Identifying factors that influence participation of farmers in maize marketing in the Highveld region of Eswatini

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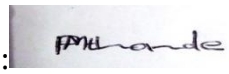
DECLARATION

I, Phumelele Tandzile Mthande, declare that this thesis, which I am submitting for the degree of Master of Science in Agricultural Economics at the University of Pretoria, is my own work and has not previously been submitted for a degree at this or any other university.

Signature: 

Date: April 2022

DEDICATION

To my Heavenly father, the son of the living God, and the Holy Spirit, because it is His purpose that prevails.

To my loving mother, Thabsile Reginah Mthande, whose prayers and guidance got me through the most difficult stages of my study.

To my siblings, Kholekile, Zandile, Phetsile and Sakhile, whom I love and thank for carrying my burdens and responsibilities as I pursued my calling.

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By

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ABSTRACT

The benefits of market participation are well established and primarily involve income generation and/or profits. Market participation is a farmer's preference for selling crops in the output market, creating opportunities for the commercialisation of production by smallholders. The transformation of subsistence farming to market-oriented agriculture is essential. A major benefit of this transition is that the money generated can be channelled to procure other essential goods and services to improve the livelihoods of farmers and rural families. In addition, if agriculture is market-oriented, then the product will meet the market standard in terms of quantity and quality and therefore improve food security while ensuring a healthy diet. However, while efforts to support agriculture and boost food security have been put in place, smallholder maize farmers in Eswatini have a limited meaningful participation in the market.

This shows that other underlying structural constraints limit smallholder maize market participation. Some of the elements influencing farmer market participation are climate, demography and socio-economic characteristics. Eswatini is divided into four agroclimatic regions, i.e. the Highveld, Middleveld, Lowveld and the Lubombo plateau. Of these, the Highveld region has the highest annual rainfall, and is thus reported to have climatic conditions

most suited to maize production. The present study examines the dynamics of the participation of smallholder farmers in maize production in Eswatini's Highveld region and identifies factors that are likely to promote such participation. The study used secondary data which is farm household data that was collected from 191 smallholder maize farmers between the October 2016 and March 2017 cropping seasons. The data was collected from six communities in the Motshane rural development area (RDA) in the Highveld agroclimatic region, and a logit regression model was used to determine the factors that influence smallholder farmers' participation or non-participation in market-oriented agriculture.

Findings showed that access to farmer groups, the size of planted maize area, the use of fertiliser, access to credit and the availability of market information has a favorable impact and significant influence on the farmers' decision to sell in the market. However, the age of the head of the household had a significant but negative impact. Furthermore, a t-test was used to investigate if there was a difference in the means of the non-market participants and the market participants. The t-test results showed that there was a significant difference between the population means of the participants and non-participants. for variables such as age, maize area planted, surplus produce, member of farmer group, access to credit, availability of market information, use of fertiliser and hybrid seed varieties.

Therefore, policies that focus on providing access to land, lowering inputs costs and providing the poor with access to credit should be strengthened to enhance productivity and thereby promote market participation.

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LIST OF ACRONYMS AND ABBREVIATIONS

AIC	Akaike Information Criteria
FAO	Food and Agricultural Organisation
GDP	Gross Domestic Product
LAN	Ammonium Nitrate
MoA	Ministry of Agriculture
NamBoard	National Marketing Board
NMC	National Maize Corporation
NPK	Nitrogen Phosphorus Potassium
TDL	Title Deed Land
SADP	Swaziland Agricultural Development Programme
SNL	Swazi Nation Land
RDA	Rural Development Area
VIF	Variance Inflation Factor

CHAPTER 1: INTRODUCTION

1.1 Background to the study

The economic outlook report of Eswatini[1] (2019-2022) issued by the Ministry of Economic Planning and Development reported that economic growth declined from 2,4% to 1,3% in 2019 (MOEPD, 2020). This slowdown in economic growth can be attributed to weakened investments in emerging markets and developing economies, high unemployment and high-income inequality (WorldBank, 2021). Nonetheless, agriculture, accounting for about 8,9% of the total gross domestic product (GDP), is still regarded as one of the main economic sectors to address poverty and hunger in Eswatini (Plecher, 2020, Leal Filho et al., 2020). Agriculture provides an opportunity to improve household income and livelihood through profits from the sale of agricultural products (Leal Filho et al., 2020). Therefore, increased market participation by smallholders could improve the agricultural sector, especially as more than 70% of Eswatini'**s** population depends directly or indirectly on agriculture and provides food security (Cele, 2021). This is a viable strategy to secure and improve the economy (FAO, 2020). Agricultural transformation must become a reality in order to accelerate economic growth and end hunger and malnutrition (Lin, 2018).

Maize occupies 80% of the total area under production and a majority of it is largely for subsistence purposes (Ginindza, 2018). The government of Eswatini still aims to realise sustainable development and poverty reduction by commercialising agriculture (Poole et al., 2013). According to the WorldBank (2021), 58,9% of the population in Eswatini lives below the poverty line, with limited access to goods and services. Considering agribusiness as afundamental componentof economic growth, markets are seen as the avenue to increasing income and sustainable development (Otekunrin et al., 2019). Therefore, the government of Eswatini aims to eliminate poverty and create long term development through improving output and the commercialisation of agriculture (Poole et al., 2013).

The government's efforts to shift the agriculture sector away from subsistence farming to high-level commercial production have been evident in some projects commenced in the mid-2000s (FAO, 2020, Nordjo, 2018). One of these was the Swaziland Agricultural Development

[1] Eswatini was formerly known as Swaziland.

Programme (SADP) established in 2007/2008. The SADP aimed to improved quality produce and marketing systems that would enable the effective marketing of farmer products and lead to long-term food security and better quality of life for rural households in Eswatini. One of the program's objectives was to enhance smallholders' market access. (FAO, 2011, Dlamini-Mazibuko, 2020). The project was meant to support the agricultural sector through several initiatives, such as building capacity for the extension services, Non-Governmental organisations, the private sector to provide market information, estimate market demand, procure internal and external markets, enable business plan development, provide financial services, create backward and forward linkages between wholesalers/buyers and producers and provide extension and advice to alleviate constraints on market participation (FAO, 2011).

In the context of the current study, market participation refers to the farmers' involvement in the sales of their produce (Mmbando, 2014, Dlamini, 2019, Sala et al., 2020)– farmers can decide not to sell any or some of their produce. For example. not to participate in the produce market (Musah, 2013). As a result, market involvement is frequently viewed as a household decision to maximise utility, subject to budget constraints . Although smallholder farmers plan how much of their produce to sell in the market and how much to consume at the household level, others have shown that the amount produced is affected by the increasing prices of inputs (e.g. seed, fertiliser, chemicals, tractor hire for farm operations) (Xaba and Masuku, 2013).

This implies that Farmers' decisions to engage in the maize market are not solely motivated by the commodity price, but also by their ability to meet production costs (Musah, 2013). For this reason, the Government of Eswatini introduced an agricultural input subsidy program in 2014 (through a loan from the Bank of Development of India) to improve access to farmers' funds (Ginindza, 2018)**.** This gap was identified by the SADP evaluation team **.** The main goal of this program was to increase domestic food production and reduce poverty (FAO, 2011) . The input subsidy fund assisted smallholder farmers owning maize fields of at least one hectare to acquire inputs such as hybrid seed varieties and fertilisers. Farmers were expected to pay for one-third of the cost of the inputs[2] (Dlamini et al., 2020, Ginindza, 2018). Input subsidies, improved farming skills and resource management were emphasized as options for increasing income from maize production (Agbugba et al., 2020). There is a link between crop production and

[2] The input subsidy package for one hectare of maize field contained 25 kg hybrid maize seeds, 6x50 kg bags of NPK[2] fertilizer and 4x50 kg bags of LAN (28) - limestone ammonium nitrate.

income growth: when there is a surplus (i.e. there is enough to feed for their own household), market participation increases (Jack, 2013).

The agricultural strategy to increase crop production and subsequently improve market participation requires the identification of relevant factors. Previous studies looked at the factors that affect crop production, but few have specifically investigated what factors affect market participation. For example, Masuku et al. (2001) showed that high production and transaction costs, household characteristics and access to information influence market participation by smallholder farmers. As noted by (Poole, 2017), factors that determine market participation must not be generalised across all farmers and all regions, since they are not uniform. There are differences in infrastructure, institutions and production technologies that need to be taken into account. Other factors to consider include the establishment of efficient market systems to provide infrastructure, institutions and production technologies that intensify agricultural production and market participation (Otekunrin et al., 2019).

Previous studies such as (Barrett, 2008, Jaleta et al., 2009, Mbitsemunda and Karangwa, 2017) have proposed several frameworks relating to the relationship between market participation and improved livelihood. Furthermore, when smallholder farmers participate in agricultural output markets, they become drivers of development in their communities because marketing encourages infrastructure development, working institutions and improved technologies (Moono, 2015). That is why market participation Smallholder farmers' restrictions must be addressed (FAO, 2011). By identifying the primary elements influencing smallholder farmers' decisions to engage in the maize market, the means of promoting development and performance of the agriculture sector and the effects of market participation on smallholder welfare can be determined (Muricho et al., 2015). This study aims to investigate these factors in the Highveld region of Eswatini. Furthermore, participation in the market has the capability to increase earnings and development as a result of an improved the standard of living and welfare (Randela et al., 2008, Moono, 2015).

Agriculture in Eswatini is dualistic and comprises subsistence production by smallholder farmers on Swazi Nation Land (SNL) and commercial farming on Title Deed land (TDL) (Shabangu, 2016). SNL accounts for 75% of the total land and the TDL accounts for 25% (Manyatsi and Singwane, 2019). Swazi Nation Land is a communal property owned by the royalty (king) and administered and distributed by chiefs (overseers) in accordance with

customary procedures. These structures do not encourage increased agricultural investment, because only the monarchy holds the property rights to Swazi Nation Land. According to (Dradri, 2006), the lack of ownership rights in this system slows the rate of investment in production. The Title Deed Land farms produce crops such as sugar cane, cotton, pineapples and citrus, mostly for export purposes. The subsistence farms on Swazi Nation Land produce mainly white maize as the staple crop.

Farming systems in Eswatini are still predominantly subsistence-based and rain fed, which makes them dependent on weather fluctuations. The rainiest periods for the country are between November and February. The average rainfall during the rainy season is most favourable in the Highveld. With a mean annual rainfall ranging from 750 mm to 1,500 mm, agricultural production is higher in this area than in the Middleveld, which has average production conditions (Dlamini et al., 2020). It is for this reason that the Highveld was chosen for the investigation.

1.2 Problem statement

Eswatini, like most developing countries, has been reported to be food insecure, as it is dependent on agriculture for consumption and income (Muricho et al., 2015, Dradri, 2006). Since agriculture provides an opportunity to improve household income and livelihoods through profits gained from selling produce, smallholder farmers who participate in output markets become drivers of development in their communities because their efforts encourage infrastructure development, working institutions and improved technologies (Moono, 2015). That is why market participation constraints faced by smallholder farmers need to be addressed (FAO, 2011).

There has been a steady increase in the demand for maize over the years, and farmers have been encouraged by the government to take part in the maize supply market (Dlamini et al., 2012). To gain from this rising market demand, smallholder farmers must enhance their market engagement, and the Eswatini government created the SADP programme to assist smallholders to strengthen their productiveness and marketing systems. But the smallholder farmers in Eswatini are still facing obstacles to participation in agricultural markets, as they lack adequate

means to surmount the variable and fixed costs of entering the market (Mmbando et al., 2015). These conditions have resulted in Eswatini being considered uncompetitive (FAO, 2011).

Improved climatic conditions in some parts of the country have offered some hope for these farmers. Since smallholder farmers on Swazi Nation Land depend on rain, the improved yields due to increased rainfall lead to surplus , hence increased market participation (Dlamini et al., 2012). However, this does not seem to have occurred; smallholder famers still lag behind and are not taking full advantage of the favourable climatic conditions. Again, the factors that play a role in or lead to constraints preventing them from accessing markets require investigation.

Several studies on market participation have been conducted in Eswatini, and various factors have been outlined (Dlamini, 2019, Mabuza et al., 2014, Makhura et al., 2001, Masuku et al., 2001). Increased market participation has been hindered by a lack of social capital, transaction costs, household characteristics and household physical costs. These factors inhibit smallholders from participating in the market. They are also greatly affected by the poor marketing structure of the maize industry, which is dominated by high input costs and low selling prices. Furthermore, Wollverton and Neven (2014) highlighted that heterogeneity of farming characteristics due to differences in climatic conditions and location should not be overlooked. This is supported by Moono (2015), who reported different results for a study conducted in different provinces amongst rice producers in Zambia.

Strasberg et al. (1999) conducted a study on how to better structure the market linkages so that farmers could experience the benefits of commercialisation. The results showed that with commercialisation, important aspects to consider include the fact that households differ significantly in their decision to commercialise. Moreover, past empirical studies have linked the decision and intensity to participate in the market by smallholder farmers to several endogenic factors, such as the farm facilities, as well as factors beyond the farmers' control, such as infrastructure endowment, networks and immaterial factors (Coppola et al., 2018).

The purpose of this research is to discover characteristics that impact a smallholder farmer's likelihood of participating in the maize output market. Further compare the characteristics of market participants and non-participants to draw conclusions about their effects on decision of smallholder farmers to join in the market. A better understanding of farming households can

inform policymakers (and farmers) and reveal alternatives that can improve the standard of living and stimulate rural development.

1.3 Research questions

1 Is there a significant difference between the factors that induce smallholder maize farmers to market and those that induce others not to market their maize?

2 What are the factors that influence the smallholder maize farmers' probability to participate in the maize market in the Highveld region of Eswatini?

1.4 Objectives of the study

The ultimate goal of the study is to determine what factors affect maize farmers' decisions to engage in the maize market in Eswatini's Highveld region. The specific objectives of the study are presented below:

– To determine the difference in the socio-economic characteristics of smallholder farmers who participate in the output market and those who did not.

– Identify factors influencing smallholder maize farmers' decision to participate in the maize market.

1.5 Hypotheses

The study is testing the following two hypotheses:

H_0: There is a significant difference between socio-economic factors affecting market participants and non-participants.

H_1: Factors are important in promoting market participation amongst smallholder maize farmers.

1.6 Justification of the study

Market participation has the potential to increase incomes and improve farmers livelihoods through sales (Poole, 2017, Rabbi et al., 2019). To increase the level of market participation by smallholder maize farmers in the Highveld region of Eswatini, suitable strategies for agricultural market development projects must be designed and relevant adjustments must be made to the farm. These strategies and adjustments must be based on knowledge of the reasons for the low market participation, which this study aims to gather.

1.7 Limitations of the study

The study was limited to Motshane rural development area (RDA) in the Highveld Region due to financial and time constraints. Other areas, such as Hhukwini Lamgabhi, are areas also in the Motshane RDA, with a large production of maize, and can be considered for further studies.

1.8 Organisation/structure of the mini dissertation

This mini dissertation has five chapters. The first chapter discussed the overall study background, the problem statement and the study objectives. Chapter 2 presents the literature review on market participation, starting with the demographics of the country, followed by a review of studies on the identification of factors that influence market participation. The third chapter covers the data collection and methods section in detail and further describes the model that was employed in the econometric analysis. Chapter 4 presents the results of the descriptive statistics and the econometric results of the logit model. Chapter 5 presents the conclusions and recommendations of the study.

CHAPTER 2: LITERATURE REVIEW

2.1 Overview

This section presents a review of market participation, relevant concepts and the theoretical context. Previous studies and models used in this field are reviewed and information on smallholder farmers' market involvement and the structure of Eswatini's maize marketing system is also provided.

2.2 Agriculture in Eswatini

In most developing countries, the agricultural sector is the main economic sector, especially since it provides for the survival and the bulk of rural poor people's means of subsistence (Nkonya et al., 2016). Eswatini is no different. However, the sector's performance over the past years has been compromised by climate change and its effects (FAO, 2015). Land tenure in the country is dualistic and comprises subsistence production by smallholder farmers on Swazi Nation Land (SNL) and commercial farming on Title Deed Land (TDL) (Dradri, 2006, Dlamini et al., 2012). About 28% of total agricultural output comes from SNL; the remaining 72% is produced on TDL (Mlenga and Maseko, 2015). Smallholders make up 78% of the agricultural sector (IFAD, 2015). Subsistence farming (on SNL) depends mainly on rain and is regarded as labour intensive (Dlamini et al., 2012). Under this farming system, crops grown include sweet potato, cotton, legumes and maize.

However, maize still represents the dominant crop produced across the four agroclimatic regions (Mncube et al., 2017). This might be because maize is Eswatini's widely grown crop. and is promoted for efficiency and commercialisation by the government because national self-sufficiency is yet to be attained (Dlamini et al., 2012, Mbonane, 2018). The TDL farm owners have purchased or inherited property rights (Dlamini and Masuku, 2011). They produce crops such as sugar cane, cotton, pineapples and citrus, mostly for commercial purposes (Dlamini, 2016). There are also some subsistence farms on TDL, most of which produce mainly white maize.

Eswatini is divided into four agroclimatic regions, namely the Highveld, Middleveld, Lowveld and the Lubombo plateau, in all of which agriculture is practised (Oseni and Masarirambi, 2011, van Zyl Engelbrecht, 2018). In light of the different soil characteristics and resources available in the different agroclimatic regions, the final maize yield is expected to vary. The

Highveld region receives an annual rainfall ranging between 750 mm to 1 500 mm (Dlamini et al., 2020). The Middleveld climate is subtropical, with a rainfall averaging between 762 and 1 193 mm per annum. The annual rainfall in the Lowveld is between 508 and 890 mm (MoA, 2021), while the Lubombo plateau has an annual rainfall of 650 to 1200 mm (CountryReports, 2021).

Table 2.1 shows the smallholder maize production characteristics based on a survey carried out in 2014/2015 (Mncube et al., 2017). These findings show that the Highveld region was the biggest producer, with an output of 1,97 t/ha, even though its maize production area is smaller than that of the Middleveld.

Table 2. 1 Smallholder maize production characteristics

Agroclimatic region	Area under maize production (ha)	Yield (tons/ha)
Highveld	16 630	1,97
Middleveld	28 506	1,25
Lowveld	13 976	0,94
Lubombo	7 438	0,74

Source: (Mncube et al., 2017)

The country's low agricultural output (especially of maize) led to the governments' decision to boost production through subsidies. In partnership with India, the government introduced an agricultural input subsidy programme in 2014 (Marazza et al., 2020/21). The package for one hectare of maize field comprised 25 kg hybrid maize seeds, 6x50 kg bags of NPK[3] fertiliser and 4x50 kg bags of LAN (28)[4]. According to studies by, amongst others, Dlamini et al. (2020) and Ginindza (2018) conducted after the implementation in all regions showed that the The Highveld region's small-scale maize producers enhanced their maize productivity. after the government agricultural input subsidy programme. This led to increased participation in the informal and formal markets for farmers. The dryland crop production in the Highveld region for the 2018/2019 cropping season is summarised in Table 2.2. Maize is the dominant crop in

[3] NPK: nitrogen, phosphorus and potassium

[4] LAN (28): limestone ammonium nitrate

the Highveld region, in terms of area planted (2803 ha) and total production (8913 ha). Maize farming is popular in the Highveld region when compared to other prevalent crops (MoA, 2019, Matthys et al., 2021).

Table 2. 2: Crop production in the Highveld region

Crop	Total area planted (ha)	Total production (Tons)	Average yield (Tons/ha)
Maize	2803	8913	3,18
Cotton	8	11,2	1,4
Sorghum	8,2	4,4	0,54
Groundnuts	34,7	31,2	0,9
Jugo beans	9,3	6,51	0,7
Cowpeas	3	1,26	0,42
Sweet potato	93,51	732,2	7,83
Cassava	1,65	3,22	2
Taro	3,2	11,2	3,5
Sunflower	0	0	0
Dry beans	117,2	83	0,708

Source:(MoA, 2019)

2.3 Eswatini maize market

Smallholder farmers usually only sell maize after satisfying household consumption (Masuku et al., 2001). According to a market assessment conducted by the Ministry of Agriculture in 2016, the constraints on the maize trade in Eswatini include, but are not limited to environment, structure and network (MoA, 2016). Thus, the greater the production profits, the greater the possibilities to sell output. Farmers in Eswatini sell their produce through both formal and informal channels – the farm gate, wholesalers, middlemen and small traders/retailers, amongst others (Xaba and Masuku, 2013). Up to 10% of Swaziland's annual maize harvest is believed to be sold informally between surrounding households (MoA, 2016). The National Maize Corporation (NMC) is the only public enterprise mandated to control the flow of white maize flow in the country – among other things, the flow of white maize from the producers to the final consumer in Eswatini (NMC, 2016) and to stabilise domestic white maize prices (Dlamini, 2016). It is worthy of note that the NMC favors highly commercialised maize growers. (Dlamini et al., 2017).

The NMC recently reported high demand for maize in Eswatini, evident from the large volumes of maize imported from South Africa for sale in the country. It is not clear why the country records a downward trend of maize production while demand increases (Dlamini et al., 2012). In 2018, the NMC imported 35118 tons of white maize because the local farmers were not supplying enough to meet the demand (NAMBoard, 2018). Much has been done to increase smallholder farmers' access to markets and thereby increase market participation. The national marketing board (NAMBoard) has decentralised some of its services by bringing maize silos closer to highly productive communities; with the intention of reducing transaction costs for the farmer (NMC, 2016). Eswatini's government, in partnership with its affiliates (the FAO and the European Union), launched the SADP in 2009. One of the goals of the programme was to improve smallholder market ties, which was a reaction to several problems affecting agriculture production. Assessments conducted at the end of the programme revealed that it helped over 20 000 Smallholder farmers produce more high-quality food and expanded their market reach, despite the fact that the initiative only lasted five years (Roest, 2014, Dlamini et al., 2020, UNEP DTU Partnership, 2017).

2.4 Basic concepts of market participation

Agriculture has the ability to significantly contribute to the growth of the economy of the majority of African countries (Von Braun, 1995, Kabane, 2020). Previous studies have suggested alternatives to make agriculture contribute to the growth of the economy. In this study, market participation is widely defined as smallholder farmers' involvement in the input and output markets of agricultural goods (Otekunrin et al., 2019, Kalauba, 2021). Market participation is a possible solution to various constraints that limit growth and livelihood improvement (Olwande and Mathenge, 2011); when smallholder farmers participate in the market, they can improve agricultural production for household consumption and increase incomes, thereby gaining purchasing power to pay for other goods and services necessary for the household (Ramorathudi and Terblanche, 2018). After careful analysis of the costs and benefits of participating in the maize market, a smallholder farmer will choose to participate if the expected gains from involvement have a net present value larger than the projected expenses (Enete and Igbokwe, 2009, Michael, 2014, Sebatta et al., 2014). Market participation colloquially known as agricultural commercialization (Makhura et al., 2001, Omiti et al., 2009).

Authors such as Dradri (2006) and Jagwe (2011) have shown evidence of the need for agricultural product commercialisation to enhance smallholder farmers' capacity to participate in marketplaces and so increase their incomes and standard of living. Commercialisation is defined by Martey et al. (2012) as a two-dimensional process, which involves (i) the transition from livelihood to increasingly market-oriented agricultural production; and (ii) input use and the nature of the output (relating to profitability). However, some studies have linked smallholder commercialisation to negative food production and food insecurity if the markets are inefficient and not reliable (Strasberg et al., 1999).

Some studies such as those conducted by (Linderhof et al., 2019, Pender and Alemu, 2007, Namulindwa, 2018) have shown that Promoting agricultural output commercialization is indeed a fundamental of smallholder farmer prosperity and poverty reduction methods.. Furthermore, commercialisation induces competition, thereby lowering food marketing and processing costs, which in turn results in a decline in real food prices (Omiti et al., 2009). The fall in actual food costs alleviates hunger because the commodities become accessible to a larger part of the community. The agricultural sector's transition from subsistence farming to commercialisation affords developing countries like Eswatini prospects for smallholder farmers to maximise utility and profits from agriculture (Xaba and Masuku, 2013). Total factor productivity and commercialisation go hand in hand with the transformation from low productivity to high productivity and increased market participation (Barrett, 2008).

2.5 Market participation and market channels

2.5.1 Market participation

Market participation is generally defined as an individual’s decision to sell products and buy commodities to maximise utility. Marketing the agricultural division needs increasing the probability of market engagement by smallholder farmers (Mmbando, 2014). Developed countries have adopted advanced measures to improve their agricultural sectors, one of which is replacing the informal marketing channels, which are based on ad hoc sales, with coordinated vertical linkages between farmers, processors and retailers (Shepherd, 2007). Such changes push the farmers to produce quality output for the market. Farmers' market participation is connected with the determinants of food security, health and nutrition, which ultimately lead to well-being and development (Poole, 2017, Jagwe, 2011). This is a goal that the global economy aims to achieve. Some linkages make it possible for farmers to gain market access,

be competitive and gain market information that is necessary for participation (Bekkerman et al., 2013). These linkages are vertical and horizontal and include private sectors, membership organisations, public sector institutions and nongovernmental organisations (Forstner, 2004).

However, even when these linkages are functioning properly, a farmer can still decide not to be involved in the market. This may be due to farmers lack of adequate means to pay the variable and fixed costs of entering the market (Mmbando et al., 2015). This causes most of the efforts by the government to increase product supply in the market to fail. Market participation in developing countries remains very low due to other constraints as well. According to Pender and Alemu (2007) and Osmani and Hossain (2015), smallholder farmers decide to participate and how much to sell based on regional social and economic development. Jagwe (2011) concurs with thist this theory which is supported by empirical data from his study, that identified the following as some of the variables that impede smallholder farmer involvement in the output market., such as the absence of institutional reforms that make it possible for rural communities to access efficient services, development of markets, infrastructure and supportive government policies that ensure a stable and favourable political environment. Extensive reviews about smallholder participation in the output market have identified numerous challenges that smallholder farmers are faced with. Many previous studies have examined the effect of transaction costs on farmers' decision to go to market.

2.5.2 Factors affecting market participation

Based on the work by Randela et al. (2008) the following variables have been found to directly correspond to market participation, although the intensity of the relationship still differs from household to household. Factors that impede market participation can be classified as social capital, transaction costs, private and public assets and technology. Furthermore, smallholder farmers are greatly affected by the poor marketing structure in the maize industry, which is dominated by high costs of inputs and low sales volumes (Mmbando et al., 2015).

Household background characteristics –Smallholder farmers' main aim is to provide in their own consumption needs and sell the remainder in the market for cash income. Livelihood conditions are largely reflected in the household's behavioural decisions to maximise utility and profit. According to Musah et al. (2014), households characteristics have a favorable correlation with market activity. Examples of household background characteristics Age,

education level, household size, ownership of livestock. The study intends to find out which of these household characteristics influence market participation positively and which contribute to a negative outcome. Characteristics such as the gender of the leader of the household, income ratio, labour force and the number of family members helping out on the farm should be examined.

Household physical assets – Household physical assets can be used as capital and also as collateral that boosts the smallholder production process. Examples of limited access to land ownership constitutes one of the biggest constraints facing households. Variation in production assets creates differences in the market participation by smallholder farmers (Barrett, 2008). A farm that diversifies its production and marketing uses the different farm products as a buffer to minimise risks. Thus, ownership of household physical assets can contribute to a farmer becoming risk tolerant, thus increasing the intensity of his participation in the market. Property rights linked to the different assets can determine how much an individual is willing to invest in its use. Hence, farmers who have complete property rights on the land they are using will be more likely to improve it with a view to better results and higher productivity (Sankhulani, 2021). Examples of household physical assets ownership of livestock, mobile phone and own transport.

Social costs – Households invest in non-farming activities that serve as security against the risk of market failure. Previous studies have found farmers' participation in schemes to be beneficial in raising incomes that are higher than those of non-participants (Strasberg et al., 1999). Farmer associations and credit and savings cooperatives assist farmers by increasing their capital, and some cooperatives encourage farmers to plant the same crops at the same time to get better market access. This type of system also helps reduce transport costs where farmers share the expenses. Farmers who have their investments spread out are more inclined to be risk tolerant than farmers who depend on farming is their largest source of revenue.

Transaction costs – There are several types of transaction costs that apply directly to the problem faced by maize industry participants. Martey et al. (2012) outline the most common. The first is the contact; some farmers lack information about the market they are supplying. The second is contracting; farmers have difficulty enforcing contracts with suppliers of inputs, or with the retailers they sell to. Smallholder farmers do not often sign contracts; they conclude verbal agreements, which are difficult to monitor and enforce. Last, there is the question of

control; the institutions that control how farmers engage are weak, and there is no accountability if one of the parties to the agreement defaults. It may also be possible that all the listed costs are embodied in one cost. Thus the intensity of participation in the market differs by household (Martey et al., 2012). Previous studies by Musah et al. (2014), amongst others, argue that transaction costs are amongst the main aspects of commercialisation. The types of transaction costs they investigated included the distance between the farmand the location of sale, access to market information and pricing.

Improved agricultural technologies (hybrid seed varieties and fertiliser) – Over the years it has been proven that the application of technology in agriculture has the possibility to to increase productivity (Okoroji et al., 2021). Improved seed varieties, the use of fertiliser and other forms of technology contribute greatly to the farmer's yield. The challenge that is experienced by smallholder farmers in this regard is the financial backing to invest more in this input allocation. Governments of developing countries, with the assistance of donor funds, have introduced input subsidies to encourage farmers to increase their planting capacity so as to increase output. Malawi is one of the countries that have had great success with such a programme, as they were able to substantially increase national maize production and productivity (Dorward and Chirwa, 2011).

Improved agricultural technologies provide an excellent opportunity for higher crop productivity levels (Pingali and Rosegrant, 1995), but a farmer's lack of knowledge of their use may reduce the perceived benefits. Hybrid seed varieties are an important technology that is expected to ensure high productivity. An additional justification for using improved agricultural technologies is to deepen the share of agricultural output by maximising profits (Awotide et al., 2016). Subsidising technologies such as tractor services, fertiliser and hybrid seed had a positive influence on Eswatini (Dlamini et al., 2020). The use of the hybrid seed varieties also ensures reduced risk of pests and therefore leads to larger harvests (Mutanyagwa, 2017). Moreover, study results indicate that agricultural technology adoption decisions play a significant effect on market participation and product quantity (Singbo et al., 2021). Many farmers in delveloping world have little accessibilty to agricultural technology yet evidence on the utility of agricultural technology to support market participation have been proven (Baumüller, 2013).

2.6 The agricultural household model

The agricultural household model approach, as developed by Singh et al. (1986), focuses on the probability decision faced by smallholder farmers. Theoretical economic modelling analyses the complexities of intra-household decision making (Mmbando et al., 2015). The agricultural household model provides intuition about the structure of the estimation models that describe consumer choice. It gives insight into the smallholder farmer's behaviour and interactions characteristics of decisions concerning the farm (Musah et al., 2014). These households produce some for sale and some for their personal consumption (Otekunrin et al., 2019).

The household model is a function that determines whether a household will sell all or some of its produce. The basic idea of the model is to align interactions of production possibilities, supply and consumption possibilities by smallholder farms. This is because in subsistence farming these decisions are not independent. Farmers grow food for their own consumption as well as for sale, and a farmer will not sell if the needs of his own family are not satisfied by his production. Therefore market participation has a demand and a supply side (Musah et al., 2014). As stated by Rabbi et al. (2019), the farmer is not only selling output, but is also faced with input decisions that are guided by the profit maximisation principle. Smallholder farmers often have the choice of purchasing certain inputs and where to market their produce, so return analyses often look at total maximum utility. Policy changes influence not just output, but also expenditure and labor supply (Otekunrin et al., 2019).

The model is divided between components that maximise profit and those that maximise utility. (Otekunrin et al., 2019). A basic agricultural household model is given below. Sale implies that income becomes a function of the consumer's willingness to exchange part of their total time endowment (T) for income from labour (L), giving up enjoyment of such time for leisure (ζ). Full income distinguishes the farmers' income resulting from selling off own time from the value of what they own, which is endowment of consumption goods and own time. Some of a farmers' time is used to work on the farm and some is spent on leisure. When farmers decide to maximise profit, then the trade-off between consumption and leisure equals the real wage (Varian, 1995). In addition to income from labour, the household also earns profit (π) from its productive activities. These modify the household income (Y) to be the sum of income from wage work (wL) and profit (π) from farming (Singh et al., 1986).

$$Y = wL + \pi = w(T - \zeta) + \pi \quad (2.1)$$

where w is the wage rate.

The household produces the commodity Q (maize), part of which is for own consumption (Qc) and the remainder is sold in the market for cash (Qs), so that:

$$Qs = Q - Qc \quad (2.2)$$

Commodity Q is produced using inputs of labour (L) and other variable inputs (X), with production determined by the production function. Commercial producers must adhere to this model to grow their agribusiness.

$$Q = F(L, X) \quad (2.3)$$

The household family labour (L) is sold only to work on the own farm; the household does not sell labour to other farmers or non-farming activities. It does not hire non-family labour either. On the market, product Q is sold at price Pq, inputs X are purchased at price r and labour is paid at the wage rate w. The farmer does not set the output prices, but is merely a price taker in the market. This then means that the household income is:

$$Y = w(T - \zeta) + \pi = w(T - \zeta) + PqQ - wL - rX \quad (2.4)$$

The household derives satisfaction given its income and prices of the two goods – Qc (self-supplied) and composite good (C) bought on the market at price Pc, as well as from time spent on leisure (ζ), so that utility is U (Qc, C , ζ). The budget constraint for the household becomes:

$$w(T - \zeta) + PqQ - wL - rX = PcC + PqQc \quad (2.5)$$

To solve the optimisation problem, one must first find the optimal choices for consumption and technology. Using the Lagrangian function to solve first-order conditions will determine the consumption choices: C *, ζ*, Qc * and λ* and production choices: L *, X * and Q *. With this solution the farmer is able to solve the decision problems by first solving the profit maximising problem. The farmer then uses solutions for profit maximising to get the solutions to solve the

utility maximising problem. The agricultural household model posits that a person will choose to participate in maize markets in order to maximise his or her utility. Utility maximisation is dependent on various decisions that a farmer must make, and the value that one farmer attaches to a particular option may differ from that of another farmer. The tools obtained from participation simply encourage the producer to participate in the maize markets or the consumer goods larger than the benefits obtained from the alternative (non-participation).(Mmbando, 2014). Agricultural household models apply to a farm household that consumes part of the production, and this makes them an appropriate tool to examine smallholder commercialisation of food production (Singh et al., 1986, Ginindza, 2018).

The agricultural household model approach hypothesises that the structure of a smallholder farm developes in a specific setting and represents the farm's effort to reduce production and technological costs while increasing utility, subject to budget constraints (Moyo, 2010). It is expected that the household will maximize utility by deciding how much of each commodity or service to use, what to plant, when to plant and when and where to sell (Otekunrin et al., 2019). The constraints include household background, physical assets, social capital, development services, technology and transaction costs. A binary variable model was employed in the study to assess the factors that impact market participation (Nordjo, 2018). The factors that were identified are all those that could influence the problem; then a statistical test identified the ones that were significantly related to the indicator variable, i.e. market participation. Insignificant variables were ignored, because they would influence the significance of the model. This led to the use of only 10 explanatory variables.

2.7 Review of empirical studies

A number of methodologies have been used to explore market participation variables in various agricultural products, as shown below. The Probit and Logit models can be used to determine the likelihood of commercialization. The ordinary least squares (OLS) estimator can be used to solve the intensity question. The Tobit model is a cross between the Logit, Probit and OLS models (Makhura, 2002).

Several studies on smallholder farmers' market involvement in local, national, and global agricultural markets have been done.. Randela et al. (2008) and Nordjo (2018) used a logistic regression model to discover elements that increase small-scale cotton producers' market involvement. They were able to establish not only the influences on the likelihood of commercialisation, but also the significance of those elements using the model. They realised

that out of 11 potential determinants evaluated in the model, the choice to participate in the cotton market was influenced by 9 of those variables, namely household head age, English language fluency of the household head, the region in which a farmer is based, possession of transport, access to market information, distance to market, dependency magnitude relation, trust, land size and possession of livestock. They discovered that a growth in livestock ownership, land size, trust, and the level of reliance had a negative association with market participation.. Considering that market participation has a demand side and a supply side, Musah et al. (2014) applied a household commercialisation index in the initial stage to estimate the amount of market participation amongst smallholder maize farmers in the upper western region of Ghana. The study concluded market involvement was positively related to the total quantity of land planted for maize production and overall family income.. Also, assess to credit by farmer and farmer contact with extension officer and transaction cost such as farmer access to market information and point of sale of output variables considerably influenced the likelihood of market participation (Musah, 2013).

Similarly, a study in the Federal Democratic Republic of Ethiopia on the market participation decision of smallholder haricot bean farmers and its determinants utilised a Heckman selection model. The primary step determined that possession of several oxen, availability, the use of communication facilities, being able to source credit, participation in a cooperative, the number of family members supported by the household and distance to the road significantly had an impact farmers' decision to sell haricot beans in the output market (Abera et al., 2016). According to a study that was conducted in Pakistan, about participation in the market by smallholder rice farmers in the Makaland region, gender of the household head, age, size of farm labour, household size, education distribution, farm size, off-farm income from a farmer being a landlord, played a part in the probability of participation in the rice market (Rabbi et al., 2019).

In a study in Zambia's Western Province, researchers looking for characteristics that determined smallholder rice farmers' decision to engage in the maize market made notable discoveries. Social-economic factors such as household asset endowment (livestock), institutional factors such as membership in farmer organisations, access to information about output prices before selling, output price and rice production volume were important variables affecting market participation (Moono, 2015). Similarly, a study in the United Republic of Tanzania to examine the factors that have an effect on market participation and marketed supply revealed that cost that do not change with an increase or decrease with the quantity

produced or sold associated with market information influenced involvement in the market. Household characteristics such as gender, Distance to the nearest market, mean community prices, land size, working population, membership in farmer groups, geographic location of households, and degree of education of the household head were all strongly associated to output market participation decisions. (Mmbando et al., 2015, Musah, 2013). However, some sources reported conflicting findings on the correlation of the age of household head and the probability of market participation, while some studies reported age as an influential factor. In other studies correlation between age and market participation was found to differ (Kyaw et al., 2018). Martey et al. (2012) used the tobit regression analysis to quantify the size and direction of factors influencing the intensity of commercialisation by farm households. Results of the study indicated that output price, farm size, distance to market and access to extension services positively influenced the farmer's decision to sell.

This can be attested by authors such as Musah et al. (2014), who employed the double-hurdle model to find out which factors influenced the probability and intensity of market participation. From this review, it is evident that findings by Masuku et al. (2001) remain true, confirming that high production and transaction costs, household characteristics and access to information influence market participation by smallholder farmers. Labour, land and capital are some factors that influence a farmer's decision to sell or not to sell (Nordjo, 2018). Previous studies have also argued that reducing transaction costs helps farmers to profit from market participation (Xaba and Masuku, 2013, Makhura et al., 2001, Makhura, 2002). Similarly, Barrett (2008) suggests that transaction costs are highly influential in the level of market participation by smallholder farmers. This means that transaction costs linked with strong institutions and physical infrastructure have a significantly positive influence on market participation.

2.8 Chapter summary

The purpose of this chapter was to show the importance of enhancing market participation as a tool that has the potential to increase income and development, thereby improving the standard of living and welfare. Most smallholder farmers are at the low end of the income scale, and market participation can change the lives of those farmers. This chapter reviewed existing literature related to factors that influence market participation. Moreover, some variables that have been tested in their probability to influence market participation were provided. The

identification of key factors that might influence market participation would assist policy makers and programme managers in providing the right tools to promote market-oriented output that will help smallholder farmers to switch from subsistence farming to high-level commercial productivity and productivity growth.

CHAPTER 3: RESEARCH METHODS AND PROCEDURES

3.1 Overview

This chapter presents the research design, study area and methods used for data collection and analysis. The variables used as factors that affect agricultural market participation are listed based on economic theory to establish their expected relationships. The chapter also presents the econometric models used for the study based on the objectives presented in Chapter 1 including a review of previous methodological approaches. The section also describes the conceptual background and review empirical evidence by addressing estimation procedures and definition of variables that were used in the regression model.

3.2 Conceptual framework

The conceptual framework of this study illustrates the conceptual variable linkages that are hypothesised to be important for understanding how socio-economic factors impact market participation given the demographic structure of the population, physical assets, social capital, development services, technology and transaction costs. As producers consider a variety of factors when determining whether or not to sell a certain commodity (which includes the transaction costs related to making that commodity available (Mabuza et al., 2014), market participation is a result of simultaneous decision-making behaviour in production and marketing (Melesse, 2015, Mphafi, 2017). Household characteristics are an important determinant of market participation, because a household's decision to sell is based on family size, amount of income, educational background, gender and age of the household head (Nordjo, 2018). The quantity produced must be enough to feed the family before deciding to engage in trade. In a system where there is no limitation by socio-economic factors, there is some level of economic activity, determined by the availability of extension services to assist with the production management and the availability of market information. The introduction of socio-economic factors into the system affects market participation and household income. These impacts, in turn, affect farm productivity, which then impacts output and income.

In areas where information between farmer and trader is asymmetric, traders may gain more from this, which discourages farmers from participating in the market (Muto and Yamano, 2009). Rural households are unable to take advantage of the market because of institutional factors, such as road infrastructure, which are beyond their control and increase transport costs. Technology such as hybrid seeds and fertiliser is believed to increase productivity, especially

if it is used in the correct measure and time as specified by experts. Figure 2:1 illustrates the relationship between factors a smallholder farmer needs to consider when deciding to sell or not to sell a commodity they are producing.

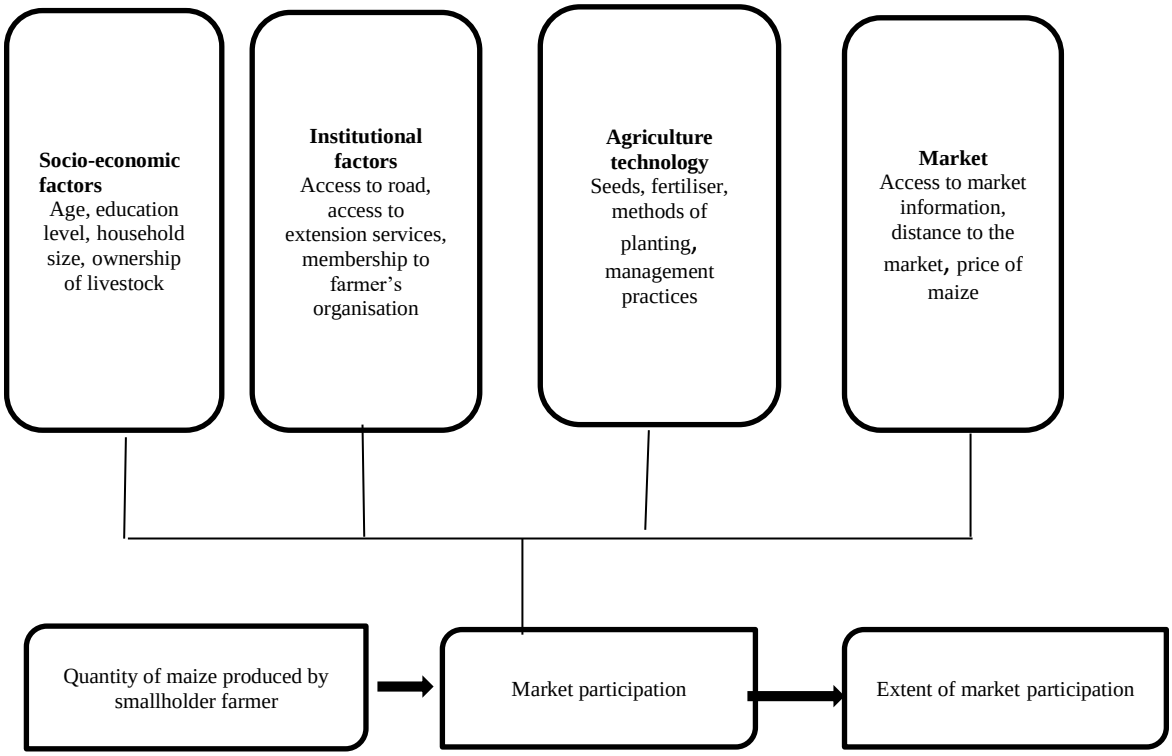

Figure 3.2: Conceptual framework

Source: Adapted and modified from Kyaw et al. (2018)

3.3 Research design

This research assesses the factors that influence market participation by smallholder maize farmers. It is centered in the Highveld region of Eswatini. Data analysis employed a combination of descriptive and econometric regression model was adopted for this study. A comparison of characteristics of non- market participants and market participants from the informants perspective was carried out to understand human behaviour.The logit model was employed to determine factors that influence market participation.

3.4 Study area

The study focuses on the Highveld region of Eswatini because it is one of the largest producers of maize in the country. The Highveld region has six RDAs where the Ministry of Agriculture has decentralised its services, namely Motshane, Ngwempisi, Mahlangatsha, Mahamba zombodze, Dumako and Hluthi. Motshane is the largest and most representative RDA in the

Highveld. Data was collected from six communities (eNdlozini, Motshane, Nsingweni, Maphalaleni, Sitseni and Kasiko) in the major maize producing areas in the Motshane RDA. They also have bimodal rainfall of 841,8 ml per year, with the long rainy season occurring from October to March (MoA, 2019). Figure 3.1 below is a map of the Motshane RDA.

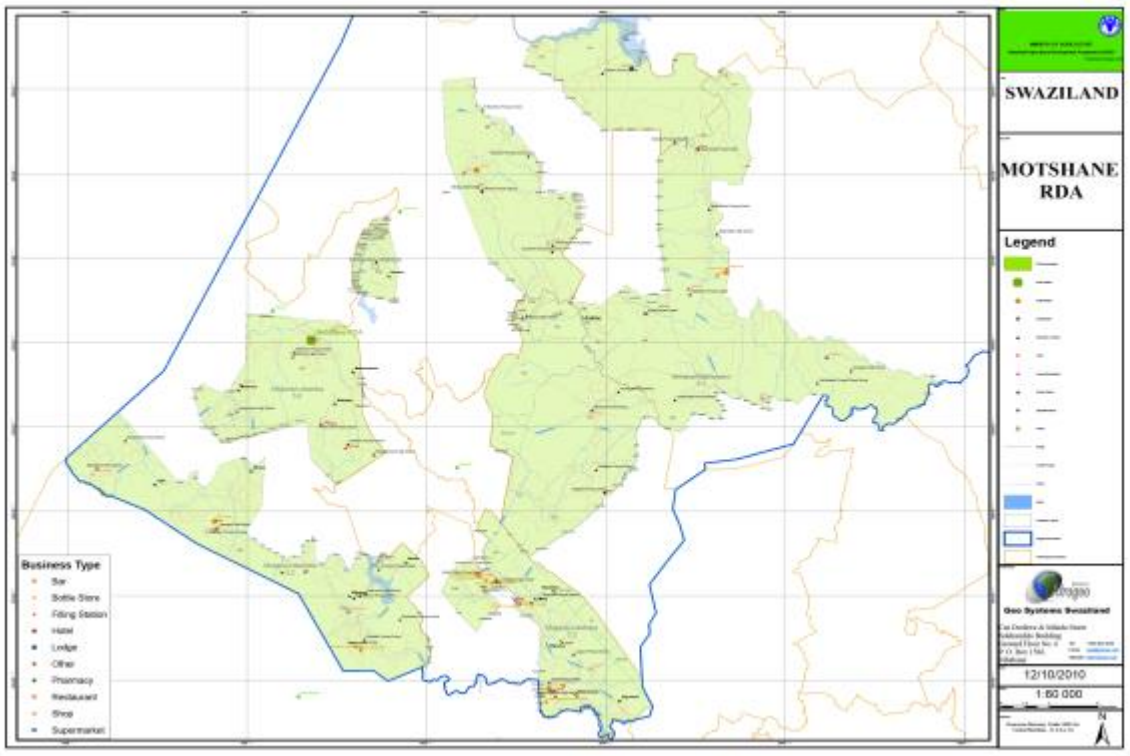

Figure 3. 2: Motshane Figure RDA map showing the communities

Source:(MoA,2019)

Table 3. 1: Smallholder farmers per community

Communities	No. Of participants
Maphalaleni	40
Nsingweni	50
Motshane	17
Endlozini	37
Kasiko	19
Sitseni	28
Total	191

Source: (Dlamini, 2019)

3.5 Data and data sources

The study uses secondary data at farm household level collected for a mni-dissertation which was conducted in 2018. The study had employed a purposive multi-stage random sampling technique a purposive selection of the Highveld region, based on preceding knowledge of it being one of the largest producers of maize in the country. The second stage involved the selection of six communities, namely Nsingweni, Maphalaleni, Endlozini, Sitseni, Kasiko and Motjane. These communities were purposefully selected based on their ability to produce surplus. The last stage involved the random selection of men (61) and women (131) farmers from the six communities, making a total of 191 farmers. A total of 191 respondents consisting of men and women farmers participated in the survey.

The data that was extracted for this particular study included household background characteristics, household physical characteristics, social costs and transaction costs of the smallholder farmers. Table 3.2 below presents the list of independent variables expected to influence the farmers' choice to participate in the market. Selected variables are supported by the theory that provides the a priori expectations between the dependent and explanatory variables and empirical work that was carried out in similar studies (Kyaw et al., 2018, Martey et al., 2012, Randela et al., 2008, Omiti et al., 2009). The study then follows the definition of market participation by Mmbando et al. (2015), with the focus on sales of agricultural produce. The dependent variable was binary. Farmers were asked if they had sold their maize production in the year 2018. All variables are presented in Table 3.2 below.

Table 3. 2: List of independent variables

Variables	Description	Measurement	Expected sign
Dependant variable			
Did the household sell (Market participation)	Did you sell maize in the past year?	1 = Yes 0 = No	
Socio-economic factors			
Age (Age)	Age of household head	Years	+/-
Gender (Gender)	Gender of the household head	1=Male, 0 = Female	+/-
Surplus (Quantity produced – quantity consumed) Kg	This is the product a farmer is expected to sell after consumption	Bags x 50	+
Agriculture technology			
Fertiliser (Fertiliser)	Type of fertiliser used for the maize	1=Organic, 0= Inorganic	+
Seed (seed)	Did you plant hybrid seeds?	1= Yes, 0 = No	+
Maize area planted (maizeareaplanted)	Size of land where maize was planted	Hectares	+
Market			
Access to market information (Market info)	Can the household access market information?	1= Yes, 0= No	+
Institutional factors			
Access to credit (Credit)	Is the household able to borrow capital?	1 = Yes, 0 = No	+
Savings account (savingsacc)	Does the farmer have a savings account?	1=Yes, 0= No	+
Membership of farmer group (ASS	Does the farmer belong to any farmer group?	1=Yes, 0=No	+

3.6 Definition of variables

Dependant variable

Market participation- The dependant variable in the equation was equal to one if the farmer had participated in the market and equal to zero if the farmer had not participated in the market. During the October 2016/ March 2017 cropping season.

Explanatory variables

Age – The impact of age on the farmer's decision is an empirical question and can be positive or negative, depending on the farmer. Therefore, the expected sign is +/-. For example, Randela et al. (2008) found that the effect of age was positive, while Kyaw et al. (2018) found the opposite. Age is used as a proxy for experience, as defined by Omiti et al. (2009) and Kyaw et al. (2018).

Gender – The influence of gender to market participation has been found in past studies to have either a positive or negative effect (Nordjo, 2018). And sometimes not even significant. For instance, Mmbando et al. (2015) found that it had a positive effect on a farmers decision to participate in the market, meanwhile most studies such as Abera et al. (2016) and Muricho (2015) found it to be insignificant, which is why the expectation can go either way.

Access to credit – Abera et al. (2016) found the use of credit to have a positive relation to market participation. A farmer's access to credit is expected to increase the scale of production.

Maize area planted – Maize area planted indicates the potential to produce more for the market; therefore the expectation is positive (Martey et al., 2012).

Surplus produce – Surplus production increases the probability of selling.

Marketing information – When a smallholder farmer is knowledgeable, he becomes more familiar with the benefits of marketing; hence the expectation is a positive relationship between market information and market participation (Musah et al., 2014).

Farmer group – Being part of some kind of agricultural group has benefits that include shared information and costs, amongst other things. This puts a smallholder farmer at an advantage when deciding to participate in the market, which is why membership of farmer groups is expected to be positive and increase the possibility of participating in the market (Olwande and Mathenge, 2011).

Hybrid seed varieties – The adoption and use of hybrid maize varieties is likely to increase production. A high production results in a surplus that can be sold to the market.

Fertiliser – The use of fertiliser is likely to enhance production and raises an opportunity to produce surplus maize (Awotide et al., 2013). That is why all three variables (hybrid seed, fertiliser and surplus produce) are expected to make participation in the market more likely.

Savings account- Ownership of savings account is expected to have a positive relationship with market participation(Nordjo, 2018). This is because farmers that had saved for the next savings commercialized more than those that did not. It was discovered that they had enough inputs for production.

3.7 Methodological approaches

This section reviews the methods used in smallholder market participation analyses – logit model, commercialisation index, the double-hurdle model, Heckman selection model and tobit model.

3.7.1 Commercialisation index

A household commercialisation index is designed to determine specific level of commercialization (Agwu et al., 2013).The index measures the proportion of sales to the total value of the agricultural production (Otekunrin et al., 2019). It is the ratio of the gross value of all sales to the gross value of all crops produced per household per year (Jaleta et al., 2009). The household commercialisation index acknowledges the fact that a household can decide to participate in the market as a buyer and a seller. The issue with this function is the extent to which estimates can be considered as accurate overtime (Strasberg et al., 1999). The limitation of the commercialisation index is that one can only measure the household transition from subsistence farming to market oriented. A value of zero would signify a totally subsistence oriented household and the closer the index is to 100, the higher the degree of commercialization (Agwu et al., 2013). After using it one would need to conduct a second stage of analysis which would then determine the factors affecting market participation. Which is why it was not relevant for use in this study. This ratio analysis also requires good record keeping a component smallholder farmers usually lack in.

3.7.2 The double-hurdle model

The structure of the double-hurdle model introduced by Cragg can be described by consumer choice. The individual first makes a participation decision, then a quantity decision to determine optimal consumption (García, 2013). The double-hurdle model is an extension of the tobit model. With this generalised tobit, the possibility that zeros are due to non-participation in the market for non-economic reasons is accounted for (Newman et al., 2003).Thus it is not clear whether the double hurdle is appropriate for this kind of data where some smallholder farmers did not participate in the output market during October2016/March 2017 season. Moreover, the double hurdle model can be used when a continuous dependent variable needs to be regressed but is skewed in one direction. The double hurdle also corrects the problem of selection bias, which may result from correlation of error terms from the equation of factors affecting market participation and the equation of the intensity of market participation (Wooldridge, 2014). It is designed to allow a separation of the first hurdle, which determines participation estimation with the probit model, from the second hurdle, which represents a smallholder farmer's decision about how much to sell by a tobit model (Gao et al., 1995). The Tobit model commonly used in the second hurdle of the double-hurdle model is also similar to the Heckman selection model (Makhura et al., 2001). It is important to note that in both hurdles the explanatory variables used are the same. The assumption is that factors that induce a household to sell are the same factors that determine how much to sell. The suitability of this model is seen when the decision to participate and the intensity of participation is taken concurrently.

3.7.3 The Heckman selection model

Marketing behaviour is a two-step decision process: first, the household decides whether to participate in the market, and secondly, it establishes how much to sell (Randela et al., 2008; Dlamini, 2019). This model captures the theory of the household model for the probability. For instance, the models allow for a separation of the initial decision to sell from the decision how much to sell (Olwande and Mathenge, 2011; Dlamini, 2019). Furthermore, it is more efficient, simpler and more robust than alternative procedures (Plümper et al., 2006). The Heckman selection model is the most popular tool used to model agricultural commercialisation as involving the unobservable decision to commercialise and the observed degree or extent of commercialisation. This is probably because this model relaxes these assumptions guiding the tobit model by taking care of the omitted variables. In the quantifying stage, the tobit model

treats a record of 0 time for a particular event as non-participant. Under this assumption, the individual's optimal value of the dependent variable is negative.

This form of analytical approach by the Heckman selection model helps to deal with selectivity bias, which is often a problem in non-randomly selected samples. It allows for the use of different independent variables in the first and second stage of estimators, something that is not permitted in the tobit model; hence it is also viewed as a generalised version of the tobit model. In the first step of involving a stated decision, the dependent or outcome variable can be binary or dichotomous. For example, the smallholder's decision to whether to participate in the output market can require a "yes" or a "no" response. In the first stage, the Probit model estimates the selection equation as applied in previous studies by Moono (2015), Muricho et al. (2015) and Makhura et al. (2001) in order to determine factors that influence the decision to participate in an output market. Conceptually, this is achieved by jointly modelling the individual sampling probability of each observation and the conditional expectation of the dependent variable. For this function, a probit model is used to estimate the probability in the observation of a dichotomous dependent variable (Wooldridge, 2014).

The probit model also estimates the inverse Mills ratio, which is later incorporated into stage 2 as a regressor in the second model. The inverse Mills ratio is estimated for each case by dividing the normal density function by 1 minus the normal cumulative distribution function (Bushway et al., 2007). Then the second stage is estimated using an ordinary least squares (OLS) regression equation by including the inverse Mills ratio (λ) from the first model as a regressor and produces consistent estimates by eliminating selectivity bias (Heckman, 1977, Makhura et al., 2001). Since in this study the interest was only in analysing the probability of market participation and not the quantification of how much to be sold. An estimation given by the OLS regression part of the Heckman selection model was not necessary.

3.7.4 Tobit model

The tobit regression model is used to estimate the intensity of market participation as used in other studies (Martey et al., 2012). The tobit model is convenient for implying non-negative predicted values for Y, which is important in utility maximisation where the response is negative (Stewart, 2013). With this model the probability that variance of Y would be heteroscedastic can be eliminated (Wooldridge, 2014). If the variance is not constant, the

standard errors will be wrong, which implies an inefficient estimator. The procedure for building the tobit model is stepwise selection of main effects and subsequent testing for interactions (Kleijnen et al., 2001). As the distribution of y piles up at 0, y clearly cannot have a conditional normal distribution.

"Tobit models are deemed necessary to address the significant censoring (i.e. large numbers of zeroes) typically found in time-use data, in the face of which ordinary least squares estimators would be biased and inconsistent (Foster and Kalenkoski, 2013)". However, there is a limitation on the use of this model for the quantifying stage, because it treats a record of 0 time for a particular activity as strict non-participation (Foster and Kalenkoski, 2013). Under this assumption, the individual's optimal value of the dependent variable is negative, but non-negativity constraints force the value to be zero. This form of the rule misinforms the situation in cases where the individual could not have been participating only at the period when research was conducted but has participated earlier on and/or intends to participate later. Other researchers argue that the tobit model is also limited in its assumption of some parameters and variables for the probability estimation and the regression for the level of transactions (Olwande and Mathenge, 2011). Therefore a logit model approach is more appropriate because a zero does not necessarily imply that a farmer never sells their maize..

3.7.5 Logit model

The logit regression model is useful when analysing a binary dependent variable where the dependent variable is a dummy variable (Wright, 1995). It is popular because of its availability in user-friendly software packages for both mainframes and microcomputers. Logit regression models log odds. If simplicity is preferred, then the logit regression is the best choice. It is also easy to interpret results from the fitted model (Hosmer et al., 1997). The slope coefficients represent the change in the logit corresponding to a change in one unit in the covariant (Wi, 2000). The logit regression separates the decision to trade and the amount to be traded and also overcomes the likely problem of heteroscedasticity, which would lead to inefficient parameters (Masuku et al., 2001).

Because of its simplicity, the current study used the logit model to estimate the factors that influence a farmer's choice to participate in the maize market. Since market participation is a binary variable (yes or no), the logit model best fits the study. The objective of the binary

variable model is to estimate the probability of an event occurring (Wi, 2000). The logit is a binary variable model, but although similar to the Probit model, it does not use log normality. Therefore any violation of the assumption that the independent variables are normally distributed is irrelevant (Masuku et al., 2001). This is important, because when this assumption of normally distributed errors is violated, then the maximum likelihood parameter estimates become inconsistent (Fennema and Sinning, 2007). It is this relaxation that allows many other indicator variables to be included in a logit model (Masuku et al., 2001). The logit model estimated the odds of market participation with regard to household background, technology adoption, transaction costs and socio-economic costs. For this study, the specification of a logit regression model according to Wooldridge (2014) was used. As this is a binary variable, the outcome will help determine the direction of the relationship, but not the magnitude. Results are interpreted as a normal regression, where the probability value (P-value) of < 0.05 will be considered statistically significant (Altman and Bland, 1995). If the coefficient is positive, then it means that the independent variable increases the probability to influence the dependent variables, and if it is negative it reduces the probability.

3.8 Model specification

The modelling of the logit regression model that informs this study is taken from Wooldridge (2014). The logit regression model is presented in equation 3.1 as follows:

$$P(y = 1|x) = G(\beta 0 + x\beta) \quad (3.1)$$

The expectation of the error term conditional to the independent variable can take the value of 0 or 1. If y =1, means $G(x\beta)$and when y = 0, means $1 - G(x\beta)$. The logit regression model describes the probability of market participation. The variable y takes the value of 1 if the marginal utility the smallholder farmer gets from participating in the maize market is greater than zero, and zero otherwise. This is shown as follows in equations 3.2 and 3.3.

Where $\Upsilon *$ is the latent variable for utility the smallholder farmer gets for participating in the output market, hence;

$$y = 1 \; if \; \Upsilon * \leq 0 \quad (3.2)$$

$$y = 0 \; if \; \Upsilon * > 0 \quad (3.3)$$

Thus, the conditional distribution of the outcome variable follows a binomial distribution. The binominal describes the distribution of the errors upon which the analysis is based (Wi, 2000). The logit model transformation, which is important for this study, is given by the cumulative distribution function (CDF), defined as G($\beta 0 + \boldsymbol{x}\beta$). The CDF takes on predicted probabilities limited to 0 and 1 for all real numbers (Cramer, 2004), so the logit model *G* is the logistic function model defined in terms of $G(z)$:

$$G(z) = \frac{\exp(z)}{[1+\exp(z)]} = \Lambda(z) \qquad (3.4)$$

In the fitted model Yi = market participation, Xi = vector of factors and β= coefficients.
It is assumed that the predictors have a linear relationship with the log odds of the successful outcome. Log odds will be increased by the value of β in equation 3.4 above for each increase in 1 unit of x.

3.9 Diagnostic test

Researchers must conduct statistical tests to detect whether the regression was used effectively. There are many measures that can be used for detecting violations of assumptions as well as for detecting outliers, but this study is concerned with testing procedures that can be used to address the problem of the inefficient and biased estimator. The study considered the following statistical tests: the two-sample t-test, chi-square test, Breusch-Pagan test, the variance inflation factor, the Akaike information criterion and Mc Fadden's Pseudo R^2.

3.9.1 Two-sample t-test

The two-sample t-test is used to check whether the population means of two groups are equal or not (Kim, 2015). A two-tailed t-test was used to test if the means of the two groups (farmers that participated and those that did not) have statistically different means to conclude the x variables that have been identified in the literature as affecting market participation. The mean was considered significantly different from x when the test statistic was in the top 2,5% or bottom 2,5% of its probability distribution, resulting in a p-value < 0,05, which led to failure to reject the null hypothesis of significant difference between the two groups when the p-value < 0,05. The total population was 191. The total number of market participants was 119 which made up 62% of the total population that was interviewed. Non-market participating

smallholder farmers was 37% of the total population that was interviewed. The formula for this, as outlined by Walker (2010), is much simpler than the independent-samples version:

$$t = \frac{\bar{\times}_D}{s_D/\sqrt{n}} \quad (3.5)$$

where

$\bar{\times}_D$ is the average difference,

s_D is the standard deviation of the differences, and

n is the number of differences.

3.9.2 Pearson's Chi-square test

Pearson's chi-squared test was also used to test whether the econometric model was adequate (Howell, 2011). The chi-squared test compares the multiple observed probabilities with the expected probabilities. This helped to determine the goodness of fit of the model that was employed. Furthermore, the chi-squared test was used in the descriptive statistics of the study of categorical variables (Madiba, 2006). In the descriptive statistics, the chi-squared test was performed to find the likelihood that a random chance could explain any observed differences between the actual frequencies in the data and the theoretical expectations. This was to determine whether two variables selected from the same population had a significant correlation. The formulation as given by Rana and Singhal (2015) is:

$$x_c^2 = \sum \frac{(O_i - E_i)^2}{E_i} \quad (3.6)$$

where x^2 is the chi-square statistic,

O is the observed, and

E is the expected.

3.9.3 McFadden's pseudo-R^2

The goodness-of-fit test of the econometric model was used to explain variations in the outcome between individuals. McFadden's pseudo-R^2 as specified by Herriges (1999) that was employed is specified below:

$$R^2 = \frac{ss(mean) - ss(fit)}{ss(mean)} \quad (3.7)$$

R^2 must be between 0 and 1. It uses the log likelihood of the data because values for logit are infinite. Where the log likelihood (fit) is used as a substitute for the sum-of-squares (ss) (fit) and the log likelihood (overall probability) is used as a substitute for the sum of squares (ss) (mean).

3.9.4 The Akaike information criterion

The Akaike information criterion (AIC) is one of the widely used statistics to select regressors (Mphafi, 2017). To choose the best fit model between the logit and Probit, after running both regressions we picked the one with the smallest AIC (Vrieze, 2012). Equation 3.8 is a definition of the AIC.

$$AIC = -2/N * LL + 2 * k/N \quad (3.8)$$

where
N = the number of examples in the dataset,
LL = the log likelihood of the model on the data set, and
k = the number of parameters in the model.

3.9.5 Variance inflation factor

While it is tempting to run models and choose one with high adjusted R-squared, it is best to use statistical tests to decide whether a variable belongs to the model or not. Multicollinearity exists where there are strong linear dependents among the explanatory variables (Alin, 2010). The independent variables should be independent of each other to avoid possible correlation among the covariates, since such correlation leads to statistical problems of multicollinearity. The latter inflates the variance of the parameter estimates, which may result in wrong signs and magnitudes and also high standard errors (Moono, 2015, Kyaw et al., 2018). The variance inflation factor (VIF) is used to detect multicollinearity. If a variable has a strong linear relationship with at least one other variable, the correlation coefficient would be close to 1, and the VIF for that variable would be large (Lavery et al., 2019). A VIF greater than 5 or 10 is a

signal that the model has a multicollinearity problem, and the model has a problem estimating the coefficients.

3.9.6 Breusch-Pagan test

When there is heteroscedasticity, the model gives values for the slope and intercept that are simply incorrect. Coefficients become biased due to non-constant estimators of the maximum likelihood (Holden, 2011); therefore it is important to check whether the error term is homoscedastic. The data were tested for heteroscedasticity using the Breusch-Pagan test (Wooldridge, 2014). The null hypothesis was that the variance is constant. The expected outcome was a constant variance, with a p-value < 0,05.

3.10 Summary

This chapter addressed the steps in the methodology. The methods and procedures were described in detail.Methodological approaches from previous studies were discussed.

CHAPTER 4: RESULTS AND DISCUSSION

4.1 Overview

The chapter presents the results in line with the study objectives. The chapter starts with the descriptive statistics of the main variables used in the study. Then the econometric estimation results based on equation 3.1 are presented and discussed.

4.2 Socio-economic and demographic characteristics

The conditions of livelihood are reflected in socio-economic,demographic and economic factors, which in turn influence the household economic behaviour. The background of a household influences the marketing decisions taken on the farm. This section, therefore, presents the socio-economic, demographic and economic factors of the farmers, such as gender, age, education and type of occupation.

4.2.1 Gender

The sample of 191 participants contained only 119 farmers who participated in the maize output market, while 72 respondents did not participate. In terms of gender distribution, table 4.1 below shows that the majority of the farmers that participated were female household heads (41% women and only 21% men). In the same way amongst the non-participants males were recorded to be 11% which was lower than the females at 27%. Women become heads of households in the absence of adult males that capable of being the hosehold head. Often times in the rural areas men go to the city seeking employment and leave the women behind to take care of the household. This is likely one of the explainantions behind the high number of women respondednts in the current study. Another likelihood could be the result of the projects that strive to develop and empower women and youth in the agricultural sector. Such projects have focused more on the rural areas, where the low social and economic status is more prevalent. When the women are informed they are able to make market decisions that promote market participation.

Table 4. 1: Gender breakdown of participants

Variable		Participants		Non-participants	
		Frequency	Percentage	Frequency	Percentage
Gender	Male	40	21%	21	11%
	Female	79	41%	51	27%
	Total	119	62%	72	38%

4.2.2 Age

For classification and better understanding of the person who makes production and selling decisions on the farm, the survey also considered age. The age of the household is an important variable in the present study, because the aim is to explore the differences in the decision-making of households by age. The figures presented in table 4.2 show that the mean age of participants is lower than that of non-participants. This indicates a normal distribution. In addition the minimum age for participants is 25 which is lower that that of non-participants at 29. The meaning of these results are that farmers that are likely to participate in the market as sellers are those that are young in age.

Table 4. 2: Age breakdown of participants and non-participants

	Characteristics	N	Mean	Minimum	Maximum	Standard deviation
Age of household head	Participants	119	49.5	25	76	10.8
	Non-participants	72	53.7	29	80	12.8

4.2.3 Education

Figure 4.1 below shows the distribution of the level of education of household heads in the survey . The highest number of the sample had reached secondary level of education. Amongst

the sample population 28% market participants had reached secondary education and 11% of non-participants had reached secondary education. This is true to what was observed by (randela alemu) whose explanation for this was that more educated households have higher income thus resulting in reduced searching, screening and information costs (Randela et al., 2008). Primary education has a high number of non-participants as compared with market participants. This implies that education level has an influence in the selling of maize in the output market (Seyoum et al., 2011).

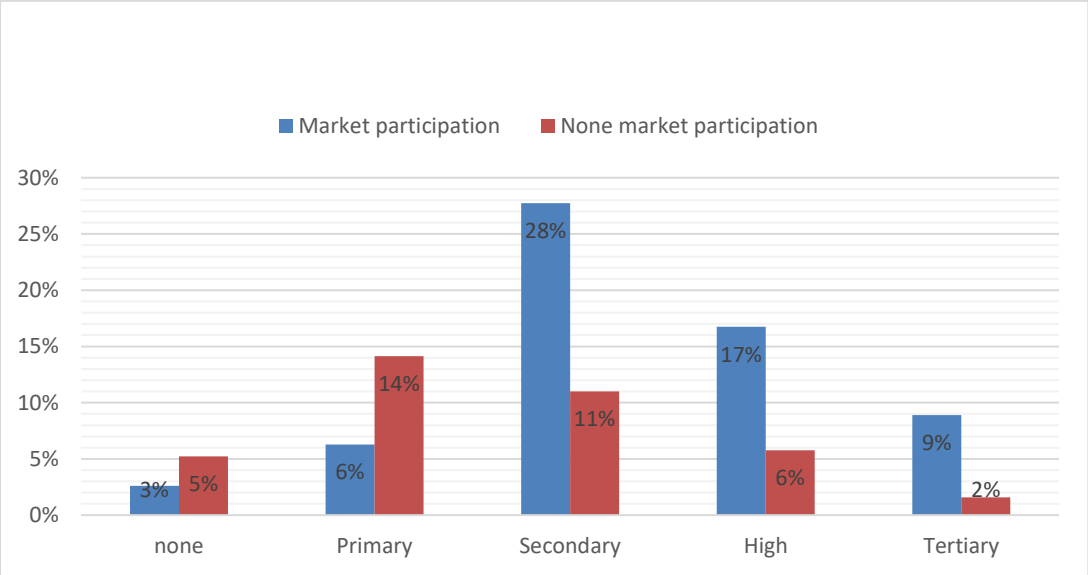

Figure 4.1: Education levels of market participants and non-participants

4.2.4 Occupation distribution

The occupation of the household head is important in describing possible behaviour. This is because occupation can be a representation of off-farm income which act as security or financer for some farmers. Most respondents (73%) were farmers, smallholder farmers that participated in selling of maize was 45% of the total smallholder farmers that were interviewed. 15% of the market participants said that they had salaried employment. This is a higher percentage than non-participants ,which implies that the salaries were helping in the financing of the farm production. 3% of self employed respondent participated in the market. Non-participants whose occupation was farming were 29% and those that had salaried employment were 9% of the sample size 191. See table 4.3 below.

Table 4. 3: Occupation distribution

Occupation	Participants	Non-participants	Pooled
Farming	45%	29%	73%
Salaried employment	15%	9%	24%
Self-employed	3%	0	3%

4.2.5 Land ownership

Ineffective and limited property rights restrict income from land, making it difficult for developing countries like Eswatini to escape poverty. According to Lipton (2009), increasing the proportion of title deed land, i.e. the number of farmers with full ownership of the land, can increase income. In the sample, 31% of the farmers that participated had and ownership and also 31% participated yet they did not have land ownership. 16% of the questionnaire respondents had land ownership but did not participate in the maize output market. If smallholder farmers own land they can be able to use this as collateral to obtain credit or other inputs (Mbonane and Makhura, 2018). Access to things would lead to increased output and potential market participation.

4.2.6 Farmer groups

41% of the smallholder farmers that participated in farmer groups or associations also sold their maize. 21% farmers who were not affiliated in any type of farmer groups participated in the maize output market. A mere 9% of smallholder farmers who are part of farmer groups did not participate in the market , and 28% were not in farmer groups and also did not participate in the market. In most cases, farmers join these groups hoping to increase their household earnings. Participation in farmer groups is expected to increase farmers' knowledge of their enterprises. This is because most farmer groups have multiple benefits, one of which is low interest loans with reasonable payback plans compared with well-established financial services. Farmers in these associations can share risks and share some costs, for example in the case of transport and finding a market. This is likely to promote their participation in the output market.

4.2.7 Access to extension services

49% of smallholder farmers who sold maize reported having access to extension services. 14 % of smallholder farmers who sold corn lacked access to extension services. 28% lacked access to extension services and were unable to engage in the maize output market. 10% of smallholder farmers who did not engage in the maize output market also lacked access to extension services. Extension services involve instruction in proper agricultural techniques, such as selecting the best variety for planting, preparing the ground for planting, planting, and managing the crops, as well as selling the crops. Smallholder farmers with access to extension services are expected to follow these excellent agricultural practices, which has a favorable impact on market participation..

4.2.8 Market information

Before selling maize, farmers should know whom they are selling to and what price buyers are willing to pay. When looking for this information, farmers will bear the costs. The magnitude of these costs makes it difficult for some farmers to research this market information. Access to marketing information is expected to reduce marketing costs, thereby motivating farmers to participate in product markets and increase returns for their products. The results show that most farmers do not have access to this information, which explains why fewer farmers participate in the produce market. 46% of smallholder farmers who participated in the maize production market also had access to marketing information. 17% did not have access to marketing information but participated in the corn production market. 35% of them did not have access to marketing information and also did not participate in the maize production market. 3% had access to marketing information but did not participate in the maize production market.

4.2.7 Private assets

The results in table 4.4 show that the minimum size of land owned by farmers that participated in the market is 0,5 ha and the maximum is 5 ha, with a median of 2ha. In comparison smallholder farmers who were non-participants had minimum sizeofland at 0.5 ha, and a maximum lower than that of participants at 3ha. Since the Swazi Nation Land cannot be sold (it belongs to the king), the chiefs are there to oversee if it is used correctly. That implies people can only use the traditional land, but do not have ownership to ensure efficient use. In the absence of property rights and difficulty of accessing land, a large number of farmers do not have sufficient funds to own tracts of land.

The results for land under maize production by the smallholder farmers yielded the same results as those of size of landowned. Most farmers used a mixed cropping system. Generally, a maize yield of 3628,74 kg per hectare is expected under good conditions. The results showed that the maximum quantity produced by market participants was is 290 kg and the median was 60kg . The maximum quantity sold was 200 kg and the median was 40kg.

Table 4. 4: Private assets

	Participants				**Non-participants**			
Characteristics	**Median**	**Minimum**	**Maximum**	**Standard deviation**	**Median**	**Minimum**	**Maximum**	**Standard deviation**
Size of land owned (ha)	2	0.5	5	0.8	1	0.5	3	0.5
Size of land under maize production (ha)	2	0.5	5	0.9	1	0.5	3	0.5
Quantity of maize produced (kg)	60	5	290	45	30	6	90	18.9
Quantity of maize sold (kg)	40	2	200	33.9				

4.2.8 Improved agricultural technology

The results showed that in terms of adoption of technology, namely, the use of improved varieties and organic fertilizers, the number of smallholder farmers who adopted improved hybrid varieties was higher than the number of plant home varieties. 12% of smallholder farmers sold maize after sowing pure seed and 51% of smallholder farmers sold maize after sowing hybrid seeds. 25% used hybrid seeds but did not participate in the maize production market.

Furthermore, 55% participated and used inorganic fertilizers and 23% of inorganic fertilizers did not participate in the market. This may be due to the fact that few farmers have livestock, which makes it difficult to obtain natural fertilizers and is expensive. These results show that the adoption of modern agricultural technology has the potential to increase productivity, leading to more and more markets in the market. Improved technology provides a more reliable vehicle for additional supply (Barrett, 2008).

4.2.9 Type of road

The type of road used to get to the market plays has a role in the farmer's decision to participate in the market. The assumption is that if the roads are well kept then there would be flow of transport leading to the market place. Although most of the interviewed households were located in areas where there are gravel roads only; the tarmac road leading to towns lies a few kilometres from the community areas ,this still contributes to the probability to participate in the market. Market participants that use tarmac road were 3%, those that use gravel road were 38% and 22% said that they used both tarmac and gravel road to get to the market place. Whereas with non-participants 19% said that they use gravel road only and another 19% use both the tarmac and gravel road.

4.3 Characteristics of participants versus non-participants

Objective 1 was to test for the difference between the socio-economic characteristics of smallholder farmers who participated in the output market and those who did not.

The t-test was used to draw general conclusions about the population means of the two samples. Table 4.6 indicates whether the means of the two groups differ based on the listed variables. The hypothesis that there is a significant difference between the means of smallholder farmers

that participate in the market and those that do not, was accepted at a $P < 0.05$ significance level.

The T-test: Sample means

The null hypothesis of the t-test was that the means of the two groups (smallholder farmers that participated and those that did not participate in the market) are equal or that the differences between them was zero. This test was conducted to find out if the smallholder farmers were likely or not to participate in the output market, given the different variables (age, gender, maize area planted, surplus produce, membership in farmer group, ownership of a savings account, access to credit, access to market information, use of fertiliser and the use of hybrid seed varieties).

The mean age of market participants was 53,7 and that of non-participants was 49,5. The higher mean for participants implies that the older generation of farmers are likely to participate in the maize market. There was no significant difference between the means of the gender of farmers that participate in the market and those that did not; consequently, it is not likely that the gender of a farmer has anything to do with the decision made about selling. As regards maize area planted, there was a significant difference between the means of participants and non-participants. This is logical, because if farmers are unable to make the necessary investment for large farms, then the possibilities of integrating into the market are unlikely (Binswanger-Mkhize and Savastano, 2017). The surplus mean for market participants was 1136,11 kg, and this was lower than the mean for non-participants (2589,17 kg). The significant difference between the surplus means indicates that smallholder farmers will decide about participating based on the surplus produced.

The smallholder farmers' preference for membership in farmer groups was significantly different in the two groups. Access to credit showed that there was a significant difference between the means of the two groups. The availability of credit is an essential element of market participation. As regards marketing information, there was a significant difference between the means of the two groups. The mean for participants was 0,0833333; for non-participants it was higher (0,7310924), which indicates that access to information about maize marketing is crucial in a smallholder farmer’s decision to participate in the market. There is a significant difference in means between the two groups based on fertiliser application. The reason for this finding is that improved agriculture technology influences factor productivity.

In hybrid seed varieties, there is a significant difference between the two groups. This implies that a smallholder farmer's choice to use a hybrid seed variety is decisive in a farmer's final decision to sell. Having a savings account makes no significant difference between the means; evidently, this is not an important factor in a farmer's decision to participate in the market.

Table 4.5: T-test results for differences in means between participants and non-participants

Variables	Participants	Non-participants	T-value	P-value
Age	53,72222	49,52941	2,4210	0,0164**
Gender	0,916667	0,3361345	-0,6361	0,5255
Maize area planted	1,236111	1,920168	-5,8998	0,0000***
Surplus	1136,111	2589,176	-6,0434	0,0000***
Member of farmer group	0,25	0,6554622	-5,8756	0,0000***
Savings account	0,0972222	0,1848739	-1,6388	0,1029
Access to credit	0,1111111	0,7478992	-10,7866	0,0000***
Market information	0,0833333	0,7310924	-11,0957	0,0000***
Fertiliser	0,5972222	0,8823529	-4,8197	0,0000***
Hybrid seed varieties	0,6666667	0,8151261	-2,3467	0,0200**

Source: survey data * Significant at 10%, ** significant at 5%, *** significant at 1%.

4.4 Analysis of socio-economic factors that influence market participation

The study adopted the definition of market participation given by Lapar et al. (2003), using the discrete choice to sell as the dependent variable. The logistic regression model presented in equation 3.1 was used to analyse the relationship between market participation and a list of independent variables as guided by the literature (Mmbando et al., 2015). The econometric results from the logit regression model are presented in table 4.5. The null hypothesis says that there is an association between the dummy variable market participation and the factors listed as the independent variables presented in table 3.1.

The dummy variable market participation was defined by 1 for participants and 0 for non-participants as specified here:

Glm(didtheHHsell)= f(Age + ASS + Sex + Fertiliser + maizeareaplanted + SavingsAc + credit + marketinginfo + surplus)

This hypothesis addresses Objective 2: To determine the influence of factors on smallholder maize farmers' decision to participate in the maize market in the Highveld region of Eswatini.

Table 4.6: Determinants of market participation

Variables	**Model 1: Estimated logit for factors that influence market participation**		
Market participation	Estimates	Std.Err	P-value
Gender	-0,592669	0,3930262	0,404
Age	-0,059802	0,234114	0,016*
Farmer group	1,672550	0,5498145	0,002 **
Savings account	-0,772779	0,792146	0,32929
Maize area planted	0,9006928	0,451433	0,04602 *
Hybrid seed	-1,020280	0,692873	0,14088
Fertiliser	2,267623	0,751444	0,003 **
Surplus	0,000214	0,0002889	0,457
Credit	2,821720	0,697083	0,00 ***
Marketing info	2,742816	0,671541	0,00 ***

** Significant at 10%, ** significant at 5%, *** significant at 1%.*
Statistical Diagnostics
Null deviance: 253,10 on 190 degrees of freedom
Residual deviance: 98,76 on 180 degrees of freedom
AIC: 120,76
Wald chi2(10) = 45,33
Log likelihood = -49,99919
Prob > chi2 = 0,0000
Number of orbs = 191 LR chi2(10) = 154,34
Pseudo R2 = 0,6098

Deteminants of market participation: Logit estimation

Statistical validity of the model

As shown in table 4.6 the overall goodness of fit as reflected by Prob > chi^2 is less than 0,001, which shows that the model is well specified. The results indicate that the sample data match the characteristics of the larger population, and it is in order to conclude that the logit model employed in the study fits the set of observations well. The value of R^2 for the logit model is 0,6, which implies that 60% of the variation in the dependent variable is explained by the explanatory variables. Results of the variance inflation factor (VIF) test are presented in the Appendix and show that all the values were less than 5. This is an indication that there was no correlation amongst the explanatory variables.

Heteroscedasticity

The logit model was tested for the Homoskedasticity assumption, which states that the variance of the unobserved error μ, conditional on the explanatory variable s, is constant. The Breusch-Pagan test results were as follows:

BP = 26,74 for df = 10, p-value = 0,002863.

The Breusch-Pagan Test for Heteroscedasticity results p-value = 0,002863 was smaller than the significant level of 0,05, which led to the acceptance of the null hypothesis of Homoscedasticity.

Factors affecting market participation

Farmer group: The rate of membership in the group of farmers was positive and significant. This may be due to the fact that members of farmers' groups have better access to information, which reduces transaction costs as well as trade chances in purchasing products and overall market costs, contributing to market share Similarly,Olwande and Mathenge (2011) found in a study in Tanzania that belonging to the agricultural group had a positive and significant impact on market share, arguing that belonging to the agricultural group improves family access to important information for business decisions. production and marketing. Thus, group membership is expected to have a positive impact on market share.

Maize area planted: The variable maize area planted was significant and positive. Maize area under plantation motivates a farmer's decision to sell output. The justification is that more land under plantation means more yield, which then leads to the availability of enough produce to feed the family and to sell. This is attested by findings of (Abera et al., 2016).

Fertiliser: Consequently The use of fertiliser showed positive significance as regards its probability to influence market participation. This implies that fertiliser use is expected to increase productivity by reducing production costs and improving yield. This thereby encourages market participation. This is agreed upon by Viatte (2001) whose findings mentioned that agricultural technology is the basis for increased production, productivity and agricultural development. All of which are encouragors for market participation.

Access to credit: Access to credit had a positive and significant impact on the decision to participate in the output market. This eases household liquidity restrictions that facilitate market-oriented production. Access to credit is one of the main constraints facing household leaders, allowing them to purchase farm products, cover transaction costs and cover distance from the market (Martey et al., 2012). Cindy (2008) and Macharia et al. (2014),also found that access to credit increases capital, leading to more resources, increased chances of better productivity, and higher chances of market participation. In addition, credit groups take further action and this forces the farmer to use the loan wisely and make a profit to repay the loans.

Marketing information: Access to marketing information was statistically significant and positively related to market participation. Acquiring such information can be costly thus discouraging market participation. This is also confirmed by Masuku et al. (2001) who implied that access to agricultural information is associated with better opportunities to sell maize. This positive impact means that farmers usually use market information that enhances their products and provides them with market opportunities.

Age of the household head: According to Randela et al. (2008) The relationship of age should be negative depending on the stages of development. Similarly, in this study it was found that the age of the landowner is both important and negative, meaning that once a farmer has grown up, they are less likely to enter the market. When a farmer is young, he is expected to acquire sufficient knowledge and be able to invest in new knowledge. This lowers the cost of sales and improves productivity, thus facilitating market-oriented production. This was confirmed by Kyaw et al. (2018), who also found a negative corelation between age and market participation.

4.5 Summary

This chapter presented the main results of the study, starting with the descriptive statistics of the smallholder farmers that participated in the maize output market and those that did not participate. Followed by the estimation results of the logit model. Most of the variables used in

the model have a statistical influence on the farmers' decision to participate in the market for maize. The results presented were in line with the two hypotheses of the study.

CHAPTER 5: CONCLUSIONS AND RECOMMENDATIONS

5.1 Overview

This chapter summarises the findings of the study of factors associated with the smallholder farmer's participation in the maize market. It goes further by drawing some conclusions based on the results generated.

5.2 Conclusions

The study was carried to show that a relation exists between socio-economic factors and market participation. The study followed the logit regression model approach to analyse the first objective, which was to determine the influence of socio-economic factors on smallholder maize farmers' decisions to participate in the maize market in the Highveld region of Eswatini. The literature showed that smallholder farmers face challenges to participation in the maize output market. It is shown that if farmers sell their products in the market, they have a chance to increase their income and improve their livelihoods. Therefore, marketing cannot be considered as existing independently from other livelihood activities.

The study identified several challenges faced by smallholder farmers that limit their participation in the market. A major challenge is the existing land policy; acquiring land ownership rights is difficult in rural areas, and this discourages households from investing fully. Loans are difficult to get, farmer organisations are inactive, the levels of good agricultural practice are low, governmental extension services are inefficient, the marketing structure is poor and characterised by high costs of inputs and low prices of produce. These factors need to be taken care of. Factors such as the availability of marketing information, access to credit, the size of the planted area, credit availability, the use of fertiliser (regarded as a new technology) and being a member of a group (association, cooperative) have a significant positive impact on a smallholder farmer's decision to participate in the maize market.
The study also found that factors such as the age of the household head and the use of hybrid seed varieties (also a new technology) were found to affect farmers' decision to participate in the maize market negatively.

The study showed that smallholder farmers who participated in the market and those that do not participate differ as regards their socio-economic features. Results of the two-sample t-test presented age, maize area planted, access to credit, adoption of hybrid seed varieties, use of

fertiliser, availability of market information, membership of farmer groups and surplus production as significantly different factors for maize market participants and non-participants. This means that we reject the null hypothesis of equal means at the 0.05 level amongst the two groups. For the gender and savings account, we have insufficient evidence to reject the null hypothesis of equal means at the 0.05 level.

5.3 Recommendations

The need to support commercialisation in agriculture is often related to a variety of conditions. These are conditions that prevent smallholder farmers from participating in the output market. Furthermore, smallholder farmers still need to embrace programmes that are responsive to their needs. Principal incentives that can assist farmers include subsidies, production credit, tax structure and land tenure arrangements. The land tenure systems of a country determine the legal and customary rights to own and use land. Security of tenure requires clarity about a user's right to the land and permanence of that right over time. Smallholder farmers need to have property rights to the land for them to use it efficiently and develop it. Farmers should have access to better credit, at a reasonable cost, to finance improved production methods. Credit requirements for commercialising agriculture on a national scale involve considerable amounts and substantial organisational efforts that only government initiatives can provide.

Government support or subsidies can have positive results for the farmer, provided that the government can make direct payments to farmers as a way of maintaining prices to consumers while assuring farmers of a return above world market levels. Farmers need to be encouraged to organise themselves into groups, depending on what benefit they want. Smallholder farmers need to collaborate to increase their bargaining power, or rather their ability to buy at a lower price when buying farm inputs in large quantities, to share technical skills and to access information, thus producing larger volumes and being able to supply more rewarding markets. Smallholder farmers need to build working relationships with buyers. The existence of mutual trust between farmers and the parties involved in the market can contribute to the farmers' knowledge and therefore influence their decisions. The challenge remains to support smallholder farmers for productivity and profit maximisation through entities that uplift their livelihood. More research is needed to quantify the welfare impact of greater maize market participation in the rural areas and to raise awareness of the incentives to participate in the produce market.

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APPENDIX A: VIF values for hypothesized variables

Variable	VIF
Age	1,43
Gender	1,57
Credit	1,52
Farmer group	1,13
Marketing information	1,21
Surplus produce	1,54
Maize area planted	1,47
Savings account	1,12
Hybrid seed	1,69
Fertiliser	1,62