DETERMINANTS OF FARMERS' PARTICIPATION IN IRISH POTATO PRODUCTION IN MOKHOTLONG DISTRICT, LESOTHO.

BY

MATSEBO HESHEPE (201703591)

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SUPERVISOR:

DR BRIAN MUROYIWA

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DECLARATION AND APPROVAL

Declaration

I, ‘Matsebo Heshepe, declare that the thesis is a record of original and independent research work carried out by me under the guidance and supervision of Dr. Brian Muroyiwa. This work has not been submitted elsewhere for any other degree or diploma. All sources of information used in this thesis have been duly acknowledged.

Signature……. Date…….

Approval

This thesis has been submitted to graduate school for examination under our approval as university supervisors.

Signature: ..... Date ……

Department of Agricultural Economics and Extension, National University of Lesotho

Signature: ..... Date……

DEDICATION

This thesis is dedicated to my family, whose unwavering support and encouragement have been my source of strength and motivation throughout this journey.

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LIST OF ACRONYMS

AfDB African Development Bank

APPSA Agricultural Productivity Programme for Southern Africa

BoS Bureau of Statistics

FAO Food and Agriculture Organization

FAOSTAT Food and Agriculture Organization Statistics

GDP Gross Domestic Product

GHG Green House Gas emissions

ICT Information Communication Technology

LBoS Lesotho Bureau of Statistics

LENA Lesotho News Agency

LENAFU Lesotho National Farmers' Union

NSDP National Strategic Development Plan

OLS Ordinary Least Squares

PLA Potato Lesotho Association

SADC Southern African Development Committee

SPSS. Software Program for Social Sciences

SSA Sub-Saharan Africa

UNICEF United Nations Children's Fund

WFP World Food Programme

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ABSTRACT

Potato farming is a very important activity in Mokhotlong, Lesotho contributing significantly towards household's food security and income. However, farmers are constraint from sustainable potato production by several factors. The main aim of this study was to analyze factors that influence participation of farmers in potato production in Mokhotlong, Lesotho. The survey used cross-sectional data that was obtained in 2024 from 99 potato farmers. A two-stage sampling procedure which includes purposive and simple random sampling was employed to construct a sample. Descriptive statistics and Binary Logistic Regression Model were used to analyze these factors. The results revealed that farmers are constraint from participating in potato by factors which include high production costs, lack of transport, pests and diseases encountered, lack of storage facilities and poor access to quality seeds. The Binary Logistic Regression Model results revealed that gender, age, social media access, source of income, level of education, access to seeds and distance to the market influence farmers to participate in potato farming. In light of these, it is recommended that the government should address the constraints and challenges. The Ministry of Agriculture, Food Security, and Nutrition should assist farmers in developing value chains and formulating marketing tactics to enhance their competitiveness. The Ministry should also encourage women 's participation in potato farming and establish training initiatives aimed at improving soil fertility and implementing crop rotation to boost women's participation in potato production.

Keywords: Potato farmers, potato production, participation, Mokhotlong

CHAPTER I

INTRODUCTION

1.1 Background of the study

Potatoes are an essential component of global agriculture, grown in 149 countries, and consumed by over a billion people daily (Wijesinha-Bettoni & Mouillé, 2019). Potato is the most important non-grain crop and tuber worldwide, playing a crucial role in maintaining global food security FAO, 2015). Potatoes are indigenous to all continents except Antarctica and can thrive in diverse climates, ranging from latitudes of 65^0 N to 50^0 S and altitudes from sea level to 4,000 meters (Birch *et al*., 2012). Potatoes rank among the top ten food commodities grown annually, featuring on a list of 50 food commodities that account for 90% of the world's calories, fat, and body weight (Gupta & Gupta, 2018). Research shows that potatoes are the fourth most crucial food crop globally, with developing countries producing over half of the world's production (Zaheer, K., & Akhtar, 2016).

Potato production serves two primary purposes: fresh markets and seed potatoes for planting. The global potato production stands at 361 million metric tonnes, with Asia contributing around 50% and Europe accounting for 30%. Africa, America, and Oceania contribute 7%, 12.6%, and 0.5%, respectively. China and India, the world's largest potato producers, account for over 30% of the world's potato production (Arora, 2024). The global per capita consumption of potatoes in 2018 was 32.3 kg, experiencing a 3.67% decline compared to 2017 and a 2.2% decrease compared to the consumption a decade earlier (Helgi Library, 2021). According to Gupta & Gupta, (2018), this rise in potato consumption can be attributed to a growing global population, rising incomes, rapid urbanization, and government policy interventions.

When determining crop patterns on farms, various factors are considered. Farmers aim to maximize income, but must also consider natural, economic, and political conditions. Sometimes farmers can tailor their production based on their knowledge and habits (Satyasai & Mehrotra, 2016). The crops grown on irrigable lands can change over time and under different conditions. For instance, farmers may opt for crops that require less water during dry periods, those with low costs during economic crises and high input prices, and those that require less labor during labor force shortages. Additionally, farmers' product choices can vary by region.

Potatoes serve as a primary crop and cultivated for winter use as an early-season potato. The significant benefit of early-season potato cultivation is that farmers can generate substantial income during winter when other crops are in short supply. According to LENAFU, (2021), potato yields in developing countries, such as Lesotho, remain low because of the limited availability of high-yielding and disease-resistant varieties and challenges with access to credit, climate variability, and trade barriers.

Many studies have delved into the economic aspects of potato cultivation, with experts like Burhan *et al*., (2022) exploring the topic. However, recent price fluctuations have emphasized the importance of this matter and called for further investigation. Instead of addressing production issues, imports contribute to higher potato prices when they rise, as highlighted by Devaux *et al*., (2021). This makes understanding farmers' decisions and the factors influencing them an essential task. In 2020, Southern Africa produced a total of 2.7 million tonnes of potatoes, with South Africa standing out as the leading producer within the SADC (FAOSTAT, 2024). Lesotho's agricultural sector is vital to its economy, contributing an average of 6 percent to the national Gross Domestic Product (GDP). However, the industry faces significant challenges such as hunger and food insecurity, underscoring the importance of recognizing the factors that impact farmers' participation in potato production. The introduction of potatoes in mountainous areas has shown promise in terms of improving land productivity and generating substantial cash income, contributing to the region's economic significance (Devaux *et al*., 2021).

Agriculture is a crucial sector in Lesotho's economy, providing jobs for around 60 percent of the population and contributing just 0.2 percent to the country's total exports, as indicated by FAO in 2013. Potatoes are the most abundant crop grown in Lesotho, followed closely by maize and vegetables. Potato production in Mokhotlong district, is significant due to the quality of soil and weather conditions that are suitable for potato cultivation. According to a recent study by LENA, (2024), Mokhotlong is one of the top-performing districts in Lesotho in terms of growing high-quality potatoes. While potato production declined by 2 percent from 1999 to 2009, vegetable production increased by 50 percent during the same period (FAO, 2013). Despite this trend, the potential for potato production in Mokhotlong remains significant and could help improve food security, generate income, and support agricultural development in the region.

As per the findings of Burhan *et al*., (2022), the crop pattern and rotation system of a farmer can be influenced by various critical factors. It is essential to closely monitor any changes that may occur over time, along with local production resources, to ensure optimal efficiency and increased income for farmers. Conducting research in this area can shed light on issues faced and help determine the most suitable agricultural policies to implement. The primary objective of this study is to identify and analyze the factors that influence the potato farming decisions of potato producers operating in the Mokhotlong district, Lesotho. The study aims to provide a comprehensive understanding of the drivers that shape farmers' decision-making process in the region, thereby contributing to the existing literature on agricultural practices and rural development.

1.2 Problem statement

The significance of potato production in Lesotho's economy cannot be overstated, as it serves as a vital source of income for many rural households (Mohlakoana, 2019). Potatoes are not only a staple food in the country but also represent a high-value crop that can significantly contribute to economic development. Bokaako, (2023) argued that the cultivation of potatoes provides employment opportunities and generates income for many smallholder farmers, particularly in rural areas where agriculture remains the primary livelihood source for approximately 70% of the population. However, despite its importance, the current production levels are suboptimal, with many farmers relying on traditional farming practices that yield minimal returns (Bokaako, 2023; Mohlakoana, 2019). Several challenges hinder the growth of potato production in Lesotho. One of the most pressing issues is the limited access to credit for small-scale farmers. Many of these farmers face significant difficulties in obtaining financial resources necessary for investing in better farming techniques and inputs, which in turn limits their ability to improve productivity and expand their operations (LENAFU, 2021). Additionally, trade barriers pose a significant challenge, as the agricultural sector is affected by policies that may restrict access to markets, both domestically and internationally. This situation can lead to reduced competitiveness of local produce compared to imports, further complicating the economic landscape for potato farmers (FAO, 2020).

Inadequate infrastructure and market access also play critical roles in the challenges faced by potato producers. Poor road networks and insufficient storage facilities limit farmers' ability to transport their products to markets efficiently, resulting in high post-harvest losses and reduced

profitability (World Bank Group, 2019). Furthermore, climate change presents a formidable threat to agricultural sustainability in Lesotho. The agricultural landscape is increasingly affected by climate variability, including erratic rainfall and extreme weather events, which pose significant risks to crop yields (World Bank Group, 2019).Compounding these issues is a notable knowledge gap regarding the best practices for potato cultivation. There is currently a lack of consensus on the key factors that influence potato production, which stifles innovation and the adoption of modern agricultural techniques. Many farmers continue to rely on outdated methods that do not maximize yield potential, thereby limiting the overall productivity of the sector (LENAFU, 2021).

1.3 Research questions

a) What are the socioeconomic characteristics of potato farmers in Mokhotlong district of Lesotho?
b) What are the constraints associated with potato farming in Mokhotlong district of Lesotho?
c) What are the factors that influence potato production in Mokhotlong district of Lesotho?

1.4 Objectives

1.4.1 Overall Objective;

To analyze the factors influencing farmers' participation in potato production in Mokhotlong district.

1.4.2 Specific Objectives;

- To describe the socioeconomic characteristics of potato farmers in Mokhotlong district of Lesotho.
- To examine the constraints associated with potato farming in Mokhotlong district of Lesotho.
- To identify the factors influencing potato production in Mokhotlong district of Lesotho.

1.5 Hypothesis

Null Hypothesis (H_{01}): There is no constraints associated with potato production.

Alternative Hypothesis (H_{11}): There is constraints associated with potato production.

Null Hypothesis (H_{02}): There is no significant effect of the identified factors on farmers' participation in potato production.

Alternative Hypothesis (H_{12}): There is a significant effect of the identified factors on farmers' participation in potato production.

1.6 Significance of the study

These findings of the study are expected to have a positive impact on the potato farming community of Mokhotlong. By shedding light on the factors that encourage or impede potato production participation, farmers can make more informed decisions that align with their objectives, thereby enhancing productivity and livelihoods. With this knowledge, agricultural policymakers and government officials in Lesotho can design more effective and targeted policies to promote sustainable agricultural practices, contributing to the growth of the agricultural sector and rural development.

Moreover, the insights gleaned from this study are of interest to international development organizations, NGOs, and researchers working on agricultural development. The context-specific understanding of Mokhotlong's potato production dynamics serves as a valuable case study, offering lessons that could be applied to similar regions facing similar challenges globally. The study's outcomes may contribute to the broader knowledge base on sustainable agricultural practices and rural development strategies.

Private sector stakeholders such as marketers, processors, and agricultural suppliers might also benefit from this study's findings. An in-depth understanding of the factors influencing farmers' decisions can help these stakeholders tailor their offerings to better meet the needs and preferences of potato producers in the Mokhotlong district. Finally, this study fills a gap in existing research on potato production participation in Lesotho, adding empirical insights into a specific geographic context and contributing to the knowledge of agricultural economics, rural sociology, and development studies.

1.7 Limitations of the study

Participants may be compelled to provide socially appropriate responses or omit certain information, giving an incomplete or inaccurate picture of their motivations, challenges, and choices related to potato production. Because of a lack of record keeping, respondents may not be able to provide accurate reports of their potato production, prices, and earnings. However, to minimize this problem, different approaches were used, which. involved asking different questions for the same result.

1.8 Delimitation of the study

The scope of this study was limited to the Mokhotlong district of Lesotho and does not encompass other regions or districts within the country, despite any potential variations that may exist. The main objective of this research is to gain insights into the farmers' perspectives, experiences, and decision-making processes involved in potato production. While acknowledging the impact of climate on potato production, the investigation focused solely on their influence on farmers' decisions and actions. The involvement of other stakeholders, such as government officials or market intermediaries, was limited. Although this study acknowledges the broader socioeconomic factors that influence agricultural practices, its primary focus will be on those directly related to farmers' participation in potato production. The study employed specific data collection methods, such as surveys and interviews, to gather information from farmers. Due to time and resource constraints, other methods such as focus groups were not included.

Definitions of major concepts/terms used

Participation; refers to the active involvement of farmers, agricultural stakeholders, and communities in the various stages of potato farming. Participation in potato production often extends beyond individual farmers to include collaboration with agricultural extension services, cooperatives, and other partners to enhance productivity, share knowledge, and improve market access (FAO, 2013).

Potato production; refers to the process of cultivating, growing, and harvesting potatoes as a crop. This includes various stages such as seed selection, land preparation, planting, irrigation, pest and disease management, fertilization, harvesting, and post-harvest handling (Devaux *et al*., 2021).

1.9 Outline of the Study

This research study contains five chapters. Chapter 1 presents an introduction to the study, the background to the study, the statement of the problem, the aim, objectives, limitations and delimitations, significance of the study, definition of terms and study organization. Chapter 2 presents the conceptual and theoretical literature on the factors influencing participation of farmers in potato production. Additionally, chapter 3 is the methodological approach used in undertaking this research. Chapter 4 presents the collected data and its interpretation. It also discusses the findings in relation to the objectives of the study, the literature and theory and makes an analysis with regards to the aim of the study. Lastly, chapter 5 presents the conclusions drawn from the findings and makes some recommendations

CHAPTER II

LITERATURE REVIEW

2.1 Introduction

This chapter intends to give a brief outline of the literature on participants' socio-economic characteristics and factors affecting their participation in potato farming. Lastly, the chapter reviews the constraints associated with participation of farmers in potato production.

2.2 Background of Agriculture in Lesotho

Farming is the primary source of income in Lesotho and plays a crucial role in food security and rural employment (NSDP II, 2019). Nevertheless, it has a limited impact on poverty reduction since it fails to fully meet households' food requirements. Consequently, nearly half of the population (49.7%) lives below the poverty line. Lesotho's Global Hunger Index score of 32.4 highlights severe food insecurity in the nation (World Bank Group, 2019). The country practices both subsistence and semi-commercial farming, with smallholder farmers characterized by low productivity (Mofolo & Kheleli, 2021). According to the NSDP II, (2019), over 70% of rural households in Lesotho engage in subsistence agriculture. However, Rantšo & Seboka, (2019) noted that this mainly involves small-scale farmers with fragmented land plots, leading to low crop yields. Unfortunately, this form of farming is ineffective in reducing poverty as it does not supply sufficient food for households. Typically, farming in Lesotho revolves around a three-month monoculture of crops like maize, wheat, or potatoes. Additionally, due to shifting climatic and agro-ecological conditions, such as irregular rainfall and frequent droughts, the agricultural sector, which forms the backbone of the rural economy, has remained stagnant since the early 1990s (AfDB, 2013). In Lesotho, the majority of rural residents depend on agriculture for their livelihoods. Specifically, 70% to 80% of the population is engaged in this sector, which mainly involves low-input, low-output rain-fed wheat cultivation and extensive livestock grazing (Mofolo & Kheleli, 2021). For enhanced crop production, farmers in Lesotho need quick, comprehensive, and high-quality agricultural information (Mojaki & Keregero, 2019). Traditionally, agricultural extension workers would visit farmers to provide advice, but this approach is becoming outdated. Unfortunately, more than 90% of farmers still use animal-drawn farm implements for ploughing, planting, ridging, and harvesting, leading to low production and significant production losses.

2.2.1 The importance of potato production in Lesotho

Potato production in Lesotho plays a crucial role in enhancing food security and rural livelihoods. The country's high-altitude regions provide ideal climatic conditions for potato farming, with

research indicating that late cultivars planted in higher altitudes can minimize risks associated with late frosts and improve yield potential (Mphahama, 2011). However, the reliance on chemical inputs raises concerns regarding environmental sustainability and human health (Devaux *et al*., 2021). The potato sector is recognized as a high-value crop that can significantly contribute to the rural economy of Lesotho. Despite this potential, farmers face challenges in enhancing productivity, stabilizing production, and accessing processing facilities (LENAFU, 2021). The economic landscape of Lesotho's agriculture is characterized by a decline in the sector's contribution to GDP, emphasizing the need for targeted interventions to boost productivity and market access (Citaristi, 2022). Potato farming holds significant importance in Lesotho, contributing significantly to the local communities and the nation's economy by generating job opportunities for both the unemployed and self-employed individuals (Mphahama, 2011). Potatoes are a staple and popular food source in Lesotho. However, potato cultivation lags behind other essential crops such as grain, wheat, sorghum, and pulses (Molahlehi *et al*., 2013). Small-scale traditional methods are predominantly used for potato farming in Lesotho (Mofolo & Kheleli, 2021). Nevertheless, aspiring small-scale farmers, under the guidance of the Potato Lesotho Association (PLA) and the Lesotho National Farmers Union, are aiming to transition from subsistence to commercial potato farming (LENAFU, 2021). In a country where 58% of the population resides in rural areas and 70% of households rely on subsistence farming and livestock, agriculture continues to be crucial for rural livelihoods (Akintunde & Oladele, 2019).

LENAFU, (2021) asserts that the potato industry has struggled to grow due to low farm productivity, unstable production, and limited processing facilities for farmers. The study also found that households typically prioritize planting crops for food security over income generation. However, potatoes have the potential to significantly boost the rural economy as a high-value crop that can generate revenue. Unfortunately, heavy reliance on pesticides and fungicides to maintain production negatively impacts both the environment and human health. On a positive note, the cold temperatures in potato-growing regions have potential for high yields and excellent quality production (LENAFU, 2021). The right to food security is acknowledged worldwide, but certain developing countries, such as Lesotho, face challenges in providing enough food for their population (Mwembe *et al*., 2021). According to the NSDP II, (2019), it is projected that 78% of the rural population will continue to experience food insecurity in the future. Citaristi, (2022) asserts that Lesotho's food security worsened in 2022 due to various factors, including a three-year

drought, the socioeconomic effects of COVID-19, a global food crisis, excessive rainfall during the growing season affecting production, and decreased revenue from livestock and related products. Agricultural production is the primary source of income and food security for rural households, accounting for 70% of their earnings. Despite a decline in productivity, agriculture remains one of the most crucial sectors in the country, with the potential to drive sustainable economic growth, facilitate job creation, generate income, and alleviate poverty (Bokaako, 2023).

The NSDP II underscores the significance of promoting sustainable commercial agriculture as a vital measure through diversify of crops. However, with fewer livelihood opportunities, such as reduced job options, remittances, and income from animals, coupled with increasing food and commodity prices, the Lesotho Vulnerability Assessment Committee (LVAC, 2022) anticipated a rise in food insecurity. It is estimated that 521,000 Basotho, equivalent to almost 25% of the population, will experience food insecurity, with approximately 470,000 people affected in 2021 and 2022, including around 320,000 in rural areas and 201,000 in urban areas. Food insecurity was projected to particularly impact poor and very poor households and worsen slightly during the lean season from October 2022 to March 2023 (The government of Lesotho, 2022).

2.3 Empirical Literature

2.3.1 Socioeconomic characteristics of farmers influencing participation in potato farming

Various socio-economic factors may influence potato farmers participation in potato production. It is important to establish views of previous scholars on this subject. In a study conducted on India, Arun *et al*., (2010) opined that farmers in irrigated areas produced primarily the Kufri Jyoti variety of potatoes. These farmers had higher non-farm income, and planted a larger percentage of potatoes on their cultivated land. Farmers in rain-fed areas lagged behind their counterparts in irrigated areas in the adoption of potato technologies. The study also highlighted that increasing potato yield was significantly aided by the introduction of new technology. Arun *et al*., (2010) utilized regression analysis to clearly show that a 1% increase in the use of potato production technology would boost yield in rain-fed and irrigated areas by 0.88% and 0.96 percent, respectively. However, the main obstacles faced by potato producers in rain-fed and irrigated areas were the insufficient amount of healthy seed, the absence of a late blight forecasting system, and the poor effectiveness of mancozeb in preventing late blight (Arun *et al*.,2010).

According to a study by Fayera (2018) that assessed gender roles in potato production and marketing, women played a significant role in seed collection (46.3%), land preparation (60.3%),

planting (96.8%), weeding (50.3%), cultivation (32.6%), harvesting (38%), transporting (39.9%), and marketing (68.9%). While men primarily dominated the potato production and marketing field, women were occasionally involved as well. The study identified several barriers to women's participation, including a lack of access to and control of assets (19.2%), limited control over income (30.6%), insufficient land (6.7%), and inadequate decision-making power in potato production (39.9%).

Abebe, (2015) argued that farmers' selling decisions are influenced by several socioeconomic factors, such as ethnicity, religion, age, education, farm size, wealth, and geography. Farmers who sell their produce directly without intermediaries experienced a 225% increase in gross profit. This could have been due to the ability of the farmers to access better-quality inputs, more favorable contract terms, and higher prices for their crops. However, most farmers still preferred to work with middlemen. Yassin *et al*., (2016) found that family size and participation in off-farm/non-farm activities might negatively affect potato sales. Conversely, livestock ownership and access to market information positively influenced farmers' potato sales. Abitew *et al*., (2015) used descriptive statistics and OLS to analyze variations in age, dependence ratio, access to market information, and production quantity across households. Their study found that potato production volume, animal ownership, and farming experience significantly impacted the household potato supply at different probability levels. Moreover, Mudege, (2015) indicated that agricultural market interventions that do not address underlying social structures, such as gender relations and resource access, will disproportionately benefit certain groups in this case, men over women.

Enete and Igbogwe (2009) found that price had an important influence on the level of farmers' market participation in cassava markets which is supported by economic theory that price induces increased supply. Omiti *et al*., (2009) also asserted that better output price and market information were key incentives for increased sales in the market, while household size and non-farm income significantly reduced the sales of vegetables in the market. Enete and Igbogwe (2009) further found that the probability of market participation declined with declining farm size for sellers of cassava but increased with farm sizes for buyers though not significant in either case. Gebremedhim and Hoekstra (2007) found size of cultivable land, human and physical capital to be important factors in inducing smallholder market participation. Farmers with bigger cultivable land were found to participate more because of their ability to produce bigger volumes that ensured marketed surpluses. Furthermore, Lerman (2004) found household labour to be an influential but cheaper

asset that leads to higher production volumes and positively influences farmers' market participation.

Boughton *et al*., (2007) used an asset-based approach to study patterns of household market participation in Mozambique. The authors found that private household assets especially land, livestock and farm equipment positively affected crop market participation. Barret, (2007), studying market participation in staple grains, found that barriers to participation in markets by smallholders were mainly land, livestock, capital and improved technologies like farm equipment needed to generate a surplus that influenced market participation. Pravakar *et al*., (2010) on the other hand found that households with larger land holdings per adult member sold larger volumes of their produce as compared to those with smaller land holdings. The authors further found that households with larger livestock endowments produced and sold more crop produce. They explained that it was because the households used manures from the livestock to enhance crop yields. However, Jaleta (2009) pointed out that ownership of livestock by a household negatively affected its participation in the crop market because it distracts the farmer into an alternative source of income.

2.4 Factors Influencing Farmers' Participation in Potato Production

2.4.1 Socio-Economic factors

In potato production, socio-economic factors refer to the social and economic conditions that influence individual' or communities' involvement in farming activities. These factors include income levels, education, access to resources, market opportunities, labor availability, and social norms, which collectively affect the ability and motivation to participate in potato production. As reported by Mukamana *et al*., (2018) identified income and farming experience as key factors influencing farmers' participation in agro-processing markets in South Africa. The study found that higher non-farm income negatively impacted market participation, as farmers with more non-farm income invested less in farming and consumed more of their produce, reducing their market involvement. However, off-farm income had a positive effect on the quantity of output sold, as it helped farmers cover transportation costs. Additionally, farming experience positively influenced market participation, serving as a proxy for effective farm management, market information access, and marketing intelligence in competitive markets (Mukamana et al., 2018). Abitew *et al*., (2015) found that household differences, such as age, dependency ratio, access to market information, and production quantity, were associated with varying levels of potato supply at the household level. Significant factors included livestock ownership and farming experience. Sebatta *et al*., (2014) discovered that non-farm income negatively affected the level of market participation among potato farmers, with a positive influence on their decision to participate.

Negerssa *et al*., (2020) conducted a study in Ethiopia to identify factors that influence the market participation among smallholder vegetable producers using the probit model and in their study socio-economic characteristics such as education level, family size and age of farmers were statistically significant determinants of market participation. Both age and family size were found to have a negative influence on market participation while education level was found to influence farmers' participation in vegetable markets. For the positive impact of education on market engagement, the argument is that education is a proxy for information access and farm management that, in turn, improves their productivity thus increasing the marketable output. Family size had a negative influence in this study, they argued that the number of people in the household increases family consumption thus reducing the marketable surplus, and they argued that older farmers are risk-averse and they lack access to market information and productive technology as opposed to younger farmers hence the is an inverse relationship between age and market participation. Tarekegn and Kibreab (2017) evaluated determinants of poultry market

participation decisions in Southern Ethiopia and among the significant variables, flock size was determined to have a positive influence on farmers' decision to participate in the market and the level of output sold in the market. These authors argued that the large poultry size on the farm ensures that family consumption does not significantly reduce the quantity to be sold in the market. The same results were found by Goitom *et al*., (2018) as they confirmed that flock size ensures a quantity that drives farmers to commercialize. The large size of poultry stock creates an opportunity for farmers to negotiate prices and increases the probability of farmers securing contracts (Goitom *et al*., 2018).

2.4.2 Marketing factors

Marketing factors in potato farming refer to the elements that influence the sale and distribution of potatoes, including market demand, pricing, competition, distribution channels, quality standards and consumer preferences. The factors determine how effectively farmers can sell their produce and maximize profits. Market infrastructure, including transportation networks, storage facilities, and access to market information, significantly affect farmers' participation in potato production (Angwenyi, 2016). Efficient market infrastructure reduces post-harvest losses and ensures that farmers can sell their produce at favourable prices. Adhikari *et al*., (2019) reported that farmers' participation in potato production was positively correlated with the availability of good market infrastructure, as it facilitated timely access to markets and reduced the cost of transportation. Similarly, Muthoni *et al*., (2022) highlighted that inadequate market infrastructure in rural areas of Kenya resulted in low potato prices, discouraging farmers from expanding their production. Small-scale farmers in many developing nations are often underserved by markets, leading to agricultural market failure due to their limited access to information and knowledge inequality between farmers and buyers (Barrett *et al*., 2022). Smallholder farmers face challenges in obtaining essential marketing information, dealing with intermediary collusion, and managing inadequate transportation infrastructure which therefore hinder their participation in potato farming (Barrett *et al*., 2022).

Sigei *et al*., (2014) reported that farmers with access to pre-sale price information could make more informed decisions about their output quantity and selling location. Additionally, Moono, (2015) emphasized that access to such information encourages farmers to participate in market activities, and higher output prices help them cover transaction costs. Kumilachew, (2016) argue that potato production can be a profitable and semi-commercialized venture. The results suggested that

positive and significant correlations exist for potato sales and variables that include off-farm income, information access, seed improvement, and irrigation use, while the number of plots has a negative correlation. Yassin *et al*., (2016) also discovered that factors such as education level, livestock count, potato market price, and access to market information influence farmers' decisions to participate in the potato output market. However, off-farm/non-farm activities have a negative impact on this factor.

Many smallholder farmers struggle with transporting and selling their crops due to limited storage and processing facilities, leading to significant post-harvest losses (Ayim *et al*., 2022). Additionally, regions with underdeveloped road and transportation systems often lack reliable markets for agricultural inputs and outputs, negatively impacting smallholder farmers (Atiso *et al*., 2021). Businesses face challenges due to unstable production and supply capacity, limited market knowledge, and weak negotiation power, resulting in narrow profit margins. Consequently, smallholder farmers often receive lower earnings when selling their products directly at the farm gate (Atiso *et al*., 2021). Lukungu (2022) stresses the importance of providing information to rural populations, especially those with limited literacy skills, to enable them to make informed decisions and actively contribute to national development, particularly in agriculture. Musingafi *et al*., (2015) also argue that capacity-building is crucial for encouraging the adoption and effective use of Information Communication Technologies (ICTs) in society. However, the use of communication technology is hindered by factors such as illiteracy, technical limitations, and a lack of practical digital resources (Khan *et al*., 2024).

Farmer market access is a vital component of market participation. A smallholder farmer can access the market either by selling to a buyer at the farm gate or physically transporting the produce to the market place using available means. A number of scholars have researched about what drives farmers' market access and much has been revealed, for instance, Jari and Fraser (2009) found that good road condition and access to information positively influenced farmer participation and access to markets due to their effect on reduction in transaction costs. In Ethiopia, challenges such as inadequate knowledge of agronomic and crop protection management technologies, limited access to market information, input supply, and credit have been identified as important factors affecting potato production (Bukul, 2018). Meanwhile, positive factors influencing potato production in Rwanda include gender, age, family size, farming background, livestock ownership, total area cultivated, farm gate prices, access to credit, extension services, and training on farm

records. However, distance to market and natural control of pests and diseases were identified as negative factors (Manishimwe *et al*., 2019). A central Ethiopian study found that farmers' gross margin was influenced by varying degrees of factors such as education level, household size, and size of cultivated land (Mersha & Asahel, 2017).

Moraket (2001) found that 19% of sampled households sold their fruits and vegetables through various market outlets, ranging from informal markets to large urban fresh produce markets. Households producing fruits and vegetables often own dry land plots, which are typically used to grow maize and other field crops. Hirpa *et al*., (2016) stated that the informal seed system and seed potato value chains were negatively affected by a poor enabling environment. This included inadequate technical support, lack of quality control, substandard storage and transportation technologies, low-quality farm management practices, and limited inputs. The alternative seed system faced major challenges such as the absence of a quality control mechanism for seed potatoes, ineffective farming techniques, limited input use by seed potato farmers, and market distortions caused by institutional buyers.

2.4.3 Institutional factors

Institutional factors encompass the policies, regulatory frameworks, and organizational structures that influence the production, distribution, and marketing of potatoes (Kubungo, 2014). These factors include access to extension services, availability of financial credit, government interventions, all of which significantly shape the farming environment and productivity outcomes. Agricultural extension services are vital in providing farmers with the necessary knowledge and skills to improve potato production. Extension services offer training on modern farming practices, pest and disease management, and post-harvest handling. A study by Chirwa and Matita (2016) in Malawi emphasized that farmers who received extension support were more likely to adopt improved potato varieties and farming techniques, leading to higher productivity. The lack of extension services, on the other hand, was identified as a major constraint in potato production, as highlighted by Kanyua *et al.*, (2018), who noted that inadequate extension services limit farmers' access to the latest agricultural innovations. Mussema, (2006) analyzed the pepper marketing chain and identified several factors affecting marketable supply, including market access, production level, extension contact, and access to market information. Similarly, Gizachew (2006) investigated the factors affecting dairy supply, such as household demographic traits, transaction costs, physical and financial wealth, education level, and extension visits.

An empirical study by Abdul-Hanan *et al*., (2014) while investigating determinants of rice farmers' participation in direct marketing channels revealed that access to credit had a significant influence on market participation. The study argued that constant access to credit facilities increases farmers' investment in agriculture through securing productive inputs and technology that improves their output level. These results are in line with the results obtained by Tura *et al*., (2016) where credit access by teff farmers in Ethiopia was found to have a significant positive impact on both market participation and intensity of marketed surplus and the reason for these was linked to the ability of credit in helping farmers to pay for all transaction costs on inputs and output.

Moono, (2015) evaluated factors influencing the market participation of rice farmers in Zambia where membership in farmers' organizations had a significant and positive influence on the probability of market participation and intensity of output sold in the market. The reasons attributed to this impact are that farmers' organizations improve farmers' access to productive inputs, and access to market information and they enhance farmers' bargaining power while negotiating the prices for their output. Jaqwe (2007) emphasized that belonging to a farmer's group, household size and distance to the market significantly influenced extent of farmers' participation in banana markets. The author found that farmers who belonged to a farmers' group had cohesion in terms of gaining and sharing knowledge as well as capacity to produce more for a marketable surplus.

Shepherd (2007) also suggested collective action in form of farmer cooperatives or groups to increase smallholder market participation. Njuki *et al*., (2006), however added that forming farmer groups though recognized as essential for efficient farmer learning, receiving external support and achieving economies of scale, it must be accompanied by incentives to participate in markets. Jaleta (2009) on the other hand, found that household crop market participation was determined by literacy of the head of household, nearness to the market place and household's market orientation, which is the making of production decisions based on market signals. Jaqwe (2009) found that transaction cost-related factors such as geographical location, market information sources, and travel time to the nearest market, labour availability, farming experience, gender of household head, off-farm income and household asset base affect smallholders' likelihood and intensity of participation in markets.

2.5 Constraints associated with participation in potato farming

Potato farming is a crucial source of income for many farmers. However, there are several challenges associated with effectively participating in this activity. According to a study by Ahmed

et al., (2022), efficient use of resources such as modern technology, fertilizers, and other inputs is necessary to improve the current situation. Another study by Zheng *et al*., (2024) found that participating in rural e-commerce can increase potato farmers' income. Factors such as cooperative participation and position in the village are important for building a long-term mechanism to promote farmers' income. Alemu, (2014) used the value chain framework to show that different actors play various roles within the potato value chains. Notably, public sector actors manage the input supply and production stages, while the private sector handles trading and marketing. Despite favorable land and climatic conditions, high productivity potential, and a supportive policy environment for agricultural development, the value chain is hindered by several factors. These include inadequate input supply, high input prices, inappropriate delivery systems, poor harvesting technology, limited knowledge about post-harvest handling, lack of support for producers and traders, poor infrastructure, lack of market information, and incomplete integration among value chain actors.

Low potato productivity in Africa is mainly due to a lack of good-quality seed potatoes of improved cultivars, inadequate utilization of better varieties, and limited use of modern crop management techniques (Thomas-Sharma *et al*., 2016). Over 95% of seed potatoes in SSA are obtained from regional sources, as stated by Kaguongongo *et al*., (2014). World bank, (2008) puts to light the fact that especially for seed and fertilizer, market failures continue to be pervasive in Sub-Saharan Africa because of high transaction costs, risks and low economies of scale. Johnson *et al*., (2003) noted that the green revolution in Asia spurred economic growth and reduced rural poverty significantly because many smallholders accessed inputs like improved seed and fertilizer profitably. Jayne *et al*., (2010) stated that most smallholders lack the land and other resources to produce a surplus. Aliquma *et al*., (2007) found that the low crop yields were attributed to farmers' failure to use improved inputs leading to lack of competitive production and low market participation.

Insect pest, disease and weed management in potato cultivation are very important practices, as they have negative effects that lead to reduced yields. Chilipa *et al*., (2021) indicated that farmers in Mbala district are employing a number of management strategies in their potato cultivation. However, the proportion of farmers recorded as not practicing crop management (30.2%). Similarly, Echodua *et al*., (2019) reported that farmers failed to distinguish disease symptoms as a crop management strategy. This may have some bearing on low production as farmers would not

realize the full potential of the crop yield. Furthermore, not using resistant varieties as a control measure could be due to the inability of farmers to purchase the resistant varieties, the unavailability of known resistant varieties and, to a lesser extent, the lack of knowledge of resistant varieties among farmers (Echodua *et al*., 2019). High cost of inputs, especially seeds, fungicides, and fertilizers greatly limit the production of ware potatoes in Kenya (Kaguongo *et al*., 2008). This leads to under application of fungicides and fertilizers, and coupled with poor quality seeds, the net returns to the farmers are minimal. Seed prices vary with varieties and from one area to another, with prices of most improved varieties having higher prices compared to the local varieties (Kaguongo *et al*., 2008). Higher cost of inputs is to a large extent a reflection of poor producer prices (Nganga *et al*., 2003). Low producer prices are mainly due to seasonality of production coupled by lack of proper non-farm storage methods and monopolization of market by the middlemen who exploit the small-scale producers (Talal & Barbara, 2017). The immediate cash needs and lack of appropriate preservation techniques force farmers to sell their produce from the field at a price dictated by middlemen.

Amon *et al*., (2014) emphasized that rainfall variations, lack of clean seeds, and crop diseases are the major issues facing potato production in Kenya. The study results indicated that 45% of the respondents attribute decreased potato yields to rainfall variation, 33% to a lack of clean seeds, and 6% to crop diseases (Amon *et al*., 2014). Ensuring the protection of potato yields amidst unpredictable weather patterns involves taking into account plant diseases and storage expenses. While the scarcity of seasonal laborers poses a significant challenge, the search for skilled workers, particularly in positions such as machine operators and potato sorters, remains a hindrance for potato producers. Fortunately, smart farming methods can help mitigate certain technical obstacles in the potato industry (Clarke and Williams, 2016).

2.5.1 Influence of climate variability and environmental conditions on farmers' decision to engage in potato farming

Climate change is a consequence of anthropogenic greenhouse gas (GHG) emissions related to resource consumption and production processes, which simultaneously influence the productive basis of the economy and human living conditions (Jannat *et al*., 2021). Climate variability, characterized by unpredictable rainfall patterns and temperature fluctuations, plays a crucial role in shaping agricultural practices in SSA, including potato farming. (Hirpa et al., 2016) reported

that in the Ethiopian Highlands, irregular rainfall and increasing temperatures have led to significant reductions in potato yields. This has forced many farmers to reconsider their commitment to potato farming, particularly in regions where climate change is exacerbating these challenges. In Kenya, a study by Amon *et al*., (2014) examined the impact of climate variability on potato production in the Central Highlands. The findings indicated that unpredictable weather patterns, especially late onset and early cessation of rains, negatively affected potato yields. Farmers in the region reported difficulties in planning planting and harvesting times, which are crucial for maximizing potato production. As a result, some farmers have shifted to other crops that are perceived to be less vulnerable to climatic fluctuations.

Environmental conditions such as soil fertility, altitude, and water availability are critical factors influencing farmers' decisions to engage in potato farming in Sub-Saharan Africa. Potatoes thrive in well-drained, fertile soils, which are increasingly scarce in many parts of SSA due to land degradation and poor soil management practices. Nkurunziza *et al*., (2015) reported that in Rwanda, declining soil fertility is a major constraint for potato farmers, leading some to either abandon potato farming or reduce the area under cultivation. In addition, water availability significantly affects potato farming decisions. Potatoes require consistent moisture, particularly during tuber formation. However, water scarcity is a growing concern in many parts of SSA, exacerbated by prolonged droughts and competition for water resources. Namugwanya *et al*., (2016) found that water shortages during critical growing periods forced many farmers to reduce the scale of their potato farming or switch to drought-tolerant crops like cassava and millet in Uganda. These environmental challenges have led to a reduction in potato farming across several regions in SSA, as farmers seek alternative crops that are better suited to the increasingly harsh conditions.

Nonetheless, to cope with the challenges posed by climate variability and unfavorable environmental conditions, farmers in SSA have adopted various adaptation strategies. These include altering planting schedules, adopting improved potato varieties, and implementing water-saving irrigation techniques. In Tanzania, farmers who adopted early-maturing and drought-resistant potato varieties were found to be more resilient to climate variability, allowing them to continue potato farming even under adverse conditions (Ndunguru et al., 2016). Similarly, some farmers have embraced soil conservation practices, such as terracing and the use of organic fertilizers, to combat soil degradation and improve potato yields. However, the adoption of these

strategies is often limited by factors such as lack of access to resources, information, and technology. Kamanga *et al*., (2015) noted that while many farmers in Malawi were aware of adaptation strategies, financial constraints and limited access to extension services hindered their ability to implement these measures effectively.

2.6 Conceptual Framework

A conceptual framework, according to Kivunja, (2018), acts as a foundational structure that visually represents the interconnections between variables explaining a research problem. It's a way for researchers to showcase their understanding of a topic, including how different concepts relate to empirical research and the primary theories supporting and enriching scientific knowledge (Adom, Hussain, and Joe, 2018). These frameworks can be graphical diagrams or narratives, highlighting key variables or constructs to be studied and their presumed relationships, aiding researchers in gaining a comprehensive understanding of the phenomenon under investigation.

In this study, the conceptual framework assumes that farmers' engagement in potato production is influenced by several factors, categorized into three groups: socio-economic, institutional, and technological. Socio-economic factors encompass demographics like age, gender, education level, household size, income, and land ownership. Institutional factors include access to extension services, credit, transportation, and membership in farmer organizations. Additionally, the framework acknowledges constraints like high input costs, information gaps, market limitations, lack of training, and pest issues, all of which pose challenges to farmers and impact their participation levels in potato farming. Addressing these constraints is vital for enhancing participation and ensuring sustainable potato farming practices.

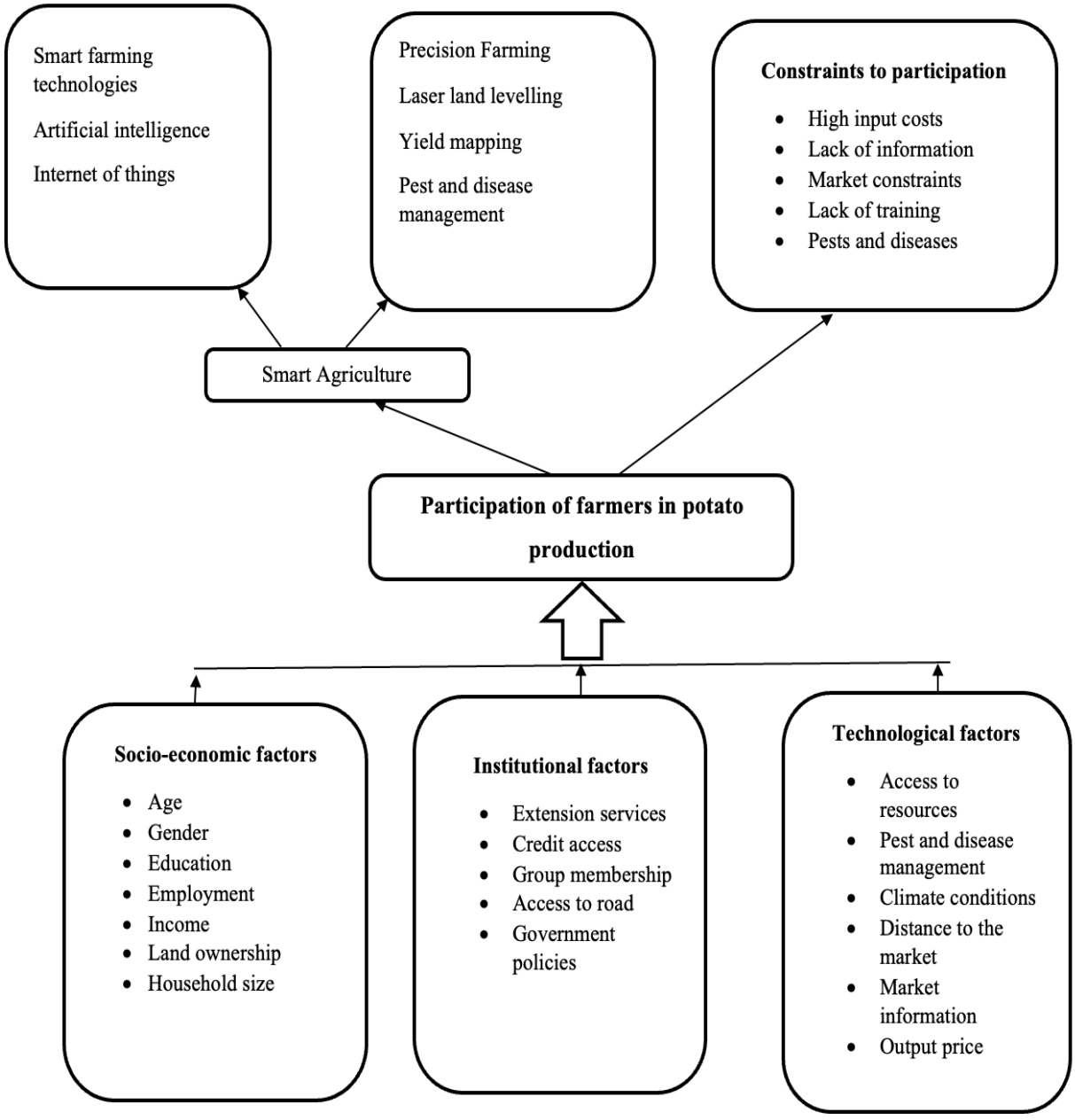

Figure 1: Conceptual framework

2.7 Chapter Summary

This chapter provided a comprehensive review of the literature related to potato farming in Lesotho. It begins by discussing the broader agricultural background, highlighting the sector's role in livelihoods and food security despite challenges such as harsh climatic conditions and limited arable land. The chapter also highlighted the importance and current status of potato production, emphasizing its economic and food security contributions. Key factors influencing farmers'

participation in potato farming were explored, including socio-economic characteristics, market and institutional factors, and environmental conditions like climate variability. The chapter further examined the constraints faced by potato farmers, such as limited access to quality inputs and market challenges, and presented a conceptual framework that integrates these factors to understand the dynamics of potato farming in Lesotho. The research methodology used in the study is detailed in the following chapter.

CHAPTER III

METHODOLOGY

3.1 Introduction

This chapter presents a description of the study area, research design, and methodology adopted in this research. It stipulates the rationale that will be used by the researcher in choosing the research design, data collection method, sampling technique, sample size determination, and data analysis.

3.2 Description of the study area

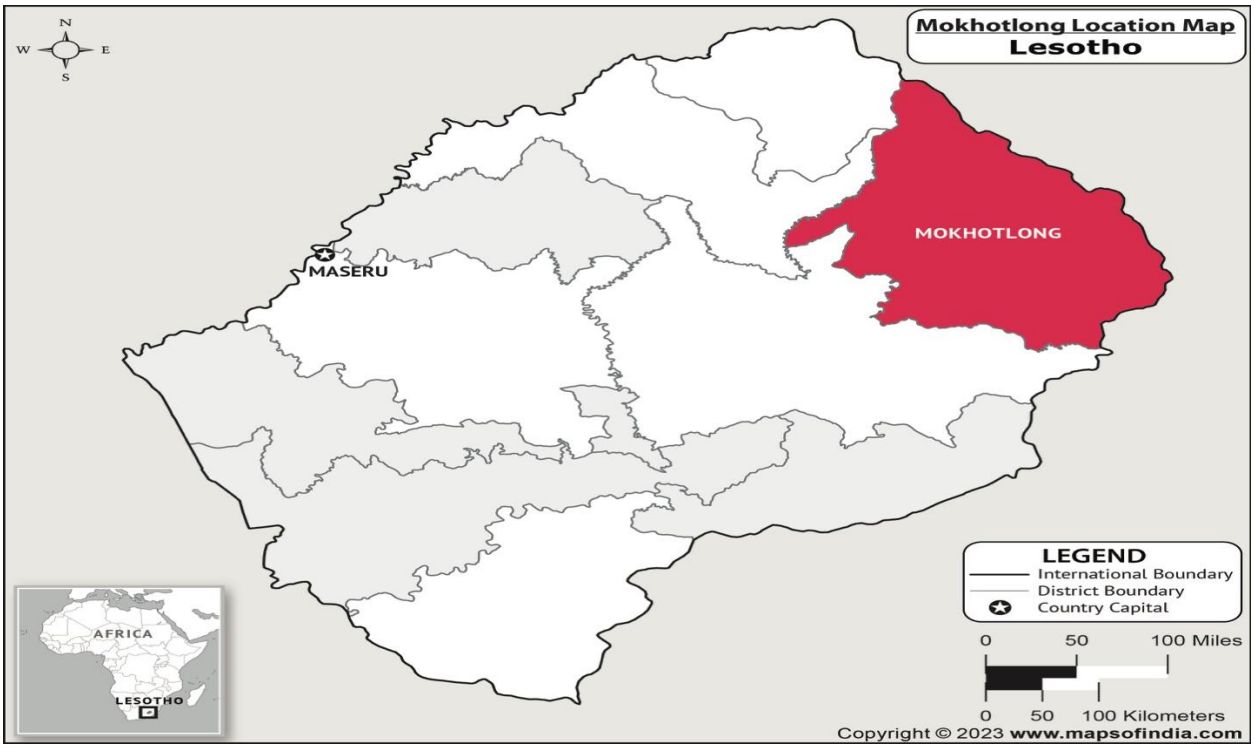

Figure 2: Study Area Map

The research focus is centered on the Mokhotlong district in Lesotho which located in the north-eastern part of Lesotho (Figure 2). According to Masupha & Jankielsohn, (2018), the district of Mokhotlong, situated at 29°20´S 29°00´E, is located entirely within the Mountain region of Lesotho and boasts of the highest terrain in the Maluti range. This district holds immense significance as it serves as the primary watershed for the Senqu River, which is the primary water source in Lesotho (Masupha & Jankielsohn, 2018). Its topography and geographical location make it an important region for academic exploration and research.

Potato production in Mokhotlong district, Lesotho is significant for farming due to the quality of soil and weather conditions that are suitable particularly for potato cultivation. Research has shown that Mokhotlong is one of the districts in Lesotho that has the potential to produce quality potatoes (LENA, 2024). The district is characterized by a cool, temperate climate, with cold winters and mild summers, making it an ideal location for growing potatoes (Nteletsana, 2007). During the potato-growing season, which typically runs from October to April, temperatures in Mokhotlong district range from about 10°C to 25°C, providing the perfect conditions for robust plant growth and development and, as a result, excellent potato yields. Furthermore, the district receives a significant amount of precipitation, averaging from 600mm to 800mm annually, which ensures adequate irrigation and significantly boosts potato production (World Bank Group, 2021). Since Mokhotlong district has a significant constituency of potato farmers, it is a suitable study area to investigate factors that influence farmers' participation in potato production. Potato farming is among the district's primary agricultural activities, therefore this provides a perfect backdrop for exploring the motivations and challenges that farmers in this sector encounter. Additionally, the district's varied topography and climatic conditions across different regions offer a comprehensive view of how these factors influence farmers' decisions and practices regarding potato cultivation.

3.3 Research design

According to Maree, (2016), research design is a systematic approach to organizing data based on philosophical assumptions for selecting subjects, collecting data, and analyzing it. This study employed a cross-sectional approach, gathering descriptive quantitative data from farmers through a survey method. A cross-sectional study design involves collecting data on multiple variables at a single point in time to assess relationships between the variables (Bell, 2022). The study aimed to describe these variables by generating numerical data that could be analyzed statistically, as highlighted by Gondwe, (2020), emphasizing the quantitative design's ability to quantify issues effectively.

3.5 Target population, sampling technique, and sample size determination

As noted by Shukla (2020), the study population refers to the group of individuals to whom the research findings will be applied. This particular investigation centers on potato farmers residing in the district of Mokhotlong, Lesotho. Though it would be ideal to examine the entire population, Vohra & Bhardwaj, (2019) highlights that various limitations, such as cost, time, and accessibility, often necessitate researchers to gather data from smaller groups or samples. Essentially, a sample

is a collection of individuals chosen to represent the broader population (Divarkar, 2021). The ultimate aim of selecting sample components from a population is to use the data obtained to draw conclusions about the entire population (Alvi, 2016). Bluman (2012) emphasizes that well-selected sample participants should possess characteristics that are comparable to those of the population as a whole.

To ensure accuracy and representativeness, both probability and non-probability multistage sampling technique were adopted for the selection of potato farmers in Mokhotlong District. In the first stage resource centres from Mokhotlong were purposively selected because as recommended by the Department of Agricultural Research in the Ministry of Agriculture, Food Security, and Nutrition, and District Agricultural Administrators in the Department of Field Services. The second stage involved Purposive random selection of villages under the chosen resource centres with the guidance of the extension officers in-charge. The third stage involved use of simple random selection of respondents in each of the chosen villages from the list of potato farmers provided by the Ministry of Agriculture, Food Security, and Nutrition. Taherdoost, (2018) defines simple random sampling as having an equal chance of including every component of the research population in the sample. In order to determine the representative sample size for potato farmers practicing conventional and conservation agriculture the researcher adopted Slovin`s formular from (Oduniyi *et al*., 2022; Taherdoost, 2018) and used since it provides the researcher with an estimate of the necessary sample size to ensure accurate results and allows for sampling the population with a certain level of precision (Mafuse *et al*., 2021).

Slovin`s formula (1960):

$$n = \frac{N}{(1+N(e)^2)} \qquad (1)$$

Where;

$n =$ Sample size

$N =$ Total population

$e =$ Precision level 5% (0.05)

Sample size calculation;

According to data provided by the Department of Crop Services and Department of Field Services within the Ministry of Agriculture, Food Security, and Nutrition, villages known for their significant potato production have a combined population of 116 potato farmers.

$$n = \frac{116}{(1 + 116(0.05)^2)} = 89.922$$

$$= 90$$

Instrumentation

Pardjono, (2015) defines a research instrument as a measuring tool that researchers use to collect data for a study. Examples of these tools include tests, questionnaires, interview guides, and observation guidelines. This study used structured interview schedule with open and closed-ended questions to conduct face-to-face interviews for collection of primary data. Interviews make it easy to clarify issues that may arise and in some cases the researcher will translate questions in respondent's local language for their understanding since the questionnaire will be written in English. This tool was created with guidance from existing literature and consultation with a supervisor.

3.6.1 Reliability and Validity of the Questionnaire

In quantitative research, ensuring the validity and reliability of a study is critical for maintaining transparency, minimizing researcher bias, and achieving accuracy (Mohajan & Kumar, 2017). Mohajan & Kumar, (2017) also pointed out that without establishing validity and reliability, determining the correlation between variables can be challenging. Moreover, the reliability of an instrument is intricately connected to its validity; a test cannot be deemed valid if it doesn't demonstrate reliability (Hasnida & Ghazali, 2016). Validity assessment often involves leveraging knowledge bases, whereas reliability evaluation focuses on quantifiable and consistent scores, making it a more complex process (Hasnida & Ghazali, 2016).

3.6.1 Reliability

According to Maree, (2016), the reliability of a measurement tool refers to its ability to produce consistent and reproducible results. Similarly, Mohajan & Kumar, (2017) defines reliability as the combination of reproducibility and credibility. Questionnaire findings must remain highly consistent with those of unrelated situations, as regular replication enhances research credibility.

An instrument's reliability is determined by its consistent and predictable performance, as noted by Bolarinwa, (2015). Hasnida & Ghazali, (2016) identifies test-retest, alternate form, and internal reliability as examples of different types of reliability.

Hasnida & Ghazali, (2016) explains that test-retest reliability involves using the same instrument twice and evaluating the correlation coefficient between the two sets of scores obtained. Good test-retest reliability results indicate stable and representative instrument data over time, reflecting high internal validity. To ensure the test-retest method's effectiveness, farmers from Mokhotlong who were not in the target demographic but live in the same study region and will not be included in the study participated in a pilot study as part of a test-retest method. Face-to-face interviews were conducted by the piloting enumerator group to ensure that farmers completely understood the questions. The data was analysed and the correlation coefficient was recorded. Cronbach's Alpha was used to determine the internal consistency of the instrument. There is some variation in the interpretation of Cronbach's Alpha scores. Sekaran and Bougie (2013) suggest that a value below 0.60 indicates poor reliability, 0.70 represents an acceptable level, and scores above 0.80 are considered good. However, Heale & Twycross, (2015) provide a more general guideline, stating that Cronbach's Alpha values fall between 0 and 1, with 0.7 or higher indicating acceptable reliability.

The following is the Alpha Cronbach's formula:

$$r_{11} = \left[\frac{k}{k-1}\right]\left[1 - \frac{\sum \sigma b^2}{\sigma^2 t}\right] \qquad (4)$$

Where:

r_{11}: Reliability Instrument

k: Amount of item question

$\sum \sigma b^2$: Sum of variant item question

$\sigma^2 t$: Variant Total

To assess the reliability of the statement items, a comparison is made between the calculated value of r alpha and a predetermined critical value, denoted as r table (set at 0.444). If the value of r alpha, obtained through the analysis, exceeds the predefined r table value, which indicates reliability, it suggests that the statement items are reliable. This study utilized software SPSS

Statistics Version 20.0 for Windows to ease and minimize a miscalculation in computing the reliability on processing the data. The criteria index reliability as follows:

Table 3.1: Index of Reliability

Interval	**Criteria**
< 0.60	Low
0.60 – 0.70	Sufficient
0.70 – 0.80	High
0.80 – 0.96	Very High

Source: Zikmund and Babin (2010)

Data collection

Data was collected through a structured and pretested digital questionnaire designed in Kobo collect complemented by face-to-face interview, which was administered by the researcher, and trained enumerators were also deployed during data collection for data quality assurance using tablets. The questionnaire that was used to collect data is shown in Appendix A. To avoid respondent's bias, no payments or compensations were offered to participants.

3.7.2 Validity

The accuracy of a measurement technique or tool in capturing or measuring its intended object is known as validity (Heale & Twycross, 2015). In order to ensure that the data collected supports the conclusions drawn from quantitative research, it is crucial to have high-quality scientific research with dependable validity (Gundry & Deterding, 2019). To achieve this, the study's equipment must be able to gather sufficient data, and the validity of an instrument is determined by the degree to which theoretical concepts and empirical data validate the correctness and completeness of conclusions made from test results or other assessment methods (Gundry & Deterding, 2019). Maree, (2016) asserts that validity measures how well an instrument measures what it should measure, with various types of validity including criterion, face, content, and construct validity

Kilangi, (2012) argues that the validity of a research tool centers on how well its content, the indicators employed to assess concepts, and the observed phenomenon are correlated. The content validity of an instrument is determined by the extent to which it includes all aspects of the specific construct it is intended to evaluate (Maree, 2016). The content validity of a questionnaire ensures that the items and components are representative of all relevant topics intended for the intended audience, as alluded by (Mohajan & Kumar, 2017). To effectively measure the impact of various factors on the constructs being assessed, the instrument must have a clear scale and investigate all relevant factors in its questions. The data collection instrument for this study underwent both content validity and face validity by being sent to the specialized staff at the National University of Lesotho (NUL) Department of Agricultural Economics and Extension. Their opinions were used to inform the research instrument improvements and finalization.

3.7.3 Ethical Issues

The practice of survey design, data collection, presentation methods, and report preparation and publication is heavily rooted in ethical principles. According to Fleming & Zegwaard, (2018), researchers must adhere to all procedures outlined in research guidelines before collecting data and during reporting to avoid potential suspension of their study due to non-compliance with the ethical code of conduct. Ethical guidelines must be followed. If the proposed study is not approved by the institution's research ethics board, the research may be delayed or not conducted. Kilangi, (2012) emphasizes that effective quantitative research design requires informed consent from all relevant stakeholders, confidentiality of obtained information, and disclosure of potential outcomes. All ethical standards must be met. All research participants, including those who participate in surveys and interviews, are exposed to certain risks that could be harmful (Kilangi, 2012). It is crucial to consider all potential risks that could affect research participants and take appropriate measures to minimize them. Informed consent remains the cornerstone of numerous ethical studies and requires that all research participants be provided with relevant information regarding the study. It includes specific recommendations regarding the expectations, use, and potential outcomes of their input. Informed consent, as described by Fleming & Zegwaard, (2018), is a contract between the researcher and the participant, where the research purpose must be fully specified. Safeguarding sensitive or personal information and the participants' identities through confidentiality and anonymity is a critical aspect of research.

Bos, (2020) states that confidential information refers to anything that research participants do not wish to share publicly and is free to keep private. Fleming & Zegwaard, (2018) advise researchers to protect the privacy and interests of research participants when handling any potentially sensitive information. To ensure confidentiality, this study participants were assured that information will be kept strictly between the university and the researchers involved in the study. The Department of Agricultural Economics and Extension oversaw the study's ethical approval, while the Ministry of Agriculture, Food Security, and Nutrition in Mokhotlong granted the permission to conduct interviews and surveys with study participants. Local extension officers and community leaders, such as chiefs and town councils, collaborated with study participants during the data collection process. All interested individuals had the opportunity to participate, and those who choose not to participate were replaced.

3.8 Data analysis

3.8.1 Descriptive Statistics

The study utilized descriptive statistics to identify and characterize the socioeconomic features of households, as well as examine the limitations associated with farmers' involvement in potato farming (Almeida *et al*., 2017). Descriptive statistics used in this study involved the calculation of means, standard deviations, frequency counts, and percentages. The Statistical Package for Social Sciences (SPSS), version 20 was used for data analysis.

3.9.2 Binary Logistic Regression Model

To determine the variables that influence farmers' participation in potato production, a binary logistic regression model was utilized. This model is appropriate when there are two possible states for the dependent variable, as is the case in this study where the dependent variable is binary and can either participate or not. The binary logistic regression model operates using a binomial response, which is represented as a probability falling between 0 and 1 (Sperandei, 2013). The analysis was conducted using the SPSS software.

The use of the binary logistic regression model in the study was based on the assumption that households must choose between participating or not participating in potato production. This choice is represented by the numbers 1 and 0, respectively. Logistic regression is considered to be relatively flexible, easy to use, and yields results that are easy to interpret, as it has no assumptions

of linearity or heteroscedasticity (Liu *et al*., 2014). Therefore, the binary logistic model can be written as follows:

$$ln\left(\frac{P_i}{1-P_i}\right) = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \cdots + \beta_n X_n + \varepsilon_i \quad (2)$$

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \cdots + \beta_n X_n + \varepsilon_i \quad (3)$$

Where;

Y = dependent variable

ln = natural logarithm

β_0 = intercept

$\beta_1, \ldots, \beta_n$ = coefficients of the estimated parameters

$X_1, \ldots, X_n$ = independent variables

ε_i = error term

Thus, the empirical model equation employed to identify the socioeconomic, institutional, and market factors influencing farmers' participation in potato production is stated as follows:

$$Y = \beta_0 + \beta_1 Gender + \beta_2 Age + \beta_3 Educlevel + \beta_4 SMedia + \beta_5 Sincome + \beta_6 Aseeds + \beta_7 Dmarket + \beta_8 Pchange + \beta_9 Mstatus + \beta_{10} Fsize + \beta_{11} Gmemb + \beta_{12} Fexp + \beta_{13} Acredit + \beta_{14} AmrktInfo + \varepsilon_i \quad (4)$$

PRIORI EXPECTATIONS OF THE INDEPENDENT VARIABLES

The predictive influence of independent variables on farmers' decision to participate in potato production is illustrated in Table 1.

Table 1: Variables in the binary logistic regression model

Variable code	Description	Type	Measurement	Expected signs
		Dependent variable		
TypFrmer	Type of a farmer	Dummy	Participatory (1), not participatory (0)	
		Independent variables		

Age	Age of the respondent	Continuous	In years	+/-
Gender	Gender of the respondent	Dummy	Female (1), Male (0)	+/-
Educ	Level of education	Categorical	No education (1), Primary (2), Secondary (3), Tertiary (4)	+
Price.V	Price volatility	Categorical	Strongly agree (1), Agree (2), Neutral (3), Disagree (4), Strongly disagree (5)	+/-
Farm size	Size of the farm	Continuous	In acres	+/-
Extservice	Access to extension services	Dummy	Yes (1), No (0)	+
DstMkt	Distance to the market	Continuous	In kilometers	+/-
A.Crdt	Access to credit	Dummy	Yes (1), No (0)	+
GrpMembrshp	Group membership	Dummy	Yes (1), No (0)	+
MktInfo	Access to market information	Dummy	Yes (1), No (0)	+
FrmExp	Farming experience	Continuous	In years	+/-
A.seeds	Access to seeds	Categorical	Easy (1), hard (2), very hard (3)	+
Social.M	Use of social media	Dummy	Yes (1), No (2)	+/-
Source.L	Source of labor	Categorical	Family (1), Hired (2), Casual (3),	+/-

Table 2 provides a comprehensive overview of the study's objectives, data variables, and the data analysis methods that were employed in the research.

Table 2: Nature and Description of Data and Data Analysis Methods

Objectives	**Variables**	**Data analysis methods**
To describe the socioeconomic characteristics of potato farmers in Mokhotlong	Socioeconomic and institutional characteristics of potato farmers	Descriptive analysis
To identify and analyze the factors influencing farmers' participation in potato production in Mokhotlong.	Factors that influence farmers' participation in potato production.	Binary logistic regression
To examine the constraints associated with farmers' participation in potato farming in the study area.	factors that might impede or limit farmers' engagement in potato farming.	Descriptive analysis

3.9 Chapter Summary

This chapter detailed the research methodology used in the study, focusing on the description of the study area, research design, and target population. The study was conducted in Mokhotlong district of Lesotho. A two-stage sampling technique was used to select a representative sample of potato farmers, and data was collected through structured questionnaires. The reliability and validity of the questionnaire were ensured through a pilot test, and ethical considerations, including informed consent and confidentiality, were strictly adhered to. Data analysis involved descriptive statistics to summarize the socio-economic characteristics and constraints, while a Binary Logistic Regression Model was used to assess the factors influencing farmers' participation in potato farming. The findings of the study are presented and discussed in the next chapter.

CHAPTER IV

RESULTS AND DISCUSSIONS

4.1 Introduction

This chapter contains a detailed presentation of the socio-economic characteristics and constraints that are closely linked to farmers' engagement in potato production. Additionally, the chapter sheds light on the outcome of the econometric analysis, which employed the Binary Logistic regression model to determine the factors that impact farmers' participation in potato production.

4.2 Socio-economic characteristics of potato farmers

Table 3 provides a comprehensive overview of the socio-economic background of the respondents under consideration. The variables include gender, age, marital status, educational attainment, farming experience, farm size, source of income, and household size. The data presented in Table 3 is useful to gain insights into the demographic and economic characteristics of the respondents.

Table 1: Descriptive results of the socio-economic characteristics

Variables		**Freq.**	**Percentage (%)**
Gender	Male	57	57
	Female	33	33
Age	20-40	24	26.6
	41-60	41	45.5
	61-80	23	25.5
	81-100	2	2.2
Educational level	No formal education	10	11.1
	Primary	45	50.0
	Secondary	33	36.7
	Tertiary	2	2.2
Marital Status	Single	11	12.2
	Married	58	64.4
	Widowed	17	18.9
	Divorced	4	4.4
Household size	1-5	53	58.9

	6-10	37	41.1
Farming Experience	less than 5	22	24.4
	6-10	22	24.4
	11-20	18	20.0
	over 20	28	31.1
Farm size	less than one (1)	10	11.1
	2-3	21	23.3
	4-5	19	21.1
	Above 6	40	44.4
Source of income	Farming	58	64.4
	farming and non-farming	14	15.6
	non-farming	5	5.6
	pension and farming	11	12.2
	pension and non-farming	1	1.1
	Pension	1	1.1

Source: Author's survey (2023)

As per the descriptive statistics in Table 3, it was observed that the majority of participants in the study (57%) were from male-headed farms, while only 33% were from female-headed households. This trend possibly influences various social and economic factors that lead to limited access to resources, including land and involvement in socio-economic activities, for female-headed households. Additionally, the study found that more males participated in the study since they may have control of means of production due to better financial status, ownership of larger land size, greater extension contacts, and improved access to market information, as compared to female-headed households (Gebre *et al.*, 2021). The age distribution results of the participants revealed that 45.5% fell within the 41-60 age range, 26.6% are between 20-40 years, 25.5% are aged between 61-80 years, and only 2.2% fell between 81-100 years of age. This distribution indicates a predominant participation of individuals in the middle age range (41-60 years) in potato production, followed by those in the younger age group (20-40 years) and then individuals in the older age groups (61-80 years and 81-100 years). The higher percentage of participants in the 41-60 age range implies that middle-aged individuals are actively engaged in potato production, which could be attributed to their experience, knowledge, and physical abilities. On the other hand, the

lower percentages in the younger and older age groups may indicate a need for targeted interventions to encourage more participation from younger individuals and to support the sustainability of potato production among older farmers (EUROSTAT, 2021).

The findings revealed that 64.4% of the respondents were married, 18.9% were widowed, 12.2% were single, and 4.4% were divorced. These results imply that marital status has an influence on participation in potato farming, with married individuals being more likely to engage in this activity. The results align with Smith and Johnson (2018) who reported that married individuals were more likely to be involved in farming compared to those who were single or divorced. However, Brown *et al*., (2015) found no significant association between marital status and participation in potato farming. Table 3 indicated that half (50%) of the participants had attained primary education, while 36.7% had attained secondary education. A small proportion of the participants (2.2%) had tertiary education, and 11.1% had no formal education, implying that education level plays a role in participation in potato farming. These findings are consistent with those of Tafida & Sa'adu, (2019), who reported that the majority of male and female respondents had attained primary education (52.80% and 56.70%, respectively), while 21.40% and 34.40% had attained secondary education, and 21.40% and 8.90% had attained tertiary education, respectively. In contrast, a study by Martinez *et al*., (2019) found no significant relationship between education level and participation in potato farming. Almeida *et al*., (2017) highlighted that obtaining a higher level of education leads to a favorable acceptance of technology and equips individuals with the knowledge and skills necessary for comprehending technology.

The results presented in Table 3 indicated that 58.9% of the respondents had household sizes of 1-5, while 41.1% had household sizes of 6-10 family members. The mean household size among participants was reported as 1.41. These findings indicate that household size may play a role in participation in potato farming, as larger households potentially have access to more labor, which is crucial for labor-intensive activities involved in potato production. A study conducted by Smith *et al*., (2016) found that larger household sizes positively influenced participation in farming activities. The study argued that larger households have a greater labor force, allowing for increased agricultural productivity and the ability to manage the labor-intensive tasks involved in crop production. In contrast, a study by Johnson and Brown (2018) found no significant relationship between household size and participation in potato farming. The study suggested that

factors such as access to agricultural inputs, market opportunities, and land availability may have a stronger influence on agricultural engagement than household size alone.

The results show that 31.1% have over 20 years of farming experience, 24.4% have less than 5 years, 24.4% have 6-10 years, and 20% have 11-20 years of experience. These descriptive statistics imply that most farmers have extensive experience in potato farming, which equips them with the necessary skills and abilities to develop their farming practices. Farming experience is linked to knowledge, expertise and better decision making. Farmers with experience in most cases excel compared to those lack experience, they would have established markets, understand the best production practices and have also learnt from previous decisions (Läpple & Thorne, 2019). Based on the distribution of farm sizes, 44.4% of farmers own land over 6 acres, while 23.3% own land between 2-3 acres. For farms ranging from 4-5 acres and less than 1 acre, the ownership rates were 21.1% and 11.1% respectively. These percentages show that majority of the farmers own land that is 5 acres and below, while minority owns land over 6 acres in size. Landholdings by Lesotho smallholder farmers are small and fragmented and this also has a negative impact on productivity (Mokene *et al*., 2017).

4.3 Factors Influencing Farmers' Participation in Potato Production

The results of the logistic regression model, examining the factors influencing farmers' participation in potato production within the study area, are presented in this section. The previously discussed variables were included and tested for significance within the model. Table 4 presents the estimated coefficients (β values), standard errors, and significance levels for the independent variables in the model. The Wald test produced a statistically significant result (Wald chi^2 (15) = 82.62, $p < .01$), indicating that the estimated coefficients are collectively significant, and the variables adequately explain the observed outcomes in the model (Mwembe *et al*., 2021). Furthermore, the likelihood ratio test for the null hypothesis yielded a statistically significant result at the 1% significance level, leading to the rejection of the null hypothesis. This suggests that decisions regarding participation in potato production are interrelated (Abate *et al*., 2019). The model explains approximately 69.43% of the variance in the dependent variable, $R^2 = .6943$, indicating that the independent variables collectively account for 69.43% of the variability in the farmers' participation decisions. This R^2 value, which exceeds the commonly accepted threshold

of 50%, suggests that the model provides a good fit, with moderate to strong explanatory power (Mwembe *et al*., 2021).

Table 2: Parameter estimates of the Binary Logistic Regression Model

Variable	**Coefficient**	**Robust Std. Err (SE)**	***z***	$P > \|z\|$ **(sig.)**
Constant	-12.156	3.899	-3.118	0.002
Price volatility	0.402	0.7570	0.532	0.595
Gender	**3.295***	1.079	3.053	0.002
Age	**3.689***	0.939	3.927	0.000
Marital status	-0.433	1.868	2.837	0.817
Educational level	**1.484****	0.523	2.350	0.005
Use of social media	**4.419*****	2.350	1.881	0.060
Source of income	**-3.175***	0.685	-4.637	0.000
Number of years in farming	0.316	0.489	0.648	0.517
Farm size	0.296	0.475	0.623	0.533
Source of labor	0.119	0.472	0.252	0.801
Access to seeds	**3.048****	1.522	2.002	0.045
Group membership	0.459	1.265	0.363	0.717
Access to market information	0.338	1.221	0.277	0.782
Distance to the market	**1.200****	0.554	2.167.	0.030
Access to credit	-0.093	0.880	-0.105	0.916

No. of observation= 90 Wald chi2 (15)= 82.62 $Prob >$chi2=0.000* Pseudo R2= 0.6943 Log pseudo likelihood= -6.675105

*, **, ***= significance level at 1%, 5% and 10%

Source: Author's survey (2023)

The results of the analysis, as presented in Table 4, showed that the coefficient associated with the gender variable is 3.295. This coefficient is positive and statistically significant at the 1% level (p = 0.002), indicating that the gender of the farmer plays a significant role in influencing their engagement in potato production. Specifically, the results suggest that male farmers are more likely to engage in potato production compared to their female counterparts. These findings support the initial hypothesis of the study, which proposed that gender has a positive effect on farmers' involvement in potato production. The results align with Sebatta *et al*., (2014), who found that males participate more in potato sales, citing factors such as better time availability and more effective management practices among male farmers, which contribute to increased potato production and a larger marketable surplus. Similarly, studies by Abitew *et al*., (2015) and Bukul, (2018) identified a positive influence of the gender of the household head on the quantity of marketed potatoes. Contrasting these findings, a study conducted in Bhutan by Rai *et al*., (2022) revealed a correlation between potato productivity and women's preference votes, indicating that women have a stronger association with household farming and are more involved in decision-making compared to men.

Contrary to the initial expectations of the study, the age coefficient (3.689) showed a statistically significant positive influence on farmers' involvement in potato production, with a p-value of 0.000 at a 1% level of significance. This suggests a strong correlation between age and the decision to engage in potato production. Specifically, older farmers, particularly those above 40 years, tend to be more involved in potato production compared to their younger counterparts. This positive correlation can be attributed to the fact that older farmers often possess more experience in farm management and have accumulated resources such as labor and farm tools, which enhance their involvement in potato production (Ahmed *et al*., 2018). Additionally, as older family members are typically responsible for decisions impacting family welfare, they are more likely to participate in the potato market. Heltberg & Tarp, (2002) further argue that age is an important indicator of a household's position in the life cycle, which reflects their ability to comprehend and utilize market information. Similarly, Gebremedhin & Hoekstra, (2008) found that older farmers have a positive relationship with both potato production and marketing, with a higher proportion of their produce sold in the market.

The coefficient for the educational level was 1.484 and was statistically significant at the 1% level of significance. This indicates that education has a positive impact on farmers' participation in

potato production. This positive relationship can be explained by the fact that education equips farmers with critical skills and knowledge that are beneficial for improving farming practices. Higher education levels contribute to better crop management, increased productivity, and enhanced engagement in potato production activities (Mathews *et al*., 2021). The use of social media was found to have a positive and statistically significant effect on farmer participation in potato production. The correlation coefficient for social media usage was 4.419, and it was statistically significant at the 10% level (*p=0.060*). This suggests that while women may not always be able to engage in traditional information dissemination programs offered by extension services due to household and family responsibilities, they can still access crucial agricultural information through ICT platforms, particularly social media. These findings highlight the importance of social media in empowering potato growers by facilitating access to valuable agricultural knowledge, connecting farmers with other growers, and enhancing their understanding of best practices in potato farming. Social media platforms serve as a key communication channel, enabling the exchange of ideas, market information, and agricultural innovations among farmers, which ultimately contributes to increased production and income levels (Marinello *et al*., 2023).

This conclusion is supported by Bokaako, (2023), who emphasized the significance of media in agricultural decision-making processes. Additionally, Mtega (2021) found that mobile phones, alongside radio, are commonly used by farmers to access and communicate agricultural information. However, Ireri, (2021) observed that while ICT, including social media, has potential benefits, its actual impact on productivity and participation among smallholder farmers was limited. Issues such as inconsistent access to ICT, lack of relevant content, and challenges in interpreting information were cited as factors limiting its effectiveness. The coefficient for the variable related to farmers' sources of income was negative (-3.175) and statistically significant at the 1% level (p = 0.000). This negative coefficient indicates an inverse relationship between the source of income and the likelihood of farmers engaging in potato farming. Specifically, a unit increase in income results in a 3.175 decrease in the probability of farmer participation in the potato industry. The p-value of 0.000 further underscores the reliability of this finding, as it suggests a very low probability of obtaining this result if the null hypothesis were true. Therefore, the effect of income on farmers' participation in potato production is statistically significant. These results align with Gachuhi *et al*., (2021), who found that farmers with higher income levels were less likely to commercialize their farming activities, suggesting that such farmers may not feel the need

to diversify their income sources. However, the findings contrast with those of Khoza *et al*., (2019), who observed that smallholder farmers with substantial non-farm income often invest more in their farming activities, leading to higher output for sale.

The variable for access to seeds demonstrated a positive relationship with farmers' engagement in potato production. The coefficient for access to seeds was 3.048, and the p-value was 0.045, which is statistically significant at the 5% level. This indicates that farmers with better access to potato seeds are more likely to participate actively in potato farming. These findings are consistent with Bukul, (2018), who found a significant positive effect of access to complementary inputs such as seeds, fertilizer, and chemicals on the quantity of potato production. Additionally, Kumilachew, (2016) found that access to improved seeds positively influenced the value of potatoes sold. The study also found that the distance to the market affected farmers' participation in potato farming. The variable for distance to market had a positive coefficient of 1.200 and was statistically significant at the 5% level ($p = 0.030$). This suggests that proximity to urban areas plays a role in farmers' decisions to engage in potato production, as those closer to urban centers have better access to buyers who offer more favorable prices and payment terms. These findings align with the research by Mnukwa *et al*., (2023), who argued that greater distances from markets reduce smallholder farmers' participation in potato value chains due to increased transportation costs and limited access to market information. Similarly, Larochelle and Alwang (2015) found that farmers living closer to urban areas or main roads tend to have better access to buyers and are more able to transport their surplus production to lucrative markets.

4.4 Constraints associated with farmers' participation in potato production

The data presented in Table 5 and 6 reveal the various limitations that impede the involvement of farmers in potato production. Majority of the respondents agreed that lack of transport was one of the major constraints to potato production with sixty-four (64.4%) strongly agreeing and fourteen percent (14.4%) stating they agree. The minority of respondents (7.7%) disagreed that lack of transport hinder participation potato production. Most farmers use traditional means of transportation like scotch carts with very few farmers owning cars in rural areas to ferry their produce. Therefore, lack transport is a major hindrance to production as farmers require transport to ferry inputs to their home and farms, as well as to transport produce to the market (Msuku, and Moeinaddini, 2020). It is possible the few farmers that disagreed that lack of transport is not an

issue that hinder their potato production own vehicles. Access to credit is a major constraint for small holder farmers and the study results show that the majority of respondents (76.7%) agreed that poor access to credit hindered their participation in potato production.

Table 3: Constraints that hinder farmer' participation in potato production

Variables	**Strongly agree**	**Agree**	**Neutral**	**Disagree**	**Strongly disagree**
Lack of transport	58 (64.4%)	13 (14.4%)	12 (13.3%)	2 (2.2%)	5 (5.5%)
Poor access to credit	51 (56.7%)	18 (20%)	12 (13.3%)	3 (3.3%)	6 (6.7%)
Long distance to the market	52 (57.8%)	15 (16.7%)	9 (10%)	9 (10%)	5 (5.5%)
Price volatility	48 (53.3%)	18 (20%)	13 (14.4%)	7 (7.8%)	4 (4.4%)
Lack of market information	65 (72.2%)	15 (16.7%)	3 (3.3%)	2 (2.2%)	5 (5.5%)
Poor institutional support	44 (48.9%)	26 (28.9%)	7 (7.8%)	5 (5.5%)	8 (8.9%)
Lack of storage facilities	56 (62.2%)	10 (10%)	18 (20%)	1 (1.1%)	5 (5.6%)

Source: Author's survey (2023)

The research findings reveal a concerning gap in access to market information among individuals engaged in potato production, with only eight percent (7.7%) of them disagreeing that lack of information does not hinder their potato production probably because they have access to market information. Lack of access to crucial market information can have far-reaching implications for various aspects of potato production and the wider agricultural economy. Timely and accurate market data is essential for making well-informed production decisions. Farmers who have access to such information can adjust their production strategies to align with market demand, prices, and trends. However, the fact that ninety-two percent (92.3%) of respondents agree that there is a lack of market information hinders their participation in potato production, implies that many farmers

may be making production decisions based on intuition or outdated information, leading to inefficiencies. This can result in either an oversupply or undersupply of potatoes, impacting prices and potentially causing financial losses. The absence of market information can significantly affect the pricing strategies of potato producers. Without knowledge of current market prices, farmers are disadvantaged when negotiating with buyers and middlemen, often resulting in lower prices for their produce (Sahoo, 2023). This reduces their profitability and can discourage investment in improved production techniques or technologies. The reduced profitability may also discourage new entrants into potato farming, negatively influencing the sector's growth and sustainability. Market information does not solely pertain to prices, but also encompasses details about potential buyers, market locations, and the quality standards required by various markets (Ranjan, 2017). Farmers without access to this crucial information are likely to encounter difficulties in accessing broader and more profitable markets. They might be limited to local markets where competition is high and prices are low. This limitation can impede the ability of potato producers to expand their operations and increase their income.

The research findings revealed that the majority (76.7%) of farmers agreed that poor access to credit hampered participation in potato production. Conversely, only 10% of the surveyed farmers disagreed that poor access to credit impeded their participation in potato production. The limited access to credit has a direct impact on the farmers' ability to invest in important resources such as high-quality seeds, fertilizers, and modern storage facilities (Assouto and Houngbeme, 2023). This limitation ultimately hinders their productivity and agricultural output, potentially resulting in lower yields and impeding their success in potato farming. Meitei & Dutta, (2022) reported that the primary challenge faced by institutional borrowers is the unavailability of farm credit on time, insufficient credit limit, high interest rates charged by financial institutions, and delays in loan approval. However, for non-institutional borrowers, the main obstacles were the fear of repayment, lack of extra income sources, and collateral issues. Nevertheless, these results differ from those reported by Arigo (2011), who found that 66% of the participants had access to credit from multiple sources, while 34% had no access to credit. The research findings revealed that majority (73.3%) of respondents agreed that a lack of institutional support is a major obstacle in potato production. This suggests that farmers require more assistance, resources, and guidance from relevant institutions to effectively participate in and grow the potato industry. In addition, the results indicated that 77.8% of the respondents agreed that high production costs are a key factor that

limits their participation in potato farming. The high expenses associated with inputs, labor, and other costs of production appear to be deterring many farmers from investing in potato crops. These challenges have profound implications for participation in potato production. High production costs place a significant financial burden on farmers, leading to lower productivity and reduced profitability (Turley, 2021). This can discourage farmers from continuing or expanding potato production, leading to reduced overall participation in the industry and potentially pushing some farmers to switch to other crops. The research conducted by (Hama Salih & Layeeq, 2023) revealed that 97.7% of respondents cited the absence of state support for exporting potatoes.

The results indicated that 78.8% of potato farmers have identified the lack of transportation as the most pressing challenge, highlighting a significant bottleneck in the potato production process. This high percentage shows that transportation issues are widespread and likely have extensive implications for various aspects of potato farming. In the absence of reliable transportation, farmers encounter difficulties in transporting their produce to markets (Lalzai *et al*., 2023). This not only hampers their ability to sell their potatoes but also undermines their bargaining power and the prices they can obtain. Given the perishable nature of potatoes, any delays or insufficient transport options can result in spoilage. The fact that 78.8% of potato farmers identify lack of transport as a significant challenge underscores the critical need for improved infrastructure and supportive policies to enhance the viability and profitability of potato farming. In Parwan, Afghanistan, thirty-five percent (35%) of potato farmers strongly agreed that transportation issues were a prominent concern in marketing their crop (Lalzai *et al*., 2023). Moreover, Atiso *et al*., (2021) reported that regions with underdeveloped road and transportation infrastructure often lack reliable markets for agricultural inputs and outputs, adversely impacting smallholder farmers.

The results revealed that majority of the participants (72.2%) agreed that there is lack of storage facilities, which therefore hinders their participation in potato production. Thus, without proper storage, farmers face significant post-harvest losses due to spoilage, deterioration of potato quality and sprouting, which can lead to financial losses and reduced motivation to continue farming. Singh and Kaur (2017) reported that lack of storage means that farmers are forced to sell their produce immediately after harvest, often when prices are at their lowest due to market saturation. This therefore limits their ability to participate effectively in the market and take advantage of higher prices in the season. Gebeyehu *et al*., (2021) found that lack of storage facilities was a major

constraint for potato farmers in Ethiopia, leading to significant post-harvest losses. This study indicated that about seventy percent (70%) of farmers did not have access to adequate storage. In contrast, Jager *et al*., (2019) in their study on Dutch potato farmers showed that nearly all participants had access to advanced storage facilities. This access enabled them to store potatoes for extended periods, sell at optimal times, and maintain high-quality standards, significantly enhancing their market participation and profitability. The study findings revealed that the majority of farmers (74.5%) agreed that they travel a long distance to the market, while a minority disagreed. This could lead to reduced market participation and lower incomes for farmers. The necessity for farmers to travel long distance is frequently linked to inadequate transportation infrastructure. Barret (2008) demonstrated that poor road networks significantly hinder farmers' market access, forcing them to travel extensive distances to sell their produce. A study by Bokaako, (2023) noted that farmers with more expertise are more likely to adopt agricultural practices that boost their yield and enable them to participate in the market places, which may also be influenced by distance to markets. Similarly, a study in Ethiopia found that distance to all-weather roads significantly influenced farmers' potato market participation decisions, with a marginal effect showing that a 1 km increase in distance would reduce the likelihood of farmers selling their produce by 21.20% (Gurmu *et al*., 2024).

4.4.7 Pests and diseases

Table 6 indicates the frequencies and percentages of the respondents' perceived pests and diseases, as well their accessibility to quality seeds.

Table 4: Perceived pests and diseases encounters and access to quality seeds

Variable		**Freq.**	**%**
Do you encounter pests?	Yes	72	80
	No	18	20
Do you encounter diseases	Yes	60	66.7
	No	30	33.3
Access to quality seeds	Easy	15	16.7
	Hard	46	51.1

	Very hard	29	32.2
Diseases encountered	Early blight	42	46.6
	Late blight	22	24.4
	Bacterial wilt	11	12.2
	Other	15	16.6
Pests encountered	Lady bugs	50	55.6
	Millipede	12	13.3
	Snails	11	12.2
	Ladybugs, millipede and snails	11	12.2
	None	6	6.7

Source: Author' survey (2023)

The results in table 6 indicated that 72% of the respondents were of the opinion that that crop yield is significantly threatened by pests and diseases, while 60% perceived pests affecting and diseases had a negative impact on potato crop. The study results show that the study participants confirmed that they have encountered certain pests and diseases on their farms. Potato diseases such as late and early blight have resulted in pre and post-harvest losses in the study area, as indicated 24.4% and 46.6% of the respondents respectively. Potato diseases such as late blight, bacterial wilt, and viral diseases can also have a major impact on yield and quality. Late blight alone can cause yield reductions if left uncontrolled (Fasulo, 2015; Okonya *et al*., 2019). On the other hand, the results indicated that farmers confirmed that they encountered pests such as lady bugs, millipede, and snails. These issues result in substantial losses for farmers, leading to lower-than-expected potato harvests and affecting overall production and profitability. Furthermore, both pests and diseases have the potential to degrade the quality of harvested potatoes, resulting in lower market prices and reducing the appeal of potatoes as a cash crop (Okonya and Kroschel, 2016). The findings of the study revealed that majority of the respondents (51.1%) reported that they find it hard to access quality seeds, while only seventeen percent (16.7%) of them reported that they can easily have access. This situation reflects broader trends observed in agricultural studies, where access to quality seeds is critical for enhancing crop yields and ensuring food security. The difficulty in accessing quality seeds can be attributed to several factors, including limited availability, high costs, and inadequate distribution systems. In many regions, farmers rely heavily on informal seed

systems, which often provide lower-quality seeds that do not meet the standards necessary for optimal crop production. Boughton et al., (2020) reported that lack of awareness, in addition to access issues, significantly hindered farmers from adopting improved seed varieties. Farmers often relied to older varieties due to a combination of trust issues with new seeds and inadequate dissemination of information regarding their benefits. In contrast, a study of Kansiime *et al*., (2021) revealed that farmers reported increased access to quality seeds due to the emergence of local seed producers and enhanced farmer knowledge about seed quality attributes.

4.5 Chapter Summary

This chapter presented the collected data and its interpretation. It also discussed the results in relation to the objectives of the study, literature and theory, and made analysis with regard to the aim of the study. The next chapter presents the summary of the study and conclusions drawn from the findings and makes recommendations.

CHAPTER V

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS OF THE STUDY.

5.1 Introduction

This section includes the summary, conclusions, recommendations of the study, and potential future areas of study. The study's conclusions and recommendations are derived from the findings in the previous section. This section employs the study's findings for each objective to form conclusions. It also outlines the practical implications of the study's findings to aid stakeholders such as farmers and policymakers in understanding the factors that influence farmers' participation in potato cultivation, thereby enhancing the well-being of farming communities.

5.2 Summary of the study

The main objective of the study was to identify the factors that influence farmers' participation in potato production in Mokhotlong district, Lesotho. The study had three specific objectives: to describe the socio-economic characteristics of potato farmers, to identify and analyze factors that influence potato production, and to examine the constraints associated with participation of farmers in potato production in the study area. The study focused on villages in Mokhotlong with active participation of farmers in the potato farming, and information about these villages was obtained from the Department of Agricultural Research in the Ministry of Agriculture, Food Security, and Nutrition. A combination of multi-stage sampling and random sampling techniques was used to sample 90 households in the study area. In describing the socio-economic characteristics of potato farmers and the constraints associated with their participation in potato production, descriptive statistics such as frequencies and percentages were utilized. The findings revealed that the majority of participants hailed from male-headed households (57%), potentially leading to restricted resource access for female-headed households. The higher participation of males is attributed to their improved financial status and resource access. The age distribution reflected a prevalent involvement of individuals in the middle age range (41-60 years) in potato production, underscoring the necessity for interventions to encourage younger individuals to participate and to support the sustainability of potato production among older farmers.

The study findings indicated that marital status and education level significantly impact participation in potato farming. Married individuals (64.4%) were found to be more likely to engage in potato farming, potentially due to the availability of labor and support from spouses. Concerning education, higher education levels were associated with a positive adoption of technologies and the acquisition of necessary skills. The study also highlighted the significance of household size, farming experience, and farm sizes as influential factors in potato farming, with larger household sizes potentially and positively affecting participation in farming. Farming experience was linked to better decision-making and expertise. The study also concluded that most farmers own small land holdings, which may adversely impact productivity. The research emphasized significant threats to crop yield from pests and diseases, as potato farmers experienced substantial losses due to late and early blight, bacterial wilt, and viral diseases. Moreover, there is a notable lack of access to essential market information among individuals engaged in potato production, hindering their ability to make well-informed production decisions and impacting market prices. Access to credit also presents a major challenge for farmers, affecting their ability to invest in resources and hindering their productivity and agricultural output.

The text also discusses significant challenges faced by potato farmers, including high production costs, lack of institutional support, absence of state support for exporting potatoes, transportation issues, lack of storage facilities, and long distances to the market, all of which have implications for participation in potato production, leading to lower productivity, reduced profitability, and significant post-harvest losses. The need for improved infrastructure and supportive policies to enhance the viability and profitability of potato farming is underscored. Furthermore, the study employed the Binary Logistic Regression Model to analyze the factors influencing farmers' participation in potato production. The results demonstrated that gender, age, education level, and social media usage significantly impact farmer involvement in potato production. Specifically, male farmers are more likely to participate in potato production compared to females. Older farmers and those with higher education levels are also more involved in potato production. Additionally, the use of social media by farmers had a significant positive impact on their participation in potato production. These findings underscore the importance of gender, age, education, and social media in empowering potato growers and promoting innovation in the agricultural sector. The study results also showed that the farmers' engagement in the potato

industry has a positive relationship with their source of income and access to seed. Proximity to the market also significantly influences farmers' decision to engage in potato production due to better access to buyers and more favorable payment terms.

5.3 Conclusions

The study concludes that majority of participants in potato production are from male-headed households, with males showing higher participation due to their improved financial status and access to resources. Middle-aged individuals are predominantly involved in potato farming, with marital status and education level playing significant roles in participation. Married individuals are more likely to engage in potato farming, likely due to the availability of labour and support from spouses. Higher education levels correlate with positive adoption of technology and skill acquisition, further enhancing participation in potato farming. Additionally, household size, farming experience, and farm size are influential factors in potato farming. Larger household sizes may positively impact participation, while farming experience contributes to better decision-making and expertise. However, most farmers own small landholdings, which can negatively affect productivity. The research highlights major threats to crop yield from pests and diseases, including late and early blight, bacterial wilt, and viral diseases, leading to substantial losses. A lack of access to essential market information and credit presents significant challenges, hindering farmers' ability to make informed production decisions and invest in necessary resources, ultimately affecting productivity and output. Furthermore, potato farmers face high production costs, lack of institutional support, and absence of state support for exporting potatoes, transportation issues, inadequate storage facilities, and long distances to markets. The study demonstrated that gender, age, education level, and social media usage significantly impact farmer involvement in potato production. Male farmers are more likely to participate than females. Engagement in the potato farming is positively influenced by income sources, access to seeds, and proximity to markets, which provide better access to buyers and favourable payment terms.

5.4 Recommendations

Based on the findings and the conclusions of this research the following recommendations are made:

1. **Promote Market Access and Commercialization:**

Ministry of Agriculture, Food Security, and Nutrition through the Department of Marketing, should support farmers by creating a reliable market for potato farmers to sell their produce. Farmers require a consistent market and income which promotes large-scale production. It is also important to assist farmers in developing value chains and formulating marketing tactics to enhance their competitiveness.

2. Enhance Farmer Training and Capacity Building:

The Ministry of Agriculture, Food Security, and Nutrition in Lesotho should implement training programs for farmers. These programs should focus on soil fertility management, crop rotation, and best practices in potato production to enhance farmers' expertise. It's important to highlight the significance of organic manure and fertilizers in potato cultivation to encourage sustainable farming practices.

3. Address Constraints and Challenges:

The government should identify and address the constraints encountered by farmers, these include limited resources, inadequate infrastructure, and insufficient support from governmental or non-governmental entities. The study recommends that government, development and technical partners should devise specific interventions aimed at assisting farmers to overcome the obstacles identified in this study and therefore successfully enhance the overall potato farming ecosystem.

4. Encourage Women's Participation in Potato Value Chains:

The Ministry of Agriculture, Food Security and Nutrition should acknowledge the vital contribution of women in potato farming and establish training initiatives aimed at improving soil fertility and implementing crop rotation to boost women's participation in potato production. It is important to promote gender equality and empower women to assume greater responsibilities in potato farming, which will lead to improved productivity and sustainability.

5. Increase Funding and Support:

It is imperative to allocate adequate funding for agricultural development, specifically for potato farming, to facilitate the adoption of new technologies and practices by farmers. Collaboration with governmental and non-governmental bodies is crucial to ensure the provision of essential resources and support for potato farmers.

5.5 Area for further research

The study identified several limitations, and based on these; some suggestions have been made for further research.

- The study was conducted on only 90 smallholder potato farmers, using a binary logistic regression model, in one district, hence, a need for conducting the study in other districts with a relatively large sample.
- The main purpose of this research was to identify the factors that influence farmers' participation in potato production in Mokhotlong district, Lesotho. Future scholars may expand the focus of this research by exploring the impact of climate change on potato yields and how this influences farmers' decisions to engage in potato farming.

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APPENDIX: BASELINE SURVEY QUESTIONNAIRE

TITLE: REGULATION OF POTATO TUBER SPROUTING AND DORMANCY FOR SEED AND TABLE POTATO USE

Questionnaire Number: ☐

[FOR OFFICIAL USE ONLY]

Introduction: My name is ……., I am an enumerator for the APPSA Sub-Project on Regulation of potato tuber sprouting and dormancy for seed and table potato use. This survey, which is aimed at reaching at least 1000 respondents aims to learn more about the accomplishments and difficulties associated with the existing regulation of potato tuber dormancy and sprouting. The survey aims to determine how to regulate sprouting in table potato to increase storability of potato for consumption. It also seeks to regulate dormancy in seed potato and find ways to trigger sprouting in seed potato having understood the current farmers' challenges regarding the matter and how they are handling it. It seeks to understand how local value chain actors who are dealing with the twin challenges of sprouting and dormancy in potatoes. The study/project seeks to prescribe possible solutions while building more awareness of this challenge amongst stakeholders in the potato value chain and appreciating the various perceptions of the actors concerning these twin challenges and how they deal with them. Please give us your consent before we ask you any questions. You are not compelled to take part in this study. If you choose to take part, the information you share will be handled in the strictest of confidence and anonymity.

Enumerator Name: …… Date: ……

GEOGRAPHIC LOCATION

Name of the Farmer: …….

Contacts: …….

Resource Centre: …….....

Village Name: …….

SECTION A: SOCIO-ECONOMIC CHARACTERISTICS OF THE FARMER

A1. Gender of the farmer ***(Tick on the appropriate box)***					
Male [1]	Female [2]				
A2. How old are you? (In years) …….					
A3. Indicate your age group in years (tick as appropriate)					
<18[1]	19-30[2]	31-40 [3]	41-50 [4]	>51[5]	
A4. Marital Status ***(Tick where appropriate)***					
Single [1]	Married [2]	Divorced [3]	Widowed [4]		
A5. Household Size……					
A6. Are you the head of the household?					
Yes [1]	No [0]				
A7. What is your highest level of formal education?					
No Education [1]	Primary [2]	Secondary [3]	Tertiary Diploma [4]	Tertiary Degree [5]	
A8. Indicate the total numbers of years attained/Number of years of schooling?.....					
A9. Do you have any non-formal education (Adult Education)?					
Yes [1]	No[2]				
A10. If yes state the number of weeks……					
A11. Do you use social networks?					
Yes [1]	No [2]				
A12. Which main social network(s) do you use more frequently?					
Facebook [1]	Twitter [2]				
A13. Do you have any off-farm employment?					

Yes [1]	No [0]				
A14. If yes in A11, what is your employment status?					
Self-Employed [1]	Formal Employment [2]	Part-Time worker [3]	Pensioner [4]	Other [5]	
A15. What is your source(s) of income. Please tick any of the relevant box(es)					
Pension [1]	Farming [2] Non-Farm Income (Agric) [3]	Full-Time Job [4]	Remittances [5]	Social Grant [5]	
A16. Please indicate household monthly income in Maloti (M)					
5,00 [1]	5,00 – 1,000 [2]	2,000 [3]	5 ,000 [4]	> 5,000 [5]	
A17. How long have you been farming?					
Less than 5 years	6 to 10 years	11 to 20 years	Over 20 years		
A18. Mean s of land ownership					
Allocated by Chief [1]	Inherited [2]	Borrowed [3]	Rental [4]		
A19. What is your farm size? (In acres)			Actual no. of acres		
< 3 [1]	3- 6 [2]	6-9 [3]	9-12 [4]	>12 [5]	
A20. What area of your farm (in acres) did you use to grow potatoes last season? Actual no. of acres**.....**					
< 1 [1]	1- 2 [2]	2- 4 [3]	5- 6 [4]	7- 8 [5]	>8 [6]

A21. What was the land used for in the previous farming season?					
Cropping [1]	Grazing [2]	Fallow [3]	Other (Specify)……... …….		
A22. If the land was used for cropping in the previous season indicate the crops……...					
A23. What is the size of the land you usually cultivate?					
Quarter of the land [1]	Half of the land [2]	Total area [3]			
A24. How do you perceive your land's fertility?					
Very fertile [1]	Fertile [2]	Infertile [3]	Do not know [4]		
A25. What is the location on of your land?					
Upper land [1]	Lowland [2]	Plain [3]	River Valley [4]		
A26. Do you own livestock					
Yes [1]	No [2]				
A27. Do you own any of the following? Tick all relevant boxes.					
Cellphone [1]	Radio [2]	Television (TV) [3]			

SECTION B: FARM AND FARMER PRODUCTION CHARACTERISTICS

B1. Which term describes your farming the operation best?

Conservation-minimum tillage [ ]

Maximum soil cover and crops rotation [ ]

Conventional- practice monoculture, spreading and cover, burn stubble [ ]

Organic/ Biological- production without chemical fertilizer, herbicides or pesticides [ ]

B2. How long have you been farming this way?

< 5 years [ ]

5-10 years [ ]

10-20 years [ ]

20-30 years [ ]

>30 years [ ]

B3. What is your main source of labour?

Hired [ ] family [ ] other (specify)……

B4. What happens to the crop residue after harvest?

I keep it to protect the soil [ ]
Bale for feed [ ]

Let livestock graze [ ]

Burn [ ]

B5. Which product do you use as a fertiliser? Choose one of the following answers

Chemical [ ] Organic [ ] Combination of chemical and organic [ ]
Manure [ ] Compost [ ]

B6. What Agricultural Training do you have?

None [ ] Certificate in Agriculture [ ] Diploma in Agriculture [ ]

Degree or Higher Degree in Agriculture [ ] Master farmer certificate [ ]

B7. Do you plough your fields on a regular basis

Never [ ]

Once every year [ ]

Twice every year [ ]

Once every two years [ ]

B9. How easy is it to access good quality seeds?

Easy [ ] Hard [ ] Very hard [ ]

B10. Do you usually buy certified seed or you use seed from the previous harvest?

Buy certified seed [ ] Use previous harvest as seed [ ] Both [ ]

B11. How do you have access to key inputs such as seed, fertiliser, herbicides etc?

Purchase from Input Shops [ ] Government Input Subsidy [ ] Donations [ ]

B12. B12. Have you visited experimental/demonstration plots on potato production?

Yes [ ] No [ ]

B13. If your answer is yes, what did you learn?

_____

_____

B14. Do you encounter any diseases when growing potato tubers for seed and table use?

Yes [ ] No [ ]

B15. If yes, what diseases have you encountered?

Late blight [ ]

Early blight [ ]

Bacterial wilt [ ]

Potato virus [ ]

Other (specify)……

❑

B16. How do you manage potato diseases on your farm?

Chemical treatments (e.g Application of fungicides) [ ]

Biological treatments [ ]

Use of disease-resistant varieties [ ]

Crop rotation [ ]

Other (specify)……

SECTION C: POTATO SPROUTING AND DORMANCY

C1. Are you a tableware or potato seed producer?

Ware Potatoes [ ] Seed Potato [ ] Both [ ]

C2. State the quantity that you produce.

Ware Potatoes …… Seed Potato ……

C3. What do you do with your harvest?

Use it as ware potato [ ] Sell Seed Potato [ ] Stock to use as Seed Potato [ ]

Use ware potato as seed [ ]

C4. Do you know the varieties of potato you grow? Yes [ ] No [ ]

C5. If yes to C4, Which of the following varieties of potato do you cultivate/grow?

Mondial [ ]

Panamera [ ]

BP1 [ ]

❑

Rodeo [ ]

Valor [ ]

Sifra [ ]

Fabula [ ]

Other (specify)……..

C6. **If yes to C4, Why do you cultivate the type of variety in C5?**

……
……

C7. Please indicate your source of seed(s).

Local seed producers [ ]

Import from South Africa [ ]

Seed from previous harvest [ ]

Sprouting ware potatoes [ ]

C8. Please state the quantity of seed you normally buy per season……

C9. How do you store ware potato and seed potato?

In a cool, dry place [ ]

Away from light [ ]

In a well-ventilated place [ ]
with sufficient airflow [ ]

Other (specify)……

C10. Which method do you use for storage of your potato?

In Diffused Light Store [ ] In pit Store [ ] In farm-yard manure [ ]

Other (Specify)_____

C11. Do you experience any challenges in storing potato tubers for seed and table use?

❑

Yes [ ] No [ ]

C12. If yes, what challenges do you experience?

Sprouting [ ] Decay [ ] Temperature and humidity control [ ]

Other (specify)……

C13. If you indicated you experience sprouting and decay please quantify your losses due to sprouting and decay during storage.

……..

C14. What do you use to suppress sprouting a longer time on your tableware potato?

Indigenous knowledge [ ]

Sprouting suppressants [ ]

C15. How do you regulate sprouting of potato tubers for your ware potatoes?

Chemical sprout inhibitors [ ]

Storage temperature and humidity [ ]

Mechanical removal of sprouts [ ]

Other (please specify) ……

C16. How long are you able keep your tableware potato before it starts to sprout?

3months or less [ ] 4 months- 6 months [ ] 7- 8 months [ ] 9-10 months [ ] N/A [ ]

C17. Do you experience dormancy problems with potato seed when you are planning to plant?

❑

Yes [ ] No [ ]

C18. What do you use to break dormancy in your seed potato?

_____

C19. How long is the dormancy period for seed potato?

3 months or less [ ] 4 months- 6 months [ ] 7- 8 months [ ] 9-10 months [ ] N/A [ ]

C20. What varieties of potato do you prefer for seed use?

Early-maturing varieties [ ]

Late-maturing varieties [ ]

Disease-resistant varieties [ ]

Other (please specify)…….

❑

C21. From your experience which varieties are dormant for a long time?

Mondial [ ]

Panamera [ ]

BP1 [ ]

Rodeo [ ]

Valor [ ]

Sifra [ ]

Fabula [ ]

Other (specify)……..

C22. From your experience which varieties are dormant for a long time?

Mondial [ ]

Panamera [ ]

BP1 [ ]

Rodeo [ ]

Valor [ ]

Sifra [ ]

Fabula [ ]

Other (specify)……..

C23. List the factors that you think influence the length of the dormancy period except the seed variety.

_____

_____

_____

_____

❑

SECTION D: POTATO FARMERS AWARENESS OF CLIMATE CHANGE, ITS EFFECTS AND KNOWLEDGE AND UTILISATION OF CSA PRACTICES

D1. Do you agree with the below statements on seasonal weather and climate change/extreme climate events in the past 30 years in your area?

Statements:	**C.1.1 Do you agree with the following statements? (1 = Yes 0 = No)**
A. There are frequent floods	
B. Temperatures are increasing	
C. Rainfall is increasting	
D. Temperatures are decreasing	
E. Rainfall is decreasing	
F. Planting season has changed	
G. There are frequent long drought periods	
H. Rainfall patterns unpredictable	
I. There are increased dry spells	
J. Number of rainy days has declined	
K. New crop diseases have emerged	
L. There are hailstorms	
M. New pests have emerged	
N. High frequency in prevalence of pests and diseases	
O. The rate of germination failure has increased	
P. There is early frost	
Q. There is delayed frost	

D.2 Have you been exposed to some of these various climate change shocks/extreme weather events? And to what extent have they affected your production in the past 15 years?

❑

	3.2.1 Have you experienced these climate change shocks on your farm? (1 = Yes 0 = No)	3.2.2 If yes, what is the frequency? (number of years of experiences) (1=Rarely, 2=Often 3=Never, 4=Always)	3.2.3 If yes to 3.2.1 what did you do? (1= Nothing; 2= Something)
A. Drought			
B. Hailstorm			
C. Frequent Heat waves			
D. Strong winds and storms			
E. Floods			
F. Unpredictable rainfall			
G. Pest infestation			
H. Other (Specify)			

Climate smart technologies adopted by farmers for potato production

D.3 Please respond to the following questions in relation Climate Smart Agriculture technologies, use the benefits and constraints provided under the table to respond to questions about benefits and constraints:

CSA Technologies	Are you familiarized with? (Yes/No)	Which ones do you use in your farm? (Select)	What are the main benefits from this practice? (Classify)	What are the major constraints? (Classify)	Did you use any of these practices in the past and now you don't? (Select)	Would you like to introduce a new practice on your farm? Which one? Why? (select; classify from benefit list)
Permanent soil cover (Intercropping/Live Mulch)						

❑

Crop diversification/Mixed Cropping						
Permanent soil cover-Dead Mulch						
Change of planting dates						
Composting and organic fertiliser						
Improved storage and processing techniques						
Protected Agriculture(shade houses/nets, tunnels and greenhouses)						
Crop rotation						
Keyhole gardens						
Trech gardens						
Minumum/ Zero tillage						
Integrated pest management						
Irrigation/ Drip irrigation						
Contour planting						
Water harvesting technologies						
Rotational grazing/stocking rate management and stock size management						

❑

Improved Crop Varieties/Seed Selection (Stress tolerant crops and varieties)						
Improved Livestock Breeds						
Crop residue management						
Agroforestry						
Agro-meteorological services/Agroweather tools						

BENEFITS: 1 Increased yield, 2 Better soil fertility and structure, 3 Less risk related to drought, 4 less risk related to flooding, 5 better food security, 6 Better income or more sources of income, 7 Less labour, 8 Less soil erosion, 9 Better soil moisture, 10 better access to water, 11 better access to manure, 12 better access to fertilizer, 13 better access to cover crop, 14 better access to livestock feed, 14 forestry products (wood, fruits, etc), 15 Environmental services (rain, shadow, temperature regulation, biodiversity), 16 Better livestock production, 17 Better livestock nutrition, 18 Disease/pest prevention, 19 Better product quality, 20 Less costs, 21 Easier or safer income access, 22 Insurance for crop losses, 23 Production diversification, 24 Less risk of loss for crop and livestock, 25 Better wellbeing, 26 No perceived benefit, 27 other-specify.

CONSTRAINTS: 1 Less yield, 2 hard to get materials, 3 more labour requirement, 4 higher costs, 5 more pests/diseases, 6 poor quality product, 7 high initial investment, 8 no market for products, 9 higher risk for livestock/crop losses, 10 higher risk for financial loss, 11 lower soil fertility, 12 higher weed infestation, 13 reduction in arable area, 14 no difficulty observed.

D4. How do you perceive the effect of climate variability on agriculture? [Allow for multiple ticks].

Inadequate food supply [ ]

Poor crop yields [ ]

Incidence of crop diseases [ ]

Death of livestock [ ]

D.5 Do you harvest the same quantity of potato now as compared to the past number of years?

❑

Yes [ ] No [ ] No idea [ ]

D.6 What is the trend of the quantity of crop yield?

Increase [ ] Decrease [ ]

D.7 If your yield has decreased, what might possibly be the cause(s) for that in your opinion?

……
……

D.8 What has been the rainfall pattern in this community for the past ten years in terms of intensity, quantity and timing?

Intensity	**Quantity**	**Timing**
High [ ]	High [ ]	Right time [ ]
Low [ ]	Low [ ]	Delay [ ]

D9. Have you experienced any drought condition over the last 10 years?

Yes [ ] No [ ] No idea [ ]

D10. If yes, how do you describe the drought condition in this community in terms of severity and longevity?

Severity	**Longevity**
Highly	Very long
Moderately	Moderate
Low	Short

D12. Have you ever experienced any flooding on your farm?

Yes [ ] No [ ] No idea [ ]

D13. If yes, how frequent is it on your farm?

Rarely [ ] Often [ ] Never [ ] Always [ ]

D14. Have you heard of the following weather and climate information services? 1 = Yes, 0 = No

❑

Weather and Climate Information	**12.2 Do you have access to the following climate and weather information?**	**12.3 If yes, with which source format do you receive the information? 1 = Radio, 2 = Phone call, 3 = Sms, 4 = face to face individual presentation, 5 = Newspaper, 6 = Poster, 7 = Flyer, 8 = Online, 9 = Television, 10 = Other (Specify)**	**12.4 Which is your preferred source of access; 1 = Radio, 2 = Television, 3 = Extension officer, 4 = Newspaper, 5 = Peer farmers, 6 = Friend/relative, 7 = Internet, 8 = Printed materials, 9 = Other (Specify)**
1 Seasonal forecast on resumption of the rainfall			
2 Daily weather forecast (for current day or next 2 to 3 days on rainfall and temperatures)			
3 Weekly weather forecast (next 7 days; rainfall, temperature, clouds etc)			
4 Monthly weather forecast (rain, clouds, temp…..)			
5 Long term climate forecast (long term period climate variability trends)			

❑

6	Forecast of extreme weather (very heavy rains, floods, and strong winds)			
7	Indigenous forecast (includes indigenous knowledge and empirical observations)			

SECTION E: ACCESS TO FINANCE AND EXTENSION SERVICES AND GROUP MEMBERSHIP

E1. With respect to financing your farm operations, what do you use?

☐ Internal/ Personal Funds ☐ External Funds

E2. Which of the following sources of finance do you use for financing farm operations?

☐ Grant ☐ Bank Loan ☐ Personal Savings ☐ Other (Specify)

☐ Machinery Subsidy ☐ Other Subsidy (Specify)

☐ ☐ Seed Subsidy ☐ Fertilizer Subsidy ☐

E3. If you ticked grant specify the name of the provider of the grant……..

E4. Have you ever applied for credit for the farm activities and equipment?

Yes [1] No [0]

E5. If yes, was the credit availed

Yes [1] No [0]

E6. Have you ever applied for credit to purchase a Climate Smart Agriculture technology?

Yes [1] No [0]

E7. If yes, was the credit availed

Yes [1] No [0]

❑

E8. Have you ever received a grant to purchase a Climate Smart Agriculture technology?

Yes [1] No [0]

Yes [1]		No [0]		

E9. If you have accessed credit, indicate the source of credit

For mal Sources [1]		**Informal Sources [0]**	
Commercial ban ks [1]		Friends [1]	
Agricultural Coo peratives [2]		Family members and relatives [2]	
Micro-finance In stitutions [3]		Informal Money lenders [3]	
Other (specify) [5]……..		Farmers Association [4]	
		Villages Saving and Lending Associations/ Self Help Groups/ Stokvels[5]	
…… …….		Other (specify)……	

E10. If your loa n/credit application was unsuccessful, please state the reasons:

Lack of Collater al

Concerns about l evel of debt already incurred

Problems with credit history or credit report

Incomplete loan application

Other (Specify)

E11. Do you have access to Extension Services?

Yes [1]		No [0]		

E12. If yes, which of the following are your sources of extension information/services?

Extension Officers [1]		**Printed Media [2]**		**Electronic Media [3]**	
Public Extensions Workers [1]		Agricultural Newspapers [1]		Televisions [1]	
Private Extension Workers [2]		Agricultural Magazines [2]		Radio [2]	
NGOs [3]		Brochures/Leaflets [3]		Facebook [3]	
Others [4]		Others[4]		Internet [4]	
				Others [5]	

E13. If you have access to extension officers, how often do you have contact with them? (tick)

❑

Daily [1]		Quarterly [4]		
Weekly [2]		Annually [5]		
Monthly [3]		Other(specify) [6]		

E14. What is the distance to extension office?.....

E15. Have you ever received training on potato dormancy and sprouting from an extension officer?

Yes [1] No [0]

E16. Have you ever received any information on potato dormancy and sprouting from an extension officer

Yes [1] No [0]

E17. If you answer was yes to E15 and E16, do you perceive the extension officer competent in potato dormancy and sprouting?

Yes [1] No [0]

E18. Are you a member of any farmers' organization/cooperative?

Yes [1]		No [0]		

E19. If yes E18, which of the following organization(s) do you belong to? ***(Tick the appropriate)***

ORGANISATION	TICK	NAME
Agricultural Cooperatives [1]		
Community Groups [2]		
Farmer Associations/Producer Organisations [3] e.g., LENAFU/ PLA		
Other (specify)		

E20. If yes to E19, how do the cooperative(s)/farmer organisation(s) help you in your farming operations a experience? ***(Tick the appropriate)***

SERVICES	TICK	
Potato dormancy and sprouting Training [1]		
Access to credit [2]		
Input Acquisition [3]		
Farmer to Farmer Extension Services [4]		
Lobby for Markets [5]		
Provide market information [6]		
Other(specify)		

❑

SECTION F: MARKETING OF PRODUCE

F1. Do you have access to market information?

Yes [1]		No [0]		

F2. Do you sell your produce?

Yes [1] No [2]

F3. If yes to F2 previous question. Tick the correct box.

Seed Potato [1] Table ware[2] Both [3]

F4. Do you receive market information before selling?

Yes [1]		No [0]		

F5. What are your sources of information? Please *tick* the appropriate box and *rate* them according to importance as your sources of information using the *Likert Scale* below.

SOURCES	**Rate**	**TYPE OF MARKET INFORMATION**				
		Buyers ***[1]***	*Prices* ***[2]***	*Market demand* ***[3]***	*Market opportunities* ***[4]***	*Other (specify)* ***[5]***
Extension Officers [1]						
Peer Farmers [2]						
Cooperatives [3]						
Family and Friends [4]						
Media [5]						
Traders [6]						
Other(specify)						

LIKERT SCALE: ***1= Very Important, 2= Somewhat Important, 3= Neutral, 4=Somewhat Unimportant, 5=Very Unimportant***

F6. What is the estimated proportion of produce sold?

Quarter of the produce [1]	Half the produce [2]	Sell everything [3]	None [4]

F7. Indicate the average quantities of produce in the previous year of potato you produced?

……

……

❑

F8. Which of the following market outlets do you sell your produce for? Please indicate if there is contractual agreement with the market outlet and how the farm produce is sold *(tick as appropriate)*.

Market Outlet	**Tick**	**Contractual Agreement*(tick)***
Cooperatives [1]		
Street Vendors [2]		
Collectors [3]		
Wholesalers [4]		
Retailers [5]		
Consumers [6]		
Farm Gate [7]		**N/A**
Other (Specify)____		

F9. How is the price for your produce set during sales?

Market Driven [1]		I set the Price [2]		Buyer Di ctate Price [3]		We negotiate [4]	

F10. If you are the one who set the price, how do you decide on the selling price of the produce?

(Tick the appropriate)

Price Setting Strategy	**Very Important [1]**	**Important [2]**	**Not Important [3]**
a) It depends on the price of other local farmers [1]			
b) It depends on the quality and quantity of produce [2]			
c) It depends on the market I sell to [3]			
d) It depends on the production costs [4]			
e) It depends on the transaction costs [5]			

F11. How do most of your customers rate a price for your produce? *(tick)*

Very Expensive [1]	
Somewhat Expensive [2]	
Moderate Price [3]	
Somewhat Cheap [4]	

❑

Cheap [5]	

F12. If you are not selling at the farm-gate, what is the approximate distance and or time spent travellin the nearest place to sell agricultural outputs? (In km) …….

F13. Do you own any of the following means of transport? If yes, indicate by ticking any of the optio provided.

Yes [1]		No [0]		

Transportation Assets	**Tick**	
Vehicle [1]		
Motorbike [2]		
Bicycle [3]		
Wheelbarrow [4]		
Oxcart [5]		
Other(specify)……		

F14. How do you transport your products to the markets? (Means of transport)

MEANS OF TRANSPORT	**TICK WHERE APPLICABLE**
Own Transport [1]	
Hired Transport [2]	
Public Transport [3]	
By Foot [4]	
Customers Collect for themselves [5]	
Other (specify)	

F15. What is the distance to the market?.....

F16. Which challenges do you encounter the most when marketing your produce? Tick the appropriate an rate them using the Likert scale below.

Market Challenges	**Tick**	**Rate**
Lack of market information [1]		
Lack of access to formal markets [2]		
Inability to have contractual agreements [3]		
Poor institutional support [4]		
Long-distance to the market outlet [5]		
Lack of storage facilities [6]		

❑

Lack of transport [7]		
Poor access to credit [8]		
Quality control failure to meet standards [9]		
Competition [10]		
Price volitility [11]		
Potato Sprouting/Spoiling/Decay [12]		
Other(specify)[13]……		
Likert Scale: ***1=strongly agree, 2= Agree, 3= Neutral, 4= Disagree, 5=Strongly Disagree***		

SECTION G: POTATO PRODUCTION AND HOUSEHOLD FOOD SECURITY

1. What is the main purpose for potato production?
    a) Selling
    b) Household consumption
    c) Both
2. Do you generate income from potato production?
    a) Yes
    b) No
3. Does the potato production contribute to acquiring diversified diets?
    a) Yes
    b) No
4. To what extend does potato production contribute to household food security?
    a) Little contribution
    b) Average contribution
    c) Large contribution
5. Please explain the ways in which potato production contributes to household food security

……

……

……

……

6. Household Food insecurity Access scale

NO.	QUESTION	RESPONSE OPTIONS	CODE

❑

1	In the past two weeks, did you worry that your household would not have enough food?	0= No (skip to 2) 1=Yes	
1.a	How often did this happen?	1=Rarely (one or twice in the past two weeks) 2 = Sometimes (three to ten times in the past two weeks) 0= No (skip to Q2)	
2	In the past two weeks, were you or any household member not able to eat the kinds of food you preferred because of a lack of resources?	0= No (skip to Q3) 1=Yes	
2.a	How often did this happen?	1=Rarely (one or twice in the past two weeks) 2 = Sometimes (three to ten times in the past two weeks)	
		0= No (skip to Q3)	
3	In the past four weeks, did you or any household member have to eat a limited variety of foods due to a lack of resources?	0= No (skip to Q3) 1=Yes	

❑

3.a	How often did this happen?	1=Rarely (one or twice in the past two weeks) 2 = Sometimes (three to ten times in the past two weeks) 0= No (skip to Q4)	
4	In the past four weeks, did you or any household member have to eat some foods that you really did not want to eat because of a lack of resources to obtain other types of food?	0= No (skip to Q5) 1=Yes	
4.a	How often did this happen?	1=Rarely (one or twice in the past two weeks) 2 = Sometimes (three to ten times in the past two weeks) 0= No (skip to Q5)	
5	In the past four weeks, did you or any household member have to eat a smaller meal than you felt you needed because there was not enough food?	0= No (skip to Q6) 1=Yes	
5.a	How often did this happen?	1=Rarely (one or twice in the past two weeks) 2 = Sometimes (three to ten times in the past two weeks) 0= No (skip to Q6)	

❑

6	In the past four weeks, did you or any other household member have to eat fewer meals in a day because there was not enough food?	0= No (skip to Q7) 1=Yes	
6.a	How often did this happen?	1=Rarely (one or twice in the past two weeks) 2 = Sometimes (three to ten times in the past two weeks) 0= No (skip to Q7)	
7	In the past four weeks, was there ever no food to eat of any kind in your household because of lack of resources to get food?	0= No (skip to Q8) 1=Yes	
7.a	How often did this happen?	1=Rarely (one or twice in the past two weeks) 2 = Sometimes (three to ten times in the past two weeks) 0= No (skip to Q8)	
8	In the past four weeks, did you or any household member go to sleep at night hungry because there was not enough food?	0= No (skip to Q9) 1=Yes	

❑

8.a	How often did this happen?	1=Rarely (one or twice in the past two weeks) 2 = Sometimes (three to ten times in the past two weeks) 0= No (skip to Q9)	
9	In the past four weeks, did you or any household member go a whole day and night without eating anything because there was not enough food?	0= No (skip to Q10) 1=Yes	
9.a	How often did this happen?	1=Rarely (one or twice in the past two weeks) 2 = Sometimes (three to ten times in the past two weeks) 0= No (skip to Q10)	

SECTION H: POTATO FARMERS ENTREPRENEURSHIP ORIENTATION

1. Do you affirm the following Entrepreneurship orientation statements apply to you as a farmer in terms of characteristic of an entrepreneur?

Farmers Entrepreneurship Orientation

Statement	**Do you Agree or Disagree? Yes/ No**	**Innovativeness**	**Proactiveness**	**Risk-Taking**
I like to use new farming practices				

❑

I often improve my farming practices				
I like to have the latest information on farming practices				
I respond more quickly to changes in the environment of my farm				
I am constantly looking out for new ways to improve my farm				
I am among the first farmers to adopt new farming practices in my area				
I practice value addition before selling my potato produce				
I am always ready to try new farming practices				

With the current challenging farming environment, I prefer to avoid further investment on my farm				
I prefer to stick to my current farming practices rather than trying new ones.				