

Agricultural commercialization through market participation by smallholder tomato farmers in Bojanala district, North West Province

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DECLARATION

I hereby state that the research project, "Agricultural commercialization through market participation by smallholder tomato producers in Bojanala district, North-West province," is entirely unique with me and has not been submitted in whole or in part to another university for any academic reason. Complete references have been provided for every source that has been used or quoted.

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Signature:

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DEDICATION

In memory of my late parents, relatives, and friends, I dedicate this dissertation. A particular thank you to my dear sister Ms. D.M. Diphoko, my 3am squad (Ms. P.A. Applegreen, Ms. T. Dikgole, and Ms. L.K.P. Moote), and Ntwe Ofentse, whose words of support and push for perseverance will never be forgotten. Also honoured in this piece are my late parents, my only sibling, my niece, my daughter, and I.

ABSTRACT

*The tomato (*Solanum lycopersicum*) is a significant crop with significant commercial market potential and health promise for farmers. If (1) the degree of commercialization; (2) commercialization indices; and (3) the level of market participation by smallholder farmers are properly understood, smallholder tomato farming could be improved. As a result, the primary aim of this study was to analyze the degree of agricultural commercialization and the volumes sold by tomato farmers in the Bojanala district of the North-West province. The study's specific objectives were to determine the volumes produced, marketed, and marketing channels currently employed by tomato producers; gauge their level of commercialization; and to outline the factors that influence their level of market participation in the Bojanala district. A cross sectional research design was employed to achieve the specific objectives of the study. The data was collected through a structured questionnaire consisting of four sections. In addition, the sections were namely demographic and socio-economic information, household resource ownership, marketing of produce and financial management. Descriptive statistics was employed to analyse objective (1) of the study by using frequency, percentage, mean, maximum value and minimum value. To analyse objective (2), commercialization index was computed by the gross value of sales over gross value of production. Tobit regression was used to analyse objective (3), where factors were extracted, which influence market participation.*

According to the descriptive findings, tomato producers in the research area range in age from 25 to 74, with an average age of 44. Furthermore, 50.54% of farmers were men, compared to 49.46% of households headed by women. Additionally, the findings of the descriptive analysis showed that 86.02% of tomato farmers sell at the farm gate and 90.32% sell to their neighbours, taking into account the fact that a farmer can sell at both places. On the other hand, it was discovered that 6 years is the average number of years spent in school. Tomato farmers in Bojanala attend school for a maximum of 17 years and for a minimum of 0 years.

According to the commercialization index, 40,86% of farmers are subsistence farmers, 51,61% are semi-commercial farmers, and 7.53% are completely commercial farmers. The Tobit analysis showed that there is a 5% threshold of significance for years of farming experience, land area, number of tomatoes produced, and value of produce sold. This

suggests that each additional year of farming will lead to a 0.036 reduction in market participation. The Tobit model also demonstrates how land negatively affects smallholder tomato farmers' ability to participate in the market. The findings showed that market involvement decreased by 0.154 as land (Ha) increased. The data also showed a strong positive correlation between market participation and tomato production volume (Kg). The findings also indicated that market involvement rises by 0.763 when tomato production volume rises. Furthermore, it was discovered that market participation had a positive association with the value of produce sold (Kg). The findings also showed that as the value of produce sold increase so does market participation by 0.208.

The study indicated that the average age of farmers was 44 years old, indicating a dearth of youth engagement in the studied area. Additionally, the findings indicated that as age increases, farmers will participate in markets less, suggesting that youth participation can boost market participation and eventually lead to a larger degree of commercialization. Additionally, this study argues that lack of extension services in the area has led to low volumes of tomato being produces as 93.55% of the farmers do not receive extension services. Furthermore, the study showed that majority of the farmers sell their produce near the farm or at the farm, this can be associated with high cost of reaching distant markets. Lastly, the study recommends that government creates high value market linkage programmes for smallholder farmers, government to improve extension services in the study area and encourage value adding activities by farmers.

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Key words: Commercialization, agricultural marketing, market participation, tomato farmers

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CHAPTER ONE: INTRODUCTION

1.1 Background of the study

Agriculture intensification, output, food security, and farm income in Africa have long been viewed as being significantly influenced by agricultural commercialization (Ochieng *et al.*, 2016). Agriculture's commercialization, according to Jaleta *et al.* (2009), is best characterized as a rise in the percentage of output that is sold or that is purchased per unit of output. In addition, agricultural enterprises and/or the agricultural sector as a whole, may become more dependent on the market for product sales and the procurement of production inputs, such as labour, as noted by Ochieng *et al.* (2016). According to Takesure (2017) and Hinderink and Sterkenburg (2022) commercialization in agriculture is diverse, and it is preferable to separate how specific commercialization activities are organized, as well as their effects on smallholder access to inputs, market outlets, market prices, and produce, rather than generalizing about commercialization. Agricultural commercialization also occurs when a farmer participates in agricultural markets as a vendor or a buyer, according to Ochieng *et al.* (2016).

Increasing the excess that is sold or increasing the use of purchased inputs are two ways that agricultural production can be made more commercial (Hagos and Geta, 2016). According to Dube and Guveya (2016), the output side of commercialization has been estimated as a proportion of the value of agricultural sales to the value of agricultural commodities produced. The value of market-purchased inputs divided by the value of agricultural produce on the input side has been used to quantify the input side of commercialization (Dube and Guveya, 2016). With a highly developed agricultural sector, South Africa has by far the most advanced, fruitful, and diverse agricultural economy in Africa (Mathews, 2016). According to Gwebu and Mathews (2018), a small number of highly productive, prosperous, and profit-driven farmers dominate South Africa's commercial sector. Additionally, in rural South Africa, where 70% of the poorest households live, these farmers mostly do not use innovative agricultural techniques and smallholder farming (Dube and Guveya, 2016).

In South Africa, there are about 32,000 commercial farmers, and between 5,000 and 7,000 of them provide nearly 80% of the country's agricultural output (Kaup *et al.*, 2022). According to earlier studies (DAFF, 2018; Nekhavhambe, 2017; Maharatha *et al.*, 2019), South Africa's agricultural economy is market-oriented, highly diversified, and produces all major grains

(except rice), oilseeds, deciduous and subtropical fruits, sugar, citrus, wine, and the majority of vegetables (Reimers and Keast, 2016). Subsistence and smallholder commercial agriculture are the main forms of agriculture practiced by farmers in rural areas with limited marketing prospects, which has limited the improvement of their living conditions (Martey *et al.*, 2012). The South African government wants to strengthen its economy, develop a strategy to fight poverty, and open up new commercial prospects for South African companies (DAFF, 2018). Out of the seven workstreams that made up Operation Phakisa for Agriculture, Forestry, and Fisheries, including grains, livestock, horticulture, producer support, rural development, land reform, and labor, 27 initiatives were created. Stimulating rural economies, identifying lucrative markets, and enhancing market accessibility for commercial and smallholder farmers were two of Operation Phakisa's goals (DAFF, 2018). The South African government has created a number of agricultural programs, including MAFISA, Iiima-Letsema, and SEDA, to address the difficulties faced in agriculture.

There are other programs and Comprehensive Agricultural Support Programmes in South Africa to help smallholder farmers. IDC, SEDA, Farm Africa, Oxfarm, and service providers like MAFISA, Iiima-Letsema, and the Comprehensive Agricultural Support Program are a few of the existing support programs. Non-governmental organizations and farmers' associations are also included (Nekhavambe, 2017). Through the Comprehensive Agricultural Support Programs, South African smallholder farmers benefited from upgraded irrigation systems, equipment, and farming inputs (Nekhavambe, 2017). It is unknown whether smallholder tomato farmers in the Bojanala district have benefited from such programs, which opens up the possibility of additional investigation of government intervention to aid smallholder vegetable producers in the area. This would result in more market participation intensity, as more smallholder farmers will be more market-oriented and produce for markets other than for subsistence.

Market involvement, as defined by Selowa *et al.* (2015), is the capacity of farmers to sell their goods on reputable agricultural output marketplaces. A farmer is considered to be engaging in the market when he or she has the potential to profit from selling their produce there (Selowa *et al.*, 2015). Agriculture market participation is the integration of smallholder farmers into the input and output markets for agricultural products in order to enhance their income and, in turn, decrease their level of poverty and improve their standard of living (Kalauba, 2021). The ability of smallholder tomato growers to sell 30% of their crop in both formal and informal markets in 2019/2020 is referred to as market participation (Kalauba,

2021). Tomatoes are grown all throughout the nation on large and small farms, on productive and unproductive ground, in urban and rural locations, and by both small-scale farmers and large commercial growers.

Tomatoes are South Africa's second-most significant and widely consumed vegetable crop, after potatoes, according to DAFF (2018). Not only are tomatoes grown commercially, but they are also frequently grown by subsistence, resource-constrained farmers, and home gardeners. Without potatoes, it contributed about 18.3% to the gross value of vegetable production in 2015 (DAFF, 2018). According to recent estimates, Southern Africa's fresh market tomato losses were 9.8%, with South Africa making up 10.2% of the region's overall percentage. This resulted in supply chain losses of more than \$1 million (Sibomana, 2016). However, no research was conducted to determine the extent to which smallholder tomato and vegetable growers in South Africa's Bojanala district are commercialized.

1.2 Problem statement

The challenge for tomato growers is to produce a large production of high-quality tomatoes to meet local and global demand (DAFF, 2018). South Africa is a minor tomato exporter, accounting for about 0.1% of global exports and ranking number 38 in 2017. It does, however, sell tomato products to African nations such as Botswana, Lesotho, Angola, and Namibia (DAFF, 2018). Traditional marketing strategies are rapidly giving way to more contemporary methods used in industrialized nations Nekhavhambe (2017). Supermarkets, long-distance shipping, international marketing, varied processing and packaging techniques, safety and quality requirements, continuous product supply, and product diversity are other examples of modern practices Nekhavhambe (2017). Traditional, rural, and impoverished farmers are under more pressure to keep up with the demands of good seed, efficient techniques, recruiting aid outside the family, market awareness, and the capacity to produce safe and high-quality tomatoes as a result of these developments.

Nekhavhambe (2017) asserts that through strengthening the connection between corporate business and smallholder farming to promote smallholder agriculture in rural areas, the government has significantly contributed to increasing smallholder market participation. However, it is unknown whether all smallholder tomato growers in the Bojanala district benefited from these programs, leaving open the possibility of investigating government involvement in encouraging smallholder commercialization of tomato growers. In addition, a number of research (Dube and Guveya, 2016; Ochieng *et al.*, 2016; Gwebu and Mathews,

2018) on the subject of agricultural commercialization did not examine the degree to which smallholder farmers were commercialized. This statistic indicates fewer numbers of farmers are commercialized in South Africa and invites research to explore commercialization through market participation. To date, little or no research has been done in the Bojanala district to ascertain the level at which smallholder vegetable farmers are commercialized. Given the differences in production requirements and the perishable nature of horticultural crops it is important to look at the commercialization level of smallholder tomato farmers.

By concentrating on the level of commercialization of smallholder tomato producers, the second-most significant and popular vegetable in South Africa after potatoes, this study seeks to fill that knowledge vacuum (DAFF, 2018). Due to the significant demand for tomatoes in metropolitan areas, tomato cultivation offers a chance to increase rural incomes, especially for smallholder farmers (Takesure, 2017). As a result, this research was done in various locations to determine what factors affect smallholder farmers' decisions to participate in markets or not. It is required to evaluate the level of agricultural commercialization through market participation among smallholder tomato growers in the Bojanala district in order to give empirical evidence for these challenges.

1.3 Research aim

To assess agricultural commercialization through market participation by smallholder tomato farmers in Bojanala district, North West province.

1.4 Specific research questions

- I. How many volumes produced, marketed and marketing channels currently used by tomato farmers in the Bojanala district?
- II. What is the commercialization level of tomato farmers in the Bojanala district?
- III. What are the factors influencing the level of market participation by tomato farmers in Bojanala district?

1.5 Main research objective

To analyse agricultural commercialization through market participation by smallholder tomato farmers in Bojanala district, North West province

1.6 Specific objectives

- I. To determine the volumes produced, marketed and marketing channels currently used by tomato farmers in the Bojanala district.
- II. To identify the commercialization level of tomato farmers in the Bojanala district.
- III. To identify the factors influencing the level of market participation by tomato farmers in Bojanala district.

1.7 Hypotheses

- H02: The level of agriculture commercialization and market participation are statistically significantly correlated.

1.8 Justification of the study

Previous research on the commercialization of smallholder agriculture (Chauke, 2016; Jari *et al.*, 2013; Jaleta *et al.*, 2009; Kaluaba, 2021; Thamaga-Chitja and Morojele, 2014) either focused solely on commercialization or neglected to consider how market participation can enhance commercialization. By concentrating on the commercialization of smallholder tomato farmers, this project aims to close that gap. In South Africa, tomato is the second most important and widely consumed horticultural crop after potato, which in 2015 generated about 18.3% of the gross value of vegetable production (DAFF, 2018). There is, therefore, a need to concentrate research that helps the government and involved stakeholder better understand the challenges smallholder farmers in the country face and how to overcome them. This study aimed to assess the commercialization of smallholder tomato farmers through market participation in the Bojanala district. There are studies that were conducted in Southern Africa but little or none looked explicitly at commercialization through market participation.

With the general goal of identifying socio-economic factors affecting commercialization, Takesure (2017) undertook a study on factors influencing the commercialization of tomato production in Zimbabwe. Takesure's study, however, omitted information on tomato farmers' preferred selling channels as well as the relationships between production quantities and those choices. Therefore, there is a vacuum in understanding the level of commercialization of horticulture products, notably tomatoes, and describing the impact that smallholder vegetable farmers' choice of marketing channel has on the amount of produce they bring to

market. A study on agricultural commercialization through market participation among smallholder tomato growers in the Bojanala district, North-West, was therefore, required.

1.9 Delimitation of the study

Delimitation is the phrase for factors and variables that the researcher uses to define the parameters for the study's duration, population size, and participant types (Cooper and Schindler 2008). In general, these decisions should be acknowledged as being made by the researcher. For instance, the researcher may decide to collect data using specific research tools and techniques while avoiding others (Cooper and Schindler 2008).

The North West province's Bojanala District served as the site of this study. The study was based on market participation, the level of agricultural commercialization, and how much volume vegetable growers sold as a result. Only tomato producers were included in the study; the rest of the smallholder vegetable farmers were not. Additionally, the study solely looked at market participation and did not examine smallholders' access to markets in the study area.

1.10 Ethical consideration

The nature of the issue being examined, the data being gathered, and the data gathering techniques all offer ethical issues throughout the research process (Cooper and Schindler 2008). Cooper and Schindler (2008) also discussed the difficulties faced by scientists when doing their research, including securing access, obtaining informed consent, and ensuring that the results do not negatively impact individuals or the community.

Standardization and universality of research ethics were established for the study method for all smallholder vegetable producers in the Bojanala district in accordance with the laws and regulations of the North West University. All participants received detailed information about the study's purpose and how the findings will be applied (smallholder tomato farmer). Prior to giving out the questionnaires to each participant in the data collection process, these convincing procedures were carried out. After the questionnaire was explained to the participants, they had the option of participating or not, and they also had the option to stop participation if they so desired. When gathering data, confidentiality and anonymity declarations were also taken into account. Since the majority of the data was gathered during the Covid-19 epidemic, both respondents and the researcher adhered to the covid-19 guidelines. With the help of the extension agent, the farmers were visited on their farms. Farmers, researchers, and extension agents were required to deal with the jury while wearing

masks, and their hands were often cleansed. The extension agent and agricultural graduates who assisted with data collecting physically collected the information from the farmers. The information for this research was gathered during regular weekly visits by the extension worker to farmers.

1.11 Outline of the dissertation

There are five chapters that make up this study. The topic that was addressed, the importance of the study, and its goals were all covered in detail in Chapter 1 of the study introduction. The second chapter reviewed the literature on smallholder farmers, the quantities produced, sold, and marketing strategies employed by tomato growers, as well as the commercialization of tomato farming, its degree of commercialization, and market participation. The study's methodology, including a description of the study area, research design, study population, and technique of data processing, was covered in Chapter 3. In Chapter 4, the study's findings were covered in detail. Chapter 5 has the summary, conclusion, recommendation, and study implications as well as references.

CHAPTER 2: LITERATURE REVIEW

2.1 Introduction

A review of the study-related literature is included in this chapter. It primarily focuses on a review of the literature on smallholder farmers, the quantities produced, sold, and marketing channels utilized by tomato growers, as well as the commercialization of tomato farming, its degree of commercialization, and market involvement. Literature in this chapter includes the definition of terms, farmers in rural South Africa, vegetable production systems, international tomato production, tomato production in South Africa. In addition, literature reviewed also include tomato production constraints, agricultural marketing and marketing channels used. Furthermore, literature on studies concerning commercialization, socio-economic factors affecting market participation were reviewed. Lastly, the theoretical framework and conceptual framework are also inclusive in this chapter.

2.2 Definition of terms

2.2.1 Agricultural commercialization

According to the definition used in this study, agricultural commercialization is the process by which the income threshold for households rises as a result of household participation in output markets and as a result of labour and land productivity. Commercialization, according to Takesure (2017), is the key to rural development and poverty alleviation in emerging nations.

Commercialization is the process of introducing new goods or services to the market. The commercialization process includes all steps of creating a new product or service, including production, distribution, marketing, sales, customer support, and other crucial services (Takesure, 2017). Furthermore, commercialisation typically occurs once a small organization has grown and scaled its operations to the point where it can effectively tap into a larger market Takesure (2017).

2.2.2 Agricultural marketing

For the sake of this study, agricultural marketing refers to the process of manufacturing a commodity—in this case, tomatoes—and transporting them to the final consumer using a variety of tactics to make sure that the produce's target market is aware that they are ready for consumption. Marketing, according to Maharatha *et al.* (2019), is the social and management

activity of generating, obtaining, and exchanging goods with other people such that those involved receive what they desire or need.

2.2.3 Market participation

Market participants are the legal entities taking part in the buying and selling of assets or liabilities in their primary market (Kalauba, 2021). The fair market value of the instruments traded in the market is impacted by their actions. When there are more market participants, the market value seems more realistic.

2.2.4 Smallholder farmer

Smallholder farmers are defined as those that cultivate one or two cash crops and one or more subsistence crops on small parcels of land, virtually solely using family labour (DAFF, 2012). The term "smallholder" also refers to small farmers that do not own or have authority over the land they farm (DAFF, 2012). By favouring the stability of the farm home structure, using family labour for production, and using some of their goods for family use, smallholders are singled out by family-focused motivations (DAFF, 2012).

2.3 Smallholder farmers in rural South Africa

Both the terms "smallholder farmer" and "small scale farmer" are used equally. The DAFF (2012) defines South Africa's smallholder farmers as the entire number of farmers or households engaged in any agricultural production (in this case vegetables). Small, labor-intensive farms and the adoption of conventional farming techniques are characteristics of smallholder growers (Pienaar and Traub, 2015). A lot of farmers also lack institutional capacity, access to government services, and support (Louw, 2013). The majority of South Africa's vegetable growers are located in the erstwhile homelands, which were defined by the Native Land Acts of 1913 and 1936. These farmers mostly grow vegetables for domestic consumption (Pienaar and Traub, 2015). Additionally, Pienaar and Traub (2015) indicate that an estimated 160000 of South Africa's 4 million smallholder farmers farm with the purpose of selling their produce to the market. Furthermore, Pienaar and Traub (2015) found that the average age of smallholder farmers in the rural sector is 56 and that a substantial proportion of vegetable growers in South Africa are women, children, and elderly individuals.

2.3.1 Vegetable production systems

Organic production systems, hydroponic production systems, and minimal input production systems are the three main types of vegetable production systems. Organic farming is a sustainable method of producing wholesome, nutrient-dense food while enhancing the soil's fertility (Meena and Meena, 2017). It is a comprehensive farming method founded on ecological principles. Organic farming lessens reliance on synthetic inputs by using natural ecosystems and technologies for plant nutrition, pest and disease control, and crop production (Rosa-Schleich *et al.*, 2019). There hasn't been a lot of study done on organic farming practices. Information on organic farming practices suitable for resource-constrained farmers is either non-existent or very scarce.

In South Africa, open field techniques are used to cultivate the majority of vegetables, with greenhouses and shade net houses producing the remainder. For research trials, ARC-Roodeplaar primarily uses two hydroponic systems: the gravel film technique (closed system) and open bag systems. In South Africa, these two systems are employed commercially. The most widely utilized re-circulating hydroponic system in South Africa for growing green crops is called the Gravel Film Technique (GFT) (Kaur, 2016).

In a gravel film system, a nutrient solution that is well-balanced is pumped to the top of hydro lines and then flows downward by gravity on a 3% slope. A reservoir at the bottom holds the fertilizer solution, which is then pushed back to the hydro lines (re-circulated). The primary functions of the gravel are to support the plant, cover the root system, and shield the nutritional solution from sunlight (FAO, 2018). This system may produce a variety of crops, including celery, leafy herbs (like parsley and basil), spinach and Swiss chard, leeks, spring onions, chive, various types of cabbage, and mustards. In an open bag system, plants are grown in a bag that is filled with a growth medium (such as sawdust or coir) and drip-fed fertilizer solutions, with 10-15% of the bag left open for drainage. The technique is used in plastic tunnels and shade net buildings, both with and without temperature control. Growing tomatoes and sweet peppers hydroponically in open bags inside a plastic tunnel. To produce tomatoes, peppers, cucumbers, strawberries, and beans, the open bag system works well.

In order to reduce poverty and ensure food security, vegetables are crucial. Nevertheless, food insecurity persists in South Africa, especially among farmers and communities with few resources. This can be attributed to increasing expenses associated with producing vegetables

as well as higher food retail prices (Altieri, 2018). Due to a variety of factors, such as management abilities, high input costs, etc., the adoption of contemporary technology to meet the demands of rural farmers is frequently rejected (Poulton and Kydd, 2010). However, resource-poor farmers use a variety of low-input production techniques, with varying success and sustainability (Altieri, 2018). The term "low input production systems" refers to agricultural practices that optimize on-farm input resources, such as crop wastes and the use of less expensive agricultural inputs like chemical fertilizers (Wu and Ma, 2015).

2.3.2 International tomato production

According to the Food and Agriculture Organization (FAO), tomatoes are one of the most important vegetable crops in the world, producing 161 793 834 tons annually at a yield of 33.6 tons per hectare (2018). This implies that there is a potential the crop could develop into one that is very valuable. Early Indian cultures in Mexico domesticated and began cultivating tomatoes there when the Spanish explorers carried them to Spain. Eventually, they introduced tomatoes to Italy, Turkey, and Morocco (DAFF, 2012). A total of 161.8 million tons of tomatoes were produced on more than 4.8 million hectares of land worldwide in 2012, with an average farm output of 33.6 million tons per hectare (FAO, 2018). Tomato farms in the Netherlands were among the most productive in 2012, with an average yield of 476 tons per hectare, followed by those in Belgium (463 tons) and Iceland (429 tons) (FAO, 2018). In comparison to 161.8 million tons in 2012, 170.8 million tons of tomatoes were produced worldwide in 2014. Between 2012 and 2014, farmers in Turkey, the US, China, and India were the leading producers (FAO, 2018).

2.3.3 Agricultural production challenges in Southern Africa

More than 60% of people on Earth reside in rural areas. Maintaining even a subsistence-level standard of living is a daily concern for many (Kgosiemang and Oladele, 2012). Rural poverty in marginalized communities can potentially be reduced through the agricultural sector. However, obstacles including restricted access to nutrient-rich soils, poor mechanization, and insufficient irrigation levels have an impact on agricultural production and output. These difficulties are made worse by high fertilizer costs, which are considered to be the worst in sub-Saharan Africa. This condition encourages inefficient fertilizer use, which lowers agricultural yields (Kgosiemang and Oladele, 2012). Food prices fluctuate in Southern Africa as a result of rising energy costs, the conversion of cereals into biofuels in response to concerns over global warming, and drought in major producing nations (Draper *et al.*, 2009).

In Southern Africa, the availability of financial services affects agricultural production. Small-scale farmers have trouble getting formal loans, but informal loans are easier to get but cost more (Machethe *et al.*, 2011). Financial services could make seasonal or long-term investments in sustainability and productivity possible. Access to financial services lowers farming risks as well, encouraging long-term investment and planning (Whiteside, 1986). The main issues limiting the performance of agriculture in Southern Africa include inadequate input access, poor communication, land degradation, excessive reliance on rain-fed agriculture, underdeveloped marketing systems, a high prevalence of HIV/AIDS, lax legislation, and a lack of legal enforcement, among others (Muchopa *et al.*, 2004).

2.3.4 Tomato production in South Africa

The National Agricultural Marketing Council NAMC (2017) estimates that there are about 695 established and new producers in South Africa. 95% of overall production is accounted for by the commercial sector, whereas just 5% is accounted for by the emerging sector. According to FAO (2009), China produces the most tomatoes in the world, followed by India, the United States, Turkey, Egypt, Iran, and Italy. These nations produce more than 80% of the tomato crop in the globe. Egypt continues to be the only nation in Africa to rank among the top ten tomato producers worldwide (DAFF, 2013; DAFF, 2018). Tomatoes are both imported and grown locally in South Africa. The potato is the most significant vegetable crop in the world, followed by tomatoes (*Solanum Lycopersicon*). Although botanically a fruit, it is nutritionally regarded as a vegetable (Peralta and Spooner, 2001).

Tomatoes are extremely perishable and are eaten either raw or as an ingredient in a variety of meals, sauces, stews, and beverages. All of South Africa's provinces produce tomatoes. With 3590 ha, or more than 75% of the nation's total tomato planting area, the Limpopo province serves as the primary production area. Onderberg region of Mpumalanga province comes in second place with 770 ha, followed by Border region of Eastern Cape province with 450 ha (DAFF, 2012). Tomato production in South Africa is self-sufficient, and imports of tomatoes are very insignificant in comparison to exports. In comparison to 2008, the tomato industry's contribution to GDP increased by 42% in 2009. 2010 then saw the largest contribution to GDP, which was 3% greater than in 2009. (DAFF, 2014)

Due to the current 30 percent levy on imported tomato paste from China in cans (28% to 30% brix), South Africa is a net importer of tomato paste (NAMC, 2017). The impact of exchange rates, a significant factor in the price of imported tomato paste over, which importers have

limited control, is a worry for importers (DAFF, 2017). Domestic processors may create tomato paste for R210 per unit (6 × A10 3 kg tins). The identical goods might be bought from China for R107.30 less each unit (NAMC, 2017). South African tomato production decreased by 4.5 percent in 2005, and by another 5.1 percent in 2007. From 2008 to 2010, the production output significantly increased till 2011. The highest production output was recorded in 2012, up 9% from 2011's figures (DAFF, 2012).

2.3.5 Tomato Production Constraints

The limitations that farmers encounter when growing crops are called biotic and abiotic variables. The production of tomatoes is similarly restricted by biotic factors like the absence of improved seeds, pests, and illnesses, as well as abiotic factors like drought, markets, input supplies, and soil nutrients (Anang *et al.*, 2013). Farmers' biggest problems with tomato production, according to Maerere *et al.* (2006), are biotic factors like pests and diseases. Robinson and Kolavalli (2010) state that pests and illnesses, poor quality, and a lack of sufficient tomato production to compete with imports are the main obstacles to the production of tomatoes in Africa. Additionally, according to Nouhoheflin *et al.* (2007), considerable losses of tomato are brought on in West Africa by pests and illnesses brought on by bacteria, nematodes, fungus, and viruses. Farmers are also restricted by a variety of variables during production, such as limited land areas, poor soil fertility, and lack of access to modern inputs (seed, lime and fertilisers). Furthermore, poor crop yields are caused by soil degradation, which includes soil erosion, soil acidity, and nutrient depletion (Bizoza, 2005). Tomato growers, processors, distributors, retailers, and exporters all confront post-harvest issues both on and off the farm, according to Arah *et al.* (2015). These difficulties have an impact on tomato production and subsequent profitability. On farms, challenges can be found in the form of improper harvesting times and/or stages, high field temperatures, inappropriate harvesting containers, unhygienic farms, and inappropriate packaging materials. Off-farm challenges include, among other things, a lack of access to or inadequate roads leading to producing fields, inefficient transportation systems, a lack of processing factories, a lack of suitable storage facilities, a lack of market knowledge and reliable marketplaces.

2.4 Agricultural marketing and Marketing Channels used

The provision of food for all people; Contributes to the growth of the local market as well as the global market since there are more opportunities for exporting goods to overseas markets if there is an excess supply of goods locally (Bruinsma, 2017). According to Rabbi *et al.*

(2017), participation in the output market can assist reduce rural smallholder farmers' poverty because it has the ability to boost return on production. With the aid of commercialization, agricultural output and profitability can improve sustainably. Information about the market is crucial for agricultural marketing since it allows one to learn about consumer needs and wants.

This kind of data might be utilized to create an effective marketing plan and help farmers compete in the market (Mdlalose, 2016). Agriculture marketing, according to Puja (2019), is the economic procedure by which agricultural products are sold in the market. The agricultural marketing process establishes the monetary worth of agricultural products and delivers them to their end consumer (Ogbu and Usman, 2018). Agricultural marketing is crucial because it helps farmers sell their marketable excess (Acharya, 2004). The chance of making a profit is only possible if there is a market, and this profit incentive motivates farmers to continue producing their crops, expand their farms, and enhance their agricultural marketing (Glover and Kusterer, 2016). More produce that can be marketed and sold results in more rapid economic growth. Smallholder farmers have a tremendous opportunity to take part in various markets where other enterprises are active. According to Mdlalose (2016), the following table lists all potential marketplaces that are open to smallholder farmers and their descriptions.

Table 2. 1 Available market channels to smallholder tomato farmers.

Market type	Description
1. Consumer Markets	Such markets are made up of both people and households that buy products and services for their own use.
2. Business-to-business Markets	These are primarily made up of businesses that buy goods and services to process later.
3. Reseller Markets	These are made up of people who buy goods and services in order to resell them for a higher profit.
4. Government Markets	Government agencies purchase commodities and services in these markets to provide public services or to give those goods and services to those in need.
5. International Markets	These are made up of foreign buyers, such as citizens, businesses, and the government.

Source: www.globalmarkets.co.za (2021).

Consumer marketplaces, according to Myles *et al.* (2011), are simple to enter and give producers the chance to interact with end users directly, cutting out the intermediaries. Farmers who are unable to provide the high specified level of quantities for large retailers are advised to participate in these markets.

Direct marketing channels (direct-to-consumer marketplaces), according to Baiyegunh *et al.* (2018), are important for a number of reasons. These include giving nearby farmers a chance to interact personally with customers and sell the produce they grow directly to them (Feenstra *et al.*, 2003). (Onianwa and Wheelock, 2006). Direct channels might help farmers hone their entrepreneurial talents (Feenstra *et al.*, 2003). They might enable farmers to cut marketing expenses, retaining more of the retail price and earning higher net profits (Feenstra *et al.*, 2003). However, despite the rise in local farms using direct-to-consumer marketing strategies, direct sales growth is static (Onianwa and Wheelock, 2006).

2.5 Studies on commercialization

Commercialization is defined by Bouis and Haddad (1990) as the overall percentage of output value that is marketed. However, marketing agricultural products is only one aspect of agricultural commercialization, according to Pingali and Rosegrant (1995). When judgments

about which inputs to use and which products to choose are based on profit maximization, agriculture becomes commercialized. According to Von Braun and Kennedy (1994), in order to reap the rewards of commercialization, agricultural production must boost market activity. Agriculture's commercialization has the potential to lessen hunger and poverty. Farmers must think about adding value to what they offer if they want to eliminate poverty through commercializing agricultural products (Ayako & Hernandez, 2017).

According to a study by Mageto and Gathiaka (2018), non-farm income increased the likelihood of high commercialization, which has broad ramifications for household nutrition as well. Additionally, households without outside sources of revenue were undoubtedly impoverished, consumed a large portion of their agricultural output, and possibly missed out on other marketable nutritious items (Mageto and Gathiaka, 2018). Additionally, rural industrialization and growth policies that provide chances for non-farm incomes are likely to positively affect household nutrition in addition to the commercialization of farm output (Mageto and Gathiaka, 2018). Additionally, it is important to encourage farmers to diversify their businesses into non-agricultural endeavors. Alternative sources of income may promote market participation and lessen reliance on domestically generated food for household consumption (Mageto and Gathiaka, 2018).

2.5.1 Agricultural policies guiding smallholder commercialization In South Africa

According to a research by Jari *et al.* (2013), South Africa has adopted a number of policies to encourage smallholder commercialization, including land reform, AgriBEE, and sustainable development. Thamaga-Chitja and Morojele (2014) provided more evidence in a subsequent study that CASP is one of the policy tools that encourages smallholder agriculture to adopt a commercial orientation. A DAFF report (2013) highlighted CASP funding's support for smallholders. To be more precise, CASP is built on six pillars that represent the services needed to transform small-scale agriculture infrastructure both on and off farms, technical and advisory support, information and knowledge management, regulatory services, training and capacity building, marketing, business development, and finance are some of the services offered. In order to promote risk sharing between producers and financial institutions, these latter have been incorporated into the Mafisa, Ilima/Letsema pillars, and other sustainable farming models. This is a clear indication that work is being done to transform smallholder agriculture into commercial agricultural that will participate in high value chains.

According to a study by Lekgau and Jooste (2012), South Africa provides farm inputs as a sort of subsidy to help farmers with limited resources. This study confirmed to the importance of government subsidies in assisting smallholder farmers. Support for inputs includes the distribution of seeds, fertilizers, and machinery like tractors. This illustrates the importance of subsidy policy in the agricultural industry. One of the primary initiatives that aims to impact post-harvest management in South Africa is the South Africa Post-Harvest Innovation (PHI) Programme, according to Chauke (2016). This policy's objective is to create cutting-edge technologies for the fresh fruit value chain. However, given their involvement in the export market is limited, smallholder farmers have received little advantage from this program.

2.5.2 Measurements of commercialization index

Finding the extent of smallholder commercialization is crucial, according to Jaleta *et al.* (2009), primarily for three reasons. First of all, it enables us to compare homes based on their level of commercialization. Secondly, it enables us to determine how much a household is commercialized in terms of its total decisions on production, consumption, and marketing. Finally, and crucially for the purposes of this study, it enables us to examine the factors that influence commercialization. The ratio of the gross value of all agricultural sales per household annually to the gross value of all crop production is known as the household commercialization index (HCI). A value of zero here denotes complete subsistence, whereas a value close to 100 denotes a higher percentage, or level, of commercialization. The Household Commercialization Index (HCI) or the Crop Output Market Participation Index (COMPI) is used in this study to determine the household-specific level of commercialization for smallholder tomato growers in light of the information provided above.

2.6 Socio-economic factors influencing level of market participation

In the agricultural sector, where there is fierce competition between farmers who were previously disadvantaged and those who were previously favored, education is vital. Farmers with higher levels of education may be better able to comprehend and evaluate market data, express business ideas, network, have stronger overall farm management concepts and marketing skills, and build financial intelligence (Moloi, 2008).

The age of the head of the household is regarded as a critical issue since it influences whether the household benefits from an older person's experience or must base its decisions on a younger farmer's willingness to take risks (Makhura, 2001). Younger household heads are

more likely to move to cities in search of jobs than older heads of households (Ngqangweni and Delgado, 2003). As a farmer ages, it gets harder for them to take advantage of possibilities, like getting into the neighborhood market (Magingxa *et al.*, 2005). The way older people react to contemporary improvements in farming techniques can also have a significant impact. Ngqangweni and Delgado (2003) showed that older households are more willing to invest in livestock, even though it seems unsustainable if agriculture is to be an essential source of income. Their study looked into the decisions to keep livestock in Limpopo. However, older farmers were shown to be more likely to participate in horticulture markets but tended to sell much less compared to younger farmers in a study that covered all agricultural companies (Makhura, 2001).

The likelihood of engaging in the marketplaces for livestock and horticulture was negatively impacted by household size (Makhura, 2001). Additionally, household size had a detrimental effect on the amount of sales (Ramoroka, 2012). The size of the household has a detrimental influence on farm revenue, according to Mathonzi's (2000) study on the effects of market orientation on smallholder farmers' income and food security. High households that are actively engaged in farming are important for providing farm labor, but if the family size is large and the majority of the members are just dependents, it has a detrimental effect on farm income.

The South African government is now campaigning for and encouraging women's engagement in all sectors of the economy, including agriculture (Ramoroka, 2012). In agriculture, land is a valuable resource, and unequal land ownership has a higher effect on income generation. According to Argawal (1994), women's empowerment, equality, production, and welfare all increase when they own land. In Paraguay and Peru, a study by Deere *et al.* (2005) examined whether female land rights resulted in better rural household income. They discovered that in Peru, the lack of female land rights had a bad impact on farm income. According to the Deere *et al.* (2005) study, there is already a connection between farm income, gender, and land ownership. Female families were positively correlated with livestock sales in a study by Makhura (2001), and female farmers typically attend livestock markets at a higher rate than male farmers do.

2.6.1 Market and Institutional factors influencing the level of market participation

When assessing smallholders' potential for commercialization during the past ten years, experts have been particularly worried about the greater transaction costs and market risks

they confront (Goetz, 1992; Key *et al.*, 2000; Makhura *et al.*, 2001). When institutions fall short or fail to uphold their duty to lessen information asymmetries that prevent smallholders from commercializing their goods, transaction costs rise (Fafchamps and Hill, 2005; Makhura *et al.*, 2001; Poulton *et al.*, 2010). The failure to convert market data into business experience also affects the process of connecting farmers with marketplaces that offer financial incentives (Key *et al.*, 2000; Reardon *et al.*, 2009; Bhattarai *et al.*, 2013). Existing research on smallholder commercialization shows that institutions influence production decisions and market exchanges, enabling smallholders to profit from the market (Dorward *et al.*, 2004; Yaseen *et al.*, 2016; Otieno *et al.*, 2009). To overcome market information asymmetry, institutions monitor and enforce quality compliances through methods like signalling, reputation, and quality certifications (Royer *et al.*, 2016). Therefore, institutions act as a check on the behavior of those involved in the food chain, supporting MPs, lowering transaction costs, successfully managing market risk, and opening up a variety of opportunities for collective action (Alene *et al.*, 2009; Arias *et al.*, 2013; Brett, 2008)).

2.6.2 Market Access and participation intensity

Market structure (asymmetry of relationships between farmers, market intermediaries, and consumers), physical access to markets (distances, costs, etc.), and producers' lack of skills, information, and organization (understanding of the market, prices, bargaining, etc.) can all be taken into account when analyzing the issue of market access (Ramoroka, 2012). Small-scale farmers who produce surpluses frequently lack access to markets, regardless of the magnitude of their production (Mayson, 2003). Depending on the crops and countries, market liberalization has helped smallholder farmers' access to markets to varying degrees (Dorward *et al.*, 1998). Even while some farmers may now have new chances, smallholder farmers still struggle to reach official markets due of their difficulties (Boughton *et al.*, 2006). Smallholder farmers need additional certainty that they will be able to sell their produce and get a fair price, even in more accessible locations (Dorward and Kydd, 2003). According to published research, a variety of obstacles prevent smallholder farmers from increasing their market access and level of market involvement (Ramoroka, 2012).

2.7 Theoretical framework

Random Utility Maximization (RUM) is one of the theoretical models that explains how individual households decide whether to enter a market or become commercial. Takesure (2017) asserts that the perceived utility or potential net benefit of a choice influences tomato

farmers' decisions to commercialize. Furthermore, the idea that farms and businesses aim to maximize satisfaction when making economic decisions is referred to as utility maximization theory (Herrnstein *et al.*, 1993). When a farmer commercializes, he or she raises household income and level of living, maximizing the utility of the farmer.

This research incorporates these theories because it deals with commercialization, and this indicates increase in farmer's utility or maximum utility. The study also considers random utility maximization as some of the smallholder farmers use small plots of land where they live to farm so the household behaviour can affect their farming activities. In summary these are considered because as the farmer is maximizing utility by commercializing his/her household behaviour must be taken into consideration.

2.8 Conceptual framework

A variety of indicators have been generated as a result of agricultural commercialization. Leavy and Poulton (2007) claim that this ignorance of the true nature of commercialization could result in misunderstandings and impede policy from being put into practice. In general, commercialization can occur on the input side of production by expanding the use of purchased inputs or on the output side by growing the marketable excess. In talks regarding the commercialization of agriculture, simple comparisons between "subsistence" and "commercial" or "export" agriculture are frequently made, separating producers into different categories of farms (small farms, large farms), producing different kinds of crops (food crops, cash crops). Agriculture's commercialization can be characterized by the extent of output market engagement. The proportion or volume of crop production that is marketed can be used to determine how commercialized a farm or family is. In that case, a simple index of household crop commercialization is based on the percentage of output sold in markets. The commercialization indices contain zero values, which strongly reflect subsistence, and increase in commercialization as they approach 100. Von Braun and Kennedy (1994) also discuss metrics for absorption into the cash economy, as well as the quantity or proportion of purchased inputs in total inputs used on farms.

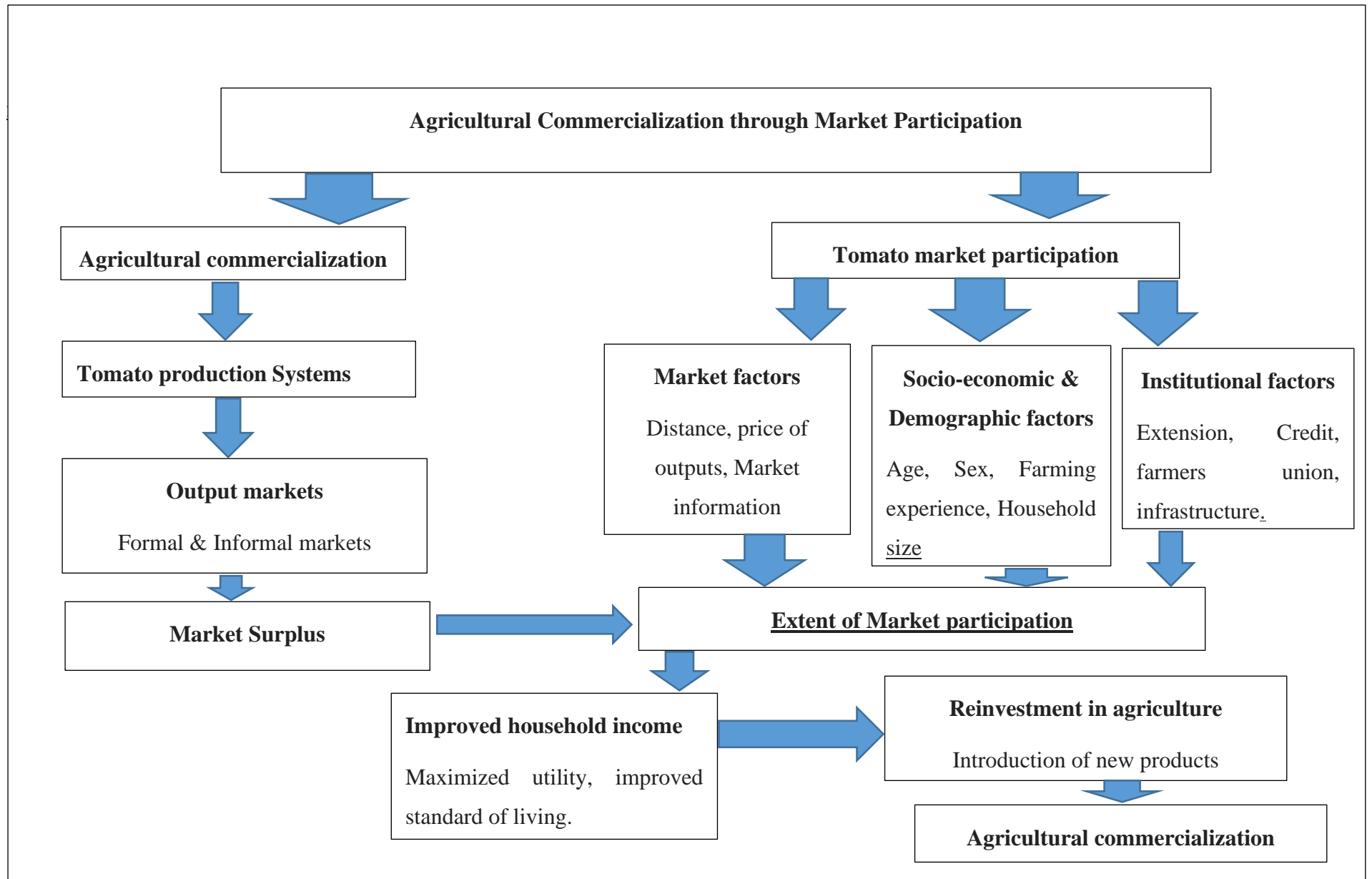


Figure 2. 1 Conceptual framework of the study.

According to some like Martey *et al.* (2012), the agricultural commercialization entails a change from subsistence-oriented to increasingly market-oriented patterns of production and input utilization. The instant commercialization starts, household decisions about production and consumption are divided. In market-oriented farming, household decisions about production and consumption can be divided, but not in subsistence farming (Gebre-Ab, 2006). The household's goal is to maximize utility when making non-separable decisions, and profit maximization when making entirely separable ones. Between the two afore-mentioned scenarios, household behaviour is influenced by a combination of two goals that are focused on utility and profit. In the initial stages of commercialization, utility maximization predominates, while profit maximizing predominates in the later stages. In subsistence and commercialized farming, decisions on what to produce and how to divide the day between work and leisure are made differently. Others, including Pingali and Rosegrant (1995), contend that the process of commercialization entails a shift away from conventional self-sufficiency aims and toward decision-making that is motivated by income and profit. Farmers typically adapt their production decisions to market trends as economies develop, and they buy more of their supplies from markets.

As a result, contracting labor rather than using family labor is a more frequent input utilization choice in manufacturing for the market. The proportion of farm income in total household income declines when family members find more desirable non-agricultural employment opportunities, which is accompanied by a significant decline in the population dependent on agriculture. However, in the early stages of agricultural development, diversification may be related to commercialization. Therefore, shifting away from the production of staple foods for household consumption requires diversification into market-oriented crops or animals, which may also be a major tactic for distributing market-related risks.

2.9 Chapter summary

This chapter provided a summary of the literature that was examined in relation to the study's goal. Because of the 1913 and 1936 native land acts, a sizable portion of smallholder farmers in South Africa live in rural areas. The infrastructure in South Africa's rural areas is inadequate for the development and growth of the economy. There are approximately 595 commercially emerging farmers in South Africa, according to NAMC. Due to poor access to arable land, insufficient irrigation, and low levels of mechanization in the agricultural sector,

production in Southern Africa is constrained. The literature also showed that market involvement is significantly influenced by education. High levels of knowledge may also help farmers appropriately analyse and interpret market information. The definition of key terms, the situation of smallholder farmers in South Africa, the output of smallholder farmers, particularly smallholder tomato farmers, the commercialization index, the channels of market participation, market participation, and market participation intensity were all covered in the literature review. The methodology of this investigation is described in the subsequent chapter.

CHAPTER 3: RESEARCH METHODOLOGY

3.1 Introduction

The study area, the research design, the study population, sampling processes and techniques, the data collection strategy, data analysis, reliability, and validity are all covered in this chapter along with the research methodology. The procedures for data sampling, data gathering, and data analysis are too covered in this chapter.

3.2 Description of the study area

The Bojanala district in South Africa's North-West province has been chosen as the study area. The Bojanala district, which makes up 17% of the North-West province's overall area, measures 18 300 km². The district is made up of five local municipalities: Marikana, Mooinooi, Phatsima, and Tlhabane in Rustenburg; Brits and Hartebeespoort in Madibeng; Mogwase and Madikwe in Moses Kotane; Derby, Koster, and Swartruggens in Kgetleng River; and Moretele in Moretele.



Figure 3. 1 A map showing Bojanala district area.

Source: Bojanala district municipality (2019).

The North West Province experiences summertime highs of 17 to 31 °C and wintertime lows of 3 to 21 °C (Mazibuko, 2018). In June/July, the average air temperature is 11,8 °C, whereas in January, it is 23,8 °C. Minimum daily temperatures range from 2,8 °C to 17,2 °C, and maximum daily temperatures range from 20,4 °C to 30,3 °C (Bojanala government, 2020). Although it rains all year round, it mostly falls between November and March, primarily as a result of thunderstorms. The annual average precipitation is 650 mm. With an average monthly total of 132 mm, January is the wettest month of the year. With an average monthly total rainfall of just 2 mm, July is the driest month (Bojanala government, 2020).

3.3 Research philosophy

A researcher's way of thinking that leads to the discovery of fresh, trustworthy information regarding the subject of their research is referred to as their "research philosophy" (Zukauskas *et al.*, 2018). The base of research, according to Zukauskas *et al.* (2018), includes the formulation of the topic, the choice of research approach, the gathering, processing, and analysis of data. Additionally, methodological decision-making might take into account the researcher's research philosophy as well as the research paradigm that focuses on ontology (Zukauskas *et al.*, 2018). The most prevalent types of research philosophy are quantitative, qualitative, and hybrid approaches (Denscombe 2008). The research methodology for this study was mixed methods, which includes both quantitative and qualitative data.

3.4 Research approach

Study approaches are comprehensive study strategies and tactics that go into considerable detail about everything from general hypotheses through data collecting, analysis, and interpretation (Denscombe 2008). Because both qualitative and quantitative data were necessary for this investigation, a mixed method approach was adopted. A qualitative study employs techniques like respondent observations or narrative-driven pieces. Numerical data are gathered and analyzed in a quantitative study. A particular set of concepts and actions separate the mixed method approach as a research paradigm from the other main research paradigms (Denscombe 2008).

3.5 Research design

This study was created with a cross sectional design. Cross-sectional research includes examining groups of people, particularly farmers, who differ on a crucial variable at a particular moment (Cherry, 2018). The information was gathered simultaneously from individuals who shared many other traits but differed in a crucial aspect of interest, such as

age, income level, or location. Cohorts are the standard term for the groups formed from participants (Cherry, 2018). Data was gathered in accordance with the study's objectives, and an analytical model was applied.

3.6 Population of the study

A group or persons chosen from the general community who have a common trait, such as age, gender, or health issues, are referred to as the study's population (Frey *et al.*, 2000). This group could be defined for a variety of purposes, such as to investigate the factors that influence smallholder vegetable farmers' agricultural commercialization and to determine how much of what they produce they sell in the formal or informal market (Frey *et al.*, 2000). All 300 of the district's smallholder tomato and vegetable producers were included in the population for this study.

3.7 Sampling size and procedures

Sampling entailed selecting a representative sample of the population and using the information gathered for research (Frey *et al.*, 2000). Using a random sampling technique, respondents were chosen at random from five municipalities in the Bojanala district: Moses Kotane, Moretele, Rustenburg, Modibeng, and Kgetleng-river. For this investigation, a multi-stage sampling approach was adopted. Multi-stage sampling, according to Kuno (1976), entails capturing samples in stages using progressively smaller sampling units. Because multi sampling is a sort of sampling that involves segmenting the population into groups, it might take the form of a complicated cluster sampling (Kuno, 1976). The multi-stage approach was used for this study because it gives the researcher flexibility in selecting the sample and is highly helpful for gathering primary data from a population that is geographically distributed. Last but not least, the sample techniques were used since they were both time and money efficient. The sample size was calculated using the sample size for an infinite population (1) and the adjusted sample size for the needed population (2). Last but not least, the sample size was grouped based on the various municipalities.

$$s = \frac{z^2 \times p \times (1-p)}{m^2} \dots \dots \dots (1)$$

$$s = \frac{1.96^2 \times 0.5 \times (1 - 0.5)}{0.05^2}$$

$$s = 384.16$$

$$\text{adjusted } S = \frac{s}{1 + \left[\frac{(s-1)}{\text{POPULATION}} \right]} \dots \dots \dots (2)$$

$$\text{adjusted } S = \frac{384.16}{1 + \frac{(384.6 - 1)}{125}}$$

$$\text{adjusted } S = 93$$

Table 3. 1 Multi-stage sample size.

Municipality area	Population sampled
MOSES KOTANE	18
MORETELE	18
KGETLHENG RIVER	18
RUSTENBURG	21
BODIBENG	18
Total	93

Source: Authors compilation (2020).

3.8 Method of data collection

The key data used in this investigation. Due to some farmers' lack of education, data for this study were collected using well-structured questionnaires administered as an interview schedule. In terms of collecting data, two colleagues from the university trained well about the questionnaire, enabling them to administer the questionnaire successfully. Assistance was granted by the local district department of agriculture affording transportation with an extension agent who was associated with these farmers. The respondents were questioned face to face at their farms or a local farm awarded by local authorities to the community for farming. All safety precautions were taken by the respondents, extension agent, and interviewers as some of the data was gathered during the COVID-19 epidemic. The presence of the extension agent helped to calm some of the respondents' anxiety when they responded to some of the questions. Researchers, extension agents, farmers, and grads were all required to wear masks and regularly sanitize their hands. Visitors met the farmers at their farms or, if the farm was located at their homes, inside. According to the extension agent's weekly visits to the farmers in various areas of the study area, the farm visits were planned.

3.9 Method of data analysis

Primary data was collected by researcher from first-hand sources using interviews, it was in line with the research project directly from the farmers (Yin, 2017), and this required farm visits. Questions included qualitative and quantitative questions and open and non-open questions. Data collected was analysed using descriptive statistics and Stata 14 computer software and Statistical Package for Social Scientist (SPSS) version 24.

Table 3. 2 Methods of data analysis.

Objectives	Data to be collected	Analytical tool
To determine the volumes produced, marketed and marketing channels currently used by smallholder tomato farmers in Bojanala district.	Production volumes Amount marketed and the prices Marketing channels used	Descriptive statistics (Frequency tables, means/medians, correlations)
To identify the commercialization level of tomato farmers in Bojanala district.	Gross value of sales Gross value of production	Commercialization index
To outline the factors influencing the level of market participation by tomato farmers in Bojanala district.	Data on socio economic and demographic factors	Tobit regression model

Source: Authors own compilation (2019).

3.9.1 Descriptive statistics

To determine the volume produced, marketed and marketing channels currently used by tomato farmers, descriptive statistics was used. The descriptive statistics containing the use of frequency tables, percentages, mean or mode was used. The descriptive statistics was used to present the results of the socio-economic and demographic features, volumes produced, volumes sold, and marketing channels used by the sample respondents. Descriptive statistics describes coefficients that summarize a given data set (Kenton, 2018). Descriptive statistics involved the use of charts, frequencies, graphs, mean, standard deviation, tables and percentages.

3.9.2 Construct commercialization indices

To measure the level of commercialization among tomato producers, commercialization indices were chosen. In order to determine the level of commercialization unique to a given household, Von Braun and Kennedy (1994), Strasberg *et al.* (1999), and Govereh *et al.* (1999) used the household commercialization index (HCI), which is a ratio of the gross value of all crop sales per household per year to the gross value of all crop production. Total subsistence is indicated by a number of zero, while any value close to 1 indicates a higher level of commercialization, or a higher percentage of agricultural output that is sold. The advantage of this approach is that it treats commercialization as a continuum as opposed to drawing clear lines between houses that are advertised to and those that are not (Leavy and Poulton, 2007). This straightforward index is subject to criticism since it fails to distinguish meaningfully between a household that grows one tomato box and sells it and one that grows sixty boxes and sells fifty of them. The first household appears to be more commercialized than the second based on the aforementioned ratio (Leavy and Poulton, 2007).

This study makes use of Household Commercialization Index (HCI) or the crop output market participation index (COMPI) to address objective two of the study which is, to ascertain the level of commercialization for smallholder tomato farmers. In this study, the HCI is expressed by equation (1) below as follows: -

$$HCI = \frac{\text{total volume of crop sold}}{\text{Total number of crop produced}} \times 100 \dots\dots\dots (1)$$

3.9.3 Tobit Regression Model

The study employed the Tobit regression model to identify the variables affecting the degree of market involvement. Because it enables the estimation of linear correlations between variables when the dependent variable exhibits either left- or right-censoring, the Tobit regression model was employed (also known as censoring from below and above, respectively). The following equations (2) and (3) describe the model.

$$Y^* = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \dots + \beta_n X_n + \mu \quad \dots\dots\dots (2)$$

$$Y = 0 \text{ if } y \leq 0, y = Y^* \text{ if } y > 0 \dots\dots\dots (3)$$

Y^* = Commercialization index

β_s = estimated parameter or coefficient

X_i = Explanatory variables

μ_i = error term and is normally distributed with zero mean and constant variance.

If the latent variable y^* falls below a certain threshold, often 0, the dependent variable, the commercialization index (y^*), equals 0. The dependent variable is equal to one if the latent variable's value is 1. The dependent variable will depend on the volume sold to volume produced ratio.

$$Y = \beta + x\beta + \mu, \mu / x \sim N, 0 \delta \dots\dots\dots(4)$$

$$Y \max, 0 y = y$$

While equation (3) indicates that the observed variable, y , equals y^* when $y^* > 0$, but $y = 0$ when $y^* \leq 0$, the latent variable, y^* , in equation (6) satisfies the classical linear model assumptions ($y \max, 0 y = y$), in particular, it has a normal, homoscedasticity distribution with a linear conditional mean. Y has a continuous distribution over strictly positive values because y^* has a normal distribution. In particular, for positive values, the density of y^* given x is the same as the concentration of y given x .

$$P(y = 0 / x) = P(y < 0 / x) = P(\mu < -x\beta) \dots\dots\dots(5)$$

$$P(\mu / \delta < -x\beta / \delta) = \Phi(-x\beta / \delta) = 1 - \Phi(x\beta / \delta) \dots\dots\dots(6)$$

For the sake of simplicity in notation, the intercept is absorbed into x because μ has a standard normal distribution and is independent of x . (Wooldridge, 2009 and Cameron, 2005). By maximizing the log-likelihood, which is simple to do in Stata, the greatest likelihood estimates for β and δ will be found (Cameron, 2005). Listed below is the Tobit model.

$$Y^* = \beta + \beta_1 X_1 + \beta_2 X_2 + \dots + \beta_k X_k + \mu \dots\dots\dots(7)$$

Where, Y^* is the dependent variable (commercialization index), and x is a vector of independent factors, and μ is the error term. The independent factors are specified as follows:

X1 = Sex of Household head (1= male, 0 = female), X2 = Age of household head (in years), X3 = Number of years spent in school (In years), X4 = Distance from the market, X5 = Years of farming (in years), X6 = Land (ha) , X7 = Contact with extension agent (1 = yes, 0 = No), X8 = Contractual agreement (1 = yes, 0 = No), X9 = Quantities of tomato produced (in kgs), X10 = Value of tomato produce sold (in ZAR).

Table 3. 3 Description of variables for Tobit model.

VARIABLES	DESCRIPTION	HYPOTHESIS (PRIOR EXPECTATION)
Dependent variable		
Y*	Market participation	-/+
Independent variables		
X1	X1 = Sex of Household head (1 = male, 0 = female)	-
X2	X2 = Age of household head (in years)	-
X3	X3 = Number of years spent in school (In years)	+
X4	X4 = Distance from the market	-
X5	X5 = Years of farming (in years)	-
X6	X6 = Land (ha)	+
X7	X7 = Contact with extension agent (1 = yes, 0 = No)	+
X8	X8 = Contractual agreement (1 = yes, 0 = No)	+
X9	X9 = Quantities of tomato produced (in kgs)	+
X10	X10 = Value of tomato produce sold (in ZAR)	+

Source: Authors own compilation (2019).

Sex: This variable was used as a dummy variable, where 1 represented the male household headed farmer, and 0 represented female headed household farmer. In traditional rural areas, it is believed that it is the responsibility of males to provide for their families than females. Sex is an important characteristic for this study because it is generally believed that women are more involved in farming in Africa compared to males. Therefore, this study sought to analyze this characteristic so as to contribute to the course of gender equality. In this study, it was hypothesized that sex would have a negative correlation to commercialization.

Age: This attribute represents the farmer's real age in years. Older farmers are said to be more resource-efficient since they are more knowledgeable (Christian, 2014). In this study, it was expected that age would correlate negatively with tomato producers' commercialization. A farmer's willingness to commercialize decreases with age.

Number of years spent in school: This was measured as continuous variable. According to Oyekale (2014), farmers who can easily read and write are more likely to adopt to new technologies. This study considers this variable because an individual that is educated is considered to be exposed to more information about farming activities compared to their counterparts. This study hypothesized that number of years in school has a positive relationship with the commercialization of tomato farmers

Distance to market: This was measured as a continuous variable, measured in kilometres. It is believed that farmers, who are far from the market, are more likely to incur more transportation cost. Therefore, this study hypothesized that distance to the market has a negative relationship with commercialization.

Years of farming: This variable was also treated as a continuous variable, which measures the farmer's experience in farming, Farmers with more experience are more likely sceptical to adopt new marketing skills. As a result, this study hypothesized that years in farming have a negative correlation with commercialization of tomato farmers.

Land: The amount of land used was continuous and measured in hectares. In this study, it was hypothesized that the amount of land being used for farming has a positive relationship with commercialization of tomato farmers. This means that the study predicts that farmers with more land for farming would be willing to commercialize.

Contact with extension agent: This variable was handled as a dummy, with 1 denoting yes and 0 denoting no. According to the study, interactions with extension agents increase market involvement. This implied that the more a farmer interacts with an extension agent, the more markets he or she would attend.

Contractual agreement: With 1 denoting yes and 0 denoting no, this variable was handled as a dummy variable. It is thought that farmers, who have contracts with retailers are more likely to successfully sell all of their produce. In light of this, the study proposed that contractual agreement influenced market participation favourably.

Quantities of tomato produced: Farmers will be more interested in selling, generally speaking, the more effectively they produce. This variable was handled as continuous, and weight was expressed in kilograms. According to the study's hypothesis, the amount of

tomatoes produced correlated favourably with market participation since increased output increases the market's surplus.

Value of tomato produce sold: This variable was treated as continuous and was measured in ZAR. For this variable, the study hypothesized that the value of tomato produce sold has a positive relationship with market participation.

3.10 Validity and reliability

In order to check for bias, the validity of the study was picked in reference to the research design. The questionnaire was compared to other questionnaires with comparable study outcomes for validity purposes. The extent to which the research's components accurately reflect the theory, concept, or variable being studied is referred to as validity in research (Yin, 2017). In order to prevent bias or erroneous results, consistency was used, which meant that each questionnaire was handled the same as the one before it and the one after it (Yin, 2017).

Reliability is the extent to which an evaluation tool produces accurate and dependable outcomes. To evaluate the questionnaire's validity and provide an accurate assessment of the study, a pilot study was carried out with 13 randomly chosen participants (10% of the sample size). The main objective of research dependability was to limit bias and mistakes in the results (Yin, 1989). According to Christian (2014), reliability looks at the conditions to determine how reliable the tools are. Additionally, reliability evaluates the results that would be produced if the data collecting tool were used on the same respondent on different occasions and takes stability into account (Christian, 2014).

3.11 Chapter summary

This chapter entailed methodologies of the study, starting with the description of the study area, research philosophy, research approach, research design, population of the study, sampling size and procedure, method of data collection, of which it was explained that a well-structured questionnaire was personally administered by the researcher and enumerators, a method of data analysis which indicated that SPSS and Stata 15 computer software was used to analyse the data. Commercialization index and Tobit regression model was then discussed. The following chapter address the results and discussions of this study.

CHAPTER 4: RESULTS AND DISCUSSION

4.1 Introduction

In this chapter, the study's findings are covered. The demographic and socioeconomic traits of smallholder tomato producers in the Bojanala district will served as the primary foundation for the data analysis and discussions. However, the findings about the variables impacting the level of market participation by smallholder farmers in the Bojanala district were discussed in order to gauge the level of commercialization.

4.2 Demographic and socio-economic characteristics of smallholder tomato farmers.

Analysing the level of agricultural commercialization and the quantities sold by tomato farmers was the major goal of this study. This study's specific goals were to identify the tomato producers' commercialization indices and to describe the elements that affect how much they participate in the market. A field research on smallholder tomato farmers was carried out to achieve this major goal. On the afore-mentioned objectives and study questions, an analysis of the survey results is offered. The findings per the particular purpose of this study, as well as the demographic and socioeconomic features of smallholder tomato farmers, are reviewed in this chapter. To learn more about whether these factors affect the commercialization of farmers and whether they have an impact on market involvement, as shown by other studies, demographic and socioeconomic data were analyzed. The most common demographic factors in the study were race, gender, age, and income, level of education, work status, and geography. Age, sex, the number of years spent in school, population group, marital status, and status as a farmer are all considered as demographics for the purposes of this study.

Table 4. 1 Demographic and socio-economic characteristics of smallholder tomato farmers (n = 93).

Variable	Mean	Minimum	Maximum
Age	44.88	25	75
No of years spent at school	6.40	0	17

Source: Field survey (2021).

4.2.1 Age

The head of the household's age was regarded as a critical issue since it influences whether the household benefits from an older person's experience or must base its decisions on a younger farmer's willingness to take risks (Makhura, 2001). According to the findings in Table 4.1, tomato producers in the research area ranged in age from 25 to 74, with an average age of 44. Given the findings, it is reasonable to infer that there is a dearth of youth involvement in farming because, in order to qualify as a youngster, a person must have been between the ages of 18 and 35, and the average age of this study was 44. This is in accord with a study conducted by Hlatshwayo *et al.* (2021), noting that young people are not interested in farming as they prefer other occupations.

4.2.2 Number of years spent in school

One of the most important aspects in agriculture is education level, which is thought to play a crucial role in improving the efficiency of the farmer in making decisions about what and how to produce, given limited resources. Literate farmers are more likely to adopt cutting-edge farming techniques, according to Oyekale (2014). Additionally, a farmer's level of education affects their human resources and their capacity to deal with contemporary farm decision-making procedures (Christian, 2014). According to Table 4.1's findings, the median number of years spent in school is 6.40. Tomato farmers in Bojanala attend school for a maximum of 17 years and for a minimum of 0 years. Given that the average number of years spent in school is six, these findings indicate that the majority of farmers have less formal education. The fact that these farmers are elderly and might have been negatively impacted by the previous apartheid government's educational practices in South Africa, may be the cause of this.

Table 4. 2 Demographic and socio-economic characteristics of smallholder tomato farmers (n = 93).

Household size	Frequency	Percentage (%)
1-5	56	60.22
6 and more	37	39.79
Gender	Frequency	Percentage (%)
Male	47	50.54
Female	46	49.46
Population group	Frequency	Percentage (%)
White	13	13.98
Indian	2	2.15
Colored	10	10.75
African	68	73.12
Marital status	Frequency	Percentage (%)
Widowed	15	16.13
Divorced	11	11.83
Single	38	40.86
Married	29	31.18
Farmer's status	Frequency	Percentage (%)
Part time	31	33.33
Full time	62	66.67
Type of income	Frequency	Percentage (%)
Off farm income	21	22.58
Pension	35	37.63
Formal employment	14	15.05
Government	11	11.83
None	12	12.90

Source: Field survey (2021).

4.2.4 Household size

Table 4.2 shows that 60.22% of the farmers live in a household that has a household size of between 1 and 5 while other farmers indicated that they lived in a household of 6 or more members. These results indicate that most of the farmers have a household size that is less than 5 members. Smallholder farming depends mainly on family labour compared to hired

labour, so having a family member helping with farm activities may result in shared responsibilities. This is in line with the findings of Egbetokun and Omonona (2012), who noted that having a family member working in the farm results in more production and increased surplus to be sold in the markets.

4.2.5 Gender

The summary of gender distribution of the smallholder tomato farmers is shown in Table 4.2. From the sampled households, majority (50.54%) of them were males while 49.46% were female headed households. Additionally, these results indicate that men have a slight advantage in the production of tomato in the study area. Furthermore, the results are in contrast with what a study conducted by Hlatshwayo *et al.* (2021), who stated that women in South Africa participate more in agricultural activities than their counterparts' men.

4.2.6 Population group

Table 4.2 indicates that 13.98% of the respondents were white, 2.15% were Indian, 10.75% of the respondents were coloured and 73.12% of the respondents were black. This proved that most of the population living in Bojanala district are Africans with a lesser number of other population groups. The results indicate that most of the smallholder tomato farmers in the area are black and this could be attributed to the Native Land Act of 1913 and 1936, which resulted in the homeland being formed and the Bojanala district used to form part of the Bophutatswana.

4.2.7 Marital status

In research, there are four categories with regards to the marital status of each personnel, that being married, single, divorced and or widowed. The results in Table 4.2 indicate that 16.13% were widowed, 11.83% were divorced while 40.86 were single and 31.18% were married. The number of the divorced being high (40.86%) might be attributed the recent spike in divorce rate in South Africa in the recent years. For this study, marital status was considered to be an important variable because of the findings of Egbetokun and Omonona (2012), indicating that marital is a major factor that influences market participation

4.2.8 Farmer's status

In this study, the variable farmers' status indicates whether the farmer is full time or not, and thus could be used to hint on the level of commitment to farming activities, and reliant on farming as a source of income. It could be hypothesized that full time farmers a likely to

monitor and manage their farm performance well, which would at the latter stage, result in high degree of commercialization. The results are shown on Table 4.1 above, which depicts that majority (66.67%) of farmers practice farming on a full-time basis, whereas 33.33% only do farming on a part-time basis. The distinction could be as a result of the farmers being old and not having any occupation, as a results, they invested more time into farming.

4.2.9 Sources and types of Income

Variety of source of income could be regarded as a positive factor contributing to the high degree of commercialization, because it poses the potential opportunity of investment into farming of high value crops like vegetables. Table 4.2 further shows that 22.58% have other businesses besides farming, which contribute to income, 37.63% of the farmers have pension as their source of income, 15.05% of the farmers have formal employment and 11.83% of the respondents have government grant as their source of income. The results in Table 4.2 also illustrates that most of the farmers have some source of outside farming contrary to previous studies (Diirro, 2013; Christian, 2014), which indicated that most of the small-scale farmers have inadequate external sources of income because they depended mostly on farming

4.3 Household resource ownership

Household resource ownership refers to the owner of farm, household owner and the resources owned by the farm. For this study land acquisition and farm ownership were considered.

Table 4. 3 Household resource ownership.

Land acquisition	Frequency	Percentage (%)
Allocated by local authority	33	35.48
Inherited	13	13.98
Lease	16	17.20
Renting or share tenancy	16	17.20
Bought	15	16.13
Farm ownership	Frequency	Percentage (%)
Other	11	11.83
Co-operatives	12	12.90
Farmers group	13	13.98
Family members	11	11.83
Individual	46	49.46

Source: Field survey (2021).

4.3.1 Land acquisition and farm ownership

According to Christian (2014), literature suggests that ownership of agriculture related assets have an influence on the production and marketing decisions of the farmer. The results on Table 4.3 show that 35.45% of the farmers acquired the land through local authority, 13.98% of the farmers inherited the land they use for farming, 17.20% leased their farming land, 17.20% is renting and 16.13% of the farmers had bought the land they used for farming. Table 4.3 also indicates that 12.90% of the farmers indicated that the farm is owned by a co-operative, 13.98% of the farmers indicated that the farm is owned by a farmers group, 11.83% of the farmers' farmed on a family-owned farm and 49.46% of farmers individually owned the land they are farming. Lastly, the results indicate that about 50% of the farmers owned the farms they produced in, this could serve as motivation for farmers to commercialize as they owned the land and their children would probably inherit the land together with the benefits.

4.4 Production of tomato

Tomato is South Africa's second-most significant vegetable, behind potatoes, according to Cherono and Workneh (2018). Additionally, the tomato sector makes a significant contribution to the South African GDP, according to Cherono and Workneh (2018). Additionally, the nation's production of tomatoes has steadily increased in recent years (Cherono and Workneh, 2018). The demand for tomatoes is also rising as a result of the growing urban population, which puts pressure on tomato farmers to expand production (Cherono and Workneh, 2018).

Table 4. 4 Volume and production factors of tomato production at the farm.

Volume produced (Kg)	Frequency	Percentage (%)
< 50 Kg	56	60.22
50<X<100 Kg	19	20.43
>100 Kg	18	19.35
Tractor	Frequency	Percentage (%)
None	2	2.15
Hired	12	12.90
Borrowed	26	27.96
Own	53	56.99
Government mechanization	Frequency	Percentage (%)
Borrowed	3	3.23
Own	4	4.30
None	86	92.47
Animal tractor	Frequency	Percentage (%)
Own	2	2.15
None	91	97.85
Other	Frequency	Percentage (%)
Own	3	3.23
None	90	96.37
Extension contact	Frequency	Percentage (%)
Yes	6	6.45
No	87	93.55
How Often is the Extension contact	Frequency	Percentage (%)
None	87	93.55
Once a month	6	6.45
Assistance from government	Frequency	Percentage (%)
Yes	9	9.68
No	84	90.32
Satisfaction of assistance	Frequency	Percentage (%)
Yes	15	16.13
No	4	4.30
N/A	74	79.57

Source: Field survey (2021).

4.4.1 Volume produced and Land cultivation

The results shown in Table 4.4 revealed that 60.22% of the farmers produced less than 50 Kg of tomato in the previous year, 20.43% of the farmers produced a volume of between 50 Kg and 100 Kg and 19.32% of the farmers produced over 100 Kg of tomato in the previous year. Additionally, The results on Table 4.4 show that 2.15% of the farmers do not use a tractor for

cultivation, 12.90% hired a tractor to use for cultivation, 27.96% of the farmers borrowed a tractor for cultivation and 56.99% of the farmers own a tractor, which they use for cultivation. In addition, Table 4.4 above also shows that 3.23% of the farmers borrowed a government machine for cultivation, 4.30% of the farmers own government machines used for farming while 92.47% of the farmers do not use any government mechanization. Moreover, only 2.15% of the farmers use animals for farming. Lastly, 3.23% of the farmers use other methods not listed for cultivation. These results show that majority of the farmers do not have government assistance. This is in line with the findings of Cherono and Workneh (2018), who argued that there is inadequate assistance from the government in assisting tomato farmers with proper mechanization for tomato production.

4.4.2 Extension agent contact

Small-scale farmers' access to extension services, which facilitate their learning process and give them important information, has been shown to have a significant impact on the adoption of contemporary technologies (Kinyanjui, 2012). Only 6.45% of farmers have contact with an extension agent, according to Table 4.4, while 93.55% of farmers report no contact with an extension agent. Additionally, the findings indicate that those farmers (6.4%) that interact with the extension agent only do so once per month. According to Kinyanjui's (2012) study, which found that the Bojanala District lacks suitable extension services for farmers, these findings demonstrate that the district's extension services are insufficient.

4.4.3 Assistance from government, farmer's union and satisfaction

Table 4.4 shows that 9.68% of the farmers receive assistance from the government while 90.32% of the farmers do not receive any assistance. Secondly, 20.43% of the farmers are a part of a farmer's union and 79.57% of the farmers do not have a farmer's union. Lastly, 16.13% of the farmers are satisfied with assistance received from the government while 4.30% of the farmers are not satisfied with government assistance.

Table 4. 5 Sources of information about markets.

Television as a source	Frequency	Percentage (%)
Yes	46	49.46
No	47	50.54
Radio as a source	Frequency	Percentage (%)
Yes	42	45.16
No	51	54.84
Newspaper as a source	Frequency	Percentage (%)
Yes	34	36.56
No	59	63.44
Magazine as a source	Frequency	Percentage (%)
Ye s	15	16.13
No	78	83.13
Other as sources	Frequency	Percentage (%)
Yes	7	7.53
No	86	92.47

Source: Field survey (2021).

4.4.4 Reliable source of information about markets

Table 4.5 indicates that 49.46% of the farmers rely on televised information about farming while 50.84% of the farmers do not rely on televised information, 45.16% of the farmers rely on radio as a source of information while 54.84% do not rely on radio information, 63.44% of the farmers rely on information obtained from reading newspapers while 36.56% do not rely on newspaper information, 16.13% of the farmers rely on magazines as source of information about markets while 83.13 do not and 7.53% of the farmers rely on other sources of information for farming information. A Signiant number of farmers rely mostly on information about markets obtained from newspapers and radio, a possible explanation for this results be because the farmers are old and have relied on information from these sources for a long time and trust the source they have been using.

4.4.5 Type of labour on the farm

According to Hlatshwayo *et al.* (2021), smallholder farmers are characterized as farmers, who use family labour at the farm. Additionally, Hlatshwayo *et al.* (2021) also notes that the use of family labour can result in increased production as activities at the farm will be shared resulting in increased surplus for the market.

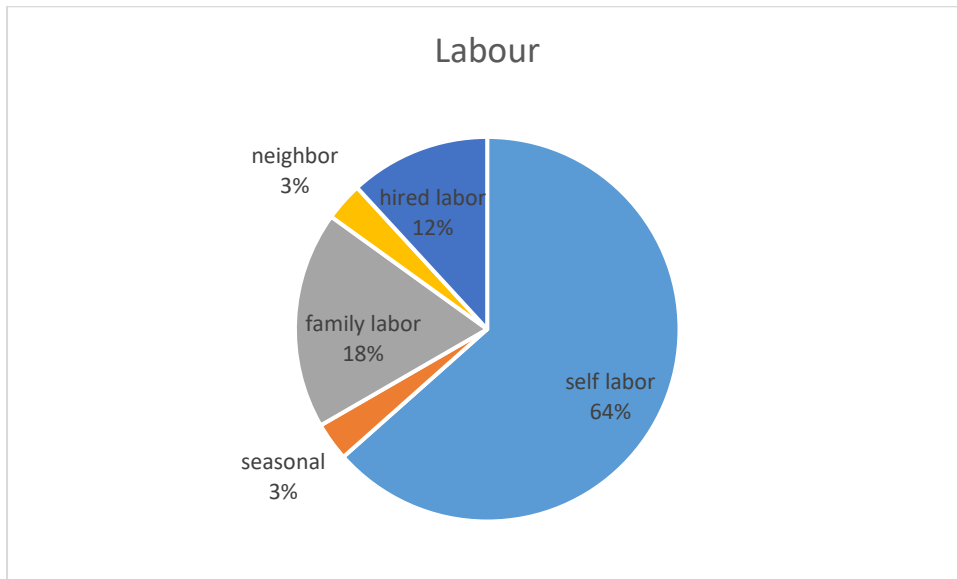


Figure 4. 1 Type of labour on the farm.

Source: Field survey (2019).

Figure 4.1 above shows the types of labour used by farmers when producing tomato produce. The figure shows that 63.44% of the farmers use self-labour to produce, 3.23% use seasonal labour to produce, 18.23% of the farmers use family labour to produce, 3.23% of the farmers use neighbours as labour and 11.83% of the farmers' use hired labour. The results show that a significant number of tomato farmers indicated that they do not use family labour on the farm, this is in contrast to the study finding of Hlatshwayo *et al* (2021), who stated that most of the labour that smallholder farmers used is family labour. These results could also be related to lack of youth participation in farming activities stated by (Hlatshwayo *et al*, 2021).

4.5. Marketing of the produce

Any form of market is key to the sustainability and growth of any business. In agriculture, a market is the linkage between a producer and a consumer, irrespective of its nature, whether formal or informal. Figure 4.2 below shows how and where farmers marketed their tomato produce.

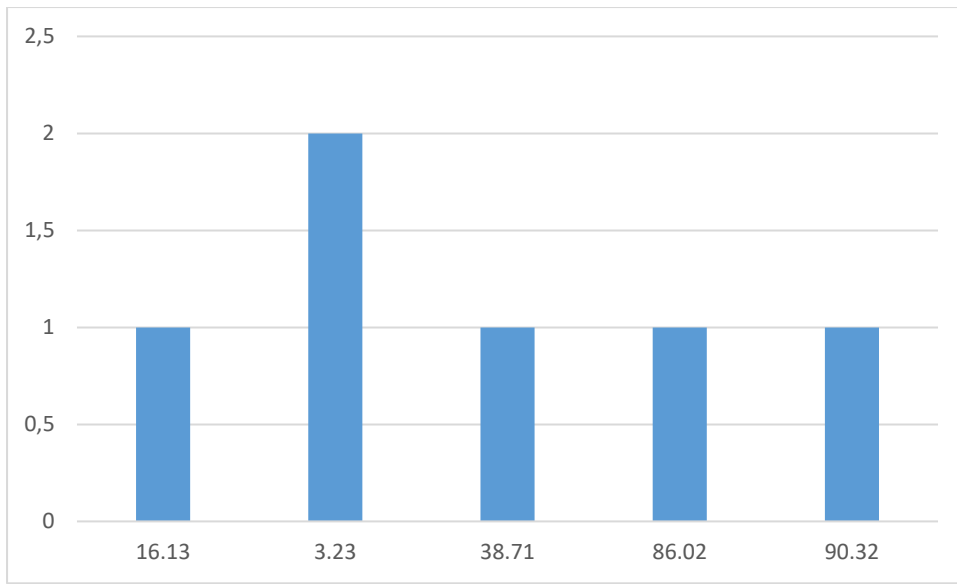


Figure 4. 2 Types of marketing channels.

Source: Field survey (2021).

4.5.1 Marketing of produce

Findings in Figure 4.2 above findings indicates that 86.02% of farmers sell their produce on the farm, whereas 3.23% sell on the side of the road. Figure 4 also shows that 38.71% of farmers sell their food to nearby supermarkets, compared to 90.32% of farmers, who said they sell to their neighbours. 16.13% of farmers sell to other community groups, compared to 3.23% of farmers who sell to large local retailers in their area. The findings indicate that the majority of farmers did sell their produce at and to their neighbours; this might be attributed to smallholder farmers' lack of market knowledge in rural areas. Additionally, these results are in line with the finding of a study conducted by Hlatshwayo *et al.* (2021), which stated that smallholder farmers in rural area do not participate in markets due to lack of information about markets, poor infrastructure and distance to markets.

Table 4. 6 Selling of tomato produce.

Regular customers	Frequency	Percentage (%)	
Yes	75	80.65	
No	18	19.35	
Grading tomatoes	Frequency	Percentage (%)	
Yes	74	79.57	
No	19	20.43	
Rating tomatoes	Frequency	Percentage (%)	
Good	53	56.99	
Average	21	22.58	
None	19	20.43	
Do you combine produce	Frequency	Percentage (%)	
Yes	20	21.51	
No	73	78.49	
Difficulty in customer searching	Frequency	Percentage (%)	
Difficult	19	20.43	
Not quite easy	18	19.35	
Easy	56	60.22	
Contractual agreement	Frequency	Percentage (%)	
Yes	11	11.83	
No	82	88.17	
Survey before selling	Frequency	Percentage (%)	
Yes	64	68.82	
No	29	31.18	
Distance to selling place	Mean	Minimum	Maximum
Neighbors	1.18	0	15
Retail	0.95	0	50
To others	5.76	0	75
Transport cost to market	93.70	20	250

Source: Field survey (2021).

4.5.2 Distance to selling place

Table 4.6 illustrates that the average distance to reach neighbours that are buying the produce is 1.18 km with a minimum of 0 km and a maximum of 15 km. In addition, the average distance of reaching retail stores is 0.95 km with a minimum of 0 and a maximum of 50 km. Moreover, the table shows that the average distance to reach other customers is 5.76 km with a minimum of 0 and a maximum of 75. Lastly, the average transport cost to reach customers is R93.70 with a minimum of R0 and a maximum of R250. This variable was analysed because a study conducted by Hlatshwayo *et al.* (2021), indicated that transportation costs is one of the constraints hindering farmers from participating in markets.

4.5.3 Buying customers and grading of produce

The results on Table 4.6 show that 80.65% of the farmers have regular customers that buy their produce with 19.35% of the farmers have no regular customers. The Table 4.6 further shows 79.57% of the farmers grade their tomatoes and 20.43% of the farmers do not grade their tomatoes. In addition, 56.99% of the farmer's grade rate their tomatoes as good, 22.58% of the farmers rate their tomatoes as average and 20.43% of the farmers do not rate their tomatoes. Table 4.6 also shows that 21.51% of the farmers combine produce with other farmers while 78.49 do not combine their produce with other farmers. Moreover, 20.43% of the farmers find it hard to locate customers, 19.35% of the farmers do not find it easy to locate customers even though they do and 60.22% find it easy to locate customers. Also, 68.82% of the farmers perform a survey before selling their produce while 31.18 do not perform any survey prior to selling their tomatoes.

4.5.4 Price setting

Price setting describes the process by which the market or a producer decides on a commodity's price or the price between other commodities (Mutayoba and Ngaruko, 2018). Additionally, a pricing needs to be high enough to cover employee salaries, enable a business to continue operating, and generate a profit (Mutayoba and Ngaruko, 2018). Lastly, a price can be set either by the government, by a mutual consent among producers or sellers of the commodity.

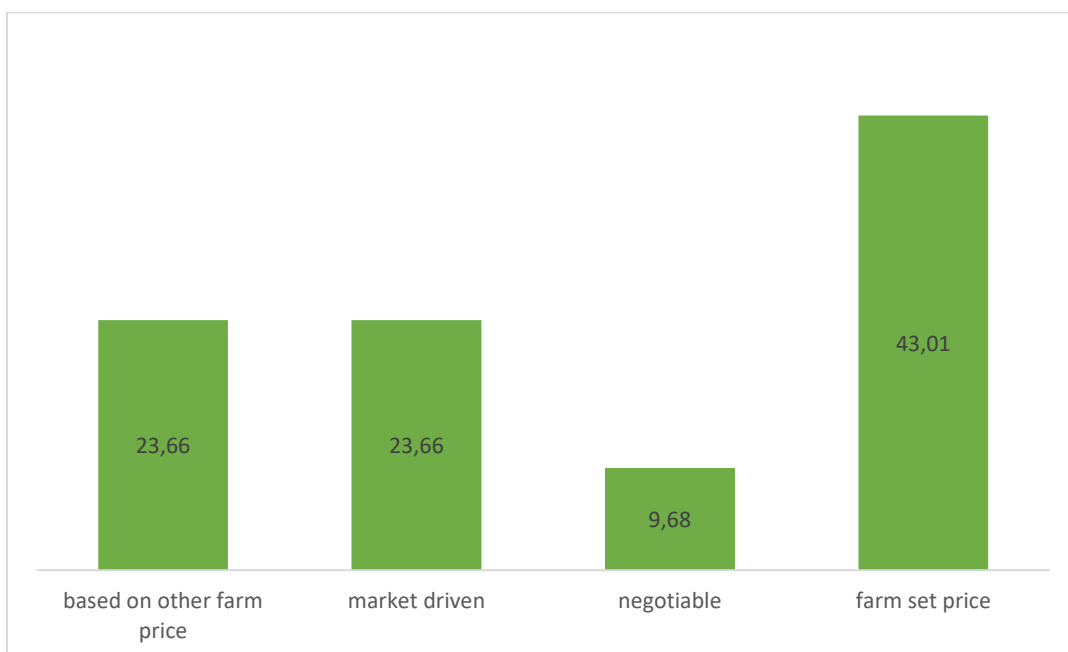


Figure 4. 3 Pricing of tomatoes.

Source: Field survey (2021).

Figure 4.3 illustrates that 23.66% of the farmers set the price of their tomatoes based on other farm prices, 23.66% set their tomatoes prices based on market prices, 9.68% indicated that their pricing is negotiable with the customer and 43.01% of the farmers set their own price not depending on other external factors. The results in Figure 4.3 shows that most of smallholder tomato farmers set their price themselves at the farm, this could be linked to lack of market information about prices by farmers due to isolation of operating in remote rural areas.

4.6 Household commercialization index

The household commercialization index (HCL) gauges how much a household's crop production is focused on the market (Mohammed *et al.*, 2017). Mohammed *et al.* (2017) further point out that a market value of zero would imply that people are entirely focused on subsistence, whereas an index that is closer to 1 implies that people are more commercialized. Additionally, Mohammed *et al.* (2017) claim that farmers can be divided into three groups: semi-commercial (HCI between 0.51 and 0.75), commercial, and persistent (HCI below or equal to 0.5) (HCI greater than 0.75).

Table 4. 7 Household commercialization.

Variable	Mean	Minimum	Maximum
HCI	74.14	46.50	100
HCI	Farmer description	Frequency	Percentage
00-0.50	Subsistence	38	40.86
0.51-0.74	Semi-commercial	48	51.61
0.75-1.0	Commercial	7	7.53

Source: Field survey (2021).

Table 4.7 above is showing the results of the classification of farmers based on their degree of commercialization. From the classification undertaken, majority of the farmers were semi-commercial with 51.61%, while 7.53% were considered commercial and 40.86 % being subsistence. The results indicate that most of the farmers were characterized as semi-commercial with a significant number of famers being subsistence. Semi-commercial means that these farmers were commercially operating small scale with some operations operating at a subsistence level. The results are in line with the report at national level issued by statistics South Africa in 2020, it stated that fewer number (4.7%) of smallholder farmers are commercial. However, the results are contrary to the report that revealed that there was a

significant amount (40,86%) of smallholder farmers, who were subsistence orientated in the study area.

4.7 Tobit regression modelling factors influencing the level of market participation by tomato farmers in Bojanala

The amount of market participation by tomato farmers in the Bojanala district was examined using a Tobit regression model. According to the Tobit regression model's findings, four (04) of the eleven (11) factors that were thought to affect market participation and/or commercialization were found to be statistically significant, whereas the remaining seven (07) were not.

Table 4. 8 Tobit results for factors influencing the level of market participation by tomato farmers in Bojanala (commercialization Index as dependent variable).

Variables	Coefficient estimate	Standard error	t	P> t
Sex	-0.0019037	.1573319	-0.01	0.990
Age	-0.649	.5192	-1.145	0.275
Household size (HHS)	-3.062	3.058283	-1.03	0.318
Years in school	0.0334818	.0624904	0.54	0.715
Distance to market	0.742	2.463	0.43	0.761
Years of farming	-0.0361868	.015532	-2.33	0.020**
Land	-0.1544029	.238873	0.60	0.045**
Contact with extension agent	-0.192118	156.2269	-0.02	0.984
Contractual arrangements	-0.972664	156.2267	0.03	0.192
Tomato quantities produced	0.763	0.033	22.81	0.000***
Value of produce sold	0.208	0.038	5.31	0.027**
constant	-0.2671499	.6560202	-1.82	0.068
Tobit model	Number of observations			93
	LR Chi2 (11)			40.65
	Prob > Chi2			0.0000
Log of Likelihood = -84.0726	R^2			0.69

Significance level: * = $p < 0.05$; ** = $p < 0.1$ and *** = $p < 0.001$???

4.7.1 Years of farming

According to Table 4.8's findings, years spent farming were negatively correlated with market participation, and this link is highly significant at the 5% level of significance. This suggests that each additional year of farming will lead to a 0.036 reduction in market participation. The findings also imply that smallholder tomato farmers' age-related decline in market participation and increased attention to health. Furthermore, because youth engagement is insufficient, market participation decreases as farmers' years of farming rise. In addition, young people tend to move to cities in search of better career possibilities. These results are in contrast to a study conducted by Hlatshwayo *et al.* (2021), who noted that older farmers with more experience tend to participate more in markets compared to young farmers as they have more contacts in the markets, which enables them to find better markets for their produce.

4.7.2 Land (Ha)

The Tobit output in Table 4.8 demonstrates that land has a negative effect on smallholder tomato growers' market involvement and is significant at the 5% level of significance. These findings are unexpected because they show that market involvement declines by 0.154 as land rises. These findings also suggest that farmers' willingness to participate in markets decreases as agricultural acreage (Ha) increases. This might be linked to smallholder farmers' lack of resources, which prevents them from producing on huge tracts of land and competing in markets. The findings also go against those of Egbetokun and Omonona (2012), who highlighted that land had no bearing on farmers' capacity to participate in markets.

4.7.3 Tomato quantity produced (Kg)

The results in Table 4.8 also show that market involvement and tomato production amount have a positive connection that is significantly significant at the 5% level of significance. The findings also indicate that market involvement rises by 0.763 as tomato production volume rises. The results could also be attributed to the fact that as output rises, the surplus that can be sold to markets rises as well, which encourages smallholder tomato producers in the research area to participate in the market. The findings support the claims made by Egbetokun and Omonona (2012) and Hlatshwayo *et al.* (2021), who both suggested that

increasing smallholder farmers' output increases market surplus, which encourages farmers to participate in the market more.

4.7.4 Value of produce sold

The results from Table 4.8 illustrate that the value of produce sold has a positive relationship with market participation and highly significant at 5% significance level. The results also reveal that as the value of produce sold increase so does market participation by 0.208. Additionally, this can be attributed to the revealed results that as the price of tomato increase, the more a farmer will participate in markets as an increase in tomato price brings an increase in profit and more income through farming. The results are in line with a study conducted by (Mutayoba and Ngaruko, (2018), who indicated that high prices of produce can stimulate market participation of smallholder farmers as they sought to maximize profit.

4.8 Chapter summary

In this chapter, the study's descriptive and empirical findings are presented and discussed. Farmers' sociodemographic traits, socioeconomic traits that affect their level of market engagement, their ownership of farm assets, how they produce and market their produce, and their level of home commercialization. In the research area, tomato farmers can be as young as 25 years old or as old as 74 years old, with an average age of 44 years. The majority of them (50.54%) were men, while 49.46% of the families were headed by women. The results also showed that majority of the farmers were semi-commercial with 51.61%, while 7.53% were considered commercial and 40.86 % being subsistence. Results from the Tobit model, which used the commercialization index as a dependent variable to determine the factors driving market involvement, were also reviewed. The summary of the results, conclusions, and recommendations are presented in the following chapter, chapter 5.

CHAPTER 5: SUMMARY, MAJOR FINDINGS, CONCLUSIONS AND RECOMMENDATION

5.1 Introduction

Analysing the level of commercialization among smallholder tomato growers in the Bojanala district was the goal of this study. The final chapter of this study is Chapter 5. This chapter carries a summary of the study's key findings, a conclusion based on the findings, and recommendations that are meant to help policymakers, the government, and other researchers.

5.2 Summary of research methods

Analysis of the level of agricultural commercialization and sales volumes made by tomato growers in the Bojanala region of the North West Province were the main goals of this study. The specific goals were to assess the commercialization level of tomato producers, the volumes produced, marketed, and marketing channels currently used by them, as well as the factors influencing their level of market participation. The sample size for the study was determined through multi-stage sampling, with a sample taken from the entire population. To gather data for this study, well-structured questionnaires were created and distributed as an interview schedule. Tables, graphs, and charts were employed to organize the data into comprehensible and legible information once it had been coded, sorted, and subjected to statistical analysis using SPSS and Stata 15. Tobit regression model was used to analyze the socioeconomic factors affecting the level of market participation among smallholder tomato farmers in Bojanala district, with a commercialization index as the dependent variable. Commercialization index was used to measure the level of commercialization (degree of commercialization).

5.3 Summary of the results

The findings revealed that smallholder tomato farming in Bojanala is relatively practiced by older farmers, as shown by the average farmer age of 44 years. However, there are farmers with a minimum age of 25 years and a maximum of 74 years. These results suggest that younger people are starting to show interest to farming, as opposed to olden days, where farming was perceived to be for old people. Furthermore, a clear indication that old people still practice agriculture is depicted, as they must provide for their families. It was further revealed that 60.22% of the farmers live in a household that has a household size of between 1 and 5 while other farmers indicated that they live in a household of 6 or more members.

Furthermore, it was indicated that the mean of the number of children of the respondents was 2.53 with a minimum of none (0) and a maximum of 7, which suggested that there would be high likelihood of these farmers to participate in markets, as they would not be any hindrance as a results of family members' expectation to consume first other than deciding to sell all their produce. These results suggest that farmers in the sample area have more chance of using family labour. Moreover, it was shown that the average mean of number of years spent in school is 6.40. The maximum years spent in school by tomato farmers in Bojanala is 17 years, with a minimum of 0 years spent in school.

The summary of gender distribution of the smallholder tomato farmers was presented in this study. From the sampled households, Majority (50.54%) of them were males while 49.46% were female headed households. The results revealed that 60.22% of the farmers produced less than 50 Kg of tomato in the previous year, 20.43% of the farmers produced a volume of between 50 Kg and 100 Kg and 19.32 of the farmers produced over 100 Kg of tomato in the previous year. These results suggest that females in Bojanala district are also interested in producing tomato, which would show a thrive for gender equality in the agricultural sector as opposed to the olden believe that men are more into farming than women, as men were expected to provide for their families. In conjunction, 79.57% of the farmers grade their tomatoes and 56.99% of those farmers' grade rate their tomatoes as good, 22.58% of the farmers rate their tomatoes as average and 20.43% of the farmers do not rate their tomatoes.

Despite the fact that the statistics suggest that just 6.45% of farmers interact with extension agents and 93.55% of farmers do not, a certain level of commercialization was established. According to the classification used in this survey, the majority of farmers (51.61%) were semi-commercial, compared to subsistence farmers (7.53%) and commercial farmers (40.86%). According to the findings, the majority of farmers are classified as semi-commercial, although a sizeable portion of farmers are subsistence farmers. Semi-commercial refers to these farmers' small-scale commercial activities that also include some subsistence farming.

According to the Tobit analysis, the factors determining smallholder farmers' market participation are years of farming experience, land, the number of tomatoes produced, and the value of output sold. The findings demonstrated a negative connection between years spent farming and market participation that is highly significant at the 5% level of significance. This suggests that each

additional year of farming will lead to a 0.036 reduction in market participation. Additionally, the Tobit model demonstrates that land significantly affects smallholder tomato growers' market involvement at the 5% level of significance. These findings are unexpected because they show that market involvement declines by 0.154 as land rises. Also found in the results is a positive association between tomato production and market participation that is significantly significant at the 5% level of significance. The findings also indicate that market involvement rises by 0.763 as tomato production volume rises. The value of produce sold shows a positive association with market participation that is highly significant at the 5% significance level, according to Tobit regression. The findings also show that market participation increases by 0.208 as the value of product sold increases.

5.4 Conclusion

The degree of market participation and/or commercialization was acknowledged in this study. The study found that the average age of farmers in the study area is 44 years old, indicating that there is little youth participation there. Additionally, the findings indicated that as age increases, farmers will participate in markets less, suggesting that youth participation can boost market participation and eventually lead to a larger degree of commercialization. The study also revealed that the majority of smallholder farmers produced less than 50 kg of tomatoes the year before. Since the majority of farmers (93.55%) reported not having access to extension services in the research area, this can be attributed to that. Additionally, smallholder farmers depend on extension services because specialists give farmers access to necessary information, reliable market data, and details about better ways to produce (Kinyanjui, 2012). As a result, smallholder farmers lack the necessary information about markets due to a lack of extension services. According to the study, most farmers sell their tomatoes on or near the farm (at the farm gate, by the roadside, to the neighbourhood, or to friends and neighbours), which is related to the expense of shipping tomatoes to distant markets.

The study's findings show that 51.61 percent of farmers are semi-commercialized, meaning that they are willing to engage but that their low production is due to a lack of extension services. The study also revealed that 41% of the farmers in the study area are focused on subsistence farming. Years spent farming and owning land (Ha) had a bad connection with market involvement, according to Tobit regression. This suggests that a farmer's likelihood of participating in markets decreases with age and increases with the amount of the smallholder farmer's landholdings. Furthermore, market involvement is positively correlated with tomato

production and sales value. This demonstrates that if a farmer produces more tomatoes, there will be more excess, and the farmer will participate in marketplaces. Finally, the findings demonstrated that as tomato prices rise, farmers will participate in markets to gain profits.

5.5 Policy recommendation

5.5.1 Government to create high value market linkage programmes for smallholder farmers

It was revealed that majority (79.57%) of smallholder tomato farmers in Bojanala district grade their tomatoes, and 56.99% of them meet high grades, but most of them (96.77% of those sampled) do not participate in large retails (high value market). This mean, when the government initiate programs of assisting smallholder farmers, from production input subsidy and others, they should work in a backward manner, firstly establishing or securing high value markets, then support smallholder farmers, such that after they produce, they are able to get right values for their produce. Also, other programmes can target the youth so as to stimulate interest of youth in agriculture and illustrate to them the important of increased production due to increasing population

5.5.2. Government to improve extension services in the study area

The study showed that there are inadequate extension services in the area and extension services or number of extension services should be improved significantly. Extension is a key part of farmers learning process Kinyanjui (2012) and is essential in graduating subsistence farmers to commercial farming. Extension agents can provide farmers with timely information about market so that farmers can participate in those markets and commercialize.

5.5.3 Encourage value adding activities

Value adding by smallholder farmers will result in maximizing profit at the farm and this can encourage farmers to participate in markets as shown by the results that increased tomato price leads to market participation by farmers. Also, market participation of smallholder farmer will lead to higher degree of commercialization as opposed to semi-commercial. An encouragement of value addition activities would result in smallholder farmers getting more income or profit if they add value to their produce. Such incentive could encourage farmers to reinvest in their farming business and or afford new technologies which would enable them to grow more on their respective degree of commercialization.

5.6 Implication for future research

This research was strictly based on smallholder tomato farmers and did not consider other type of vegetable farmers in the Bojanala district. The research findings may help other researcher when exploring other municipalities in the same province, other provinces, and the country large on other types of horticultural produce. Further studies on the determinants of agricultural commercialization could be conducted. The research can help other researchers when exploring market access of the smallholder farmers as this was not explored in this study. Moreover, this research was mainly focused on the Bojanala District and can be used by other researchers when focusing on the entire province. This research can also be used by different stakeholder in the agricultural sector when formulating policy of their different entities and the government when formulating policy for smallholder farmers in the study area.

5.7 Limitations of the study

The flaws or shortcomings of a study are its limitations, which may be brought on by a lack of funding, a small sample size, or poor methodology, among other factors (Cooper and Schindler 2008). There is no such thing as a flawless study or one that takes into account every possible angle. Therefore, addressing the limitations of your study shows honesty, integrity, and a profound understanding of the issue (Cooper and Schindler 2008).

Because of time constraints, the Bojanala area in the North West province served as the study's major target; as a result, the findings cannot be extrapolated to the North West province as a whole. Additionally, the other challenge was to get all farmers in the sample size to participate in the study because some of them were not willing to participate as they thought the government was trying to get information from them, while other were not available due to Covid-19 lockdown regulations. Some of the farmers were illiterate and some of the responses were based on mere memory.

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NORTH WEST UNIVERSITY

FACULTY OF NATURAL AND AGRICULTURAL SCIENCES

SCHOOL OF AGRICULTURAL ECONOMICS AND EXTENSION

INFORMED CONSENT

RESPONDENT

This questionnaire is for data collection for research on “Degree of agricultural commercialization through market participation among smallholder tomato farmers in Bojanala district”, and Dr M. Christian supervises the study while Mr U. Luvhengo co-supervise the study. The information collected using this questionnaire will only be used for the above-mentioned research topic.

GENERAL INFORMATION

DATE OF INTERVIEW: _____

LOCATION: _____

SECTION A

DEMOGRAPHIC AND SOCIO-ECONOMIC INFORMATION

Please indicate with an X where relevant

1. Sex:
Male____. Female____.
2. Age of respondent____.
3. Population group
African____. Coloured____. Indian____. White____.
4. Marital status
Married____. Single____. Divorced____. Widowed____.
5. Farmer status

Full time ____. Part time ____.

6. Number of years spent in school _____
7. Do you have any other source of income besides farming?
Yes ____. No ____.
8. **If yes**, please indicate the source of income below.

Source of income	Mark with X	Source of income	Mark with X
Government grant		Pension	
Formal employment		Business (other than farming)	
Other (Please specify)			

9. Do you have children?
Yes ____. No ____.
10. **If yes**, how many? ____.
11. What is the household size? _____.
12. How many household members assist with farming?
13. Amongst the following, what is your main objective for farming? (*Please mark relevant option with X*)

Own consumption	Marketing	Own consumption and marketing	Other (please specify)

14. Farming experience _____

SECTION B

HOUSEHOLD RESOURCE OWNERSHIP

15. How did you acquire the land? (*Please mark relevant option with X*)

Bought	
Renting and/or share tenancy	
Lease	
Inherited	
Allocated by local authority	
Other (please specify)	

16. Who owns the farm? (*Please mark with X*)

Individual	
------------	--

Family members	
Farmer's group	
Co-operative	
Private company	
Trust	
Other(please specify)	

SECTION C

PFRODUCTION AND MARKETING OF PRODUCE

17. How much volume of tomato do you produce in the farm?

I.Less than 50 Kg

II.Between 50 and 100 Kg

III.Above 100 Kg

18. How do you cultivate your land? *(Please mark relevant option with X)*

	Own	Borrowed	Hired
Tractor			
Government mechanization			
Animal traction			
Hand			

19. Do you have employees on your farm?

Yes____. No____.

20. If **yes**, how many? _____.

21. Which type of labor do you use? *(indicate with an X)*

Hired Labour	Neighbours	Family labour	Seasonal labour	Self labour	other

If other please specify_____

22. How do you access information? Indicate with an X

Television	Radio	Newspaper	Magazines	Extension agent	Other

23. Do you have contact with an extension agent?

Yes ____. No ____.

24. If yes, how often? *Please mark relevant option with an X*

Once a month	
Twice a month	
More than three times a month	
Other (please specify)	

25. Have you ever received assistance from the government?

26. If yes, what was the purpose of funding?

27. Are you a member of any farmers' union?

Yes ____. No ____.

28. If **yes**, are you satisfied with the Unions in terms of technical information provision?

Yes _____. No _____.

29. Where do you sell your produce and how far is the market?

Market	Mark with X	Distance in Km
Sell at the farm		
Sell on the roadside		
Sell to the neighbours		
Sell to local supermarkets		
Sell to large retailers (e.g. Pick'N Pay)		
Other (please specify)		

30. Do you have regular customers, who always buy from you?

Yes ____. No ____.

31. If yes, how long have you been trading with these customers?

_____ Years.

32. How much do you pay for a single trip to the market?

R_____.

33. How do you pay for transport?

_____.

34. Are your tomatoes graded before trading?

Yes ____. No ____.

If yes, how do you rate your tomatoes, 0=good, 1= bad, 2= average_____

35. When selling, do you combine produce with other farmers?

Yes ____ . No ____ .

36. If no, state the reason(s). *Mark relevant option(s) with X*

37. How difficult is it to find or look for buyers for your produce? *Mark relevant option with X*

Easy	
Not quite easy	
Difficult	

38. Do you have any contractual agreements (formal or informal)? (Give Details)

39. Do you perform price surveys, before selling? Yes_____ No_____

40. How is price set during the sales? (*Please tick as appropriate*)

We set the price	<input type="checkbox"/>	It is market driven	<input type="checkbox"/>	It is dictated by buyers	<input type="checkbox"/>
We negotiate	<input type="checkbox"/>	Based on production costs	<input type="checkbox"/>	Based on other farmer's price	<input type="checkbox"/>
Other (<i>Please specify</i>)					<input type="checkbox"/>

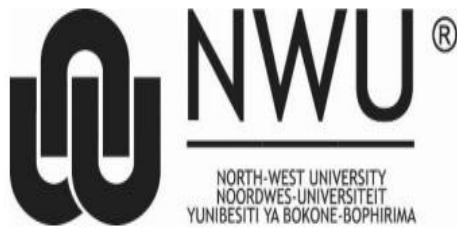
SECTION D

FINANCIAL MANAGEMENT

41. Returns from production.

Vegetable	Hectors (ha)	Quantity produced (in kg)	Income per cycle	Value of produce (GPV)	Value added	Value of produce sold in the market	Value of inputs used	Value of inputs sourced from the market
Tomato								

THANK YOUR FOR YOUR PARTICIPATION.



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ETHICS APPROVAL LETTER OF STUDY

Based on approval by the **Faculty of Natural and Agricultural Sciences Ethics Committee (FNAS-REC)**, the Faculty of Natural and Agricultural Sciences Ethics Committee hereby **approves** your study as indicated below. This implies that the North-West University Senate Committee for Research Ethics (NWU-SCRE) grants its permission that, provided the special conditions specified below are met and pending any other authorisation that may be necessary, the study may be initiated, using the ethics number below.

Study title: Agricultural commercialization through market participation by smallholder tomato farmers in Bojanala District, North West Province.

Study Leader/Supervisor: Dr M Christian

Student: IV Diphoko

Ethics number:

N	W	U	-	0	1	3	9	9	-	2	0	-	A	9
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Institution

Study Number

Year

Status

Status: S = Submission; R = Re-Submission; P = Provisional Authorisation; A = Authorisation

Application type: Single

Risk Category:

Minimal

Commencement date: 01/02/2020

Expiry date: 28/02/2023

Approval of the study is initially provided for a year, after which continuation of the study is dependent on receipt and review of the annual (or as otherwise stipulated) monitoring report and the concomitant issuing of a letter of continuation.

Special in process conditions of the research for approval (if applicable):