Assessing Perception of Small-Scale Farmers on Factors Affecting Sustainability of Soybean Production in Nkangala District Municipality

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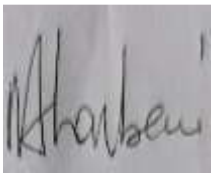
DECLARATION

I, Vutlhari Trinity Mthombeni, with student number 201740060, hereby declare that this dissertation submitted in fulfilment of the requirements for the degree of Master of Agriculture in Agricultural Extension and Rural Resource Management is my own work and that it has not previously been submitted for assessment or completion of any postgraduate qualification to another University or for another qualification. All sources and materials used in the study have been properly acknowledged.



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Vutlhari Trinity Mthombeni

DEDICATION

This study is dedicated to my mother Lydia Tinyiko Mthombeni, who is also a farmer, for her unwavering support and words of encouragement, even when it seemed impossible. The study is also dedicated to my siblings and friends, who worked hard to ensure that my success was recognized. Your assistance and advice are much welcomed and valued appreciated and acknowledged. May God keep you safe.

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ACRONYMS

DALRRD - Department of Agriculture, Land Reform and Rural Development

FAO - Food Agriculture Organization

IDP - Integrated Development Plan

SDA – Sustainable development goal

STATSA - Statistics South Africa

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ABSTRACT

This study aimed to examine small-scale farmers' perceptions of factors affecting the sustainability of soybean production in Nkangala District Municipality, Mpumalanga, South Africa. The objectives of the study were to: (i) determine the small-scale farmers perceived ideas on farming, economic, extension and education, social, and policymaking factors in the sustainability of soybean production in the study area, (ii) determine the respondent's perceived attitudes towards the sustainability of soybean production, (iii) examine the relationship between respondents' perceived attitudes about farming, economic, extension and education, social, and policymaking factors in the sustainability of soybean production and their perceived attitudes on the sustainability of soybean production. (iv) determine the actual factors affecting the perceived attitudes towards the sustainability of soybean production in the study area. A sample size of 204 was selected from a population of 418 small-scale farmers using a simple random sampling technique. The collected data from a structured questionnaire instrument was analyzed using descriptive and inferential statistics. This study discovered that the participants perceived ideas of factors in the sustainability of soybean production were farming (M=4.07), economic (4.05), extension and education (M=4.06), social (M=4.05), and policymaking (M=4.05). The results of participants' perceived attitudes towards the sustainability of soybean production were (M=4.04), obtained from statements asked about environmental (4.03), economic (4.04), and social (4.04) aspects of sustainability. The empirical findings infer that farming, economic, extension and education, social, and policymaking factors were factors affecting the sustainability of soybean production. The results suggest that any unit increase in these factors increases the probability of perceived attitudes towards the sustainability of soybean production. Therefore, this study concludes by recommending that the Extension Officers and other relevant stakeholders must consider these variables when implementing initiatives aimed at improving the sustainability of soybean production among small-scale farmers. Future studies may incorporate other factors such as agronomic and socio-economic factors in the sustainability of soybean production.

Keywords: Perception, factors affecting sustainability, sustainability, soybean production, small-scale farmers

CHAPTER ONE: INTRODUCTION

1.1. Background

The concept of sustainability focuses on promoting holistic approaches aimed at establishing flexible agricultural systems that effectively and efficiently utilize available resources to support sustainable livelihoods (Hayati *et al*. 2010). Smallholder farmers play a crucial role in fostering viable livelihoods, equity, and the efficient allocation of resources in rural smallholder farming sectors (Duprey, 2014). Sustainability in small-scale farming is essential for providing livelihoods to approximately 1.5 billion people in rural communities worldwide. In South Africa, the sustainability of small-scale farmers is pivotal for rural development and improving the living standards of around 370,000 people residing in rural areas (Pienaar and Traub, 2015). For instance, the government's initiative to increase the number of small-scale farmers from 250,000 in 2014 to 500,000 by 2020, with a budget of R2.38 billion allocated to the Development of Agriculture, reflects the commitment to enhance their capacity and sustainability (Aliber and Hall, 2012).

Participation and support of small-scale farmers in agriculture contribute significantly to achieving agricultural sustainability and ensuring local food security. However, agricultural productivity in South Africa, particularly in the small-scale rural sector, faces challenges due to declines in rural wealth and natural resources. About 60% of South African land is degraded, necessitating a formal policy for sustainable resource management to promote environmental, economic, and social sustainability in farming systems (Hoffman and Ashwell, 2001; Khwidzhili and Worth, 2017; Ibrahim, Unspecified). Therefore, evaluating the sustainability of soybean production by assessing small-scale farmers' perceived attitudes towards environmental, economic, and social aspects is imperative.

In South Africa, farmers grapple with environmental degradation exacerbated by climate change and unsustainable agricultural practices, posing threats to their sustainability in meeting current agricultural productivity and food security. The use of farm chemicals, contributing to air and water pollution, underscores the need for sustainable agricultural practices among small-scale farmers (Khwidzhili and Worth, 2019). These practices not only improve living standards and economic well-being but also align with the achievement of Sustainable Development Goals (Mbatha *et al*. 2021).

Soybean cultivation holds significant importance in South Africa for multiple reasons. Firstly, it plays a vital role in addressing the country's food security challenges and meeting the demand for animal feeds. Soybeans, known for their rich protein content, can be processed into various food products, including oil,

meal, and flour. Secondly, soybean farming makes a substantial contribution to the rural economy by creating employment opportunities and generating income for farmers. The growing demand for soybean products, both domestically and internationally, further strengthens South Africa's agricultural sector and fosters export opportunities Dlamini (2014).

Nobly, the South African soybean production is dominant in commercial sector, being responsible for the majority of the production. Despite a lack of extensive local literature on perceived attitudes towards soybean production sustainability, previous international studies have explored factors affecting sustainable agriculture, particularly among greenhouse farmers (Hosseini *et al*. 2011). This study seeks to fill this gap by examining the relationship between perceived ideas about farming, economic factors, extension and education, social factors, policymaking, and perceived attitudes towards the sustainability of soybean production. The findings aim to contribute significantly to enhancing the sustainability of small-scale farmers in the Nkangala District, Mpumalanga, South Africa

1.2. Problem statement

Sustainability has become an imperative concept of agricultural development, and the need for sustainability in the small-scale farming sector is growing exponentially. With the ever-growing human population, sustainability in the small-scale farming sector is essential for development, building the resilience of rural livelihood, economic growth, and sustainable utilization of agricultural resources, especially in developing countries (FAO, 2013). Better achievement of agricultural sustainability typically depends on farmers' perceptions of the environmental, economic, and social aspects of sustainability. Therefore, the need to determine their perceived attitudes on these three aspects of sustainability will help improve the sustainability of farming systems guided by small-scale farmers' points of view.

Khwidzhili and Worth (2016) highlighted that the lack of extension and education programs does influence how small-scale farmers perceive the sustainability of their farming systems. Consequently, such as a negative impact on overall agricultural productivity as farming rely on primary natural resources and biodiversity. To practice sustainable agriculture, farmers also require knowledge of the importance of farming, economic, extension and education, social, and policymaking factors in the sustainability of soybean production.

Soybean production prevails in the commercial farming sectors over small-scale scale in Nkalanga District Municipality (Southern African Grain Laboratory-NPC, 2021). However, there is a lack of research-based information elucidating the factors restricting small-scale farmers participation

on soybean production. Hence, the scientific background of the current study lies in the insufficient literature on small-scale farmers' perception of factors affecting the sustainability of soybean production in South Africa. The available literature on sustainability focused on decision-making and socio-economic factors, which necessitate further studies on other factors in soybean production by farmers in their locality, whereby they have common demographic history. Therefore, there is a need to conduct a scientific study on factors affecting the sustainability of soybean production in Nkangala District Municipality, Mpumalanga Province of South Africa.

1.3. Significance of the study

This study expands the knowledge of factors affecting the sustainability of soybean production by examining and testing the relationship between participants' perceived ideas on farming, economic, extension and education, social, and policymaking factors and perceived attitudes towards the sustainability of soybean production. Prior research concentrated on the relationship between factors affecting aspects of sustainable agriculture (Hosseini *et al*. 2011). The present study broadened scientific knowledge of factors affecting sustainability and sustainability of soybean production by concentrating on the relationship between five factors affecting sustainability and sustainability of soybean production by small-scale farmers. Because most previous studies did not focus on small-scale farmers, this study extended the analysis to include small-scale farmers' perceptions of factors affecting the sustainability of soybean production.

The present study provides additional scientific knowledge on the factors affecting the sustainability of soybean production in small-scale farmers' domains. The dynamic nature of the sustainability of soybean production has kept this field of study a crucial research focus. Moreover, there is insufficient literature on the factors affecting the sustainability and sustainability of soybean production by small-scale farmers in developing countries like South Africa. Furthermore, this presents an opportunity to add to the already known literature. Also, scholars have various discrepancies and differences regarding factors affecting the sustainability of small-scale farmers.

In South Africa, sustainable development depends immensely on how farmers as the user of natural resources perceive the environmental, economic, and social aspects of sustainability of their farming systems (Maree & Van Weele, 2016). The soybean production industry in South Africa is rapidly gaining attention, and small-scale farmers' environmental, economic, and social sustainability is vital, particularly given their potential and contribution to food security and

economic growth in the agricultural sector. Hence, exploring the impact of factors affecting sustainability on the sustainability of soybean production provides empirical support by indicating the influence of the perceived attitudes of factors affecting the sustainability of soybean production. As a result, the present study demonstrates the impact of five factors affecting sustainability on sustainability in various settings of the small-scale farming sector.

The sustainability of the small-scale farming sector has declined due to the loss of natural resources, intensified by the unsustainable use of natural resources resulting in low agricultural productivity (Scherr and McNeely, 2008; Wassie and Pauline, 2020). It is imperative to find answers to address factors affecting the sustainability of soybean production, as it contributes to better and improved agricultural productivity for both domestic and international markets (Department of Agriculture, Land Reform and Rural Development, 2020). Hence, it is possible to comprehend the factors pertinent to soybean production by analyzing the relationship between variables affecting sustainability and sustainability of soybean production. An insight into how factors influence the sustainability of soybean production is crucial. Based on empirical evidence, it provides a better understanding of how and why the sustainability of the small-scale farming sector has declined over time. This insight may enhance the present and future factors affecting sustainability in the sustainability of soybean production by small-scale farmers. It will help small-scale farmers make informed decisions to improve the sustainability of their farming systems, taking into account factors affecting sustainability. In addition, the study findings will encourage small-scale farmers to improve their low agricultural productivity caused by the poor sustainability of their farming systems.

The present study will further provide information to the Department of Agriculture and policymakers to make informed interventions to improve the sustainability of small-scale farmers. The scientific understanding of how small-scale farmers perceived farming, economic, extension and education, social, and policymaking factors may be relevant towards the allocation of resources for developmental purposes within the small-scale farming sectors. Improving the environmental, environmental health, economic viability, social cohesion, and welfare of small-scale farmers is vital to sustainable rural development.

1.4. Aim of the study

The study aims to investigate small-scale farmers' perceptions of factors affecting the sustainability of soybean production in Nkangala District Municipality.

1.5. Objectives

The objectives of the study are:

(i) To determine the small-scale farmers perceived ideas on farming, economic, extension and education, social, and policymaking factors in the sustainability of soybean production in the Nkangala District Municipality.

(ii) To determine the respondent's perceived attitudes towards the sustainability of soybean production in the Nkangala District Municipality.

(iii) To examine the relationship between respondents' perceived attitudes about farming, economic, extension and education, social, and policymaking factors in the sustainability of soybean production and their perceived attitudes on the sustainability of soybean production in the Nkangala District Municipality.

(iv) To determine the actual factors affecting the perceived attitudes towards the sustainability of soybean production in the Nkangala District Municipality.

1.6. Research questions

The study's research questions are:

(i) How do small-scale farmers perceive farming, economic, extension education, social, and policymaking factors in the sustainability of soybean production in the study area?

(ii) What are the perceived attitudes small-scale farmers have on sustainability of soybean production in the study area?

(iii) What is the relationship between small-scale farmers' perceived attitudes towards the sustainability of soybean production and their perceived ideas about farming, economic, extension and education, social and policymaking factors in the sustainability of soybean production in the study area?

(iv) What factors affect the perceived attitudes towards the sustainability of soybean production in the study area?

1.7. The study main hypotheses

The study main hypothesis is as followers

H1: *Perceived factors does not affect the sustainability of soybean production*

1.8. Limitations and Delimitations of the study

The major limitations were the lack of supporting studies. There was little to no literature on the perceived attitudes on sustainability and perceived ideas on farming, economic, extension and education, social, and policymaking factors in the sustainability of soybean production. Hence, the research project took time to conclude. The study focused only on small-scale farmers in the Nkangala District Municipality of Mpumalanga Province, South Africa. The factors affecting the sustainability of soybean production differ according to each farmer's perceptions and are influenced by many factors. This study focused on the perceived ideas towards the farming, economic, extension and education, social, and policymaking factors in the sustainability of soybean production and the perceived attitudes towards the environmental, economic, and social aspects to measure the sustainability of soybean production.

1.9. Chapter scheme

Since the aim the study is to examine factors affecting the sustainability of soybean production among small-scale farmers in Nkangala District Municipality, this research will be structured and organized into five chapters. Chapter two provides a literature review on sustainable agriculture, the concept and challenges of sustainability of small-scale soybean production, and factors affecting sustainability. Chapter three provides the study research design, population and sampling, data collection methods, and data analysis. Chapter four presents the study findings and discusses the findings based on the perceived ideas about factors affecting sustainability and perceived ideas on the sustainability of soybean production. Then empirical results on the factors affecting the sustainability of soybean production follow. The summary, conclusion, and recommendations are presented in Chapter five, followed by the references used in the study and appendix.

1.10. Clarification of terms and key concepts

Perception: Refers to small-scale farmers' ideas, beliefs, and attitudes from their observation and understanding of farming systems (Ibnu *et al*. 2018).

Small-scale farmers: “A producer or entity that produces (at primary, secondary and tertiary level) for household consumption and markets, therefore farming is consciously undertaken in order to meet the needs of the household and derive a source of income” (DALRRD, 2021).

Sustainability: Sustainability is the state and ability of farming systems to meet an ever-growing population's current and future environmental, economic, and social needs (Matjokana, 2013).

Soybean: It refers to a grain crop known as *Glycine max*, commonly cultivated because of its edible bean that has various economic uses (Cornelius & Goldesmith, 2019).

CHAPTER TWO: LITERATURE REVIEW

2.1. Introduction

This chapter examines the literature on public perceptions of soybean production sustainability. A description of sustainable agriculture of soybean production is provided. Furthermore, the concept and challenges of environmental, economic, and social aspects of the sustainability of soybean production are described. In addition, variables influencing the perceived attitudes towards the sustainability of soybean production are discussed.

2.2. Sustainable agriculture

The term sustainability has various, constantly improving widespread definition themes that are coming under pressure from the world's ever-growing population, climate change, and the loss of biodiversity (Glavič and Lukman, 2007; Rose *et al*. 2019; Reinhardt *et al.* 2020). The concept of sustainability is based on the need to conserve, preserve and protect natural resources and ecosystem services while maintaining current food demand. According to Gomiero *et al*. (2011), sustainable agriculture is imperative to prepare agricultural systems for an expected global human population of around 9 billion people in 2050. With the impact of climate change, the studies by Beddington *et al*. (2012); Adenle *et al*. (2019); Umesha *et al.* (2018) have shown that sustainable agriculture can help the agricultural world to better cope with climate change and the loss of biodiversity in the world.

Importantly, Ndlovu *et al.* (2015) agreed that sustainable agriculture is a philosophy guided by human needs and an in-depth understanding of the long-term future impact of agricultural practices on the environment and biodiversity. According to Broman and Robèrt (2017), the sustainability discussion is an ongoing debate that aims to achieve world sustainable development that meets current human needs without preventing future generations from using the same resource to meet their needs.

Cele and Wale (2018) define sustainable agriculture as reflecting components of sustainable development that aim to achieve environmental balance, economic viability, and social equity. According to Ansari and Tabassum (2018), sustainable agriculture is an integration of various agricultural systems that incorporate sustainable agricultural practices and limit the extent of farming risks to the environment through the use of artificial harmful farming chemicals and

further illustrate the achievements of economic efficiency, environmental balance, and social responsibility. Moreover, sustainability is measured and analyzed using three goals, which are summarized.

The significance of small-scale soybean farming is pivotal in local and regional economies, making substantial contributions to food security and rural livelihoods. These farmers cultivate soybeans, a versatile and nutritious crop utilized in diverse food products and industrial applications. Small-scale farming initiatives generate employment opportunities, particularly in rural regions, thereby addressing poverty and enhancing living standards. Furthermore, they play a role in promoting agricultural diversity and sustainability through practices like crop rotation, diminishing dependence on monoculture methods. Beyond economic advantages, small-scale soybean farming nurtures community cohesion and upholds cultural heritage associated with agricultural practices (Siamabele, 2021).

2.3. The concept and challenges of sustainability of small-scale soybean production

Sustainability of small-scale soybean production can help address environmental, economic, and social sustainability issues in farming systems (Noleppa *et al*. 2013). Sustainability of soybean production can also play a crucial role in improving the sustainable use of natural resources, economic well-being, and rural welfare and help mitigate the challenges of biodiversity loss that the expansion of agricultural activities poses to the environment. Sustainability of soybean is measured by a collection of agricultural systems' environmental, economic, and social sustainability, achieved through adopting sustainable agricultural practices by small-scale farmers. The data collected through environmental sustainability is then used to improve the health and quality of production, the health and quality of biodiversity, and the health and quality of soil and water (Delgado & Gantzer, 2015). Economic sustainability data determines whether agricultural productivity has improved from previous, farm profitability on the initial investment, farm income, and food security for producers and consumers (Spicka *et al*. 2019). Lastly, the social sustainability data collected by observers enhanced equity between farmers, self-reliance, and transfers of visible farmers to future generations (Vanlauwe *et al*. 2012).

2.3.1. Enviromental sustainability of soybean production and challenges

The environmental component of sustainability refers to the agricultural practices associated with the sustainability of essential natural resources for primary farming production, such as soil health

and quality, ecosystem protection, and biodiversity, brought about by land use (Hayati *et al*. 2010). Environmental sustainability promotes sustainable cropping systems such as intercropping, conservation agriculture, and no-till practices that aim to improve environmental health while reducing harmful products such as pesticides and other farm chemicals. Du *et al*. (2018) studied maize and soybean strip intercropping. Results showed that additional soybean production was achieved without sacrificing maize yield, offsetting high crop production and agricultural sustainability. A study by Kebebew *et al.* (2014) showed that higher grain yield was obtained when soybean was intercropped with maize at 50% planting density. Mthembu *et al*. (2019), reviewed the capability of intercropping for the environmental sustainability of small-scale farmers in Kwazulu-Natal Province, South Africa. The results showed that intercropping means better using basic natural resources, including soil fertility and pest and weed control, to achieve stable yields while preserving the environment. Moreover, intercropping practices are mostly perceived as environmental conservation strategies. However, the reviews by Iqbal *et al*. (2019); Blessing *et al*. (2022) argued that intercropping of maize and soybean in small-scale farming is limited due to mechanization, shading, and planting ratio. Hence, there is a need for a study to determine small-scale farmers' perception of soybean intercropping practices and other sustainable practices on environmental sustainability.

In a study by Muchabi *et al*. (2014) on conservation agriculture in soybean conducted in Zambia, the results indicated that conservation agriculture significantly improved the soil porosity, biological nitrogen fixation, and soil respiration compared to conventional tillage after six years of practice. The practice has the potential to improve crop productivity by enhancing its ability to enhance soil fertility. Importantly, Sharma *et al*. (2018) argued that cover crop helps to improve soil water, especially in intercropping of maize and soybean. This is because cover crops enhance soil water retention by 10% - 11% and 21% - 22%, respectively, at water potentials related to field capacity and plant available water. Similarly, Haruna and Nkongolo (2020) indicated that crop cover legumes planted to cover the soil surface helps enhance soil biological (sustaining microbial biodiversity), chemical, and physical properties. As a result, environmental sustainability of soybean production depends on achieving economic sustainability through maintaining physical soil quality over time.

A study conducted by Chauke (2021) about the application of no-till and soil fertility in small-scale farms in Mpumalanga, South Africa, found that no-till and fertilizer application improves soil fertility and soybean yield. Yin and Al-Kaisi (2004) study on the periodic response of soybean yields and economic returns to long-term no-tillage results indicated that no-till in soybean production has less than a 5% yield loss. Positively, the trial also indicated that economic returns were greater every 5 years on well-drained soils compared to other tillage systems. According to Nouri *et al*. (2019), the no-till system enhances the water infiltration rate and water holding capacity of the soil structure by improving soil organic matter, thereby increasing the likelihood that soybeans will have access to water availability. The economic sustainability and environmental sustainability challenges of soybean production is discussed in the next section.

2.3.2. Economic sustainability of soybean production and challenges

Economic sustainability of soybean production focuses on the economic returns achieved through practices that promote environmental sustainability. Ervin *et al.* (2011) agreed that economic sustainability seeks to assess the economic benefits and costs implication of adopting practices that promote environmental sustainability. This is because the economic sustainability of soybeans in small-scale farming leads to improved agricultural productivity, farm profitability on the initial investment, farm income, and food security for producers and consumers. González-Sánchez *et al*. (2016) economic sustainability and high output ecological are achieved through the integration of sustainable agricultural practices such as cover crops, no-till, intercropping, and crop rotation. This promotes adequate soil conditions to improve soil productivity, microbial activities, and production inputs management.

Matusso *et al*. (2012) found that small-scale farmer intercropping maize-soybean in Sub-Saharan Africa could help manage the production risks associated with monocropping. Moreover, intercropping also reduces input and profit maximization at lower costs, increases the sustainable use of resources, controls weeds, pests, and diseases and efficiency, and increases sustainability in soybean production. In strip intercropping, small-scale farmers are advised to adjust row spacing, decrease interplant spacing, and optimal cultivar screening (Chen *et al*. 2017). The maize-soybean intercropping is an environmentally sustainable practice that has economic profitability.

According to Derpsch *et al*. (2010), cultivating soybean without tilling the soil could save on machinery and farm labour costs and make soybean farming profitable while improving soil health

and productivity. In support, a study by Naab *et al*. (2017) conducted in Ghana on conservation agriculture improves crop yield in maize-soybean. The results indicated that costs are 20-29% cheaper with no-till and provide higher economic returns than conventional tillage.

2.3.3. Social sustainability of soybean production and challenges

Social sustainability of soybean production stretches on the ability of environmental and economic sustainability to promote societal capital that focuses on human development, human resilience, human health, human success, and human fulfillment. Watson (2008) emphasized that social sustainability in small-scale farming aimed at viewing people as the system should focus on measuring the equality between farmers, self-reliance, transfer of viable farming systems to the next generation, and improving workers' living standards and welfare. This is because social sustainability plays a crucial in promoting social cohesion in small-scale rural farming by connecting various stakeholders and other relevant bodies to achieve common or social goals. However, Janssen and Rutz (2011) argued that social sustainability of soybean production is seen in small-scale farmers' acceptance of environmental sustainability practices. Moreover, social sustainability is linked with other aspects of sustainability. For example, social activities depend on income level.

2.4. Factors affecting sustainability

2.4.1. Farming factors

Farming factors affecting sustainability include various elements. These are not limited to farm labour, soil fertility, equity in access to land, access to improved cultivars, and farm inputs affecting sustainability of soybean production. According to Giller *et al.* (2009), farm labour is a critical input in soybean production. Chianu *et al*. (2009) studied the profitability of soybean production in Kenya. The results showed that economic returns depend on labour use and grain yield. This is because soybean is labour intensive for small-scale farmers. Hence labour efficiency is important in soybean production (Collombet, 2013).

Anang *et al*. (2021) emphasized that although soybean cultivation is known to improve soil fertility, soybeans require well-drained soil with sufficient amounts of Nitrogen to Phosphorous to Potassium and other nutrients to grow well. A study by Van Vugt *et al*. (2017) in Malawi showed that soybean yields for small-scale farmers are constrained mainly by poor fertility. This is because low fertility results in poor growth, the development of diseases, and pest attack of soybean

production caused by insufficient nutrients available for crops. Thapa *et al*. (2021) argued that soil fertility is important in soybean production, and sustainable soil fertilization is crucial for optimum yield and economic returns.

Food and Agriculture Organization (2006) found that equity in access to land is imperative for sustainable rural development, economic growth, and social equity. As a result, equity in access to land remains an important issue affecting sustainability of soybean production, particularly in rural small-scale farming. A study by Mbanya (2011) on technical constraints on soybean production among small-scale farmers was conducted in Northern Ghana. The results found that women had less access to land than their counterparts. According to Lefore *et al*. (2019), sustainability in small-scale farming also requires equity in land access and water resources for women, youth, and other marginalized groups.

McFarlane and O'Connor (2014) indicated that the sustainability and competitiveness of small-scale soybean farming required improved crop cultivars. Access to improved cultivars in small-scale farming not only greatly impacts the sustainability of farming systems but also plays an important role in improving yields and economic returns and contributes to combating food insecurity and malnutrition issues exacerbated by climate change, especially in developing countries.

In small-scale soybean farming, farm machines such as combine harvesters play an important role in getting maximum yield returns with minimum post-harvest losses (Islas-Rubio *et al*. 2002). This is because harvesting must commence as soon as 95% of the leaves turn yellow to brown to avoid shattering mature pods to the ground, causing post-harvest losses. However, Botta *et al*. (2016) argued that frequent use of farm machinery negatively impacts environmental and economic sustainability as it may cause soil compaction resulting in a decrease in yield and farm profit. Hence, efficient use of farm machinery is important to the sustainability of cropping systems in small-scale soybean.

2.4.2. Economic factors

Economic factors affecting soybean sustainability refer to factors arising from changes in the economy. These include access to soybean marketing information, transport costs, price stability, support from financial institutions, and access to growers' credits. Jia *et al.* (2020) found that a small-scale soybean supply chain is important for the sustainability of soybean production. The

author also stated that the small-scale soybean supply chain is a network and needs multiple sources of services, such as the provision of infrastructure and processing facilities.

In a study by Asodina *et al*. (2020) on the economic analysis of small-scale soybeans in northern Ghana, it was pointed out that the marketing of soybean is vital to increase their participation, which has the potential to improve the economic welfare of farmers and soil fertility. This means access to marketing information by small-scale farmers will improve their perception of the economic factors affecting sustainability. Nget *et al*. (2021) found that extension workers played a vital role in providing small-scale farmers with marketing information, hence the high economic returns derived from soybean production. The availability of extension workers enables farmers to obtain reliable marketing information that leads to improved decision-making, farm profit, and living standards.

Richards and Arima (2018) found that transportation costs in small-scale farming impact the total profit generated from soybean yield. Furthermore, farmers with enough capital can afford the higher transport costs than those who are resource-poor farmers. As opined by Byron *et al*. (2014), the closer the distance to the soybean market, the lower the transportation costs and the higher the farm profits generated through sales. This implies that high transportation costs influence almost every daily farming activity. Mubichi (2017) indicated that transport costs in small-scale farming also affect access to seeds, the use of farm machineries such as tractors and other farm inputs.

A study by Roessali *et al.* (2019) found that farmer-level price stability improves the sustainability of soybean production. The price stability in farmers motivates farmers to invest more in farming activities as profit is inevitable throughout the production period. Gadanakis *et al.* (2019) indicated that price instability has a negative impact on farm economic sustainability. Price instability can also affect the prices farmers expect from selling their produce in the market, posing a negative threat to their economic well-being.

According to Sebatta *et al.* (2014), access to financial support from financial institutions such as banks plays a significant role in agricultural development. Tesfay (2019) review found that small-scale soybean farmers' access to financial institutions was poor. The results also indicated that even if they save money for future production costs, more is needed to purchase basic farming inputs. This is of concern as it poses a barrier to small-scale farmers' participation in soybean production and the sustainability of soybean production.

Government-subsidized credits and the sustainability of small-scale farming are necessary (Fearnside, 2001). In rural small-scale farming, access to credit is crucial to achieving sustainable rural development goals (Moahid *et al*., 2021). This is because credits allow farmers to purchase farming inputs and also enable them to strengthen their ability to make long-term investments in their farms. With access to credit, rural households can remain economically viable in the long term and enhance the economic viability of their farms.

2.4.3. Extension and education factors

Mesterházy *et al.* (2020) emphasized that extension and education factors are crucial factors that can promote and improve sustainability of soybean production. Extension and education factors include extension visits, e-extension, extension training workshops, demonstrations, and farmer field school for small-scale farmers to the soybean value chain. A study by Kansiime *et al*. (2021) found that frequent extension visits have positive outcomes on adopting sustainable agriculture. As a result, small-scale farmers rely primarily on extension visits for agricultural information and the importance of sustainable agriculture for their livelihoods. Baloch and Thapa (2019) agreed that frequent extension visits to small-scale farming are essential for a smooth transition from traditional to sustainable farming systems. In addition, extension visits could enable extension workers to identify the needs for e-extension, training workshops, demonstrations, field days, and trips to expose farmers to the value chain imperative to the sustainability of small-scale farmers.

According to Afzal *et al.* (2016), e-extension can help improve the effectiveness of extension services for agricultural sustainability. E-extension is also essential to enhance agricultural production by integrating multiple dimensions of information and communication technology, multi-media learning, and computer-based learning to improve access to agricultural information in the smallholder farming sector. El Bilali and Allahyari (2018) found that ICTs can contribute immensely to the sustainability of farming systems by increasing the efficient use of primary resources while decreasing production costs. This is because ICTs can help bridge the knowledge deficit among small-scale farmers.

Extension training workshops on sustainable agriculture for small-scale farmers could help assess their perceptions and attitudes towards their practices and also help bridge the knowledge gap on sustainability in farming systems. For example, a study by Zeweld *et al.* (2017) found that training on sustainable agriculture can increase the adoption rate of small-scale agricultural practices. Franz

et al. (2010) also conducted a study on training small-scale farmers in sustainable agriculture. The results indicated that 100% of small-scale farmers preferred workshops as a source of learning on sustainable agriculture.

Soybean field demonstration training helps teach small-scale farmers about sustainable agricultural practices and new or improved cultivars in the field. Field demonstrations enable extension workers to promote sustainable agricultural practices, agronomic practices, and improved cultivars. Giller *et al.* (2011) highlighted that small-scale soybean farmers learn best by observing and doing. This is because the majority of small-scale farmers are older, and by virtue, demonstration of sustainable agricultural practices gives them hands-on training during the field days.

In a study by van den Berg *et al*. (2020) on farmer field school relevancy in Malawi. The results indicated that the soybean Farmer Field School contributes to sustainable development goals. Another study by Périnelle *et al.* (2021) found that field day small-scale farmers agreed that soybean production is suitable for improving soil fertility. Kansiime *et al*. (2021) argued that extension workers must provide farmers with farmer field school programs which could help bridge the illiteracy among farmers.

2.4.4. Social factors

According to Archer *et al*. (2008), social factors influence agricultural systems. Those social factors are not limited to cultural and community diversity, the use of indigenous knowledge, the belief of farmers, and the use of genetically modified crops and cooperatives. Sacco *et al.* (2009) indicated that sustainable development strategies integrated with cultural diversity are essential for environmental sustainability and biodiversity. Ortmann and King (2010) confirmed that their cultural diversity influences small-scale farmers' perceptions. And that those sustainable agricultural practices that do not fit within the cultural diversity of a predefined community are likely to be rejected by small-scale farmers.

In a study by Tikai and Kama (2010) on the role of small-scale farmers' indigenous knowledge on sustainable agriculture in Samoa, the result indicates that indigenous knowledge must be used to devise innovative research for agricultural researchers, extension workers, and other relevant stakeholders for sustainable agriculture development and sustainable use of natural resources. According to Lwoga *et al.* (2010), most small-scale farmers in developing countries rely on

indigenous knowledge for planting, fertilization, crop protection, harvesting, processing among others, to sustain their livelihoods. Sustainable agricultural development must take into account the indigenous knowledge of small-scale farmers.

Kazmi *et al*. (2014) also studied farmers' beliefs about indigenous farming practices and SAD in Pakistan. This study found that long-term indigenous knowledge requires multi-disciplinary approaches to achieve sustainable agricultural development. Mesfin (2017) argued that small-scale farmers' beliefs in sustainable agriculture assume a vital role in soybean production, mainly in developing countries. Various countries perceive sustainable agriculture as improved agricultural production. Giller *et al*. (2011) noted that farmers in Zimbabwe believed that soybean production is a crop that is not suitable for small-scale farmers. Small-scale farmers' positive belief in sustainable agricultural practices associated with improved agricultural production can also help improve sustainability in farming systems (Rodriguez *et al*. 2009).

Small-scale farmers' perception of the use of modified crops, for example, closely related to be positively impacting their beliefs and social norms. Aerni (2005) noted that small-scale farmers' positive attitudes toward using GM crops and sustainability in their farming systems are essential for improved agricultural productivity and crop yields using minimum farming chemicals. According to Azadi *et al*. (2015), small-scale farmers' utilization of Genetically Modified Organisms could help boost no-tilling farming, improve yield, decrease land use and save beneficial insects.

According to Ortmann and King (2007), in South Africa, agricultural cooperatives play a crucial role in enhancing the agricultural productivity of small-scale farmers. Asogwa *et al.* (2012) found that cooperative is one of the sources of agricultural marketing information among rural small-scale soybean farmers. Soybean group producers can also help build a reliable channeling of the long-term benefits of the sustainable agricultural practice's extension workers could use to dissimilate knowledge and information of sustainable agriculture. The farmers' culture and beliefs could be informed in a cooperative and change in attitudes toward adoption can easily be achieved and improved in cooperatives (Wiley *et al*., 2010).

2.4.5. Policymaking factors

According to Milano *et al* (2014) “policy making is an extremely complex process occurring in changing environments and affecting the three pillars of sustainable development: social, economic and the environmental”. Khwidzhili and Worth (2017) stated that the policy affirms that land degradation is the most important environmental issue affecting sustainability. The authors also argued that the lack of sustainable agriculture policies requires attention to other agricultural policies that affect sustainability in agricultural productivity. These policymaking factors affecting small-scale farmers' sustainability are not limited to policies on food security, management of soil resources, price and marketing, pests, weed and diseases, and agricultural research systems (National Department of Agriculture, Unspecified).

Gwada *et al*. (2020) emphasized that understanding the factors affecting food (in)security among small-scale soybean farmers is crucial to formulating food security policies. In a study by Islam *et al.* (2022) on soybean and sustainable agriculture for food security. The study indicated that soybean production “plays a significant role in global food security and agricultural sustainability due to a high seed protein, oil concentration and low reliance on Nitrogen fertilization”. Soybean has got health benefits that are relevant in fighting against household malnutrition issues in the rural small-scale farming sector. This is because soybean seeds have over 35% protein content, healthy unsaturated fats, and carbohydrates required to fight malnutrition, especially in developing countries caused by food insecurity issues (Maphosa and Jideani, 2017).

Laarhoven (2019), on indicators for sustainable agriculture, indicated that policies on soil conservation could help promote environmental sustainability and facilitate sustainable agricultural practices. According to Reytar *et al*. (2014), soil conservation promotes health practices that maintain balanced ecosystems while producing higher agricultural products. Wu *et al*. (2004) also conducted on soil conservation benefits of soybean. The results indicated that increased soybean residue production in soybean production could contribute positively to environmental sustainability as soil conservation reduced soil erosion. However, Nkonya (2012) study on soil conservation practices in the Southwestern highlands of Uganda highlighted that price and marketing policies impact farmers' decisions on soil conservation. According to Baines (2017), instability in small-scale farmers' income in developing countries is influenced by unstable farm prices. Manthata (2018) argued that pricing and marketing policies play a vital role in soybean

price stability. International prices determine marketing and competitiveness. An enabling agricultural policy could help in a sustainable increase in the production of soybean yields in the long term.

According to Nguyen *et al.* (2017), the policy on pesticides would allow for minimizing the use, the associated health and environmental impacts. A study by Mergia *et al*. (2021) indicated that most small-scale farmers were unaware of the impacts of farm chemicals on the environment. Hence, small-scale farmers' sustainable use of pesticides implicates extension workers (Ngowi *et al*. 2007). Conley and Santini (2007) emphasized that it is imperative to have agricultural research systems that will enable researchers and extension workers to comprehensively soybean production. Sustainability also depends on the advanced technologies and advanced technologies that are acquired through agricultural research systems.

2.5. Summary

The chapter reviewed abroad previous literature on the factors affecting the sustainability of soybean production. The chapter focused on sustainable agriculture, the concept and challenges of sustainability of soybean production. Factors perceived as important in the sustainability of soybean production are likely to influence respondents' perceived attitudes towards the sustainability of soybean production. Moreover, the significantly perceived factors affecting the sustainability of soybean production may determine farmers' decisions to improve or maintain environmental, economic, and social aspects of sustainability. The following chapter outline the research methodology.

CHAPTER THREE: METHODOLOGY

3.1. Introduction

This section provides a description of the study area and a series of steps and procedures to organize, collect, and analyze data. This chapter deals in particular with the study area, the research design, the study population, the sampling methods, the sample size, the survey instruments, types and the sources of data, and the methods of data analysis. The study will also provide the rationale for the methods used in this study.

3.2. Descriptive of study, population and sampling

3.2.1. Description of the study

The population of the study refers to some of the subjects or people that the study focuses on. This study, therefore, focused on Nkangala District Municipality, South Africa. These sampled local municipalities are the Emakazeni Local Municipality at 25°32'43.9" S, 29°59'51.5"E; Emalahleni Local Municipality, 25°52'27.6" S, 29°15'26.4" E; and Steve Tshwete Local Municipality, 25°46'09.5" S, 29°28'52.8” E, as illustrated in figure 1. The predominant race group and language are black Africans, accounting for about 88.95%. The selection of these municipalities was based on the most important soybean growing area in the district's local municipalities, farming type, and small-scale farmers' willingness to participate. According to the Department of Agriculture, land reform and rural development (2021), 418 small-scale farmers from the selected study areas are relevant to this study. Figure 1 displays a map of Nkangala District Municipality.

Figure 1: Map of Nkangala
Source: https//www.municipalities.co.za

3.2.2. Sampling methods

In this study, the probability sampling method was used. Simple random sampling was utilized to select registered small-scale farmers from the list acquired from the district office of the Department of Agriculture in Nkangala District Municipality, whereby each farmer had an equal chance of being selected to partake in this study. There were 418 small-scale farmers from the three selected local municipalities of Nkangala District Municipality. The simple random sampling method minimizes bias during sampling (Meng, 2013).

3.2.3. Sampling size

A stratified random sample was used to get a recommended sample size for this study. The sample size was calculated as thus;

n = N/1+N(e)^2, where n = sample size, N= Population, e = Precision (Leedy and Ormrod, 2014)

n = 418/1+418(0.05)^2

n = 204

3.2.4. The research instrument

The research instrument was compiled to measure the study's dependent and independent variables. A pilot study was conducted to assess the strength of the research instrument in measuring the research objectives. Those tested variables include farming, economic, extension and education, social and policymaking factors. The questionnaire was designed and compiled based on the research objectives and consisted of three sections.

The first section collected data on participants' perceptions of farming, economic, extension and education, social and policymaking factors in the sustainability of soybean production from a five-point Likert scale ranging from 1= not at all important to 5= extremely important. The second section focused on captured data on their perceived ideas on environment, economic and social aspects of sustainability of soybean production from Likert-Scale ranging from strongly disagree to strongly agree. Likert scale was utilized because of its capability to permit respondents to indicate their meanings and perceptions based on anticipated circumstances.

3.3. Research design

Delosi and Nadder (2014) defined research design as a written plan for selecting participants, study areas, and data collection methods to address research hypotheses or questions. In addition, the author stated that the appropriate selection of the research design enables the researcher to arrive at valid findings, judgments, and conclusions. According to Sileyew (2019), the research design is a process carried out in a scientific study by a researcher that outlines a plan of action from start to end. Bickman and Rog (2008) emphasized that the research design should demonstrate the numerous approaches used in the study to address and solve the research problem, sources, and critical information relevant to the problem, and the timeframe and budget to carry out a project.

A quantitative research approach was used in this study. The study design was selected because it involved descriptive, correlation, and regression analysis. Kothari (2004) noted that the descriptive research approach enables the researcher to investigate the characteristics of people for a possible solution, as stated in the problem statement. Furthermore, according to Brittingham (2016), descriptive research design protects against bias and maximizes reliability. Even so, the authours noted limitations governing this design and highlighted that they are costly and time-consuming.

The survey research design was adopted during the administration of the survey questionnaire. This design enabled the researcher to comprehensively facilitate the data collection process from

participants who indicated their perceived ideas about farming, economic, extension and education, social and policymaking factors in the sustainability of soybean production, and their perceived attitudes on the sustainability of soybean production and accurately presenting of the findings.

3.4. Data analysis and presentation

Descriptive statistics will be used to analysis objective 1 and 2, whereas Multiple Linear Regression will be deployed to address the objective 3 and 4 of the study. The data are presented and discussed in Chapter 4 in figures, graphs, and tables. Excel and the Statistical Package of Social Science, also known as SPSS software version 26, were utilized to create figures, graphs and tables, frequencies, mean, standard deviations, and averages to show the statistical relationships among the studied variables (Park, 2015).

3.4.1. Regression analysis

After testing the perceived fFactors, the predictions of the output labelled y increased significantly. It is crucial to take into account the fact that every unit increase in the error variables will yield an increase in the regression sum of squares since some or at least one of the regressors will result in a significant change. The following equation illustrate the Multiple Regression Equation.

Where x is Perceived Ideas on the Sustainability of Soybean Production in Multiple Linear Regression:

$$Y = \alpha + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \beta_4 x_4 + \beta_5 x_5 + U$$

Where:

Y = dependent variable that is Sustainability of Soybean Production

x_1 = Farming factors

x_2 = Economic factors

x_3 = Extension and education factors

x_4 = Social factors

x_5 = Policymaking factors

3.5. Validity and reliability of the research instrument

3.5.1. Validity of the research instrument

According to Coronel-Santos and Ramirez (2020), validity is the ability of the research instrument to measure what it is intended to measure. It goes on to say that such studies can be replicated. From various types of validity, this study focused on external validity, which points out the strength of generalizability. It was achieved through face validity of the research instrument to expert judgment to strengthen its suitability.

3.5.2. Reliability of the research instrument

Mohajan (2017) referred reliability of the research instrument as the consistency of scores it has. This study applied standardized measures to the 5-point Likert scale guided by prior studies to improve data collection instruments. This process included Cronbach Alpha, which allowed the researcher to measure the internal consistency of the questionnaire. Bujang, Omar, and Bharum (2018), the suitability of the Cronbach Alpha coefficient ranges from 0.7 to 1. Table 1 presents reliability results per factors.

Table 1: Reliability results per factors

Variables	Cronbach's Alpha
Farming factors	0.793
Economic factors	0.795
Extension and education factors	0.764
Social factors	0.795
Policymaking factors	0.805
Sustainability	0.736

Source: SPSS computation analysis based on survey data

Table 1 illustrates the Cronbach Alpha coefficient per factor. The highest coefficient is 0.805, while the lowest is 0.736. The results indicate acceptable internal consistency as it is greater than 0.7 (Shrestha, 2021).

The study sample of 204 was generated from the population of 418 small-scale farmers in the study area. Tests were conducted to enable the testing of the study hypotheses and to prepare variables for linear regression analysis. Since the study's sample size was greater than 50, the study applies the Kolmogorov-Smirnov Test as the recommended statistical test to assess the normality of the

data when the sample is greater than 50. In contrast, Shapiro-Wilk Test recommended a sample size of less than 50.

3.6. Ethical considerations

The researcher obtained the ethical clearance from the University of Mpumalanga, consequently adhering to all research policies and procedures of the institution. At first, small-scale farmers were given informed (verbally) consent to outline that small-scale farmer participation will be voluntary. They uphold the right to withdraw from participation at any time. This was done with diligence to avoid emotional or physical damage to the participants. Afterward, the participants were given a written declaration of consent form as proof of their consent to participate in this study. This study will ensure that confidentiality and anonymity are achieved by not disclosing the names of the participants throughout the research and that the researcher will only use the provided for this research. And that their identity will not be disclosed. No pilot survey or testing was conducted.

3.7. Summary

This chapter presented a detailed research methodology. It included a detailed description of the study area and a series of steps and procedures for organizing, collecting, and analyzing data. The chapter dealt in particular with the study area, the research design, the study population, the sampling methods, the sample size, the survey instruments, types, and sources of data, as well as the methods of data analysis. The study also provided the rationale for the methods used in this study.

CHAPTER FOUR: FINDINGS AND DISCUSSION

4.1. Introduction

This chapter presents the research findings of the analysis of the data collected based on dual aspects. Even though it was arranged based on the study objectives, firstly, it will present the results on the fitness of the collected data through conducting reliability, validity, and normality tests. The reliability of the research instrument items for internal consistency was measured using Cronbach Alpha Coefficient. The normality test for the normal distribution of the sample values of the population is assured using the Kolmogorov-Smirnov diagnostic test.

Pearson Coefficient and Pearson Correlation were employed to assess the strength of the linear association between the variables under consideration. Analysis of Variance, also known as ANOVA, was deployed to test the study's hypotheses. The relationship between dependent and independent variables was obtained through the use of the Linear Regression Model. This chapter is structured into four sections. Section A will provide results on respondents' perceived ideas about farming, economic, extension and education, social and policymaking factors in the sustainability of soybean production and respondents' perceived attitudes on the sustainability of soybean production. Section C provides information on the relationship between the studied variables. Section C discusses regression results.

4.2. Section A: Descriptive results

4.2.1. Descriptive statistics of participants' perceptions of farming factors

This section presents descriptive results of participants' perceptions of farming, economic, extension, education, and social and policymaking in the sustainability of soybean production obtained from the Likert scale ranging from Not at all important to Extremely Important, which is based on the interpretation of the mean score, and standard deviation. Mansor *et al*. (2020) interpretation of mean scores are that the value ranging from 1 to 1.80 is considered very low, 1.81 to 2.60 low, 2.61 to 3.20 medium, 3.21 to 4.20 high, and 4.21 to above very high. The following presents the study findings on the perceived factors in the sustainability of soybean production. Table 2 illustrates descriptive results on participant's perceptions of farming factors.

Table 2: Descriptive results on participants perceptions of farming in the sustainability of soybean production

Items	N	Mean	Sdt. Deviation
Farm labour	204	4.07	0.751
Mechinary	204	4.02	0.752
Farm inputs	204	4.11	0.779
Access to improved cultivar	204	4.06	0.753
Equity in access to land	204	4.06	0.772
Valid N (listwise)	204		
Farming factors	204	4.07	0.762

Source: SPSS computation analysis based on survey data

Table 2 presents the mean results of small-scale farmers' perception of farming factors in the sustainability of soybean production. The scaled average mean is 4.07, and a standard deviation of 0.762, which indicates that the participants agreed that these items are very important in the sustainability of soybean production. The highest mean score (4.11), with a standard deviation of 0.779, was on farm inputs, while the lowest mean score (4.07) was on farm labour. The finding concurs with Biswas *et al* (2014).

4.2.2. Descriptive result on economic factors in the sustainability of soybean production
The following table 3 presents descriptive results on participants perceptions of economic factors in the sustainability of soybean production.

Table 3: Descriptive results on participants perceptions of economic factors in the sustainability of soybean production

Items	N	Mean	Sdt. Deviation
Access to growers credit	204	4.09	0.751
Support from financial institution	204	4.08	0.764
Transport cost	204	4.01	0.773
Access to soybean marketing information	204	4.05	0.774
Price stability	204	4.06	0.754
Valid N (listwise)	204		
Economic factors	204	4.05	0.763

Source: SPSS computation analysis based on survey data

Table 3 present the descriptive results on participants' perceptions of economic factors in the sustainability of soybean production, including an average mean of 4.05 and a standard deviation of 0.763. The highest mean score (4.09) on economic factors with a standard deviation of 0.751, as illustrated in Table 3, was access to growers' credit. The lowest mean score (4.01) was on transport cost, with a standard deviation of 0.773. The results are line with Ahmadpour *et al* (2020) on factors affecting sustainable livelihood.

4.2.3. Descriptive result on extension and education in the sustainability of soybean production

The following table 4 presents descriptive results on participants perceptions of economic factors in the sustainability of soybean production.

Table 4: Descriptive result of participants' perceptions of extension and education factors in the sustainability of soybean production

Items	N	Mean	Sdt. Deviation
Extension training program	204	4.04	0.771
E-Extension	204	4.06	0.785
Demonstration	204	4.07	0.775
Extension visits	204	4.08	0.748
Farmer Field School	204	4.07	0.771
Valid N (listwise)	204		
Extension and Education factors	204	4.06	0.770

Source: SPSS computation analysis based on survey data

Table 4 depicts average mean results (4.03) and a standard deviation (0.795) for participants' perceptions of the extension and education factors in the sustainability of soybean production. The present findings are consistent with Joneydi (2012) study on factors affecting sustainability. Table 5 shows that the highest mean score (4.05) was on extension visits with a standard deviation of 0.779. And the lowest mean score (4.00) was on e-extension. Extension visits may influence small-scale farmers' perception of the sustainability of soybean production. Similarly, Khalid and Sherzad (2019) stated that extension visits constitute more than 50% of extension activities. The

results emphasize that the questions asked on extension and education factors were perceived as very important items in the sustainability of soybean production.

4.2.4. Descriptive results on social factors in the sustainability of soybean production

Table 5 presents the findings on participants' perceptions of social factors in the sustainability of soybean production.

Table 5: Descriptive results on participants perceptions of social factors in the sustainability of soybean production

Items	N	Mean	Sdt. Deviation
Cultural and community diversity	204	4.06	0.788
Beliefs of farmers towards soybean production	204	4.04	0.783
Use of indigenous knowledge	204	4.08	0.767
Beliefs of farmers towards sustainable practices	204	4.02	0.761
Cooperatives	204	4.04	0.751
Valid N (listwise)	204		
Social factors	204	4.05	0.770

Source: SPSS computation analysis based on survey data

The study reveals that the average mean and standard deviation were 4.05 and 0.770, respectively. As indicated in Table 5, the highest mean score (4.08) with a standard deviation of 0.767 was on the use of indigenous knowledge, and the lowest (4.02) with a standard deviation of 0.761 was on the beliefs of farmers towards sustainable practices. The results suggest that social factors are very important in the sustainability of soybean production. This is consistent with the previous study by Mirzakhani *et al* (2021).

4.2.5. Descriptive results on policymaking factors in the sustainability of soybean production

According to Table 6, the average mean and standard deviation was 4.05 and 0.763, respectively.

Table 6: Descriptive results on participants perceptions of policymaking in the sustainability of soybean production

Items	N	Mean	Sdt. Deviation
Policy on sustainable agricultural practices	204	4.03	0.751
Policy on agricultural resources	204	4.06	0.788
Policy on price and marketing	204	4.07	0.781
Policy on management of pests, weeds, and diseases control	204	4.02	0.742
Policy on food security	204	4.09	0.753
Valid N (listwise)	204		
Policymaking factors	204	4.05	0.763

Source: SPSS computation analysis based on survey data

The results suggest that the items asked participants were strongly perceived. The highest mean score (4.09) with a standard deviation of 0.753 was on the policy on food security. The lowest mean (4.02) with a standard deviation of 0.742 was policy on the management of pests, weeds, and disease control. This result shows that the participants strongly viewed policymaking factors as critical factors in the sustainability of soybean.

4.2.6. Descriptive results of participants perceptions of sustainability of soybean production

This section presents the descriptive findings on participants' perceptions of soybean production's environmental, economic, and social aspects of sustainability obtained from a Likert scale ranging from strongly disagree to strongly agree. Reports are based on the average mean and standard deviation. The following table 7 presents the findings.

Table 7: Descriptive results on perceived attitudes on the sustainability of soybean production

Items	N	Mean	Sdt. Deviation
Soybean can help farmers maintain or improve their environmental aspect of sustainability	204	4.03	0.76185
Soybean can help farmers maintain or improve their economic aspect sustainability.	204	4.04	0.75136
Soybean can help farmers maintain or improve their social aspect of sustainability.	204	4.04	0.78346
Perceived attitudes towards the sustainability of soybean production	204	4.04	0.76777

Source: SPSS computation analysis based on survey data

Table 7 indicates an average mean score of 4.04 on the perceived attitudes towards the sustainability of soybean production, deriving from the mean score obtained from the asked statements towards the environmental = 4.03, economic = 4.04, and social = 4.04 aspects of sustainability of soybean production. The results infer that the respondents agreed with the statement asked about the sustainability of soybean production. Shen *et al*. (2011) emphasized that these aspects are important towards the sustainability of farming systems.

4.3. Section B: Correlation results

To prepare the variables for regression analysis, correlation analysis was conducted. This analysis aimed to assess the association between the respondents' perceived ideas (mean scores) regarding the farming, economic, extension and education, social, and policymaking factors in soybean production sustainability (independent variables) and their perceived attitudes (average mean score) towards soybean production sustainability (dependent variable). This statistical analysis is crucial as it examines the relationship between variables and allows the researcher to evaluate the strength of the relationship between specific factors and indicators of soybean production sustainability. The correlation coefficients between the independent variables and the dependent variable, as well as their interpretations, are presented in Table 8.

Table 8: Correlation Matrix of the factors

Variables	Farming factor	Economic factor	Extension and education factor	Social factor	Policy factor	Sustainability Factor
Farming factor	—					
Economic factor	0.559 ***	—				
Extension and education factor	0.426 ***	0.460 ***	—			
Social factor	0.389 ***	0.443 ***	0.624 ***	—		
Policy factor	0.508 ***	0.517 ***	0.662 ***	0.731 ***	—	
Sustainability factor	0.454 ***	0.439 ***	0.635 ***	0.905 ***	0.736 ***	—

Note. * p < .05, ** p < .01, *** p < .001
Source: SPSS computation analysis based on survey data

Table 8 displays a moderately positive relationship between participants perceived attitudes towards the sustainability of soybean production and farming factors (.454**), and economic factors (.440**). The results also indicate that perceived attitudes towards the sustainability of soybean production had a strong positive (.635**) relationship with extension and education factors and policymaking factors. The relationship between perceived attitudes towards the sustainability of soybean and social factors was found to be very strong (.905**). The results also indicated that there was neither a mediating nor a moderating influence on how small-scale farmers perceived these factors in the sustainability of soybean production. These findings show that the study's results and their interpretation were substantial and valid.

In conclusion, Table 3 suggests that there is a significant relationship between the participants' perceptions of farming, economic, extension and education, social, and policymaking factors and

their perceptions of the sustainability of soybean production. The relationships between independent variables and the dependent variable were subsequently evaluated using regression analysis.

4.4. Section C: Regression findings

4.4.1. Coefficients on the participants perceived ideas on perceived farming factors and their perceived attitudes towards the sustainability of soybean production

Table 9 presents coefficients results on farming factors and sustainability of soybean production. R-Square was used to evaluate the model fitness. The model indicates an R-Square value of 0.2059, indicating that 20% of the variation in the perceived attitudes towards the sustainability of soybean production can be explained by the model containing farming factors. The study's findings also show that the model's fitness is good.

Evaluating the adequacy of fit holds paramount significance when modeling human perceptions or attitudes. This assessment enables us to gauge the precision and dependability of our models in encapsulating the intricate nature of these phenomena. By quantifying how well our model elucidates the observed variation in human perceptions or attitudes, we can ascertain the validity of our assumptions and appraise the overall efficacy of the model. Such insights prove invaluable in diverse fields like psychology, market research, and sociological studies, where comprehending and forecasting human behavior stands as a pivotal requirement (Oll *at al., 2018*}.

Table 9: Coefficient results between the participants perceived ideas towards the farming factors and their perceived attitudes on the sustainability of soybean production.

Model	Unstandardized Coefficients		t	Sig
	B	Std. Error		
1 (Constant)	1.881	.264	7.130	.000
Farming Factor	.449	.062	7.240	.000
a. Dependent Variable: Average mean score of the participants perceived attitudes towards the sustainability of soybean production				
y = 0.4585x + 2.4933 R Square = 0.2059				

Source: SPSS computation analysis based on survey data

Table 9 shows that the farming factors had a positive coefficient of.449 and a p value of.000. This implies that there is a statistically significant relationship between participants perceived attitudes towards the sustainability of soybean production and their perceived ideas on farming factors and that any increase in the perceived ideas on farming factors will induce an increase in the probability of perceived attitudes towards the sustainability of soybean production by .449 times.

4.4.2. Coefficients based on participants' perceived ideas about perceived economic factors, as well as their perceived attitudes toward the sustainability of soybean production

Table 10 shows the model had an R-Square of 0.1928, implying that it is fit for this study and that 19% of the variation in the sustainability of soybean production can be explained by the model containing economic factors.

Table10: Coefficient results between the participants perceived ideas towards the economic factors and their perceived attitudes on the sustainability of soybean production.

Model	Unstandardized Coefficients		t	Sig
	B	Std. Error		
1 (Constant)	1.951	.264	7.382	.000
Economic factors	.434	.062	6.961	.000
a. Dependent Variable: Average mean score of the participants perceived attitudes towards the sustainability of soybean production				
y = 0.4327x + 1.9556 R Square = 0.1928				

Source: SPSS computation analysis based on survey data

Economic factors produced a p-value of 0.000 and a b-value of 0.434, as shown in Table 10. As the p value is less than 0.05, the correlation between perceptions of economic factors and perceptions of the sustainability of soybean production is statistically significant. According to the b-value, any increase in economic factors will result in a 0.434-fold increase in the probability of sustainability of soybean production.

4.4.3. Coefficients on the participants perceived ideas on perceived extension and education factors and their average mean score of the perceived attitudes towards the sustainability of soybean production

Table 11 show the Coefficients between the participants perceived ideas on extension and education Factors and their perceived attitudes towards the sustainability of soybean production. The model's R-Square value was 0.4028, indicating that it was well-fitted and that it can account for 40% of the variation in perceived attitudes towards sustainability can be explained by the model containing extension and education factors. The following table 13 presents correlation results.

Table 11: Coefficient results between the participants perceived ideas towards the extension and education and their average mean score of the perceived attitudes towards sustainability of soybean production

Model	Unstandardized Coefficients		t	Sig
	B	Std. Error		
1 (Constant)	1.071	.233	4.595	.000
Extension and Education Factors	.641	.055	11.683	.000
a. Dependent Variable: Average mean score of the participants perceived attitudes towards the sustainability of soybean production				
$y = 0.6403x + 1.0743$ R Square = 0.4028				

Source: SPSS computation analysis based on survey data

As revealed in Table 11, perceived ideas on extension and education factors obtained a b of .641 and a p-value of .000. The findings show that any increase in the participants perceived ideas on extension and education factors will induce an increase in the probability of the perceived attitudes towards the sustainability of soybean production by .641 times.

4.4.4. Coefficients on the participants perceived ideas on perceived social factors and their average mean score of the perceived attitudes towards the sustainability of soybean production.

As presented in Table 12, the Coefficients results on the participants perceived ideas on social factors and their perceived attitudes towards the sustainability in soybean production. An R-Square value of 0.819 indicates that the model is reasonably well-fit.

Table 12: Coefficient results between the participants perceived ideas towards the social factors and their average mean score of the perceived attitudes towards sustainability of soybean production.

Model	Unstandardized Coefficients		t	Sig
	B	Std. Error		
1 (Constant)	.062	.124	.501	.617
Social factors	.883	.029	30.226	.000
a. Dependent Variable: Average mean score of the participants perceived attitudes towards the sustainability of soybean production				
y = 0.8826x + 0.0633 R Square = 0.819				

Source: SPSS computation analysis based on survey data

The findings from Table 12 indicate that the social factors b-value = 0.883 and p-value = 0.000, implying that any increase in the perceived ideas on social factors will induce an increase in the probability of the perceived attitudes towards the sustainability of soybean production by 0.883 times. The p-value indicates that there is a statistically significant between the participants perceived ideas on social factors and their perceived attitudes towards the sustainability of soybean production.

4.4.5. Coefficients on the participants perceived ideas on perceived policymaking factors and their average mean score of the perceived attitudes towards the sustainability of soybean production

Table 13 illustrates the Coefficients between the participants perceived ideas on policymaking factors and their perceived attitudes sustainability of soybean production. As shown in Table 13, R Square = 0.5424, indicating that 54% of the variance in the participants perceived attitudes towards the sustainability of soybean production can be explained by the model containing participants' perceived attitudes towards the policymaking factors.

Table 13: Coefficient results between the participants perceived ideas towards the policymaking factors and their average mean score of the perceived attitudes towards sustainability of soybean production.

Model	Unstandardized Coefficients		t	Sig
	B	Std. Error		
1 (Constant)	0.755	o.197	3.840	.000
Policymaking factors	0.717	0.046	15.466	.000
a. Dependent Variable: Average mean score of the participants perceived attitudes towards the sustainability of soybean production				
y = 0.7172x + 0.7559 R Square = 0.5424				

Source: SPSS computation analysis based on survey data

According to Table 13, the b-value and p-value of the policymaking factors were 0.717 and 0.000, respectively. The results infer that that any increase in the participants perceived ideas on policymaking factors will induce an increase in the probability of their perceived attitudes towards the sustainability of soybean production by 0.717 times.

4.5. Multiple Linear Regression Model

Figure 2 below summarizes the different signs of the results for $\bar{Y}$ = perceived attitudes towards the sustainability of soybean production, where a = intercept, b = beta coefficient or slope as perceived factors. The R Square value is 0.6444, indicating that 64% of the variation in the perceived attitudes towards the sustainability of soybean production can be explained by the model containing predictor variables or overall mean score of the independent variables and implying that the model fitness was good for this study. Also, the R-square in Figure 2 is converted to *r* as follows. A square root of 0.644 equals 0.802, which confirms the correlation results. With a positive slope, this confirms that the model is satisfactory.

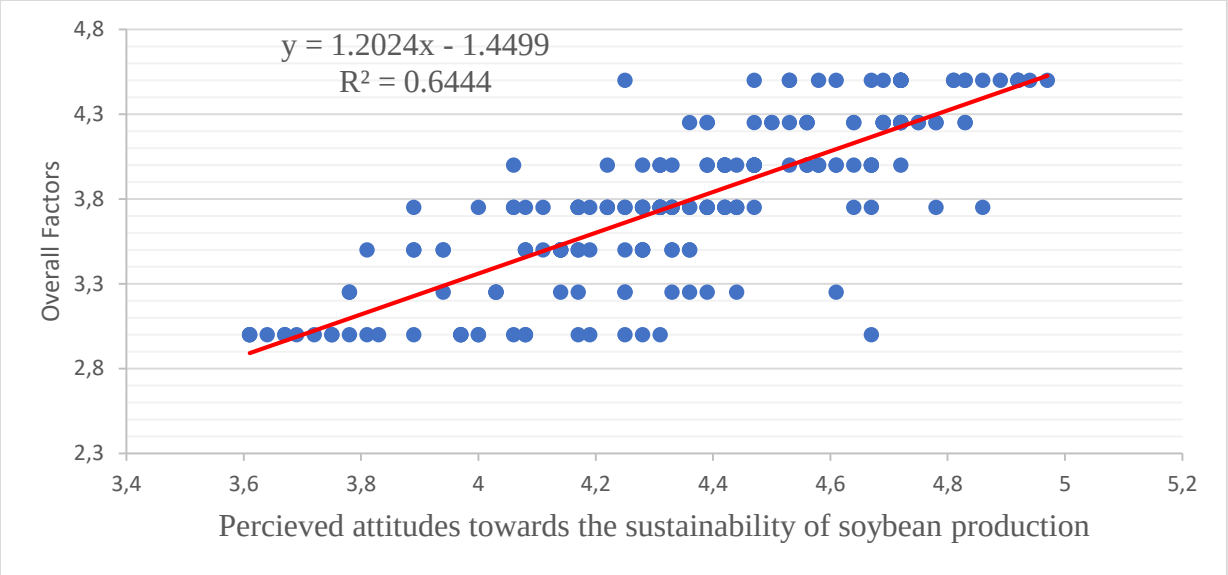

Figure 2: Linear Regression on perceived factors and perceived attitudes towards the sustainability of soybean production

Source: SPSS computation analysis based on survey data

4.6. Section D: Results of hypotheses testing

This section presents results for the analysis of objectives three and four. Section D builds on the statistical test conducted in Section C. Inferential statistics was deployed to test the relationship between the studied variables. These variables include farming, economic, extension and education, social and policymaking factors and perceived attitudes towards the sustainability of soybean production. The Analysis of Variables (ANOVA) was performed to determine differences on all axis in terms of noting the nature of the difference by testing null hypotheses. Then the ANOVA test is deployed to accept or reject the null hypothesis.

4.6.1. ANOVA results on perceived factors towards the sustainability of soybean production

Table 14 indicate the anova results for perceived factors as independent variables and perceived attitudes towards the sustainability of soybean production as dependent variable.

Table14: ANOVA results on perceived factors and perceived attitudes towards the sustainability of soybean production

ANOVA Results					
	Sum of Squares	df	Mean Square	F	Sig.
Regression	28.221	1	28.221	365.379	0.000[b]
Residual	15.602	202	0.077		
Total	43.824	203			
a. Dependent Variable: Perceived attitudes towards the sustainability of soybean production b. Predictors: (Constant), Overall mean of the studied factors					

Source: SPSS computation analysis based on survey data

The results indicate that F value = 365.379 and p value = 0.000 at significant value of less than 0.05. This indicates that there is a statistically positive significant among the studied variables and that the model accounts for a significant percentage of the variation in the sustainability of soybean production.

The study null hypothesis "H1: *Perceived factors does not affect the sustainability of soybean production*" is rejected from the results presented.

4.7. Summary

This chapter presented results from descriptive and inferential results that are consistent with the study main hypotheses for farming factors, economic factors, extension and education factors, social factors, policymaking factors and sustainability of soybean production. The study used anova, correlation and coefficients, and the Linear Regression Model to analyze the study objectives and to answer the study hypotheses.

CHAPTER FIVE: SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1. Summary

The aim of the current study was to investigate small-scale farmers' perceptions of factors affecting the sustainability of soybean production in Nkangala District Municipality, South Africa. Specific objectives of the study were to: (i) determine the small-scale farmers perceived ideas on farming, economic, extension and education, social, and policymaking factors in the sustainability of soybean production in the study area, (ii) determine the respondent's perceived attitudes towards the sustainability of soybean production, (iii) examine the relationship between respondents' perceived attitudes about farming, economic, extension and education, social, and policymaking factors in the sustainability of soybean production and their perceived attitudes on the sustainability of soybean production. (iv) determine the actual factors affecting the perceived attitudes towards the sustainability of soybean production in the study area. The study utilized a random sampling technique to obtain a sample size of 204 out of a population of 418. A simple random sampling technique was adapted based on its effectiveness in eliminating bias, and all participants had an equal opportunity to be selected. Both descriptive and inferential on SPSS software version 26 were deployed to examine the gathered data. The results of participants' ideas about factors in the sustainability of soybean production were farming factors (M=4.07), economic factors (M=4.05), extension and education Factors (M=4.06), social factors (M=4.06) and policymaking Factors (M=4.05). These results also indicate the average mean score of 4.06, inferring that the participants perceived these factors as important in the sustainability of soybean production.The study revealed the average mean of 4.04 on the participant's perceived attitudes towards sustainability of soybean production, derived from the mean results of the statements on the environmental, economic, and social aspects of sustainability, which were 4.03, 4.04, and 4.04, respectively. The result also indicated an average mean score of 4.14. These results show that the participants perceived the statement complied to measure the sustainability of soybean production as very significant.

This study found that farming and economic factors had a moderate positive relationship with the sustainability of soybean production. The findings on extension and education and policymaking factors indicate a strong positive relationship with the sustainability of soybean production. The social factors had a very strong positive relationship with the sustainability of soybean production.

5.2. Conclusion

This study found that all five factors, namely, farming, economic, extension and education, social and policymaking factors, had a significant positive influence on the sustainability of soybean production. Moreover, it was discovered that any increase in perceived ideas on independent variables would increase the probability of perceived attitudes about the sustainability of soybean production. The sustainability of soybean production has demonstrated the ability to alleviate poverty through contributing towards sustainable development goals that helps alleviate poverty and malnutrition issues, particularly in developing countries. This study revealed that respondents perceived ideas towards farming, economic, extension and education, social and policymaking factors had a positive significant influence towards their perceived attitudes on the sustainability of soybean production. Consequently, these factors were found to be factors affecting the sustainability of soybean production in a manner that any increase in these factors is associated with an increase in the probability of the perceived attitudes towards the sustainability of soybean production.

5.3. Recommendations

Based on the research findings, the study recommends that:

1. Farming, economic, extension and education, social factors and policymaking should be greatly observed when promoting and implementing initiatives towards sustainability of Soybean production
2. To strengthen the sustainable rural development for the sustainability of small-scale farmers' future studies may look at other factors, such as agronomic factors, to broaden the five studied factors.
3. The Government should develop an impact plan to address the sustainability of small-scale farmers' using limited resources in a sustainable, inclusive manner that accommodates and promotes sustainable agricultural practices.

5.4. Future research

1. Future studies may incorporate other factors such as agronomic and socio-economic factors in the sustainability of soybean production.

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APPENDICES

Appendix 3: Questionnaire

INFORMATION SHEET AND INFORMED CONSENT FORM

RESEARCH TOPIC: ASSESSING PERCEPTION OF SMALL-SCALE FARMERS ON FACTORS AFFECTING SUSTAINABILITY OF SOYBEAN PRODUCTION IN NKANGALA DISTRICT MUNICIPALITY.

RESEARCHER: MTHOMBENI VUTLHARI TRINITY

I am a student at the University of Mpumalanga enrolled for master's degree in Agricultural Extension and Rural Resource Management under the School of Agricultural Sciences. I am carrying out a research study on assessing the perception of small-scale farmers on factors affecting the sustainability of soybean production in Nkangala District Municipality as part of my academic requirement. Kindly assist me by answering the questionnaire freely and honestly. The survey questionnaire will take 10 to 20 minutes.

SUPERVISOR: DR KHWIDZILI R.H.

Co-Supervisor: Prof. Zwane E

Consent

PLEASE NOTE: This information is confidential and is going to be strictly used for the purpose of this research. No information will be disclosed to a third party without the participants consent.

If you decide to take part in this study, please note the following;

Your participation is completely voluntary.

All the identifying information that you have provided will remain confidential.

You have the right to withdraw from the study at any point without any penalty.

There is no direct or indirect risk of physical and emotional harm in this study.

Signature:

Questionnaire number:

Date:

QUESTIONNAIRE

Kindly Tick appropriate box

Demographic

1. Age	50 and under	51 and above			
2. Sex	Female	Male			
3. Marital status	Married	Widowed	Never married	Divorced	
4. Educational level	No formal education	Primary School	High School	Abet	Tertiary
5. Farming size (ha)	5 and below	6-10 ha	Above 11 ha		
6. Access to extension advisory	Yes	No			

SECTION A: Factors in the sustainability of soybean production

Instructions

The section is designed to measure small-scale farmers perceived attitudes on factors affecting sustainability of soybean productions. They will find the number of statements that will help them describes the factors affecting sustainability of soybean production. They are required to read each of the statements carefully and indicate with a tick their level of importance.

Each statement is guided by a set of possible answers, such as:

(a) Not at all important

(b) Slightly important
(c) Moderately important
(d) Very important
(e) Extremely important

FACTOR IN THE SUSTAINABILITY OF SOYBEAN PRODUCTION					
	(a)	(b)	(c)	(d)	(e)
Farming factors					
1. Farming labour					
2. Machinery					
3. Farm inputs					
4. Access to improved cultivar					
5. Equity in access to land					
Economic factors					
6. Access to growers credit					
7. Support from financial institution					
8. Transport cost					
9. Access to soybean marketing information					
10. Price stability					
Extension and education factors					
11. Extension training program					
12. E-extension					
13. Demonstration					
14. Extension visits					
15. Farmer Field School					
Social factors					
16. Cultural and community diversity					
17. Beliefs of farmers towards the soybean crop					
18. Use of indigenous knowledge					
19. Belief of farmers towards sustainable practices					
20. Cooperatives					
Policymaking factors					
21. Policy on sustainable agricultural practices					
22. Policy on agricultural resources					
23. Policy on price and marketing					
24. Policy on management of pests, weeds and disease control					
25. Policy on food security					

Section B: Sustainability of soybean production

Instruction

The section is designed to measure small-scale farmers perceived attitudes on sustainability of soybean productions. They will find the number of statements that will help them describes the sustainability of soybean production. They are required to read each of the statements carefully and indicate with a tick their level of importance.

Each statement is guided by a set of possible answers, such as:

(a) Strongly disagree with the statement
(b) Agree with the statement
(c) Neither agree or disagree with the statement
(d) Disagree with the statement
(e) Strongly disagree with the statement

Sustainability of soybean production					
	(a)	(b)	(c)	(d)	(e)
Environmental sustainability					
26. Soybean can help farmers maintain or improve their environmental aspect of sustainability.					
Economic sustainability					
27. Soybean can help farmers maintain or improve their economic aspect sustainability.					
Social sustainability					
28. Soybean can help farmers maintain or improve their social aspect of sustainability.					

Thank you!!!

Appendix 4: Certificate of Approval – Research proposal

UNIVERSITY OF MPUMALANGA

FACULTY OF AGRICULTURE AND NATURAL SCIENCES

Postgraduate Studies Committee

Certificate of Approval – Research Proposal

Date of this Approval:	01 October 2021

Student Details

1	Student Name:	VT MTHOMBENI
2	Student Number:	201740060
3	School	School of Agricultural Sciences
4	Degree Registered for:	Master of Agriculture
5	Date of First Registration:	February 2020
6	Supervisor(s): Co-supervisor:	Dr RH Khwidhzili Prof. E Zwane.

The research proposal entitled **Assessing perception of small-scale farmers on factors affecting sustainability in soybean production in Nkangala District Municipality** has been evaluated and approved by the Postgraduate Studies Committee of the Faculty of Agriculture and Natural Sciences.

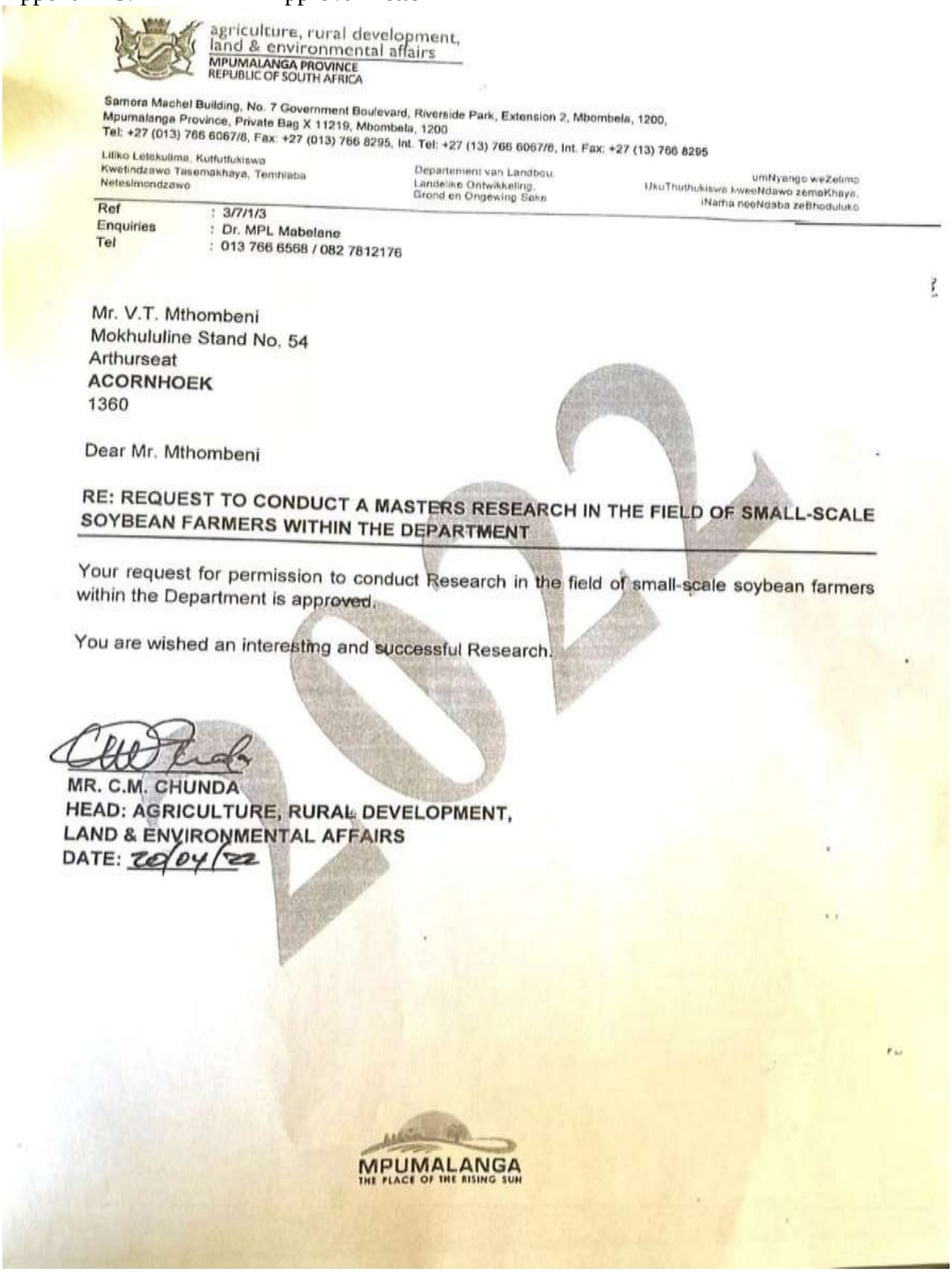
Chairperson: Prof. Victor Mlambo

UNIVERSITY OF MPUMALANGA
06 -10- 2021
FACULTY OF AGRICULTURE AND NATURAL SCIENCES

Signature:

Date & Official Stamp:

Appendix 5: DARDLEA Approval Letter



agriculture, rural development, land & environmental affairs
MPUMALANGA PROVINCE
REPUBLIC OF SOUTH AFRICA

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Litiko Letekulima, Kutfutfukiswa Kwetindzawo Tasemakhaya, Temhlaba Neteslmondzawo | Departement van Landbou, Landelike Ontwikkeling, Grond en Ongewing Seke | umNyango weZelimo lJkuThuthukiswa kweeNdawo zemaKhaya, iNarha neeNdaba zeBhoduluko

Ref : 3/7/1/3
Enquiries : Dr. MPL Mabelane
Tel : 013 766 6568 / 082 7812176

Mr. V.T. Mthombeni
Mokhululine Stand No. 54
Arthurseat
ACORNHOEK
1360

Dear Mr. Mthombeni

RE: REQUEST TO CONDUCT A MASTERS RESEARCH IN THE FIELD OF SMALL-SCALE SOYBEAN FARMERS WITHIN THE DEPARTMENT

Your request for permission to conduct Research in the field of small-scale soybean farmers within the Department is approved.

You are wished an interesting and successful Research.

MR. C.M. CHUNDA
HEAD: AGRICULTURE, RURAL DEVELOPMENT,
LAND & ENVIRONMENTAL AFFAIRS
DATE: 20/04/22

MPUMALANGA
THE PLACE OF THE RISING SUN

Appendix 6: Descriptive data

Items		Farming factors					Total
		Not at all important	Slightly important	Moderately important	Very important	Extremely important	
Farming labour	No. %.	0 0%	0 0%	50 24.5%%	88 43.1%%	66 32.4%	204 100%
Machinery	No. %.	0 0%	0 0%	54 26.5%	82 40.2%	68 33.3%	204 100%
Farm inputs	No. %.	0 0%	2 1.0%	45 22.1%	84 41.2%	73 35.8%	204 100%
Access to improved cultivar	No. %.	0 0%	0 0%	51 25.0%	88 43.1%	65 31.9%	204 100%
Equity in access to land	No. %.	0 0%	0 0%	51 25.0%	88 43.1%	65 31.9%	204 100%

Items		Economic factors					Total
		Not at all important	Slightly important	Moderately important	Very important	Extremely important	
Access to growers credit	No. %.	0 0%	0 0%	49 24.0%	88 43.1%	67 32.8%	204 100%
Support from financial institution	No. %.	0 0%	0 0%	52 25.5%	88 43.1%	64 31.3%	204 100%
Transport cost	No. %.	0 0%	0 0%	59 28.9%	83 40.7%	63 30.4%	204 100%
Access to soybean marketing information	No. %.	0 0%	0 0%	52 25.5%	84 41.2%	68 33.3%	204 100%
Price stability	No. %.	0 0%	0 0%	56 27.5%	82 40.2%	66 32.4%	204 100%

Items		Extension and education factors					Total
		Not at all important	Slightly important	Moderately important	Very important	Extremely important	
Extension training program	No. %.	0 0%	1 .5%	51 25.0%	84 41.2%%	68 33.3%	204 100%
E-extension	No. %.	0 0%	1 .5%	46 25.5%	92 45.1%	65 31.9%	204 100%
Demonstration	No. %.	0 0%	0 0%	56 27.5%	78 38.2%	70 34.3%	204 100%
Extension visits	No. %.	0 0%	0 0%	56 27.5%	83 40.7%	65 31.9%	204 100%
Farmer Field School	No. %.	0 0%	0 0%	53 26.0%	82 40.2%	69 33.8%	204 100%

Items		Social factors					Total
		Not at all important	Slightly important	Moderately important	Very important	Extremely important	
Cultural and community diversity	No. %.	0 0%	0 0%	57 27.9%	77 37.7%	70 33.3%	204 100%
Beliefs of farmers towards the soybean crop	No. %.	0 0%	1 .5%	53 26.0%	89 43.6%	61 29.7%	204 100%
Use of indigenous knowledge	No. %.	0 0%	0 0%	53 26.0%	89 43.6%	62 30.4%	204 100%
Belief of farmers towards sustainable practices	No. %.	0 0%	0 0%	58 28.4%	79 38.7%	67 32.8%	204 100%
Cooperatives	No. %.	0 0%	0 0%	52 25.5%	83 40.7%	69 33.8%	204 100%

Items		Policymaking factor					Total
		Not at all important	Slightly important	Moderately important	Very important	Extremely important	
Policy on sustainable agricultural practices	No. %.	0 0%	0 0%	57 27.9%	77 37.7%	70 34.3%	204 100%
Policy on agricultural resources	No. %.	0 0%	0 0%	54 26.5%	89 43.6%	61 29.9%	204 100%
Policy on price and marketing	No. %.	0 0%	0 0%	55 27.0%	79 38.7%	70 34.3%	204 100%
Policy on management of pests, weeds and disease control	No. %.	0 0%	0 0%	55 27.0%	92 45.1%	59 28.9%	204 100%
Policy on food security	No. %.	0 0%	1 .5%	46 22.5%	90 44.1%	67 32.8%	204 100%

Items		Sustainability of soybean production					Total
		Strongly disagree	Disagree	Neither agree or disagree	Agree	Strongly disagree	
Soybean can help farmers maintain or improve their environmental aspect of sustainability	No. %.	0 0%	1 0.5%	53 26%	89 43.6%	61 29.9%	204 100%
Soybean can help farmers maintain or improve their economic aspect sustainability	No. %.	0 0%	0 0%	53 26%	89 43.6%	62 30.4%	204 100%
Soybean can help farmers maintain or improve their social aspect of sustainability	No. %.	0 0%	0 0%	58 28.5%	79 38.7%	67 32.8%	204 100%

Demographic results					
1. Age	50 and under = 41.2%	51 and above = 48.8%			
2. Sex	Female = 42.2%	Male = 57.8%			
3. Marital status	Married = 40.2%	Widowed = 8.8%	Never married = 47.1%	Divorced = 3.9%	
4. Educational level	No formal education = 31.9%	Primary School = 36.3%	High School = 19.1%	Abet = 9.8%	Tertiary = 2.9%
5. Farming size (ha)	5 and below = 18.6%	6-10 ha = 69.6%	Above 11 = 11.8%		
6. Access to extension advisory	Yes = 96.6%	No = 3.4%			