. The longer the distance to the marketplace from a farmer's premises, the more difficult and costly it will be to access the market. This finding corresponds with the findings of Makhura *et al*. (2001) who found that distance to the market negatively influences both the decision to participate in markets and the proportion of output sold.

4.4.6 Extension contact

The extension contact variable was found to be statistically significant at 5% level of probability and positively influences market access by smallholder farmers. An increase in contact by one increases the probability of accessing the spinach market by 5.2%, all other factors held constant. This implies that contact with extension agents improves the ability of the farmers to access agricultural markets due to the knowledge, demonstrations and information they receive from the agents, which may shift the balance between the success and failure of the smallholder farmers. These results are consistent with the findings of Alene *et al.* (2008) who observed that interaction with extension agents is likely to improve marketable surplus and enhance a smallholder farmers' likelihood of accessing markets.

4.4.7 Farming experience

The years of farming experience is positive and statistically significant at 5% probability level. The positive coefficient of the variable indicates that the relationship between farming experience and market access of the farmer is positive. This implies that an increase in one year of farmer's experience increases the probability of market access by 39.2%, all other factors held constant. In other words, as the age of smallholder farmers increases their capacity to access agricultural markets also increases. The finding agrees with the work of Awan *et al.* (2012) who analysed the assessment of production practices of small-scale farm holders of tomato in Bagrote Valley and found that the more years of experience in farming determine better knowledge and the ability to access the market for farm produce among smallholder farmers.

4.5 Chapter summary

This chapter presented findings of the study, which was carried out in the Polokwane Local Municipality under the following areas: Ga-Molepo, Ga-Mamabolo and Dikgale. The socio-economic characteristics of the farmers were described and the Cobb Douglas Production Function Model was used to examine factors that determine the productivity of which four variables, namely; certified seed, farm size, fertilizer and labour, were found to be significant. The Two-limit Tobit Model was used to analyse socioeconomic factors that affect market access. The variables that were found to be significant are household size, education level, market information, farming experience, distance to the market, quantity of output produced and extension contact.

CHAPTER FIVE: SUMMARY, CONCLUSION AND POLICY RECOMMENDATIONS

5.1 Introduction

This chapter provides the summary of the study and conclusions based on the findings of the study. This chapter further provides policy recommendations that would be suitable for smallholder spinach farmers in order to enhance their productivity and market access.

5.2 Summary of findings

Increasing agricultural productivity and access to the market plays an important role in the economic development of smallholder farmers and the alleviation of poverty. In some rural households, increased production and market access serve as a main source of income. However, most of these smallholder farmers are confronted by a number of constraints, which limit their growth. The limited ability of these farmers in accessing viable markets for their produce is a major challenge for sustainable agricultural development in South Africa.

The main aim of the study was to examine the market access and productivity of smallholder spinach farmers in the Polokwane Local Municipality, Limpopo Province. The overall objective of the study was to examine farm and farmers' characteristics that influence their productivity and market access. The specific objectives of the study were as follows: (i) to identify and describe socio-economic characteristics of smallholder spinach farmers in the Polokwane Local Municipality; (ii) to examine the determinants of productivity among smallholder spinach farmers in the study area, and (iii) to analyse the socioeconomic characteristics that affect smallholder spinach farmers on market access in the study area.

Different analytical techniques were used to address each objective. The first objective, which was to identify and describe socio-economic characteristics of smallholder spinach farmers in the study area was addressed using descriptive statistics. The Cobb Douglas Production Function was used to address the second objective, which was to examine the determinants of productivity among smallholder spinach farmers in the study area. The Tobit Model was used to address the third objective, which was to analyse the effect of socio-economic characteristics of smallholder spinach farmers on market access in the study area.

The study was conducted in the Polokwane Local Municipality, which is located within the Capricorn District in the Limpopo Province. It covers a surface area of 3775 km and accounts for 3% of the Province's total surface area of ±124 000 km^2.

In terms of its physical composition, Polokwane Local Municipality is 23% urbanised and 71% is still rural. The remaining area (6%) comprises smallholdings and institutional, industrial and recreational land. A multi-stage sampling technique was used in the study because larger clusters were subdivided into smaller, more targeted groupings for surveying. At the first stage, it involved a purposive selection of the Polokwane Local Municipality from Capricorn District and at the second stage, three villages (Ga-Mamabolo, Ga-Molepo and Dikgale) were selected based on the high number of smallholder farmers who engage in the production of spinach. The third stage involved the random selection of spinach farmers from each village. A sample size of 80 farmers was then obtained. In collecting the data, a questionnaire was designed, administered; data was also collected through face-to-face interviews.

The analysis of the results on socio-economic characteristics revealed that the average age of the farmers with market access is 34 years while the average age of their counterparts with no market access is 45 years. Furthermore, the results also indicated that the average household size for farmers with market access is 9 members with a farming experience of 12 years on average while those with no market access has an average of 7 in household size and 7 years in farming experience. About 73.1% of the farmers with market access own the land while 60.7% do not own the land, 9.6% with market access leased the land and 21.4% with no access to market leased the land. The socio-economic characteristics showed that there were more female farmers with (55.8%) having market access, and 64.3% with no market access and also that there were more male farmers where 44.2% had market access while 35.7% had no market access. Overall, a large number of female smallholder spinach farmers in the study had access to markets compared to their male counterparts.

The Cobb Douglas Production Function was used to examine the determinants of productivity among smallholder spinach farmers in the study area. The results indicated that the elasticities of labour, farm size, fertiliser and certified seed were significant. Moreover, tractor costs and pesticides were not significant. The results also revealed that the return to scale is 0.897, which is less than one indicating a decreasing return to scale.

The Tobit Model tested the socio-economic characteristics that affected market access in the study. The independent variables used in the model were age, gender, education level, water access, credit access, household size, cooperative

membership, quantity produced, market information, farm size, distance to market, marital status, extension contact, farmer occupation, farming experience, non-farm income and hired labour. Eight variables were found to be statistically significant, namely; gender, education level, household size, quantity produced, market information, distance to market, extension contact and farming experience.

5.3 Conclusion

The study had two hypotheses. The first hypothesis was that; socio-economic characteristics of smallholder spinach farmers do not have an effect on their productivity level in the Polokwane Local Municipality. The second hypothesis was that; socio-economic characteristics of smallholder spinach farmers do not have an effect on their market access in the Polokwane Local Municipality.

The study identified labour, farm size, fertilizer and certified seed as the socio-economic characteristics that affect productivity level in the study area. This finding does not provide support for this hypothesis. Therefore, the hypothesis is rejected on the basis that Cobb Douglas Production Function Model results revealed that these socio-economic characteristics tend to influence the productivity level of the smallholder spinach farmers in the study.

Furthermore, the study has identified education level, household size, quantity of output produced, market information, distance to the market, extension contact and farming experience as socioeconomic characteristics that affect access to the market of smallholder spinach farmers in the study area. It means that the hypothesis which states that socio-economic characteristics of the smallholder spinach farmers do not have an effect on their market access in the study is rejected.

5.4 Policy recommendations

This section provides policy recommendations based on the empirical results of the study. In an effort to help smallholder farmers to improve their productivity level while accessing agricultural markets, the recommended policies that can be considered are as follows:

- Increase in the number of extension visits

Extension contact was one of the important factors that influenced both productivity level and market access. The results indicated that most of the surveyed farmers did not have access to market information. It was also noted that 41.2% of the smallholder farmers obtain market information from extension officers. In line of this,

this study recommends the provision of specialised agricultural marketing extension officers to improve marketing knowledge of the farmers. These extension officers should be provided with market information tools in order for them to be better informed about market issues. For example, the Extension Suite Online program, which is an internet-based system designated for agricultural extension to access information related to agriculture. This will empower extension officers to share scientific developments with farmers, thus helping them to improve their production and income.

- Provision of market information

The study recommends that farmers should be provides with information about the market. This might help the farmers with better ways of minimising the transaction costs and they will not incur more cost when they participate in the market. This can be done through workshops, seminars and training sessions so that they can learn how to analyse information related to input and output prices in the market.

- Strengthening of farmers' cooperatives

Farmers' cooperatives should be strengthened in the study area and awareness campaigns should be conducted with the help from the government to encourage farmers who do not belong to any cooperatives to join in order to improve their production and access to markets. As such, being a member of a farmer's cooperative enables the farmer to find it easier to acquire information on available markets, negotiating better prices and access extension services. Furthermore, market agents, commercial farmers or any other relevant stakeholders will be available to share market information with farmers as a group than individuals.

5.5 Proposed future research

The study examined socioeconomic characteristics that determine productivity and market access among smallholder spinach farmers. Other relevant stakeholders such as market agents and extension officers were not interviewed. The findings of the study were only based on the responses from sampled smallholder farmers. It could be more interesting if a similar study can be done on a larger scale of emerging farmers by also involving the participation of extension officers and market agents. This will provide a holistic picture regarding productivity and marketing issues within smallholder agriculture.

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APPENDICES

Appendix 1: Questionnaire

DETERMINANTS OF PRODUCTIVITY AND MARKET ACCESS OF SMALLHOLDER VEGETABLE FARMERS: A CASE STUDY OF SPINACH PRODUCERS IN POLOKWANE LOCAL MUNICIPALITY, LIMPOPO PROVINCE, SOUTH AFRICA

Name of Enumerator……..…

Date of interview ……

Name of municipality……..

Village /Community name……..

Name of Respondent……

SECTION A: SOCIO-ECONOMIC CHARACTERISTICS

1. What is the size of household? .....
2. Age of the farmer …….
3. Gender of the farmer (tick the right answer)

1. male		2. female	

4. Marital status

1=Single	2=Married	3=Widowed	4=Divorced

5. What is your level of education?

1	2	3	4
No formal education	Completed primary education	Completed secondary education	Completed tertiary education

6. Number of years in farming?.....
7. What is your farm size in hectare.....

8. Do you have land ownership?

1. Yes		2. No	

9. If yes, do you have title deeds?

1. Yes		2. No	

10. What is your tenure status?

1	2	3	4	5
Own	Inherited	Leased	Bought	Others

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

1	2	3	4	5
Salary	Farming	Pension	Grant	Other specify…….,,

SECTION B: DETAILS OF LABOUR

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

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

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

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

1	2	3	4
Own cash	Credit	Farm income	Other specify……

15. Have you ever been short of labour?

1. Yes		2. No	

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

17. Do you hire tractor for spinach production? (Tick the right answer)

1. Yes		2. No	

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

19. Do you apply fertilizer for spinach production? (Tick the right answer)

1. Yes		2. No	

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

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

22. Do you use any type of pesticides? (Tick the right answer)

1. Yes		2. No	

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

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

25. Does your household have access to non-farm income? (Tick the right answer)

1. Yes		2. No	

26. If yes, which income class does your household fall in per month?

<700	700-1500	1500-3000	3000-5000	>5000

SECTION C: WATER USE INFORMATION

27. Do you have access to water for irrigation? (Tick the right answer)

1. Yes		2. No	

28. If Yes, what is your main source of water for spinach irrigation?

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

29. How many hectares of spinach are under irrigation?.....

30. How much water do you use to irrigate one hectare of spinach in litres? ……..

SECTION D: EXTENSION INFORMATION

31. Do you receive extension services? (Tick the right answer)

1. Yes		2. No	

32. If Yes, for how long have you been getting the services?.....Years/Months

33. Who provides the extension services?

1	2	3	4
Government department	Non-government organization	Development agent	Other specify

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

SECTION E: CREDIT ACCESS INFORMATION

35. Do you have access to credit? (Tick the right answer)

1. Yes		2. No	

36. If Yes, where did you get the money? …….
37. Who provide the credit?.....
38. How much did you borrow? R…….

SECTION F: SPINACH PRODUCTION INFORMATION

39. How many years have you been in spinach farming?.....
40. How many hectares do you use to produce spinach?.....
41. How many kilograms of spinach do you normally produce per hectare?.....
42. What is the main reason for spinach production?

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

SECTION G: MARKET INFORMATION

43. Do you always find a market for all the goods you produce? (Tick the right answer)

1. Yes		2. No	

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

Hawkers	wholesalers	middlemen	Retailers	Local supermarkets	Other (specify)

45. If NO, what happens to the unsold produce? (Tick)

Lose to spoilage	Eat (family and friends)	Sell at low prices	Store and sell later	Other (specify)

46. Is the opportunity to sell spinach in the nearest markets?

1. Yes		2. No	

47. If yes indicate the approximate percentage of your produce you sell to these formal markets

Less than 25%	25-50%	51-75%	More than 75%

48. What is the distance from point of production to the nearest market?.....(in Km)
49. Do you have access to market information? (Tick the right answer)

1. Yes		2. No	

50. Do you meet the grades required in the market?

……

……

……

……

……

51. What other marketing constraints do you experience?

i.……

ii.……

iii.……

iv.……

52. Did you gain spinach production skills in the last 3 years? (Tick the right answer)

1. Yes		2. No	

53. If Yes, give details of those skills

……

……

……

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

1	2	3
Other farmers	Extension officers	Other specify……

55. Who provides transportation from the farm to the final destination (market)?

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

		transport	the themselves

56. Are you involved in any project that helps with productivity and market access? (Tick the right answer)

1. Yes		2. No	

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

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

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

……
……
……

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

……
……
……
……

THE END!!!!!!!!!!!!

Thank you very much for your patience.