EFFECT OF LAND TENURE SECURITY ON AGRICULTURAL PRODUCTIVITY AMONG SMALL SCALE MAIZE FARMERS IN LERIBE AND MASERU DISTRICTS OF LESOTHO

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DECLARATION

I hereby declare that except where otherwise indicated and acknowledged in the text, footnotes, Tables, figures and appendices, the thesis is based on my original work. I also acknowledge that it has not been previously or concurrently submitted for any other degree at NUL or other institutions.

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CERTIFICATION

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DEDICATIONS

I dedicate this work to my family.

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ABSTRACT

The productivity of small-scale maize farmers in Lesotho remains constrained by land tenure insecurity among other constraints, limiting their ability to maximize agricultural output. The primary objective of this study is to assess the effect of land tenure security on agricultural productivity among small-scale maize farmers in the Leribe and Maseru districts of Lesotho. Specifically, the study aims to identify different land tenure security systems, measure the breadth and duration of tenure, compare maize productivity across systems, and analyze the influence of land tenure security on productivity.

A multi-stage sampling technique was employed, resulting in a sample size of 49 respondents (23 from Leribe and 26 from Maseru). The study used descriptive statistics and regression analysis to evaluate the effect of land tenure security on agricultural productivity. Results indicated that land tenure security does not significantly influences maize productivity.

With regard to land tenure security, "Marital Status" and "Education Level" show weak significance in Leribe district, while in Maseru district, the "Land Tenure System" comes close to being weakly significant ($p = 0.0795$). This suggests that while land tenure security does not have a consistently strong effect across both districts, the way land is acquired and certain socio-demographic factors may have localized effects on productivity. The results highlight the need for stakeholders to implement policies that facilitate affordable access to secure land tenure by obtaining land title deeds.

Keywords: Land tenure security, agricultural productivity, Leribe district, Maseru district

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LIST OF ABBREVIATIONS AND ACRONYMS

GDP	Gross Domestic Product
SDG	Sustainable Development Goals
FAO	Food and Agricultural Organization
USDA	United States Department of Agriculture
IFAD	International Fund for Agricultural Development
LAA	Land Authority Act
LHWA	Lesotho Highlands Water Authority
OLS	Ordinary Least Square
2SLS	Two Stage Least Square
TFP	Total Factor Productivity
AVC	Average variable cost in Maloti
TVC	Total Variable Cost in Maloti
1Q	First Quartile
3Q	Third Quartile

CHAPTER ONE: INTRODUCTION

1.1.Background

Securing land tenure is widely recognized as essential for promoting agricultural productivity and fostering rural development (Singirankabo & Ertsen, 2020), particularly in countries like Lesotho, where small-scale farming plays a dominant role in the agricultural sector (Rantšo et al, 2019). Despite the critical importance of maize farming for food security in Lesotho, land tenure insecurity continues to undermine productivity, (World Bank, 2018). Research, including studies by Kanyamuka (2018), Mijatovic & Pender (2019), and Ntibagirirwa & Ntiranyibagira (2018), has underscored the significance of securing land tenure in many developing nations to enhance agricultural output and support rural development.

The relationship between land tenure security and agricultural productivity is well-established, as noted by Ali et al. (2018). When farmers have sTable tenure, they are more likely to invest in their land, access credit, make long-term improvements, and adopt sustainable agricultural practices (Place & Otsuka, 2018). Conversely, tenure insecurity can lead to decreased agricultural output, increased land degradation, and barriers to accessing critical resources such as markets and financing (Olsson et al., 2019).

In Lesotho, over 80% of the population relies on subsistence farming, and small-scale farming is vital to both the livelihoods of rural communities and the national food supply. The World Bank (2019) and ITA (2021) report that approximately 80% of the population depends on agriculture, which accounted for about 4.95% of the country's gross domestic product (GDP) in 2021 (Statista, 2021). However, small-scale farmers face significant challenges, with land tenure insecurity being one of the most pressing (FAO, 2019). This insecurity often results from a lack of sTable, long-term access to land, thereby discouraging investment in agricultural operations and negatively impacting productivity (Baptista et al, 2022).

Land tenure security, defined as the level of confidence individuals have in their rights to use, manage, and transfer land (Mbudzya et al., 2023), is key to increasing agricultural productivity. By ensuring secure land tenure, farmers gain the assurance and motivation necessary to invest in their farms (IFAD, 2020; Mbudzya et al., 2024). However, in developing countries such as Lesotho, many small-scale farmers lack formal documentation of their land rights, making them vulnerable to disputes and potential land expropriation (Mbudzya et al., 2024).

Despite the acknowledged importance of land tenure security, limited empirical research has been conducted on its relationship with agricultural productivity, specifically among small-scale maize farmers in Lesotho. While other African nations have made strides in addressing land tenure insecurity, as evidenced by studies such as Jabu et al. (2022), Lesotho's case remains relatively underexplored.

1.2.Statement of research problem

The productivity of small-scale farmers, despite their critical role in Lesotho's agricultural sector, continues to be constrained by land tenure insecurity (Pule & Thabane, 2004). Understanding how land tenure security impacts agricultural productivity among these farmers is crucial for addressing this challenge. Maize farming, in particular, holds a vital place in Lesotho’s agricultural economy, much like it does in many other African countries. As a major cereal crop, maize (Zea mays) ranks at third place globally after rice and wheat in terms of production (Mekureyaw, 2017). In Lesotho, it serves not only as a staple food crop but also as a pillar of food security, widely cultivated across the nation and central to the local diet.

The importance of maize production extends beyond household consumption to broader economic sustainability. During the 2021/22 agricultural season, approximately 129,088 hectares of land were dedicated to maize cultivation, yielding an estimated 27,963 metric tons, with a national average productivity of 0.22 metric tons per hectare. This level of production remains a critical food resource, helping to sustain Lesotho's population and secure its food supply. According to the Food and Agriculture Organization (FAO) in 2022, small-scale farmers contribute significantly to the country's maize production, a pattern similar to that observed in other African countries like Kenya. Despite this, most of the maize produced in Lesotho is consumed at the household level, underscoring the crop's dual importance as both a commercial product and a staple food source for local communities, (World Bank, 2019).

Lesotho's growing population, now estimated at around 2.35 million people (Worldometer, 2024), and its limited land area of approximately 30,360 km^2 (World Bank, 2021), place increasing pressure on agricultural resources, including land. This situation heightens the risk of land tenure insecurity, which exacerbates conflicts over land rights, discourages investment in agricultural land, and contributes to lower maize yields (Bezabih et al., 2021). Addressing these issues is critical to improving a portion of both food security and economic resilience in Lesotho's small-scale farming sector.

1.3.Objectives

1.3.1. Main Objective of the Study

The primary aim of this research is to assess the effect of land tenure security on agricultural productivity of small-scale farmers in Lesotho.

1.3.2. The specific objectives are to

i. Identify different land tenure security held by the respondents/farmers in Leribe and Maseru districts.
ii. Measure the breadth and duration of the land rights in Leribe and Maseru districts.
iii. Measure and compare maize productivity across different land tenure security systems in Leribe and Maseru districts.
iv. Analyze the influence of land tenure security on maize productivity in Leribe and Maseru districts.

1.4.Research Questions

i. What are the land tenure systems used in Leribe district and Maseru district?
ii. What is the breadth and duration of land rights in Leribe district and Maseru district?
iii. How do input usage and farming practices differ across different land tenure systems and their effect on productivity?
iv. What is the relationship between land tenure security and maize production in Leribe and Maseru districts?

1.5.Hypotheses

By addressing these aspects, the research aims to provide a holistic understanding of the effect of land tenure on maize productivity and contribute to sustainable agricultural development in Lesotho. The following hypothesis will be tested in this study:

1.5.1. The first hypothesis

$H0_1$: there is no difference in land tenure security systems between Leribe district and Maseru district

$Ha_{1:}$ there is a difference in land tenure security systems between Leribe district and Maseru district

1.5.2. The second hypothesis was

$H0_2$: Land tenure has no effect on maize productivity in Leribe and Maseru districts.
Ha_2: Land tenure has an effect on maize productivity in Leribe and Maseru districts.

1.6.Significance of the Study

The results of this study hold the potential to significantly enhance our comprehension of the effect of land tenure security on agricultural productivity among small-scale farmers in Lesotho (Rantšo et al., 2019). The findings will provide valuable information for policymakers and stakeholders in the agricultural sector, aiding in the development of strategies and interventions aimed at bolstering land tenure security and boosting agricultural productivity (Singirankabo & Ertsen, 2020). Additionally, this study will contribute to the existing body of literature on the relationship between land tenure security and agricultural productivity, with a particular focus on Lesotho's unique context.

The insights gleaned from this study will illuminate the intricate dynamics of land tenure security and offer valuable guidance for decision-makers seeking to advance agricultural productivity and rural development in Lesotho. The findings will be vital for shaping policies aimed at fostering agricultural growth and progress in the country, (Lencucha et al., 2020).

Lesotho faces significant food security challenges, with maize being a staple crop that directly impacts the food supply and livelihoods of a large portion of the population (Rantšo et al., 2019). As stated by Murken & Gornott (2022), understanding how different land tenure systems affect agricultural productivity is crucial, as land tenure security can influence farmers' willingness to invest in their land, their access to credit, and their overall farming practices. Improving maize productivity can contribute to economic growth, reduce poverty, and improve living standards for rural populations, (Mbudzya et al., 2022).

This research aims to inform policymakers about the effectiveness of current land tenure systems and assist in designing reforms that enhance agricultural productivity (Singirankabo & Ertsen, 2020). By identifying factors that affect productivity, the research can help allocate resources more effectively, such as agricultural inputs and support services, to the areas and farmers who need them most; understanding the relationship between land tenure and productivity can also attract investment in agricultural infrastructure and technologies essential for improving productivity and sustainability (Murken & Gornott, 2022).

By identifying best practices and constraints under different land tenure systems, this research can help farmers adopt more effective agricultural practices, leading to higher yields and better resource management (Autio et al., 2021). The study's insights can lead to more equitable and efficient land policies that ensure secure land tenure for farmers, encouraging long-term investments in land and boosting productivity (Murken & Gornott, 2022). Increased maize productivity can result in higher incomes for farmers, better food availability and affordability for consumers, and overall socio-economic development in rural areas as stated in the research by Matita et al., (2024). Furthermore, the research aligns with several Sustainable Development Goals (SDGs), including ending hunger (SDG 2), promoting sustainable agriculture (SDG 12), and reducing poverty (SDG 1), (Medina-Hernández et al., 2024).

1.7.Limitations

Sample Size Limitations: It's important to acknowledge that the research faces constraints when it comes to the size and representativeness of the sample group. Due to practical reasons, the researcher was working with a smaller sample, which restricted the ability to draw sweeping conclusions about the entire agricultural landscape in Lesotho.

Seasonal Variations: Agricultural production, including maize farming, can be influenced by seasonal changes and climate conditions. The study captured data during a specific period, potentially not fully representing year-round dynamics.

1.8.Delimitations

Sample Selection: Due to practical considerations, the study involves a representative sample of households engaged in market of maize production in Leribe district and Maseru district districts of Lesotho, rather than conducting an exhaustive survey of the entire population. The specific sample size and selection criteria is thoroughly detailed in the research methodology.

Long-Term effect Assessment: The study predominantly centers on assessing the present state of land tenure and maize production. It does not encompass the ongoing tracking or evaluation of the long-term effects of policy alterations or interventions beyond the study's predefined time-frame.

1.9.Definitions of terms

Small-scale farmer: according to FAO (2013), a small-scale farmer is a farmer who manage areas varying from less than one hectare to 10 hectares. Small-scale farmers are characterized by family-focused motives such as favouring the stability of the farm household system, using mainly family labour for production and using part of the produce for family consumption. However, USDA (2010) defined a small-scale farmer as a farmer who makes not more than $250,000 USD out of their yield, which is almost every farmer in Lesotho. Therefore, in this research, the definition by FAO (2013) was found the most suiTable for Lesotho.

Land tenure Security: refers to the degree of confidence landholders have that their land rights will be recognized, respected, and protected over time, allowing them to make long-term investments and use the land without fear of eviction or disputes (Tian et al., 2024)

Agricultural productivity: Agricultural productivity is generally defined as the measure of the output of agricultural activities relative to the inputs used, such as land, labour, capital, or fertilizers. It is an indicator of the efficiency with which agricultural inputs are transformed into outputs (Bouteska et al., 2024)

CHAPTER TWO: LITERATURE REVIEW

2.1. Introduction

Land tenure security is a critical component in the discourse on agricultural productivity, particularly in developing countries where agriculture serves as the backbone of the economy and a primary source of livelihood for the majority of the population (Singirankabo & Ertsen, 2020; Azadi et al., 2021). The concept of land tenure security involves the certainty that an individual's or a group's rights to land will be recognized and protected by law and can be upheld against claims by others (Doss & Meinzen-Dick, 2020). It encompasses a range of factors, including legal recognition of land rights, enforcement of these rights, and the ability to transfer land through sale, lease, or inheritance (Musah et al., 2024).

In many developing countries, land tenure insecurity is a prevalent issue, often linked to historical and socio-political factors that have shaped land distribution and ownership patterns (Holland et al., 2022). This insecurity can manifest in various forms, such as the lack of formal land titles, ambiguous or overlapping land rights, and weak enforcement of existing land laws (Lokhandwala, 2022). As a result, farmers may be reluctant to invest in land improvements or adopt sustainable agricultural practices, fearing that they may lose their land or be unable to reap the benefits of their investments (Murken & Gornott, 2022).

Agricultural productivity, defined as the output per unit of input, is significantly influenced by the security of land tenure (Deininger et al., 2020). When farmers have secure land rights, they are more likely to invest in their land, utilize improved farming techniques, and engage in long-term planning, all of which contribute to increased productivity (Murken & Gornott, 2022). Conversely, land tenure insecurity can lead to suboptimal land use, reduced investments in agricultural inputs, and lower productivity levels, which ultimately affects food security and economic development in the broader context (Holland et al., 2022).

Given the importance of secure land tenure for enhancing agricultural productivity, this research aims to explore the relationship between land tenure security and agricultural productivity among small-scale maize farmers in the Leribe district and Maseru district districts of Lesotho (LHWA, 2020). The study seeks to contribute to the existing body of knowledge by examining the specific challenges and opportunities within the context of Lesotho's land tenure system, which is characterized by a dual structure of formal and customary arrangements (ISLA, 2023; Doss & Meinzen-Dick, 2020). The findings of this research will provide insights that can inform policy decisions aimed at improving land tenure security and, consequently, agricultural productivity in the region (Deininger et al., 2020).

2.2. Overview of Land tenure security in developing countries

Land tenure security in developing countries is a multifaceted issue, deeply intertwined with historical, social, and political dynamics (Doss & Meinzen-Dick, 2020). In these regions, land serves not only as a crucial economic asset but also as a social and cultural cornerstone, often determining access to resources, social status, and political power (Deininger et al., 2020). However, the prevalence of insecure land tenure systems in many developing countries poses significant challenges to sustainable development and agricultural productivity (Murken & Gornott, 2022).

In many African countries, for example, land tenure systems are often dual in nature, encompassing both formal statutory laws and customary practices (Holland et al., 2022). Customary tenure systems, which govern the majority of rural land in Sub-Saharan Africa, are characterized by communal ownership and management, where land rights are traditionally allocated by community leaders (Ali et al., 2019). These systems, while providing some degree of tenure security through community recognition, often lack formal legal documentation, making it difficult for landholders to enforce their rights or access credit (Deininger et al., 2020).

In contrast, statutory tenure systems, which are based on formal laws and regulations, are often introduced as part of colonial legacies or modern state interventions (Doss & Meinzen-Dick, 2020). These systems tend to favor individual ownership and formal titling, which are seen as prerequisites for improving agricultural productivity and enabling land markets (Murken & Gornott, 2022). However, the introduction of statutory systems often leads to conflicts and overlaps with customary practices, resulting in tenure insecurity, especially in rural areas where customary norms are still dominant (Holland et al., 2022).

The implications of insecure land tenure in developing countries are profound. Without secure rights to land, farmers may be reluctant to invest in land improvements or adopt new agricultural technologies, fearing that they may be displaced or lose their land (Deininger et al., 2020). This lack of investment contributes to low agricultural productivity, which in turn exacerbates poverty and food insecurity (Ali et al., 2019).

Moreover, insecure land tenure can lead to land disputes, which are common in many developing countries and often result in protracted legal battles, violence, or even loss of life (Murken & Gornott, 2022).

Efforts to improve land tenure security in developing countries have included land reforms aimed at formalizing land rights, strengthening land administration systems, and improving the enforcement of land laws (Doss & Meinzen-Dick, 2020). However, these reforms have met with varying degrees of success, often depending on the local context, the political will of governments, and the capacity of institutions to implement and enforce land policies (Deininger et al., 2020). In many cases, the benefits of land reforms have been unevenly distributed, with marginalized groups, such as women and indigenous communities, often being left out of the formalization processes (Ali et al., 2019).

In conclusion, land tenure security remains a critical issue in developing countries, influencing agricultural productivity, economic development, and social stability (Holland et al., 2022). Addressing the challenges of insecure land tenure requires a nuanced understanding of the interplay between formal and customary systems, as well as targeted interventions that consider the specific needs and contexts of different communities (Murken & Gornott, 2022).

2.3. Overview of the land tenure security in Lesotho

Land tenure security in Lesotho is a complex issue shaped by the country's unique historical, legal, and socio-cultural context (De Satgé & Johnson, 2021, 2021). Lesotho’s land tenure system is characterized by a dual structure, incorporating both customary and statutory elements, which coexist and often overlap, leading to a range of challenges for landholders, particularly in rural areas (Lesotho Highlands Water Authority [LHWA], 2020).

Under the customary system, land is considered the property of the Basotho nation and is held in trust by the King. Traditional chiefs, acting as custodians of the land, allocate parcels to individuals and families based on customary laws and practices (Mokitimi, 2020). This system is deeply rooted in the cultural and social fabric of Basotho society, providing a sense of belonging and community cohesion. However, the absence of formal documentation under customary tenure often leads to tenure insecurity, as land rights are not legally recognized by the state, making it difficult for landholders to defend their claims in cases of disputes (Matela & Turner, 2021).

The statutory system, on the other hand, was introduced during the colonial period and has been further developed post-independence. It emphasizes formal land registration and titling, aiming to provide legal recognition of land rights and facilitate land transactions (Letete, 2019). The introduction of the Land Act of 2010 marked a significant step towards formalizing land tenure in Lesotho by promoting the registration of land rights and enabling leasehold tenure, which allows for more secure, transferable, and legally recognized land rights (LHWA, 2020). Despite these efforts, the implementation of statutory land tenure reforms has been uneven, particularly in rural areas where customary practices still dominate, leading to a fragmented and often contradictory land tenure landscape (The World Bank, 2022).

The duality of the land tenure system in Lesotho has created several challenges. First, the lack of integration between customary and statutory systems results in overlapping land claims and conflicts, particularly in peri-urban areas where demand for land is high (Mokitimi, 2020). Second, the process of formalizing land rights under the statutory system can be costly and complex, deterring many rural landholders from registering their land (Matela & Turner, 2021). Additionally, there are concerns about the exclusion of vulnerable groups, such as women, who often have weaker land rights under both customary and statutory systems, limiting their ability to secure land tenure and access credit (Letete, 2019).

Land tenure insecurity in Lesotho has significant implications for agricultural productivity. Farmers with insecure land rights are less likely to invest in long-term improvements, such as soil conservation or irrigation infrastructure, due to the fear of losing their land (LHWA, 2020). This reluctance to invest hinders agricultural productivity and exacerbates food insecurity, particularly among small-scale farmers who rely heavily on their land for their livelihoods (Mokitimi, 2020).

Efforts to improve land tenure security in Lesotho have included government initiatives to streamline land registration processes and enhance the capacity of local institutions to manage land disputes (Matela & Turner, 2021). However, these efforts have been met with mixed results, with ongoing challenges related to the integration of customary and statutory systems, the inclusiveness of reforms, and the capacity of institutions to enforce land rights effectively (LHWA, 2020).

In summary, while Lesotho has made strides in reforming its land tenure system, significant challenges remain, particularly in bridging the gap between customary and statutory tenure systems and ensuring that land tenure reforms are inclusive and accessible to all segments of the population (Letete, 2019).

2.4. Importance of land tenure security

Land tenure security is critical for sustainable development, particularly in agrarian economies where land is a key resource for both subsistence and commercial agriculture (Murken & Gornott, 2022). Secure land tenure encourages farmers to invest in their land, adopt improved agricultural practices, and engage in long-term planning, all of which contribute to increased agricultural productivity and food security (Ali et al., 2019). Insecure tenure, on the other hand, often leads to underinvestment in land and a reluctance to adopt sustainable farming techniques due to fears of losing access to the land (Deininger et al., 2020).

Moreover, secure land tenure is closely linked to poverty reduction. When landholders have confidence in their land rights, they are more likely to use their land as collateral to access credit, which can be invested in agricultural inputs, education, or other income-generating activities (Murken & Gornott, 2022). This access to credit is particularly important for smallholder farmers, who often lack other forms of collateral (Holland et al., 2022). Additionally, secure tenure can contribute to social stability by reducing conflicts over land and ensuring that marginalized groups, such as women and indigenous communities, have access to land and the benefits it provides (Doss & Meinzen-Dick, 2020).

Land tenure security also plays a vital role in environmental sustainability. When landholders have secure tenure, they are more likely to invest in sustainable land management practices, such as soil conservation, reforestation, and sustainable water use (Ali et al., 2019). These practices are crucial for maintaining the health of ecosystems and ensuring the long-term productivity of agricultural land (Deininger et al., 2020). In contrast, insecure land tenure can lead to land degradation, as farmers may exploit the land for short-term gains without considering the long-term consequences (Holland et al., 2022).

In the broader context of economic development, secure land tenure is essential for the functioning of land markets and the efficient allocation of resources. Well-defined and legally recognized land rights facilitate land transactions, enabling land to be transferred to those who can use it most productively (Murken & Gornott, 2022). This, in turn, can lead to more efficient land use and contribute to overall economic growth

(Doss & Meinzen-Dick, 2020). Secure land tenure also supports the development of infrastructure and public services, as it provides the legal certainty needed for investments in roads, schools, and healthcare facilities (Deininger et al., 2020).

2.5. Challenges in the land tenure security in developing countries

Land tenure security in developing countries faces numerous challenges, stemming from historical, social, and political factors (Deininger et al., 2020). One of the most significant challenges is the coexistence of formal and customary tenure systems, which often leads to conflicting claims over land and undermines tenure security (Holland et al., 2022). Customary systems, which are prevalent in many African and Asian countries, are based on traditional practices and are often not formally recognized by the state, making it difficult for landholders to enforce their rights (Ali et al., 2019).

Another major challenge is the lack of land documentation and formal registration. In many developing countries, a large proportion of land is not formally registered, leaving landholders without legal proof of their rights (Doss & Meinzen-Dick, 2020). This lack of documentation makes it difficult for landholders to defend their claims in court, access credit, or engage in land transactions (Deininger et al., 2020). The process of land registration is often complex, costly, and inaccessible, particularly for rural communities and marginalized groups such as women and indigenous peoples (Murken & Gornott, 2022).

Land tenure security is also undermined by weak governance and institutional capacity. In many developing countries, land administration systems are under-resourced and lack the capacity to effectively manage land rights, resolve disputes, and enforce land laws (Doss & Meinzen-Dick, 2020). Corruption and political interference in land administration further exacerbate these challenges, leading to arbitrary land allocations and the erosion of tenure security (Holland et al., 2022). Additionally, the impacts of climate change, such as increasing frequency and intensity of natural disasters, can exacerbate land tenure insecurity by displacing populations and creating new pressures on land resources (Ali et al., 2019).

2.6. Factors influencing land tenure security

Land tenure security is influenced by a variety of factors that can be broadly categorized into socio-economic, land tenure-specific, and institutional factors (Murken & Gornott, 2022). Understanding these factors is crucial for designing effective policies and interventions to enhance tenure security.

2.6.1. Socio-Economic factors

Socio-economic factors, such as income level, education, and social status, play a significant role in determining land tenure security (Holland et al., 2022). Wealthier and more educated individuals are often better able to navigate the complexities of land registration processes, secure formal titles, and access legal services to defend their land rights (Ali et al., 2019). Conversely, poorer households, who may lack the resources to register their land or engage in legal battles, are more vulnerable to losing their land or being unable to defend their rights (Murken & Gornott, 2022). Additionally, social status, including gender and ethnic identity, can influence access to land and tenure security, with marginalized groups often facing discrimination and exclusion in land allocation and registration processes (Doss & Meinzen-Dick, 2020).

2.6.2. Land tenure security Factors

Factors specific to the land tenure system itself also influence tenure security. The clarity of land rights, the level of documentation, and the enforcement of land laws are critical components of a secure tenure system (Deininger et al., 2020). In systems where land rights are clearly defined, well-documented, and legally recognized, tenure security is generally higher (Holland et al., 2022). Conversely, in systems where land rights are ambiguous, poorly documented, or not legally enforceable, tenure insecurity is more prevalent (Doss & Meinzen-Dick, 2020). The type of tenure system—whether customary, statutory, or a hybrid—also plays a role, with statutory systems generally offering more formal protections, although they may not always be accessible to all landholders, particularly in rural areas (Ali et al., 2019).

2.6.3. Institutional Factors

Institutional factors, including the capacity and integrity of land administration institutions, are crucial determinants of land tenure security (Murken & Gornott, 2022). Effective land administration requires institutions that are well-resourced, transparent, and accounTable, with the capacity to manage land records, resolve disputes, and enforce land rights (Deininger et al., 2020). In many developing countries, however, land administration institutions are often underfunded, lack trained personnel, and are susceptible to corruption, all of which undermine tenure security (Doss & Meinzen-Dick, 2020). Additionally, the legal and policy framework governing land rights, including the presence of strong legal protections for landholders and accessible mechanisms for dispute resolution, is essential for ensuring tenure security (Holland et al., 2022).

2.7. Agricultural productivity in developing Countries

Agricultural productivity in developing countries is a crucial determinant of economic growth, food security, and poverty reduction (FAO, 2021). However, the agricultural sector in many developing nations faces significant challenges, including low levels of productivity due to inadequate access to inputs, poor infrastructure, and limited adoption of modern agricultural techniques (World Bank, 2020). These challenges are compounded by factors such as climate change, which affects crop yields and exacerbates food insecurity (Liu et al., 2021).

In many developing countries, smallholder farmers form the backbone of the agricultural sector, yet they often operate under conditions of significant resource constraints (IFAD, 2020). Limited access to credit, technology, and markets restricts their ability to improve productivity (Balana et al., 2022). Additionally, land fragmentation, which is common in many developing countries, further hinders productivity by reducing economies of scale and making it difficult to implement mechanized farming practices (Jayne et al., 2019).

Efforts to improve agricultural productivity in developing countries have focused on enhancing access to inputs such as fertilizers, seeds, and irrigation systems, as well as promoting the adoption of sustainable agricultural practices (Branca et al, 2021). Investments in agricultural research and development, infrastructure, and extension services are also critical for boosting productivity (FAO, 2021). However, these efforts often require supportive policies and institutional frameworks to be effective, particularly in addressing the structural challenges faced by smallholder farmers (World Bank, 2020).

2.8 Land tenure security accessible to small-scale farmers in developing countries

Land tenure security is a fundamental issue for small-scale farmers in developing countries, who often lack formal land rights and face a high risk of land displacement (Murken & Gornott, 2022). In many regions, land tenure systems are characterized by a dual structure, with both formal and customary tenure arrangements coexisting (Doss & Meinzen-Dick, 2020). Customary tenure systems, which are prevalent in Sub-Saharan Africa and parts of Asia, provide some level of security through communal ownership, but these rights are often not recognized by formal legal systems, leaving small-scale farmers vulnerable to expropriation (Byamugisha & Dubosse, 2023).

Access to secure land tenure is crucial for small-scale farmers because it influences their ability to invest in their land, access credit, and plan for the long term (Ali et al., 2019). Without secure tenure, farmers are less likely to make the necessary investments in land improvement and conservation, leading to lower productivity and increased environmental degradation (Deininger et al., 2020). Furthermore, land tenure insecurity can exacerbate inequalities, particularly for women and other marginalized groups who may be excluded from land ownership under both formal and customary systems (Murken & Gornott, 2022).

Efforts to improve land tenure security for small-scale farmers often focus on formalizing land rights through land registration and titling programs (Doss & Meinzen-Dick, 2020). However, these programs can be complex and costly, and they may not always be accessible to the poorest farmers (Deininger et al., 2020). In some cases, community-based approaches to land tenure security, which strengthen customary rights and provide legal recognition of communal ownership, have been more successful in protecting the rights of small-scale farmers (Holland et al., 2022).

2.9. Land tenure security and agricultural productivity

The relationship between land tenure security and agricultural productivity has been widely studied, with most research indicating a positive correlation between secure land rights and improved agricultural outcomes (Murken & Gornott, 2022). Secure land tenure provides farmers with the confidence to invest in their land, adopt new technologies, and engage in long-term planning, all of which are critical for increasing productivity (Ali et al., 2019). This is particularly important for small-scale farmers in developing countries, where access to credit, technology, and markets is often limited (Deininger et al., 2020).

Studies have shown that land tenure security leads to higher levels of investment in land improvement, such as soil conservation, irrigation, and the adoption of high-yield crop varieties (Holland et al., 2022). These investments not only boost productivity but also enhance the sustainability of agricultural practices, reducing the risk of land degradation and ensuring the long-term viability of agricultural production (Branca et al., 2022).

Moreover, secure land tenure can facilitate the transfer of land to more productive users through land markets, contributing to more efficient land use and higher overall productivity (Deininger et al., 2020). However, the effect of land tenure security on productivity can vary depending on the specific context, including the type of crops grown, the availability of complementary inputs, and the overall policy environment (Jayne et al., 2019).

While the benefits of secure land tenure for productivity are clear, achieving tenure security in developing countries remains a challenge due to the complex interplay of social, economic, and political factors (Doss & Meinzen-Dick, 2020). Addressing these challenges requires a comprehensive approach that includes legal reforms, capacity building for land administration, and targeted interventions to protect the rights of vulnerable groups (Murken & Gornott, 2022).

2.10. Theoretical Framework

The guiding theory for this research is the Property Rights Theory. Fundamentally grounded in institutional economics, this theory posits that secure property rights are crucial for economic development and efficiency (Coase, 1960; North, 1990). According to this theory, when landholders have secure and well-defined property rights, they are more likely to invest in their land, engage in long-term planning, and adopt new technologies. This security reduces uncertainty and the risk of expropriation, thus incentivizing landholders to improve their land's productivity (Besley, 1995; Feder & Feeny, 1991).

The Property Rights Theory emphasizes several key principles, including incentives for investment, reduced transaction costs, and enhanced market functioning, (Xu et al., 2024). Secure property rights encourage landowners to invest in improvements and sustainable practices, lower the costs associated with defending and transferring land, and facilitate land markets, allowing for efficient allocation of land resources (Stirling et al., 2024). Empirical support for this theory is extensive, with studies demonstrating that secure land tenure can lead to increased agricultural productivity, higher investment in land improvements, and more efficient land use (Singirankabo & Ertsen, 2020).

Recent empirical studies further underscore the importance of secure property rights. For instance, Ghebru and Girmachew (2019) found that land tenure security in Ethiopia significantly enhances agricultural productivity by promoting long-term investments in land. Similarly, Kehinde et al. (2021) showed that secure land tenure in Ghana positively impacts crop choice and food security by encouraging farmers to invest in their land. Ali et al. (2022) provided evidence from Rwanda that land tenure reforms have led to significant increases in agricultural productivity through improved access to credit and investment incentives (Ali et al., 2022).

Further studies have reinforced these findings across various contexts. Azadi et al., (2024) showed that land tenure security promotes agricultural investment in Ethiopia. Murken et al., (2024) revealed significant positive impacts of land tenure security on agricultural productivity in Uganda. Rampa and Lovo (2023) found that land certification significantly improves agricultural productivity in Ethiopia.

These studies collectively support the Property Rights Theory, illustrating how secure land tenure can drive agricultural productivity through increased investment, improved access to credit, and adoption of sustainable practices.

2.11. Conceptual Framework

The conceptual framework for examining the effect of land tenure security on agricultural productivity involves the interplay between several key variables. This framework delineates the relationships between land tenure security, agricultural productivity, and various mediating and moderating factors that can influence these relationships.

Key Variables

Land Tenure Security: This refers to the extent to which landholders have secure and well-defined property rights. It encompasses aspects such as land registration, legal ownership, duration of land use rights, and protection from expropriation. Secure land tenure is hypothesized to positively influence agricultural productivity by encouraging long-term investments and reducing uncertainties related to land use (Feder & Feeny, 1991; Besley, 1995).

Agricultural Productivity: This is measured by indicators such as crop yield per hectare, total agricultural output, and efficiency of input use. Productivity reflects the effectiveness with which land and other inputs are converted into outputs (Franck, 2018).

Access to Credit (Capital): Secure land tenure can enhance access to credit by providing collateral, which can be used for investment in agricultural improvements and technologies (USAID, 2021). Access to credit mediates the relationship between land tenure security and agricultural productivity by enabling farmers to invest in productivity-enhancing inputs (Raoul. 2021).

Extension Services (Labour): Agricultural extension services offer training and support to farmers, which can enhance the positive effect of secure land tenure on productivity. These services help farmers adopt new technologies and practices (Raji et al., 2024).

3. Infrastructure (Land): Improved infrastructure, such as transportation and irrigation systems, can moderate the relationship between land tenure security and agricultural productivity, showing that better infrastructure facilitates market access and reduces production costs (Foster et al., 2023; Singirankabo & Ertsen 2020).

4. Socio-Economic Factors (Entrepreneurship): Variables such as farmer education, household income, and labor availability can also influence how land tenure security affects agricultural productivity (Fosu & Osei, 2021; Kijima & Tsuboi 2020). Higher levels of education and income typically enhance productivity by enabling better management practices and access to resources (Ghebru & Girmachew, 2019; Alemu & Tekle, 2022).

2.12. Empirical Review of Literature

2.12.1. Land Tenure Systems in Lesotho

Lesotho's land tenure system is notably characterized by a dual structure that encompasses both formal and customary arrangements, as documented by the Lesotho Highlands Water Authority (LHLA) in 2020. This dual system introduces intricacies in matters of land ownership, access, and security. Notably, it results in recurring challenges related to land tenure insecurity, a concern that disproportionately affects vulnerable groups within the population. The presence of land tenure insecurity, as highlighted by the Food and Agriculture Organization (FAO) in 2019, has the effect of curbing investments in the agricultural sector.

2.12.2. Global Perspectives on Land Tenure and Maize Production

International research has consistently demonstrated the pivotal role of secure land tenure in improving agricultural productivity. For instance, a study conducted in Zambia by Holden and colleagues in 2018 revealed that farmers with well-established land rights were more inclined to embrace modern agricultural practices, resulting in increased maize yields. This finding underscores the global relevance of secure land tenure in advancing agricultural outcomes.

2.12.3. Empirical Evidence from Sub-Saharan Africa

Studies carried out in neighboring South Africa have delved into the intricate connection between land tenure and agricultural practices. Cousins and Hornby's research in 2018, for example, illustrated that tenure insecurity had an adverse impact on both maize production and land conservation initiatives within the small-scale farming community in KwaZulu-Natal. This finding shed light on the potential consequences of insecure land tenure on agriculture, not only in Lesotho but also in nearby regions.

2.12.4. Results Obtained in Past Research

The consistent findings from these studies underscore the critical significance of having secure land tenure rights in elevating maize production. Secure land rights have been consistently linked to heightened investments in agriculture, the adoption of contemporary farming practices, and overall improvements in food security. These conclusions highlight the pivotal role that land tenure security plays in fostering agricultural development and food sustainability.

Coulibaly (2021) Jansen and Roquas (2022) demonstrated that secure land tenure in Honduras significantly boosts farm productivity. Singirankabo & Ertsen (2020) highlighted the relations between Land Tenure Security and Agricultural Productivity. Singirankabo & Ertsen (2020) also showed how women's land tenure security affects agricultural productivity, revealing significant positive impacts. Murken & Gornott (2022) explored the role of land tenure security in enhancing resilience to climate change in sub-Saharan Africa, with implications for agricultural productivity.

Kassie and Holden (2023) found that land certification significantly improves agricultural productivity in Ethiopia. Singirankabo & Ertsen (2020) provided evidence that land tenure security is a key determinant of agricultural productivity among smallholder farmers in Rwanda. Ali & Deininger (2022) argued that securing land rights is essential for agricultural transformation and productivity growth in Africa. Paltasingh (2018) examined how land tenure security influences technology adoption and agricultural productivity in India, finding positive effects. Holland et al., (2022) highlighted the importance of land tenure security in promoting sustainable agricultural practices and improving productivity.

Additional studies have also emphasized similar findings. For instance Selejio & Norman (2012) found that land tenure security enhances crop yields among smallholder farmers in Tanzania. Coulibaly showed that land tenure security contributes to improved agricultural investment and productivity in Burkina Faso. Meeks (2018) demonstrated that land titling programs in urban Peru led to increased agricultural productivity through improved credit access and investment. Deininger & Goyal (2022) provided evidence that secure land tenure reduces conflict over land and enhances productivity in Africa.

In Lesotho, land tenure security remains a significant challenge for small-scale farmers. The majority of small-scale farmers in Lesotho lack formal land tenure documents, and this puts their land rights at risk of disputes, expropriation, or reallocation (Rantšo et al., 2019). Studies have shown that the lack of land tenure security hinders small-scale farmers' investment in their farms, leading to low agricultural productivity and reduced food security (Ibrahim et al., 2023).

According to the World Bank (2018), land tenure security is essential for small-scale farmers, as it provides a sTable foundation for investment and allows them to access credit and other financial services. Infrastructure is another critical factor that affects land tenure security and agricultural productivity. Poor infrastructure, such as inadequate access to markets, storage facilities, and transport, limits small-scale farmers' ability to access inputs and sell their produce, hindering their investment in their farms and reducing their productivity (Khan, *et al.* 2024). Several studies have examined the relationship between land tenure security and agricultural productivity among small-scale farmers in developing countries. For instance, Mbudzya et al. (2020) conducted a study in Kenya and found that land tenure security has a positive effect on agricultural productivity among small-scale farmers. Similarly, Mekuria et al. (2018) found that land tenure security significantly affects agricultural productivity and food security in Ethiopia.

The theoretical underpinning for the relationship between land tenure security and agricultural productivity lies in the assumption that secure land tenure motivates farmers to invest in their land, thereby enhancing productivity. However, studies have shown that this relationship is not straightforward. Singirankabo and Ertsen (2020) reviewed multiple studies and found that while land registration—often seen as a pathway to secure tenure—can indeed lead to increased agricultural investments, it may also create tenure insecurity, especially where customary land rights are ignored or inadequately integrated into formal systems (Singirankabo & Ertsen, 2020).

In Lesotho, land is predominantly held under a communal tenure system, which poses unique challenges. The 2019/2020 Lesotho Agricultural Census highlighted that land tenure insecurity, characterized by fragmented land holdings and unclear land rights, is a significant constraint to agricultural productivity. Farmers in Lesotho, particularly small-scale maize producers, are often reluctant to make long-term investments in land that they do not securely own or control (FAO, 2020). This reluctance limits the adoption of productivity-enhancing practices, such as the use of improved seed varieties, soil conservation techniques, and other agricultural inputs.

Recent studies in Lesotho have echoed these concerns. Evidence suggests that farmers with more secure tenure—whether through formal or traditional means—are more likely to invest in their land, resulting in higher yields and improved food security. Conversely, tenure insecurity has been linked to lower investment levels and productivity (FAO, 2020; Singirankabo & Ertsen, 2020).

2.13. The Cobb-Douglas Production Function

The Cobb-Douglas production function is a widely used economic framework for analyzing the relationship between land tenure security and agricultural productivity (Doss, 2018). The Cobb-Douglas production function model specifies the relationship between agricultural inputs, including land, labor, and capital, and agricultural output (Gebremedhin & Swinton, 2003). The Cobb-Douglas model can be used to estimate the effect of land tenure security on agricultural productivity, while controlling for other variables such as labor, capital, and technology.

Heterogeneity and endogeneity analysis are also critical aspects of the research design. Heterogeneity analysis involves examining the impact of different factors on agricultural productivity, such as gender, education, and access to credit. Endogeneity analysis is essential for identifying the causal relationship between land tenure security and agricultural productivity (Mekuria et al., 2018). In addition, the use of instrumental variables can help address endogeneity bias (Doss, 2018).

In conclusion, land tenure security is a crucial factor that affects agricultural productivity and food security among small-scale farmers in Lesotho. The literature suggests that land tenure security has a positive effect on agricultural productivity, but there is a need for more research to understand the specific factors that influence this relationship. The Cobb-Douglas production function model, along with heterogeneity and endogeneity analysis, can provide insights into the relationship between land tenure security and agricultural productivity. The use of instrumental variables can also help address endogeneity bias.

2.14. Conceptual Model

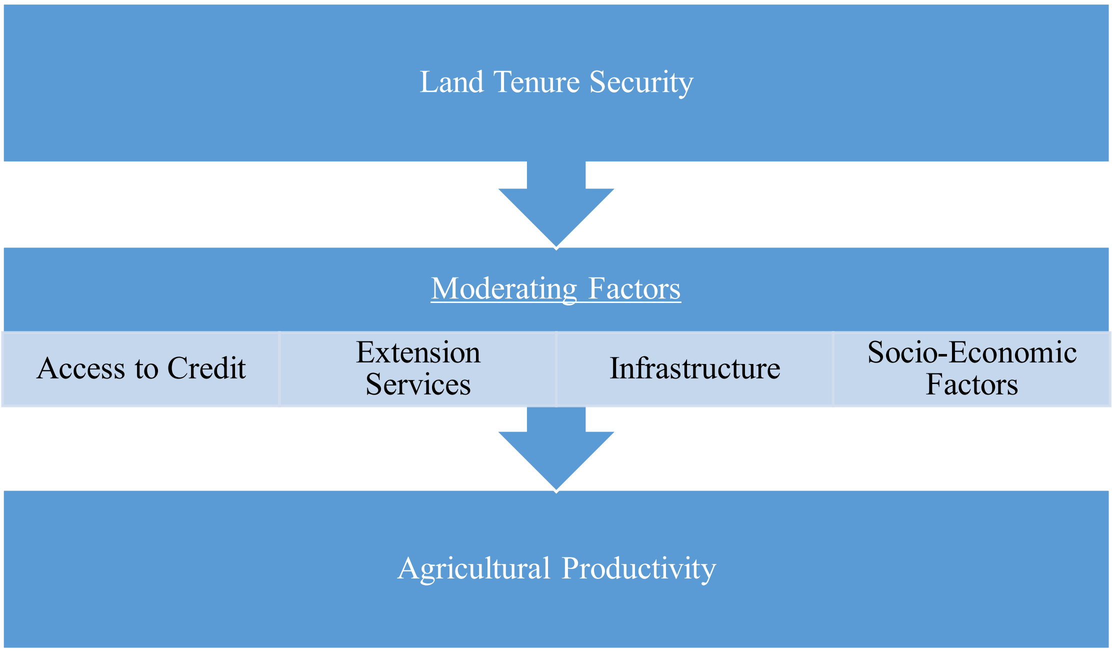


Figure 1: Conceptual Framework

2.15. Summary

In summary, the empirical literature review strongly supports the notion that land tenure systems wield a significant influence on the outcomes of maize production, and secure land rights tend to have a positive effect on agricultural productivity. While these studies offer valuable insights, it's essential to recognize that Lesotho's specific context brings its own set of unique challenges and opportunities. Therefore, a dedicated investigation is warranted to develop tailored policy recommendations that address the country's distinct circumstances.

CHAPTER THREE: METHODOLOGY

The study has used a mixed-methods approach, combining survey data collection with quantitative modeling techniques to investigate the relationship between land tenure security and maize productivity in Leribe district and Maseru district. Qualitative data was collected as secondary data using available literature. The literature review on effects of land tenure security on agricultural productivity was conducted from various sources like Google, Journals, Articles and policy documents from the government of Lesotho. These sources are used to mainly provide a theoretical perspective to the issue under study in developing countries as well as Lesotho. Most of the Journals and articles used were from 2018-2024. Some of the quantitative data was collected during the survey through the responses of the respondents.

Quantitative data was collected through the use of the survey which used structured questionnaire. Some of the respondents were interviewed through Face-to-face interaction, calls and WhatsApp while some filled the questionnaire facilitated in Google Forms. The collected data in the questionnaire was all converted to qualitative data to allow for data analysis.

3.1. Research Design

The study utilized survey-based research to gather primary data from maize farmers in the Leribe district and Maseru district districts of Lesotho. This approach involved administering structured questionnaires and conducting interviews with selected participants to collect information on land tenure arrangements, maize productivity, socio-economic factors, and farm investments.

Survey-based research allowed for the collection of rich, detailed data directly from participants, providing insights into their experiences, perceptions, and practices related to maize production and land tenure. It also allowed for the collection of data from a diverse sample of participants, providing a comprehensive understanding of the research topic. Furthermore, it allowed for the exploration of complex relationships between variables and the investigation of causal pathways.

3.2. Description of the Study Area

Figure 2: Map of Lesotho

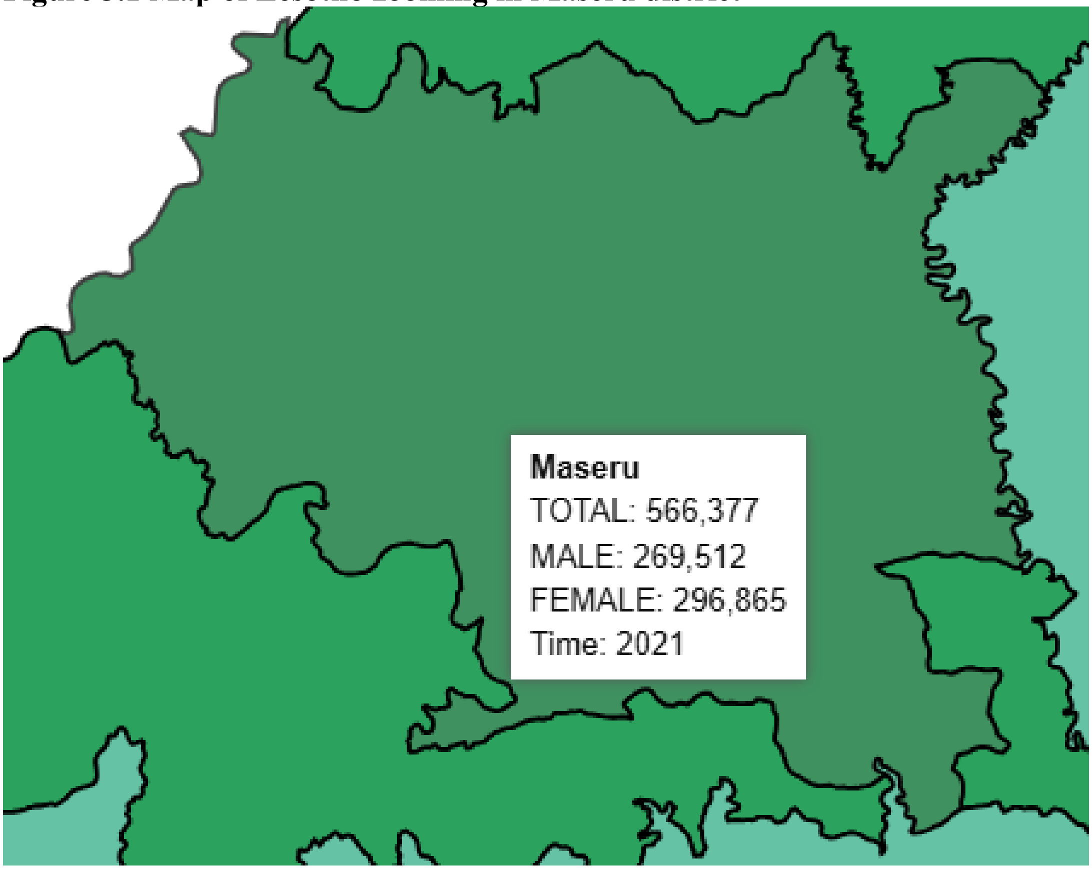
Source: www.mapsofindia.com, 2023

3.2.1. Maseru district

Maseru district, as the capital and largest city of Lesotho, is located near the western border with South Africa (Singh, 2022). It is the largest urban area in the country, and therefore the only city. The city of Maseru is located on Lesotho's western border with the Free State Province of South Africa, the frontier being the Caledon River. Maseru borders on Berea District in north, Thaba-Tseka District in the east, Mohale's Hoek District in south, and Mafeteng District in southwest (Singh, 2022).

As of 2016, Maseru district had a population of 519,816 according to Lesotho Bureau of Statistics (2016), with the population Density of 121 people per sq. km. The total area of the district was 4,279 which is 14.10 per cent of the total area of the country. It experiences a temperate climate due to its high elevation, with temperature variations throughout the year. Summers (November to February) typically have average temperatures ranging from 15°C to 25°C (59°F to 77°F), making it suiTable for maize farming (Bekuma Abdisa et al., 2022). The city receives most of its annual rainfall during the summer months, with an average annual precipitation of around 700 mm (Weather and Climate, 2024). Maseru district is not solely dependent on agriculture; it's a thriving hub for various economic activities according to Singh (2022).

Figure 3.1 Map of Lesotho zooming in Maseru district



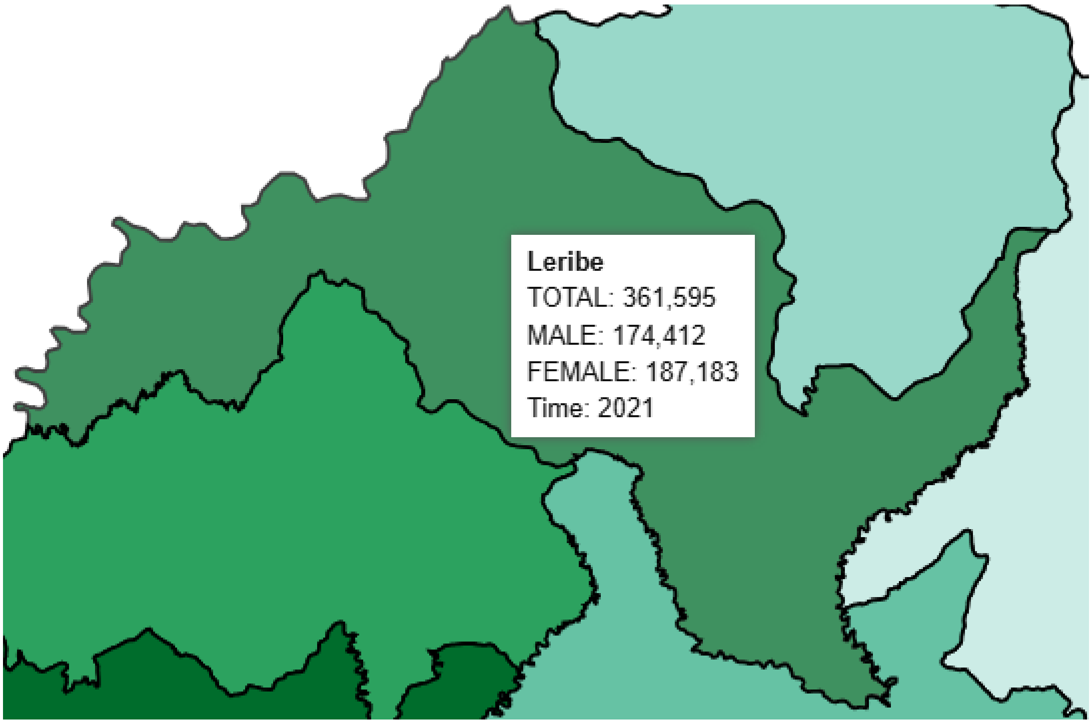
Source: Lesotho Bureau of Statistics, (2021)

3.2.2. Leribe district

Leribe district is a district located in the northern part of Lesotho, (Singh, 2022). It has an area of 2,828 km2 and a population in 2016 of approximately 337,521 according to the data from Lesotho Bureau of Statistics collected in 2004 and 2016, respectfully. Leribe district has a predominantly low land zone with an elevation of 1,500 m (4,900 ft) to 1,800 m (5,900 ft) above the sea level according to Singh (2022). These lands are the major agricultural zones in the country, the average annual rainfall in the country is 100 cm (39 in), most of which is received during the rainy season of October to April, (Singh, 2022).

Though it rains during all the months of the year, groundwater is limited on account of run-offs. The region has a temperate climate on account of the elevation and is humid during most parts of the year. The temperature in the Leribe district vary from 32 °C (90 °F) to −7 °C (19 °F) in the winter (Singh, 2022); the summers (November to February) generally feature favorable temperatures for maize farming, ranging from 15°C to 32°C (Bekuma Abdisa et al., 2022). Leribe district experiences a temperate climate due to its elevation, (Singh, 2022). Leribe district, like other parts of Lesotho, receives the majority of its annual rainfall during the summer months, a vital factor for successful maize cultivation (Weather and Climate, 2024). In Leribe district, beyond maize farming, various economic activities are prevalent, including livestock farming (cattle, sheep, and goats), subsistence agriculture, crafts and handicrafts (such as pottery and textiles), and trade and small-scale commerce according to Lesotho Bureau of Statistics, (2024); These activities contribute to the local economy and provide livelihoods for the community.

Figure 3.2: Map of Lesotho zooming in Leribe districts



Source: Lesotho Bureau of Statistics, 2021

3.3. Target population and sampling procedure

The study was conducted in two districts in Lesotho, specifically Maseru district and Leribe district. These districts were chosen due to the presence of a substantial number of small-scale farmers who depended on agriculture for their livelihoods. Also, these Maseru and Leribe districts have the largest number of farmers who sell most of their maize yield and keep some of the yield to be consumed by their families.

The sampling technique to select study participants involved multiple stages. Firstly, purposive sampling was used to select the two districts. Then, systematic sampling was utilized to select the sample of small-scale farmers from each of the selected villages. The desired sample size was 100 small-scale farmers. Finally, purposive sampling was used to select the small-scale maize farmers who sell most of their yield and reserve some of the yield to be consumed by their families. The systematic sampling was as follows:

The total population of small-scale maize farmers in Leribe and Maseru districts was: 100 from Leribe district and 210 from Maseru district, resulting to 310 farmers all together. The interval was calculated by dividing the population size by the desired sample size, which gave an interval 3. As mentioned earlier, some of the respondents were disqualified because they were not fit for the research. The left sample was 49, of which, 23 were from Leribe district and 26 were from Maseru district.

3.4. Instrumentation

To gather data from the respondents, a structured questionnaire was meticulously developed. This questionnaire was organized into four distinct sections, each serving a specific purpose:

1. Farmers' Socio-Demographic Characteristics: This section encompassed questions related to the socio-demographic attributes of the farmers, providing insight into factors like age, gender, education, and experience.

2. Land Tenure Security Status: Here, the questionnaire delved into the farmers' land tenure security, exploring aspects such as the presence of formal land documents and their confidence in their land rights.

3. Maize Productivity: The final section of the questionnaire centered on maize productivity, inquiring about factors such as the quantity of maize produced, farming practices, and challenges faced.

To ensure the questionnaire's effectiveness and reliability, a pre-testing phase was conducted among a sample of farmers. This pre-testing aimed to validate and refine the questionnaire. The reliability of the questionnaire was assessed using Cronbach's alpha coefficient, a measure of internal consistency. In addition, content validity was upheld by subjecting the questionnaire to review by experts in the Department of Agricultural Economics and Extension, National University of Lesotho (NUL), for both content validity and face validity, ensuring that the questions were appropriate and aligned with the research objectives. This meticulous approach to questionnaire development facilitated the collection of robust and relevant data from the study participants.

3.5. Data Collection

Both primary and secondary data was used in this study. The secondary data was from LENAFU, being the population of small-scale maize farmers in Leribe and Maseru districts, their location and contact details. The primary data collection for this study employed a combination of face-to-face interviews for accessible farmers and remote methods (phone calls, WhatsApp chats and Google Forms) for those at a greater distance. The questionnaire was thoughtfully translated into Sesotho, the local language, to guarantee that respondents could easily comprehend and respond to the questions. A pilot test was done on a small sample before full deployment to check for clarity and consistency and to adjust ambiguous questions or unclear instructions. The data collection process spanned a period of two weeks, allowing sufficient time to reach all selected farmers and gather their valuable input.

Furthermore, to ensure the quality and reliability of the data collected, completed questionnaires were subjected to a thorough review. This review focused on assessing the completeness and consistency of the responses. In cases where there were gaps or inconsistencies, additional contact with the respondents was necessary to obtain clarification and ensure the accuracy of the data.

By implementing these comprehensive data collection methods and quality control measures, this study aimed to compile a robust and representative dataset from small-scale farmers in Maseru district and Leribe district districts, enhancing the credibility and validity of the research findings. Overall, both primary and secondary data collection methods were employed to gather information necessary for the study. The instruments were administered systematically to ensure data quality and reliability, ultimately contributing to meaningful analysis and interpretation of the research findings.

3.6. Techniques of Data Analysis

3.6.1. Introduction

For the overall objective of examining the effect of land tenure security on agricultural productivity, combination of descriptive statistics and regression analysis, particularly the Recursive regression analysis, were employed. This analysis regresses agricultural productivity (dependent variable) on land tenure security indicators (independent variables) along with other relevant covariates (such as access to credit, farm size, education level, etc.). The study aims to quantify the direct and indirect effects of land tenure security on agricultural productivity while controlling for potential confounding factors.

3.6.2. Recursive Regression Model:

The recursive regression model is described as a form of sequential estimation of regression parameters by Gujarati (2003). It is explained as a technique where observations are added one at a time to the dataset, and the regression parameters are updated with each additional observation. This allows the estimation to evolve as new data becomes available, which can provide insights into the stability of the estimated coefficients over time.

This model, as described by Gujarati (2003), is utilized to explore relationships and dependencies among variables in a sequential manner. Empirical estimation of relationships, such as between land tenure security, investment in land improvements, and maize productivity, using specified econometric models. This approach ensures that relationships observed are not biased by omitted variables or reverse causality.

Empirically, the relationship between land tenure security and agricultural productivity was estimated with reference to Dlamini and Masuku in 2011 as follows;

Model specification:

$A = f(Z^a, H, E)$ (1)

$L = f(Z^a, T, AL)$ (2)

$I = f(Z^a, As, L)$ (3)

$M = f(L, I)$ (4)

where;

A	value of agricultural credit used to finance past fixed improvements and current operating expenses expressed based on 2023/24 prices
L	value of past fixed improvements on the land
I	value of current operating expenses on maize fields
M	maize productivity measured in TFP
Z^a	household and farmer characteristics
T	land tenure status
H	area under maize cultivation measured in hectares
E	amount of equity contribution in Maloti
AL	current value of long-term credit used to finance past fixed land improvements in Maloti.
AS	current value of short-term credit used to finance operating expenses in Maloti.

A system of endogenous and exogenous variables was used, where the endogenous variables were determined sequentially, one at a time. The first endogenous variable, A, was estimated using Ordinary Least Squares (OLS) from the first equation, independently of the other endogenous variables (L and I). The resulting coefficient for A was then applied in the second equation. This process was repeated for the estimation of the endogenous variables L and I, leading to the estimation of equations (2) and (4) using the two stage least squares (2SLS) .

Recursive causal model was adopted as illustrated by Gujarati (2003) as follows:

$Y_1 = \beta_{11}X1 + \beta_{12}X_2 + \ldots\ldots\ldots \beta_{1Z}X_Z + e_1$

$Y_2 = \beta_{21}X1 + V_{21}Y_1 + \ldots\ldots\ldots B_{2Z}X_Z + e_2$

$Y_3 = \beta_{31}X1 + V_{31}Y_1 + V_{32}Y_2 + \ldots\ldots\ldots \beta_{3Z}X_Z + e_3$

$Y4 = \beta_{41}X_1 + V_{41}Y_1 + V_{42}Y_2 + V_{43}Y_3 \ldots\ldots\ldots \beta_{4Z}X_Z + e_4$

where;

X_i = exogenous variables

Y_i = endogenous variables

e_i = independent error terms

The covariance between the error terms (e_1, e_2, e_3, and e_4) was zero, indicating that the errors in the different equations were uncorrelated (Gujarati, 2003). Wonnacott and Wonnacott (1979) observed that a recursive system is simpler to handle than a simultaneous one, as OLS can estimate parameters when the error term is independent of the regressors. Therefore, OLS was applied to Y1, since it only had exogenous variables assumed to be uncorrelated with the error term e1. For Y1, Y2, Y3, and Y4, 2SLS was used because the system now involved both endogenous and exogenous variables. The estimated values of A, L, and I were used to run equations Y2, Y3, and Y4, as these estimates were not correlated with the error terms e3, e2, and e4. This justified the use of OLS, as the estimates had no effect on the error term (Gujarati, 2003). Coulibaly (2023) and Joel & Bergaly (2019) used the recursive regression method to analyze the impact of land tenure on agricultural productivity in Burkina Faso and Cameroon, respectively, it is furthermore used by Agyei-Holmes *et al* (2020) and Gottlieb & Grobovšek (2019) on their researches relating to land tenure security and agricultural productivity; the estimation models were adopted for this study accordingly.

$$A = \beta_{01} + \beta_{11}Age + \beta_{21}Gender + \beta_{31}Years + \beta_{41}Education + \beta_{51}Transfer1 + \beta_{61}Family\ size + \beta_{71}Maize\ area + \beta_{81}Land\ tenure + \beta_{91}Equity \quad (5)$$

$$LN\ (l) = \beta_{02} + \beta_{12}Age + \beta_{22}Gender + \beta_{32}Years + \beta_{42}Education + \beta_{52}Transfer + \beta_{62}Family\ size + \beta_{72}A_L + \beta_{82}Land\ tenure \quad (6)$$

$$LN\ (i) = \beta_{03} + \beta_{13}Age + \beta_{23}Gender + \beta_{33}Married + \beta_{43}Education + \beta_{53}\ Family + \beta_{63}LN\ (l) + \beta_{73}Transfer_2 \quad (7)$$

$$M = \beta_{04} + \beta_{14}\ (capital\ used) \quad (8)$$

where;

A	present value of agricultural credit used to finance past fixed improvements and current operating expenses in Maloti.
Age	age (years) of head of household
Gender	a dummy variable scoring 1 for male and 0 for females
Education	formal schooling completed by the household head (year)
Transfer	monthly off-farm income earned by the household in Maloti
Family	number of people per household
Land	total land area (ha) available for cropping
Tenure	a dummy variable scoring one for land under Lease and Form C and zero for Customary/Tribal and Government-Owned
Equity	equity contribution in Maloti
l	present value of investment in the most prevalent fixed improvement

	in Maloti
A_L	present value of long-term credit used to finance fixed improvements, the most frequently observed improvement and the only one for which reliable data could be gathered
I	presence of current expenditure on operating inputs per unit land in Maloti
A_s	value of seasonal credit used to finance current operating inputs in Maloti
M	Maize Productivity measured as TFP
Capital	is the total value of long- and short-term credit used (l + i) in Maloti

3.6.3. Cobb-Douglas Production Function

Cobb-Douglas Production Function was employed to quantify the impact of land tenure security on maize productivity. This model helps understand how inputs (including land tenure security) influence agricultural outputs.

The Cobb-Douglas production function was used to estimate the effect of land tenure security on maize productivity. This widely used economic model examines the relationship between inputs (including land) and outputs (maize productivity) and provides insights into the impact of land tenure security on agricultural output. It takes the following form:

$$Q=A(t)L^{\beta 1}K^{\beta 1}$$

In a linear form, it takes the form expressed below:

$$Ln(Q)=\alpha+\delta T+\beta_1 L+\beta_1 K+\varepsilon$$

where Q, L and K are vectors of output, labor and capital respectively, δ is the time variable, α is a constant, β_1, β_2 are elasticities and ε is the error term. This theory is key in explaining the production behavior of firms. Maize productivity is determined by the labor, capital, farm size and input used.

Descriptive statistics (Tables, frequency, mean, percentage, standard deviation) was used to analyze the socio-economic characteristics of the respondents (Objectives 1, 2, 3).

3.6.4. Total factor productivity Model

Total Factor Productivity (TFP) was used to measure the agricultural productivity. Total Factor Productivity (TFP) is a method of calculating agricultural productivity by comparing an index of agricultural inputs to an index of outputs (Laurits, 1975). Total factor productivity is therefore measured as the inverse of unit cost following Key and McBride (2003). This is the ratio of outputs in grain equivalent to the total variable cost (TVC) of production. This translates to the inverse of the average variable cost (AVC) of production. Therefore, Agricultural Productivity of cassava-based farmer was measured by using total factor productivity (TFP).

This is expressed as;

$$TFP = \frac{Y}{\sum P_i X_i} \quad \text{.........(9)}$$

Where:

Y = total maize yield in kg

P = Unit price of *i*th variable input and *i*

X = quantity of *i*th variable input

TFP = total output/total inputs

$$AVC = \frac{TVC}{Y}$$

....(10)

Where AVC = Average variable cost in Maloti

TVC = Total Variable Cost in Maloti

Therefore:

$$TFP = \frac{Y}{TVC} = \frac{1}{AVC}$$

....(11)

Variables that contribute to TVC:

Hybrid Seeds Cost – The cost of hybrid seeds used.

Inorganic Fertilizer Cost – The cost of inorganic fertilizers applied.

Herbicides Cost – The cost of herbicides used in farming.

Payment of Labor – The amount paid for labor services (e.g., during ploughing, cultivating, or harvesting).

Operating Expenses – The value of other operational expenses that directly affect farm productivity.

These variable costs fluctuate depending on the scale of production and are part of the TVC calculation. Summing up these values for each farmer will give the TVC:

TVC = Hybrid Seeds Cost + Inorganic Fertilizer Cost + Herbicides Cost + Payment of Labor + Value of Operating Expenses

AVC = TVC/Maize Yield (KGs)

Therefore TFP = Maize Yield (KGs)/TVC

3.7. Econometric Model

Econometric modeling allowed for the quantification of the effects of various factors on maize productivity while controlling for potential confounding variables. By applying One Least Square (OLS), the study aimed to identify significant determinants of maize productivity and assess the effect of land tenure systems on agricultural outcomes.

Econometric modeling provided a rigorous framework for analyzing complex relationships between variables and testing hypotheses using statistical inference. It allowed for the estimation of causal effects and the identification of factors driving observed patterns in the data.

By combining survey-based research with econometric modeling, the study provides a comprehensive analysis of the relationship between land tenure and maize productivity in Lesotho, leveraging the strengths of both approaches to produce robust and actionable findings.

CHAPTER FOUR: RESULTS AND DISCUSSION

4.1. Results

4.1.1. Descriptive Statistics

The total sample was 100, then 33 respondents were disqualified due to not answering all questions, giving meaningless answers and/or not recalling their financial records. Furthermore, 18 respondents were disqualified due to the definition from FAO on small-scale farmers, the researcher used the definition from USDA and was advised otherwise by the supervisor. The left sample was 49, of which, 23 were from Leribe district and 26 were from Maseru district; from Leribe district, there were 17 males and 6 Females, while from Maseru district there were 14 males and 12 females. To reduce the disqualification attrition does not affect the quality of the research and results, instructions were included in the questionnaire. These included: “Please answer all questions as accurately as possible”, “if you need assistance, please ask the survey administrator” and “your responses will be kept confidential and used only for academic research purposes”.

Table 1: The averages of the variables

Variable	Average	
	Leribe district	**Maseru district**
Age	47	52
Household Size	5	6
Land Stay in years	18	21
Total Land Size in Ha	9.45	10.68
Farm Size in Ha	4.57	5.77
Days taken to plough	2	3
Days taken to Cultivate	2	3
Days taken to Harvest	7	7
Payment of Labor	2482.80	2910.01
Time taken to access Parcels (minutes)	34	31
Market Access Time (minutes)	62	54
Hybrid Seeds Cost	1376.62	2082.08

Inorganic Fertilizer cost	1514.28	1251.58
Herbicides cost	1048.21	181.1872
Maize Yield Hectares	5.9404	5.0188
Maize Yield in KGs	5705.64	4401.36
Household Income	25957.74	24187.42
Extension Contacts in a year	3	5.12
Credit Amount	2489.97	1838.46
Value of Agri-Credit	2489.97	1838.46
Value of Fixed Improvements	8473.45	3615.38
Value of Operating Expenses	13231.25	16561.15
Off-Farm Income	8426.20	11024.35
Equity contribution	1739.13	634.62
Long-Term Credit	2489.97	1838.46
TVC	17170.36	20069.02
AVC	9.616976964	10.59878801
TFP	0.785872588	0.319165685

Source: Computed from Field Survey Data, 2024

Table 1 presents a detailed analysis of the descriptive statistics pertaining to various variables related to agricultural productivity among small-scale maize farmers in the Leribe district and Maseru district of Lesotho. The analysis shows that the average age of farmers in Maseru district (52 years) is higher than in Leribe (47 years). This could suggest an older farming population in Maseru. Also, Maseru households are slightly larger (6) compared to Leribe (5), which may impact labor availability within households, (World Bank, 2019). Total Land Size and Farm Size in Maseru district have stayed longer on their land (21 years) than in Leribe district (18 years). This may reflect greater land tenure security (Rantšo et al., 2019).

Farmers in Maseru district also have larger total land sizes (10.68 Ha) and farm sizes (5.77 Ha) compared to Leribe district (9.45 Ha and 4.57 Ha, respectively). This might be linked to the farmers' extended presence in the area or differences in land access. The number of days to plough, cultivate, and harvest maize in both districts is similar, although Maseru requires slightly more time for ploughing and cultivating (3 days compared to 2 days in Leribe). This may suggest either larger farms or less access to mechanized services in Maseru. Farmers in Maseru district pay more for labor (2910.01

compared to 2482.80 in Leribe district), possibly due to higher demand for labor or higher wage rates.

Farmers in Leribe district spend more time accessing their parcels (34 minutes) compared to Maseru (31 minutes). However, market access is faster in Maseru district (54 minutes vs. 62 minutes in Leribe), which may provide better market opportunities for Maseru farmers. Maseru district farmers incur higher costs for hybrid seeds (2082.08 compared to 1376.62 in Leribe), while Leribe farmers spend more on inorganic fertilizers (1514.28 compared to 1251.58 in Maseru district). Herbicide costs in Maseru district (181.19) are much lower than in Leribe district (1048.21), which may indicate different weed control practices or herbicide availability.

Maize yield per hectare is higher in Leribe (5.94 Ha) than in Maseru (5.02 Ha), as is the total maize yield in kilograms (5705.64 kg in Leribe vs. 4401.36 kg in Maseru), suggesting higher productivity in Leribe. Leribe households report higher average income (25957.74) than those in Maseru (24187.42), possibly due to their higher maize productivity. Farmers in Maseru have more frequent extension service contacts (5.12 vs. 3 in Leribe), which could impact knowledge transfer.

Leribe farmers access more credit (2489.97) than Maseru farmers (1838.46), which may help fund their relatively higher input costs. Leribe farmers have invested more in fixed improvements (8473.45) compared to Maseru (3615.38), reflecting perhaps better infrastructure or more established farms. er in Maseru (16561.15) than in Leribe (13231.25), suggesting that running farms in Maseru may involve more costs. 35 vs. 8426.20 in Leribe), indicating that Maseru households may rely more on non-farming income. Total variable costs (TVC) are higher in Maseru (20069.02) than in Leribe (17170.36). Average variable costs (AVC) are also slightly higher in Maseru (10.60) compared to Leribe (9.62), meaning production costs are higher per unit of output in Maseru. Total factor productivity (TFP) is notably higher in Leribe (0.79) compared to Maseru (0.32), indicating that Leribe farmers are more efficient in utilizing their resources. The analysis suggests that while Leribe district farmers may experience higher agricultural productivity and efficiency, Maseru district farmers face higher costs and more reliance on off-farm income, with greater access to extension services. These results are in line with the findings from Rantšo et al. (2019) on their research on Agriculture and food security in Lesotho: Government sponsored block farming programme in the Berea, Leribe and Maseru Districts.

Below is the visualization of Table 1:

Figure 4: Average effect of land tenure security on production

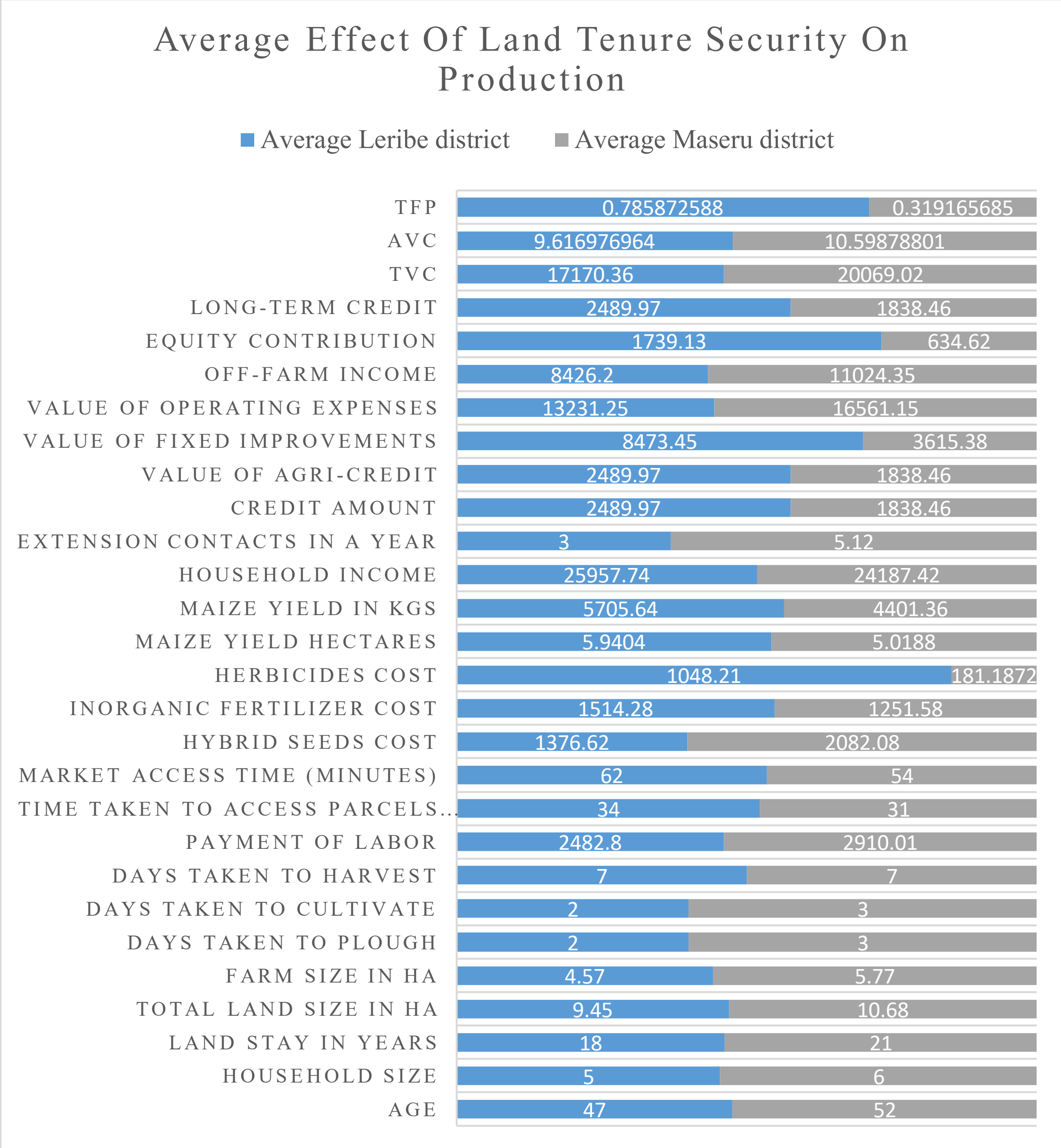


Table 2: Land tenure security systems used by small-scale maize farmers in Leribe district and Maseru district

Variable	Indicator	Leribe district		Maseru district	
		n (23)	%	n (26)	%
Age	20-25	0	0	2	7.7
	30-39	11	47.8	5	19.2
	40-49	3	13	3	11.5
	50-59	3	13	6	23.1
	60-above	6	26.1	10	38.5

Gender	Male	73.9	71	14	53.8
	Female	6	26.1	12	46.2
Marital Status	Married	6	26.1	10	38.5
	Single	3	13	5	19.2
	Divorced	6	26.1	5	19.2
	Widowed	8	34.8	6	23.1
Education Level	No education	8	34.8	1	3.9
	Primary education	1	4.3	6	23.1
	Secondary education	6	26.1	7	26.9
	Tertiary education	8	34.8	12	46.2
Household Size	1-5	15	65.2	18	61.5
	6-10	8	34.8	10	38.5
	11 and above	0	0.0	0	0.0
Community Leader	Yes	6	26.1	1	3.8
	No	17	73.9	25	96.2
Land Tenure Security	Leasehold	6	26.1	7	26.9
	Customary/Tribal	16	69.6	17	73.1
	Government owned	1	4.3	2	7.7
Title deed	Yes	15	65.2	11	42.3
	No	8	34.8	15	57.7
Land Acquisition	Inherited	7	30.4	9	34.6
	Purchased	4	17.4	4	15.4
	Allocated by community/government	6	26.1	7	26.9
	Rented	3	13	3	11.5
	Other	3	13	3	11.5
Rights on Land	Rights to use	10	43.5	8	30.8
	Rights to sell	6	26.1	9	34.6
	Rights to transfer	7	30.4	9	34.6
Number of years staying or using land	0-9	9	39.1	7	26.9
	10-19	4	17.4	7	26.9
	20-29	5	21.7	6	23.1
	30-39	3	13	3	11.5
	40 and above	2	8.7	3	11.5

Land Concentrated on one area	Yes	14	41.2	14	53.8
	No	17	54.8	12	46.2
Type of labor used	Family	7	30.4	11	42.3
	Hired labor	16	69.6	15	57.7

Source: Computed from Field Survey Data, 2024

Table 2 provides a comprehensive overview of various demographic and land tenure characteristics among small-scale maize farmers in Leribe district and Maseru district districts. The Table includes data on age, gender, marital status, education level, household size, community leadership, land tenure security, title deeds, land acquisition methods, land rights, and labor types. The age distribution reveals that Leribe district has a higher percentage of farmers in the 30-39 age bracket (47.8%) compared to Maseru district (19.27%). In contrast, Maseru district has a larger proportion of farmers aged 60 and above (38.5%) compared to Leribe district (26.1%). This demographic distribution suggests that Leribe district's farming community is relatively younger, which could be linked to more dynamic and potentially innovative farming practices, while Maseru district's older population might influence traditional farming methods and practices (Bureau of Statistics., 2020). Gender distribution indicates a higher proportion of male farmers in both districts, with 73.9% in Leribe district and 53.8% in Maseru district, (Bureau of Statistics., 2023). However, Maseru district has a larger percentage of female farmers (46.2%) compared to Leribe district (26.1%). This suggests a more inclusive participation of women in farming activities in Maseru district, which may be related to local social and economic dynamics (Phiri et al., 2022).

Marital status shows that a significant number of farmers are married, with 26.1% in Leribe district and 38.5% in Maseru district. This stability in marital status is indicative of established family structures that are essential for labor availability and land management in agriculture (Badstue et al., 2023). Education levels vary between the districts, with a higher proportion of farmers in Maseru district having tertiary education (46.2%) compared to Leribe district (34.8%). Tertiary education is often associated with better agricultural practices and improved productivity through the adoption of modern technologies (Ruzzante et al., 2021).

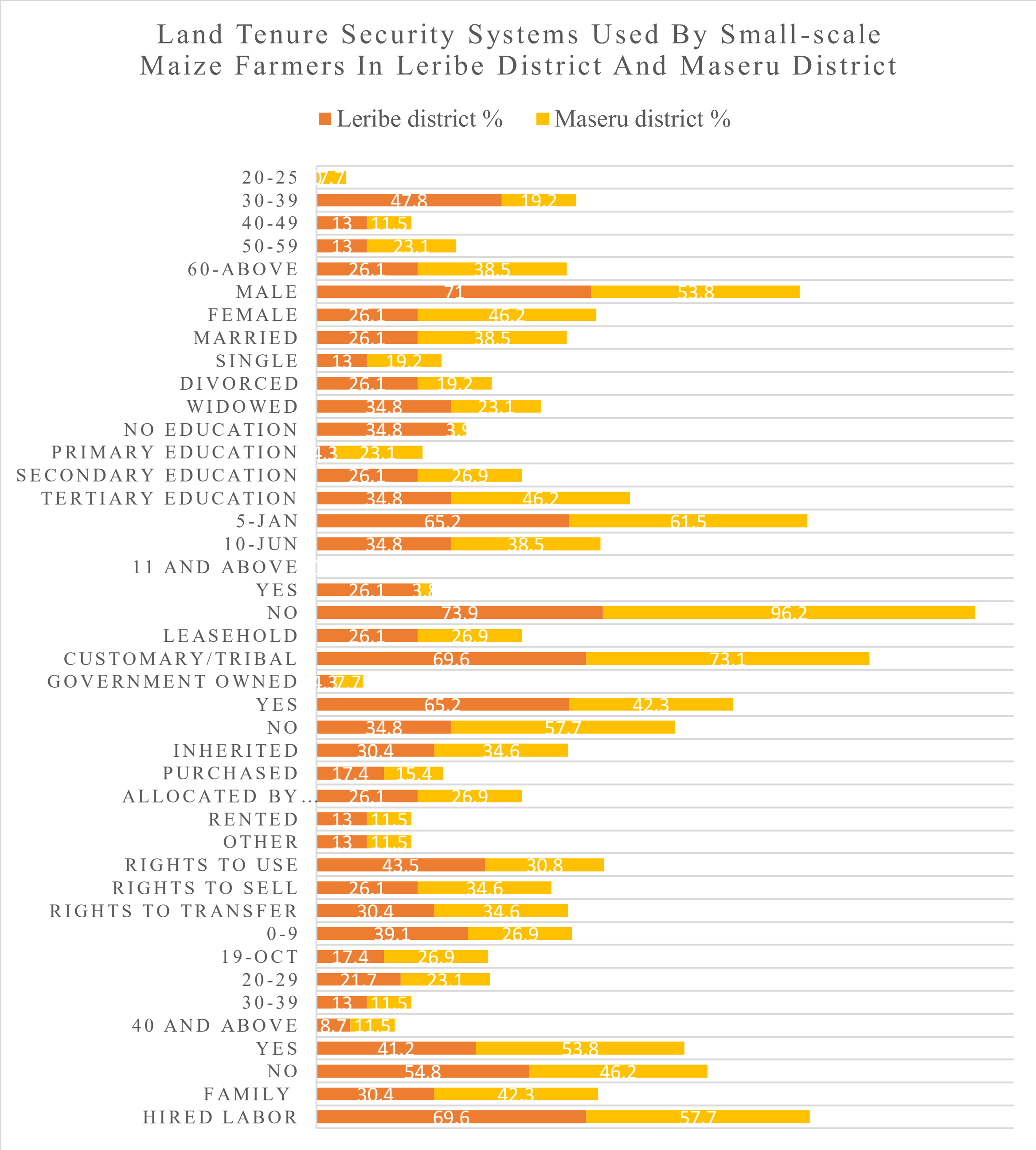
Household size data shows that most households in both districts have 1-5 members. However, Leribe district has a higher percentage of smaller households compared to Maseru district. Smaller household sizes may limit labor availability for agricultural tasks, which could affect productivity (Rantšo et al., 2023). Community leadership is more prevalent in Leribe district (26.1%) than in Maseru district (3.8%). The presence of community leaders may affect resource management and support for farming practices, potentially influencing land tenure security and productivity (Dare, 2022). Land tenure systems reveal that both districts primarily use customary or tribal tenure systems (69.6% in Leribe district and 73.1% in Maseru district). Leasehold tenure is relative the same in both districts but slightly less common in Leribe district (26.1%) compared to Maseru district (26.9%). Government-owned land tenure is relatively rare. Customary tenure often provides stability but may lack formal legal recognition, while leasehold tenure involves formal agreements that can impact farmers' investment in land improvements (Chimhowu, 2019).

The proportion of farmers with title deeds is higher in Leribe district (65.2%) than in Maseru district (42.3%). Title deeds are crucial for formal land ownership recognition and access to credit, which can enhance land tenure security and agricultural productivity (Lokhandwala, 2022). Land acquisition methods show that inheritance is a common method in both districts, with a slightly higher percentage in Maseru district (34.6%) compared to Leribe district (30.4%). Community or government allocation plays a slightly less role in Leribe district (26.1%) as compared to Maseru district (26.7%) (Rantšo et al., 2019).

Most farmers in Leribe district have rights to use land only (43.5%), while Maseru district farmers have more rights to transfer and sell land, both equal at 34.6%. The extent of land rights has a potential effect on farmers' ability to invest in and manage their land effectively (Zhou et al., 2023). Land concentration is slightly higher in Maseru district (53.8%) compared to Leribe district (41.2%). Both districts primarily use hired labor (69.6% in Leribe district and 57.7% in Maseru district) with family labor also being significant, especially in Maseru district (42.3%). The type of labor used influences farming efficiency and productivity (Hamilton et al., 2021).

Below is the visualization of Table 2:

Figure 5: Land tenure security systems used in Leribe district and Maseru district



Objective 1

Table 3: The land tenure security systems in Leribe district and Maseru district

Land tenure Security System	Leribe district		Maseru district	
	n	%	n	%
Leasehold	6	26.1	7	26.9
Customary/Tribal	16	69.6	17	73.1
Government owned	1	4.3	2	7.7
Total	23	100	26	100

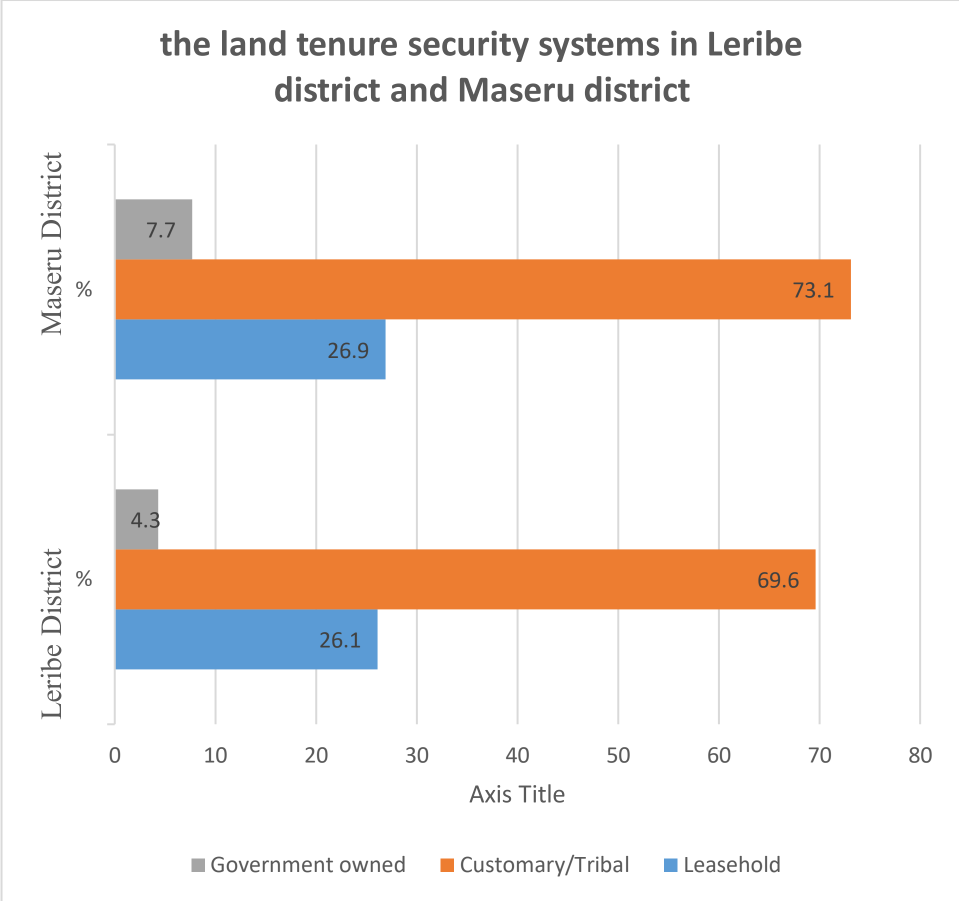
Source: Computed from Field Survey Data, 2024

Table 3 presents a comparison of land tenure security systems used by small-scale maize farmers in Leribe district and Maseru district. The data reveals distinct differences in the predominant land tenure arrangements between the two districts. In Leribe district, the majority of farmers (16) utilize customary or tribal land tenure systems. This system, which is based on traditional land use and community agreements, is prevalent among small-scale farmers in Leribe district. Customary or tribal tenure systems often provide a form of security and stability due to their long-standing traditions and community acceptance, though they may lack formal legal recognition (Nkumanda & Nte, 2018).

Government-owned land tenure is less common in Leribe district, with only 1 farmer using this system. This contrasts with Maseru district, where 2 farmers operate under government-owned tenure. Government-owned systems typically involve formal land allocation and management by state authorities, which can offer more structured and secure land rights but may also involve bureaucratic processes (Burns et al., 2023). Leasehold tenure is less frequently observed in Leribe district, with 6 farmers holding leasehold agreements compared to 7 in Maseru district. Leasehold tenure provides farmers with a contractual agreement to use the land for a specified period, usually in exchange for rental payments. This system can enhance land security for the duration of the lease but may also impose restrictions or costs that affect farmers' long-term investment decisions (LAA, 2022).

The predominance of customary or tribal tenure systems in both districts highlights the reliance on traditional land management practices. However, the variation in government-owned and leasehold systems between Leribe district and Maseru district indicates different levels of formal land tenure arrangements. Understanding these differences is crucial for developing targeted policies to improve land tenure security and support agricultural productivity in each district (Nkumanda & Nte, 2018; Singirankabo & Ertsen, 2020).

Figure 4: The land tenure security systems in Leribe district and Maseru district



Objective 2

Table 4: The breadth of land tenure security in Leribe district and Maseru district

Rights on Land	Leribe district		Maseru district	
	n	%	n	%
Rights to sell	6	26.8	9	34.6
Rights to transfer	7	30.4	9	34.6
Rights to use the land only	10	43.5	8	30.8
Total	31	100	28	100

Source: Computed from Field Survey Data, 2024

Table 4 details the breadth of land tenure security by showing the distribution of land rights among small-scale maize farmers in Leribe district and Maseru district. The data reveals important differences in the nature of land rights held by farmers in the two districts.

In Leribe district, 43.5% of farmers possess only the right to use the land, with no additional rights to sell or transfer. This implies a significant proportion of farmers have limited control over their land, which can restrict their ability to leverage the land for financial gain or to make long-term investments (Gidi, 2023). The rights to sell and transfer are less common, held by 26.8% and 30.4% of farmers, respectively. This limited breadth of rights may contribute to lower levels of investment and productivity, as farmers with fewer rights may be less inclined to invest in land improvements or may face constraints in accessing credit (Du et al., 2022).

In contrast, Maseru district exhibits a somewhat different distribution. The percentage of farmers with the right to use land only is lower at 30.8%, indicating that a greater proportion of farmers in Maseru district have additional rights, such as the ability to sell or transfer land. Specifically, 34.6% of farmers in Maseru district have the right to sell land, and 34.6% have the right to transfer it. These additional rights can enhance land security and facilitate greater investment and productivity by allowing farmers more flexibility in land management and financial planning (Singirankabo & Ertsen, 2020).

Overall, the broader range of land rights observed in Maseru district compared to Leribe district may be associated with better land tenure security and potentially higher agricultural productivity. Previous research has shown that a more comprehensive set of land rights correlates with increased investments in land and improvements in productivity due to enhanced tenure security (The World Bank, 2024). These findings underscore the importance of expanding land rights and tenure security to support agricultural development and economic stability among small-scale farmers.

Table 5: Duration of Land Rights in Leribe district and Maseru district

Duration (Years)	Leribe district	Maseru district
Mean duration	17.6522	20.92308
Median duration	18.00000	19.00000
Min duration	1.00000	1.00000
Max duration	49.00000	49.00000

Source: Computed from Field Survey Data, 2024

Table 5 provides a comparative analysis of the duration of land rights held by small-scale maize farmers in Leribe and Maseru districts. The average duration of land rights in Leribe district is 17.65 year or 18 years, while in Maseru district, it is slightly longer at 20.92 years or 30 years. This suggests that farmers in Maseru experience more prolonged tenure security, which may be indicative of a more sTable land tenure system in that region. The median duration values are 18 years for Leribe and 19 years for Maseru, reflecting that the central tendency of land tenure lengths is quite similar across both districts. These median values suggest that despite some variability, the typical land tenure duration is relatively consistent between the two areas.

The minimum duration of land rights in both districts is 1 year, indicating that some farmers have very recent or temporary tenure arrangements. This short duration could potentially limit farmers' ability to invest in their land, impacting their long-term agricultural productivity. In contrast, the maximum duration of land rights is 49 years in both districts, showing that long-term land tenure is present among some farmers. This extended duration is consistent with literature that suggests longer land tenure is associated with increased land investment and productivity (Diendéré & Wadio, 2023). The findings from Table 5 highlight the variability in land tenure security within and between the districts. The slightly longer mean duration in Maseru could imply a more secure land tenure environment, which is likely to encourage more substantial investments in land improvements. This is in line with previous studies that have linked secure land tenure to increased agricultural productivity and investment (Singirankabo & Ertsen, 2020).

Objective 3:

Table 6: Average effect of land tenure security on production

	land tenure security system					
Variable	**Customary/tribal**		**Government owned**		**Leasehold**	
	Leribe	**Maseru**	**Leribe**	**Maseru**	**Leribe**	**Maseru**
Avg yield in kgs.	5740.96	9710.49	2500	7184.67	10653.82	4088.38
Avg Credit	1626.07	6147.37	0	3000	6681.82	1428.57

Avg Extension contacts	3.28	4.6111	3	8	12.45	5.5714
Avg hybrid seeds	1837.53	6149.06	401.48	2153.12	30402.91	1799.37
Avg fertilizer	1894.26	3862.89	0	0	5680.567575	3763.73
Avg herbicides	1230.65	1995.13	0	232.03	1814.29	184.23
Avg labor payment	3059.32	6127.54	326	4331	16818.85	3734.86
Avg Expenses	12827.90	18290.33	10411.87	15974.25	27183.67	15460.56

Source: Computed from Field Survey Data, 2024

Table 6 compares various agricultural metrics across three land tenure systems—Customary/Tribal, Government-Owned, and Leasehold—for farmers in Leribe and Maseru districts. Key variables analyzed include average yield, credit access, extension contacts, and expenses related to hybrid seeds, fertilizer, herbicides, and labor payments.

Under the Customary/Tribal system, Maseru demonstrates higher productivity, with an average yield of 9710.49 kgs, significantly surpassing Leribe's average of 5740.96 kgs. Maseru farmers also access more credit on average (6147.37), while Leribe farmers receive much less (1626.07). This difference in credit availability could contribute to the higher yield in Maseru. Maseru also reports more extension contacts (4.6111) compared to Leribe (3.28), indicating better access to agricultural advisory services. Similarly, Maseru farmers invest more in hybrid seeds (6149.06) and fertilizer (3862.89), which likely contributes to their higher yields. Herbicide use is also higher in Maseru (1995.13) than in Leribe (1230.65), further suggesting that farmers in Maseru are employing more intensive farming practices. In terms of labor costs, Maseru spends significantly more (6127.54) than Leribe (3059.32), reflecting either higher labor wages or more labor-intensive farming practices. Consequently, overall average expenses are higher in Maseru (18290.33) than in Leribe (12827.90), reflecting the greater investment in inputs.

For the Government-Owned land system, Maseru again outperforms Leribe in terms of yield, with an average yield of 7184.67 kgs compared to Leribe's 2500 kgs. Interestingly, Leribe farmers report no access to credit under this system, while Maseru farmers receive an average of 3000 in credit, which could explain the productivity gap. Maseru farmers also have significantly more extension contacts (8) than Leribe farmers (3), indicating better access to agricultural advice. While both districts report no fertilizer usage under this system, Maseru farmers use a small amount of herbicides (232.03) compared to none in Leribe. Labour costs are higher in Maseru (4331) than in Leribe (326), again suggesting greater labor input or higher wages in Maseru. The total average expenses are also higher in Maseru (15974.25) compared to Leribe (10411.87), driven by higher labor and other input costs.

Under the Leasehold system, the trend shifts, with Leribe exhibiting much higher productivity than Maseru. Leribe's average yield is 10653.82 kgs, far exceeding Maseru's 4088.38 kgs. This higher yield in Leribe may be linked to the larger amount of credit accessed by farmers (6681.82 compared to Maseru's 1428.57). Leribe also has more extension contacts (12.45) than Maseru (5.5714), indicating stronger agricultural support in Leribe. In terms of input use, Leribe farmers invest significantly more in hybrid seeds (30402.91) compared to Maseru farmers (1799.37), which likely drives the higher yields. Fertilizer usage in Leribe (5680.57) also surpasses that in Maseru (3763.73), contributing to the productivity difference. Additionally, herbicide use is higher in Leribe (1814.29) than in Maseru (184.23), suggesting more intensive weed management. Labor costs are much higher in Leribe (16818.85) compared to Maseru (3734.86), reflecting either more labor input or higher wage rates. Consequently, average expenses are substantially higher in Leribe (27183.67) than in Maseru (15460.56), showing that Leribe farmers under the Leasehold system invest more heavily in inputs.

Figure 5: Average effect of land tenure security on production

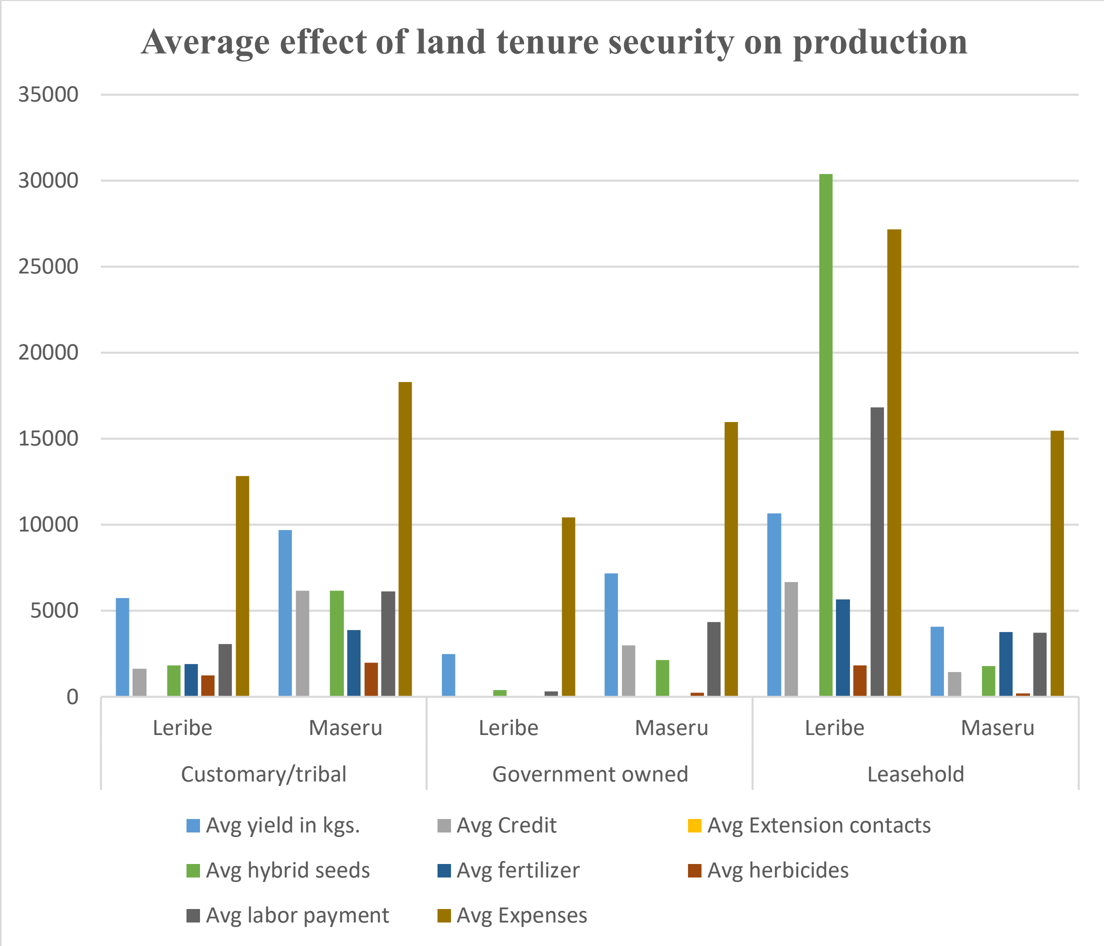


Table 7: Productivity across different Land tenure systems

	land tenure security system					
Variable	**Customary/tribal**		**Government owned**		**Leasehold**	
	Leribe	**Maseru**	**Leribe**	**Maseru**	**Leribe**	**Maseru**
Mean TFP	0.8291	0.2928	0.2312	0.4224	0.730	0.3538
Median TFP	0.2887	0.2197	0.2312	0.4224	0.3125	0.146
Min TFP	0.0103	0.0245	0.2312	0.2877	0.1104	0.0352
Max TFP	6.2021	1.0482	0.2312	0.5571	3.3053	1.4213

Source: Computed from Field Survey Data, 2024

The analysis of Table 7 reveals variations in Total Factor Productivity (TFP) across different land tenure systems in Leribe and Maseru districts. Under the customary/tribal land tenure system, Leribe has a significantly higher mean TFP (0.8291) compared to Maseru (0.2928), suggesting that farmers in Leribe under customary tenure are more productive than those in Maseru. For the government-owned land tenure system, Maseru displays a higher mean TFP (0.4224) than Leribe (0.2312), indicating better productivity in Maseru under this system. Regarding leasehold tenure, Leribe again shows higher productivity with a mean TFP of 0.730 compared to Maseru's 0.3538. These differences indicate that land tenure systems impact agricultural productivity, with the customary/tribal system being more productive in Leribe and government-owned tenure more favorable in Maseru.

Table 6.2 examines the relationship between land tenure security levels and TFP in both districts. In Leribe district, farmers classified as "Insecure" exhibit the highest average TFP (1.6649), while "Very Secure" tenure holds a lower average TFP (0.7608). Conversely, in Maseru, farmers with "Secure" tenure experience the highest productivity (0.8213), and those in "Very Insecure" conditions have a minimal average TFP (0.0285). The percentage distribution shows that most farmers in both districts fall under the "Neutral" category, accounting for 34.78% in Leribe and 38.46% in Maseru. These findings suggest that while secure land tenure generally contributes to higher productivity, the relationship between security levels and productivity is complex and varies between districts.

Table 8: Summary of Land Tenure Security level and TFP

Land Tenure Security Level	**Leribe**		**Maseru**	
	Avg TFP	%	Avg TFP	%
Very Insecure	0.962644824	17.3913	0.0285	7.692307692
Insecure	1.664988212	17.3913	0.3553	19.2308
Neutral	0.53924416	34.7826	0.2352	38.4615
Secure	0.345798966	21.7391	0.8213	7.6923
Very Secure	0.760794634	8.6957	0.3528	26.9231

Source: Computed from Field Survey Data, 2024

Table 8 presents a summary of Land Tenure Security levels and Total Factor Productivity (TFP) in the Leribe and Maseru districts. The data compares the average TFP and the percentage of farmers across five levels of land tenure security: Very Insecure, Insecure, Neutral, Secure, and Very Secure. Each land tenure security level reveals different patterns in productivity for the two districts.

In Leribe district, farmers who feel very insecure about their land tenure have an average TFP of 0.9626, accounting for 17.39% of the total farmers. Despite their insecurity, these farmers exhibit a relatively high level of productivity. Interestingly, farmers categorized as insecure show the highest average TFP of 1.665, also representing 17.39% of the farmers. This suggests that even when farmers feel insecure about their land rights, they can achieve high productivity levels in Leribe.

Farmers who feel neutral about their land tenure make up the largest group in Leribe, accounting for 34.78% of the sample. However, their average TFP is lower at 0.5392, indicating a decline in productivity compared to those who feel insecure. This suggests that neutral perceptions of tenure may not inspire the same productivity as insecurity does in this context. For those who perceive their land tenure as secure, the average TFP is 0.3458, with 21.74% of the farmers falling into this category. This lower productivity implies that secure tenure is not necessarily linked to higher agricultural productivity in Leribe. Farmers who feel very secure about their land, representing only 8.70%, show an average TFP of 0.7608. This group has moderate productivity, suggesting a possible relationship between high tenure security and a balanced level of productivity.

In contrast, Maseru district shows a different pattern. Farmers who feel very insecure have a much lower average TFP of 0.0285, representing only 7.69% of the sample. This indicates that very insecure tenure is associated with extremely low productivity in Maseru. As tenure security improves to the insecure level, the average TFP increases to 0.3553, with 19.23% of the farmers in this category. Although insecure, these farmers are more productive than their very insecure counterparts.

The largest group of farmers in Maseru (38.46%) feel neutral about their land tenure, with an average TFP of 0.2352. This suggests moderate productivity levels for the majority of farmers in this district. However, unlike Leribe, Maseru shows that secure tenure is linked to higher productivity, with an average TFP of 0.8213 for farmers who feel secure, representing 7.69% of the sample. Farmers who feel very secure about their land tenure account for 26.92% of the total in Maseru, with an average TFP of 0.3528. Although this group is larger in size compared to Leribe, their productivity remains moderate, similar to that of farmers in the neutral and insecure categories.

In Leribe, insecure land tenure is associated with the highest productivity (TFP = 1.665), while neutral and secure tenure exhibit lower productivity levels. This suggests that perceived land tenure insecurity might motivate farmers to be more productive, perhaps due to uncertainty about future land access. While, in Maseru, productivity is generally lower across all land tenure security levels. However, secure tenure is linked to the highest productivity (TFP = 0.8213), while very insecure tenure results in the lowest productivity. This indicates that tenure insecurity might have a more detrimental impact on productivity in Maseru compared to Leribe.

4.1.2. Inferential Statistics:

4.1.2.1. Parameter estimates of the agricultural credit

Table 1.1: Parameter estimates of the agricultural credit in Leribe district

Residuals

Min	1Q	Median	3Q	Max
-3595.4	-1762.1	-223.3	1393.4	5916.3

Variable	estimate	std. error	statistic	p-value
(Intercept)	-5.885e+03	6.027e+03	-0.976	0.348
Age	3.990e+01	8.120e+01	0.491	0.632
Gender	-4.650e+02	2.056e+03	-0.226	0.825
Marital Status	9.814e+02	6.790e+02	1.445	0.174
Education Level	7.070e+01	5.968e+02	0.118	0.908
Household Size	2.581e+02	3.220e+02	0.802	0.438
Household Income	2.085e-02	5.694e-02	0.366	0.721
Land Tenure System	1.744e+03	9.942e+02	1.754	0.105
Farm Size	-1.078e+02	2.894e+02	-0.372	0.716
Equity Contribution	6.518e-01	3.846e-01	1.694	0.116
Land Tenure Security	4.955e+01	6.505e+02	0.076	0.941

*Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1*

Residual standard error: 3190 on 12 degrees of freedom

Multiple R-squared: 0.5904, Adjusted R-squared: 0.2491

F-statistic: 1.73 on 10 and 12 DF, p-value: 0.1827

Source: Computed from Field Survey Data, 2024

Table 9.2: Parameter estimates of the agricultural credit in Maseru district

Residuals

Min	1Q	Median	3Q	Max
-2687.6	-1230.2	-397.0	345.4	5300.0

Variable	estimate	std. error	statistic	p-value
(Intercept)	-883.45	3766.49	-0.235	0.8177
Age	98.32	57.94	1.697	0.1104
Gender	-42.61	1388.64	-0.031	0.9759
Marital Status	-427.64	585.69	-0.730	0.4765
Education Level	-169.80	680.24	-0.250	0.8063
Household Size	80.83	322.15	0.251	0.8053
Household Income	-0.089	0.0545	-1.632	0.1235
Land Tenure System	-457.15	791.04	-0.578	0.5719
Farm Size	51.365	271.65	0.557	0.5856
Equity Contribution	10.90	4.82	2.261	0.0391 *
Land Tenure Security	70.60	337.33	0.209	0.8370

*Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1*

Residual standard error: 2660 on 15 degrees of freedom

Multiple R-squared: 0.4894, Adjusted R-squared: 0.1489

F-statistic: 1.437 on 10 and 15 DF, p-value: 0.2544

Source: Computed from Field Survey Data, 2024

Table 9.1 shows the regression of the parameter estimates of the agricultural credit in Leribe district. The residuals range from -3595.4 to 5916.3, with a median of -223.3. This wide range indicates substantial variability in the model's fit, suggesting possible issues with capturing all the determinants of agricultural credit uptake. In comparison, Table 9.2 which is the regression of the parameter estimates of the agricultural credit in Maseru district, shows residuals ranging from -2687.6 to 5300.0 with a median of -397.0, indicating somewhat less variability. The narrower residual range in Maseru district suggests a slightly better fit for the model compared to Leribe district.

Parameter Estimates

The age variable shows a positive but insignificant relationship with agricultural credit in both Tables (p-values: 0.632 in Leribe district and 0.1104 in Maseru district). Although the estimate is higher in Maseru district (98.32) compared to Leribe district (39.9), age is not a significant determinant of access to agricultural credit in either district, aligning with findings by Taremwa et al., (2022). Gender is negative in both models but is statistically insignificant (p-values: 0.825 and 0.9759), indicating that gender is not a critical factor in accessing agricultural credit, similar to the findings of Dafor et al., (2021).

Marital status shows a positive but insignificant impact on credit access in Leribe district (estimate = 981.4, p = 0.174) and a negative but insignificant impact in Maseru district (estimate = -427.64, p = 0.4765). This suggests inconsistency in how marital status affects credit access in the two samples. Education shows no significant effect in both Tables, aligning with studies indicating that education level does not always play a direct role in agricultural credit access (Silong & Gadanakis, 2020). While household size has a positive but insignificant impact on agricultural credit access in both Tables (p-values: 0.438 and 0.8053), it is not a significant determinant. The estimates for household income are low and insignificant in both models (p-values: 0.721 in Table 7.1 and 0.1235 in Table 7.2), suggesting that income levels do not have a significant impact on credit access among smallholder farmers, consistent with findings by Zhang & Lu (2021).

The positive estimate in Table 7.1 (1,744) suggests that a more secure land tenure system could enhance credit access, although it's not significant (p = 0.105). Conversely, Table 7.2 shows a negative estimate (-457.15), further indicating no substantial effect on credit access (p = 0.5719). This aligns with Holland et al. (2022), who noted that while land tenure security might affect agricultural productivity, its impact on credit access is often context-dependent. Farm size exhibits a negative effect in Table 7.1 and a positive effect in Table 7.2, but both are statistically insignificant, indicating no clear relationship with credit access, consistent with findings by Dafor et al. (2021).

Equity contribution is significant in Maseru district (estimate = 10.90, p = 0.0391*), indicating that it is a crucial factor in agricultural credit access in that district. However, it is insignificant in Leribe district (p = 0.116). This finding supports evidence from similar studies highlighting the importance of equity in accessing credit (Teramwa et al., 2021). Land tenure security has an insignificant effect on agricultural credit in both districts (p-values: 0.941 in Leribe district and 0.8370 in Maseru district), suggesting it does not play a substantial role in credit acquisition.

The R-squared value in Table 7.1 is 0.5904 (adjusted R-squared = 0.2491), meaning that approximately 59% of the variability in agricultural credit access is explained by the independent variables in Leribe district. In Table 7.2, the R-squared is 0.4894 (adjusted R-squared = 0.1489), suggesting that the model explains about 49% of the variance in Maseru district. Although the R-squared in Leribe district is higher, both districts have low adjusted R-squared values, indicating that many other factors not captured in these models could influence agricultural credit access. The F-statistics in both Tables (1.73, p = 0.1827 for Leribe district and 1.437, p = 0.2544 for Maseru distict) indicate that the models are not statistically significant as a whole, meaning the variables jointly do not significantly explain the variation in agricultural credit access.

4.1.2.2. Parameter estimates of the fixed land improvements

Table 10.1: Parameter estimates of the fixed land improvements in Leribe

Residuals

Min	1Q	Median	3Q	Max
-14004	-9130	-2628	8647	27547

Variable	Estimate	Std. Error	Statistic	p-value
(Intercept)	-7.076e+04	2.567e+04	-2.756	0.0155 *
Age	1.029e+03	3.504e+02	2.936	0.0108 *

Variable	Estimate	Std. Error	Statistic	p-value
Education Level	-8.591e+02	2.587e+03	-0.332	0.7448
Household Size	1.433e+03	1.373e+03	1.044	0.3142
Land Tenure System	2.229e+03	4.794e+03	0.465	0.6491
Farm Size	3.222e+02	1.237e+03	0.260	0.7984
Land Stay in Years	1.196e+02	2.751e+02	0.435	0.6704
Credit amount	8.099e-01	1.025e+00	0.790	0.4428
Land Tenure Security	4.661e+03	2.510e+03	1.857	0.0845 .

Significance codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 13980 on 14 degrees of freedom

Multiple R-squared: 0.5368, Adjusted R-squared: 0.2722

F-statistic: 2.028 on 8 and 14 DF, p-value: 0.1181

Source: Computed from Field Survey Data, 2024

Table 20.2: Parameter estimates of the fixed land improvements in Maseru
Residuals

Min	1Q	Median	3Q	Max
-4964.0	-1744.8	-545.6	1017.1	10079.8

Variable	Estimate	std. error	statistic	p-value
(Intercept)	-1138.7326	5211.5744	-0.219	0.8296
Age	22.3777	59.5967	0.375	0.7119
Education Level	94.3307	865.5158	0.109	0.9145
Household Size	274.6476	329.5119	0.833	0.4161
Land Tenure System	-1469.2774	941.0338	-1.561	0.1369
Farm Size	717.3109	301.0041	2.383	0.0291 *
Land Stay in Years	-44.0555	65.9645	-0.668	0.5132

Variable	Estimate	std. error	statistic	p-value
Credit amount	0.5271	0.2805	1.879	0.0774 .
Land Tenure Security	17.2692	395.6571	0.044	0.9657
Significance codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1				

Residual standard error: 3590 on 17 degrees of freedom

Multiple R-squared: 0.4955, Adjusted R-squared: 0.2581

F-statistic: 2.087 on 8 and 17 DF, p-value: 0.09632

Source: Computed from Field Survey Data, 2024

In Leribe District (Table 10.1), the residuals range from -14,004 to 27,547 with a median of -2,628, indicating considerable variability in the model's fit. The large range suggests that the model might not fully capture all the factors influencing fixed land improvements. While in Maseru District (Table 10.2), residuals range from -4,964.0 to 10,079.8, with a median of -545.6, showing less variability compared to Leribe. This indicates a relatively better model fit for fixed land improvements in Maseru.

The intercept is significant and negative in Leribe district (estimate = -70,760, p = 0.0155*), while in Maseru, it is insignificant (estimate = -1138.73, p = 0.8296). This suggests that, when all other variables are held constant, there is a significant base effect on fixed land improvements in Leribe compared to Maseru. Age has a positive and significant effect on fixed land improvements in Leribe district (estimate = 1,029, p = 0.0108*), indicating that older farmers are more likely to invest in fixed land improvements. This finding aligns with the notion that older farmers tend to have more experience and resources for long-term investments (Niavis et al., 2019). While in Maseru district, age is insignificant (estimate = 22.38, p = 0.7119), implying that it does not play a significant role in fixed land improvements in this district.

Education level is insignificant in both Leribe (estimate = -859.1, p = 0.7448) and Maseru (estimate = 94.33, p = 0.9145), suggesting that education does not directly influence fixed land improvements. This outcome is consistent with findings from Liu et al. (2020), who reported that education often influences agricultural practices indirectly. Household size shows a positive but insignificant effect in both districts (estimate = 1,433, p = 0.3142 for Leribe; estimate = 274.65, p = 0.4161 for Maseru). The lack of significance suggests that household size might not be a primary factor in decisions about fixed land improvements. The land tenure system is insignificant in both Leribe district (estimate = 2,229, p = 0.6491) and Maseru district (estimate = -1,469.28, p = 0.1369), suggesting that tenure arrangements do not significantly impact fixed land improvements. However, the positive sign in Leribe indicates potential influence that might not be fully captured, which aligns with studies by Chimhowu (2022).

Farm size has an insignificant effect in Leribe district (estimate = 322.2, p = 0.7984), indicating that fixed land improvements are not strongly tied to the size of the farm. While in Maseru district, farm size is significant (estimate = 717.31, p = 0.0291*), showing that larger farm sizes are positively associated with fixed land improvements, suggesting that farmers with more land are more likely to invest in infrastructure. This aligns with findings by Ren et al. (2021), who highlighted the importance of farm size in investment decisions.

'Land Stay in Years' is insignificant in both districts (p = 0.6704 for Leribe and p = 0.5132 for Maseru), indicating that the duration of land occupation does not have a significant impact on fixed land improvements. Credit amount is insignificant in Leribe district (estimate = 0.8099, p = 0.4428) but approaches significance in Maseru district (estimate = 0.5271, p = 0.0774). This suggests that access to credit might be more influential in Maseru, highlighting the potential importance of financial support for land improvement investments, as supported by Osabohien et al. (2023). In Leribe, Land tenure security shows a positive relationship (estimate = 4,661, p = 0.0845), approaching significance, indicating that secure land rights may encourage investment in fixed improvements. While in Maseru district it is insignificant with an estimate of 17.27 (p = 0.9657), indicating that tenure security might not be a strong driver for fixed land improvements in this district.

The R-squared for Leribe district is 0.5368 (adjusted R-squared = 0.2722), meaning 53.68% of the variation in fixed land improvements is explained by the model. For Maseru district, the R-squared is 0.4955 (adjusted R-squared = 0.2581). Although Leribe district's model explains slightly more variability, both models have relatively low explanatory power, indicating other factors not captured might be influencing fixed land improvements. The F-statistic for Leribe district (2.028, p = 0.1181) and Maseru district (2.087, p = 0.09632) indicates that neither model is significant overall, meaning the joint influence of variables included in the model do not explain the variation in the fixed land improvements.

4.1.2.3. Parameter estimates of the current expenditure

Table 3: Parameter estimates of the current expenditure in Leribe
Residuals

Min	1Q	Median	3Q	Max
-13130	-3777	-1005	4746	13180

Variable	Estimate	Std. Error	Statistic	p-value
(Intercept)	6.526e+03	9.379e+03	0.696	0.497
Age	2.001e+02	1.986e+02	1.007	0.330
Gender	-1.528e+03	4.903e+03	-0.312	0.760
Education Level	-8.824e-01	1.499e+03	-0.001	1.000
Household income	-5.536e-02	1.607e-01	-0.344	0.735
Farm Size	3.155e+01	7.663e+02	0.041	0.968
Land Stay in Years	1.277e+02	1.836e+02	0.696	0.497
Value of Fixed Improvements	-1.077e-01	1.391e-01	-0.774	0.451

*Significance codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1*

Residual standard error: 8608 on 15 degrees of freedom

Multiple R-squared: 0.1405, Adjusted R-squared: -0.2606

F-statistic: 0.3503 on 7 and 15 DF, p-value: 0.9171

Source: Computed from Field Survey Data, 2024

Table 4: Parameter estimates of the current expenditure in Maseru district
Residuals

Min	1Q	Median	3Q	Max
-12401	-5534	-1182	7002	14123

Variable	Estimate	Std. Error	statistic	p-value
(Intercept)	10129.69	12930.07	0.783	0.444
Age	112.1829	154.6094	0.726	0.477
Gender	2417.2047	4685.7162	0.516	0.612
Education Level	-1517.5755	2223.2515	-0.683	0.504
Household income	-0.2657	0.1569	-1.694	0.108
Farm Size	1194.2063	931.7594	1.282	0.216
Land Stay in Years	8.2093	165.1899	0.050	0.961
Value of Fixed Improvements	0.3027	0.5249	0.577	0.571

Significance codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 9352 on 18 degrees of freedom

Multiple R-squared: 0.3522, Adjusted R-squared: 0.1003

F-statistic: 1.398 on 7 and 18 DF, p-value: 0.2656

Source: Computed from Field Survey Data, 2024

In Leribe district, as shown in Table 11.1, the residuals range from -13,130 to 13,180, with a median of -1,005, indicating moderate variability in model fit for current expenditure. The relatively wide range suggests that there might be factors influencing expenditure not captured by the model. In Maseru District (Table 11.2), the residuals range from -12,401 to 14,123, with a median of -1,182, indicating slightly higher variability compared to Leribe. This implies that the model's explanatory power for current expenditure in Maseru might also be limited.

The intercept is positive but insignificant in both Leribe district (estimate = 6,526, p = 0.497) and Maseru district (estimate = 10,129.69, p = 0.444), indicating that the base level of current expenditure is not significantly different from zero when other variables are held constant. Age in Leribe district has a positive but insignificant effect on current expenditure (estimate = 200.1, p = 0.330). This suggests that age does not significantly impact spending decisions on farming activities in Leribe. Similarly, age in Maseru district is positive but insignificant (estimate = 112.18, p = 0.477), indicating that age does not significantly influence current expenditure in Maseru. The gender variable is negative and insignificant in Leribe district (estimate = -1,528, p = 0.760), suggesting no strong evidence that gender plays a role in influencing current expenditure in this district. While in Maseru district, Gender is positive but also insignificant (estimate = 2,417.20, p = 0.612), indicating that gender does not have a significant impact on current expenditure in Maseru either.

In both districts, education level is insignificant, Leribe: Estimate = -0.8824, p = 1.000 Maseru: Estimate = -1,517.58, p = 0.504. This suggests that educational attainment does not directly influence how much is spent on current farming operations. These findings align with other research indicating that education may not always have a direct effect on expenditure patterns in smallholder farming (Lutalo, 2024). In Leribe district, household income has a negative and insignificant effect (estimate = -0.0554, p = 0.735). It also has a negative but approaching significance effect (estimate = -0.2657, p = 0.108) in Maseru district. This suggests that in Maseru, higher household income may potentially lead to lower current expenditure, but the relationship is not statistically confirmed.

The effect of farm size is positive but insignificant (estimate = 31.55, p = 0.968) in Leribe district, suggesting farm size does not significantly impact current expenditure levels. Farm size is also positive but insignificant (estimate = 1,194.21, p = 0.216) in Maseru district, implying similar results in this district. However, the larger estimate in Maseru indicates farm size might have a relatively greater but still non-significant influence on expenditure. Land Stay in Years has Insignificant in both districts, Leribe district's Estimate = 127.7, p = 0.497 and Maseru district's Estimate = 8.21, p = 0.961 This indicates that the number of years farmers have stayed on their land does not affect current expenditure significantly.

The value of fixed improvements is insignificant in both districts: Leribe district's Estimate = -0.1077, p = 0.451 and Maseru district's Estimate = 0.3027, p = 0.571 This result suggests that investing in fixed improvements does not directly impact current expenditure patterns in either district. In Leribe district, the R-squared is 0.1405 (adjusted R-squared = -0.2606), indicating that only 14.05% of the variation in current expenditure is explained by the model, which is quite low. While in Maseru district, the R-squared is 0.3522 (adjusted R-squared = 0.1003), indicating 35.22% of the variability is explained by the model, which is still relatively low. This suggests that both models have limited explanatory power, and other factors might be influencing current expenditure. In Leribe district, the F-statistic is 0.3503 (p = 0.9171), indicating that the overall model is not statistically significant. Similarly in Maseru district, the F-statistic is 1.398 (p = 0.2656), suggesting the same outcome. Therefore, the variables in both models collectively do not provide a significant explanation for current expenditure in either district.

4.1.2.4. Effect of production costs on Maize productivity

Table 52.1: Effect of production costs on Maize productivity in Leribe

Residuals

Min	1Q	Median	3Q	Max
-0.9097	-0.6866	-0.4837	0.0117	5.2311

Variable	Estimate	Std. Error	Statistic	P-value
(Intercept)	7.539e-01	7.421e-01	1.016	0.323
Hybrid Seeds Cost	-2.663e-05	2.506e-04	-0.106	0.917
Inorganic Fertilizer Cost	-3.269e-05	1.113e-04	-0.294	0.772
Herbicides Cost	-3.702e-05	2.973e-04	-0.125	0.902
Cost of Labor	6.323e-05	2.452e-04	0.258	0.799

Significance codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 1.532 on 18 degrees of freedom
Multiple R-squared: 0.03968, Adjusted R-squared: -0.1737
F-statistic: 0.1859 on 4 and 18 DF, p-value: 0.9427

Source: Computed from Field Survey Data, 2024

Table 6: Effect of production costs on Maize productivity in Maseru

Residuals

Min	1Q	Median	3Q	Max
-0.41499	-0.20609	-0.04998	0.09646	0.95704

Variable	Estimate	Std. Error	Statistic	P-value
(Intercept)	2.960e-01	1.710e-01	1.731	0.0989 .
Hybrid Seeds Cost	-5.082e-05	2.424e-05	-2.097	0.0489 *
Inorganic Fertilizer Cost	2.567e-05	7.352e-05	0.349	0.7306
Herbicides Cost	-5.218e-05	3.899e-04	-0.134	0.8949
Cost of Labor	5.035e-05	4.363e-05	1.154	0.2621

*Significance codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1*

Residual standard error: 0.3375 on 20 degrees of freedom

Multiple R-squared: 0.2254, Adjusted R-squared: 0.07042

F-statistic: 1.455 on 4 and 20 DF, p-value: 0.2532

Source: Computed from Field Survey Data, 2024

In Leribe District (Table 12.1), the residuals range from -0.9097 to 5.2311, with a median of -0.4837. The wide range indicates variability in the data, suggesting that the model might not be adequately capturing all factors affecting maize productivity. While in Maseru District (Table 12.2), the residuals range from -0.41499 to 0.95704, with a median of -0.04998. The narrower range compared to Leribe district suggests that the model might be a slightly better fit for predicting productivity in Maseru.

The intercept in Leribe district is positive but insignificant (estimate = 0.7539, p = 0.323), indicating that when all production costs are zero, maize productivity is not significantly different from this base level. While in Maseru district the intercept is also positive but marginally significant (estimate = 0.296, p = 0.0989), suggesting a potential baseline productivity level when production costs are zero.

In Leribe district, the coefficient of hybrid seeds cost is negative and insignificant (estimate = -2.663e-05, p = 0.917), indicating no significant relationship between the cost of hybrid seeds and maize productivity. While in Maseru district, the coefficient is negative and significant (estimate = -5.082e-05, p = 0.0489), suggesting that an increase in the cost of hybrid seeds is associated with a decrease in maize productivity. This could imply that farmers spending more on hybrid seeds do not necessarily achieve higher yields, possibly due to inefficiencies or other limiting factors.

In Leribe district, the coefficient of Inorganic Fertilizer Cost is negative and insignificant (estimate = -3.269e-05, p = 0.772), indicating no significant impact on maize productivity from inorganic fertilizer costs. Similarly, in Maseru district, the coefficient is positive but insignificant (estimate = 2.567e-05, p = 0.7306), suggesting no clear relationship between inorganic fertilizer costs and productivity in this district.

The cost of herbicides is insignificant in both districts, with Leribe district's Estimate = -3.702e-05, p = 0.902 and Maseru district's Estimate = -5.218e-05, p = 0.8949. These findings suggest that herbicide expenses do not have a statistically significant effect on maize productivity in either district. The cost of labor is also insignificant in both districts, with Leribe district's Estimate = 6.323e-05, p = 0.799 and Maseru district's Estimate = 5.035e-05, p = 0.2621 This suggests that the amount spent on labor does not significantly impact maize productivity.

In Leribe district, the R-squared value is 0.03968 (adjusted R-squared = -0.1737), indicating that only about 3.97% of the variation in maize productivity is explained by the model. This is very low, suggesting that the model has little explanatory power for maize productivity. While in Maseru district, the R-squared value is 0.2254 (adjusted R-squared = 0.07042), indicating that 22.54% of the variability is explained by the model, which is better than Leribe but still quite low. The F-statistic in Leribe district is 0.1859 (p = 0.9427), indicating that the model is not statistically significant overall. while the F-statistic is 1.455 (p = 0.2532) in Maseru district, suggesting that the model is also not statistically significant overall in this district.

4.1.2.5. Effect of capital on Maize productivity

Table 7: Effect of capital on Maize productivity in Leribe

Residuals

Min	1Q	Median	3Q	Max
-0.8119	-0.6400	-0.5052	-0.2223	5.3798

Variable	Estimate	Std. Error	Statistic	P-value
(Intercept)	8.223e-01	3.532e-01	2.328	0.0295 *
Capital	-1.461e-05	8.185e-05	-0.179	0.8600

*Significance codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1*

Residual standard error: 1.413 on 22 degrees of freedom

Multiple R-squared: 0.001446, Adjusted R-squared: -0.04394

F-statistic: 0.03186 on 1 and 22 DF, p-value: 0.8632

Source: Computed from Field Survey Data, 2024

Table 8: Effect of capital on Maize productivity in Maseru
Residuals

Min	1Q	Median	3Q	Max
-0.33286	-0.24573	-0.08439	0.12073	1.06399

Variable	Estimate	Std. Error	Statistic	P-value
(Intercept)	3.573e-01	8.133e-02	4.394	0.000194 ***
Capital	-2.077e-05	2.412e-05	-0.861	0.397672

Significance codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error: 0.3477 on 24 degrees of freedom

Multiple R-squared: 0.02997, Adjusted R-squared: -0.01044

F-statistic: 0.7416 on 1 and 24 DF, p-value: 0.3977

Source: Computed from Field Survey Data, 2024

Table 13.1 shows that the capital has an insignificant effect on maize productivity in Leribe district, with an estimate of -1.461e-05 and a p-value of 0.8600, far above the 0.05 significance level. The R-squared value of 0.001446 suggests that the model explains only 0.14% of the variation in maize productivity, indicating a very weak explanatory power. Similarly, in Maseru district as shown in Table 13.2, Capital also shows an insignificant effect on maize productivity with an estimate of -2.077e-05 and a p-value of 0.3977. The R-squared value here is 0.02997, meaning that only about 3% of the variation in maize productivity is explained by the model, which is still very low. Comparison:

Both districts exhibit an insignificant relationship between the credit amount and maize productivity, suggesting that access to or the amount of credit does not have a statistically significant impact on maize productivity. However, the intercept in Maseru (3.573e-01, p-value < 0.001) is significant, indicating other factors might contribute to maize productivity in Maseru and Leribe districts.

4.1.2.6. Effect of Land tenure security on Maize productivity

Table 9: Effect of Land tenure security on Maize productivity in Leribe district
Residuals

Min	1Q	Median	3Q	Max
-2.2438	-0.5022	-0.3126	0.2140	2.4798

Variable	Estimate	Std. Error	Statistic	P-value
(Intercept)	-2.279e-01	2.624e+00	-0.087	0.9323
Land Tenure System	-3.752e-01	4.238e-01	-0.885	0.3949
Age	-2.950e-02	3.756e-02	-0.785	0.4488
Gender	1.258e+00	8.416e-01	1.495	0.1630
Marital Status	6.951e-01	3.261e-01	2.131	0.0565 .
Education Level	-5.947e-01	2.846e-01	-2.090	0.0607 .
Household Size	1.287e-01	1.394e-01	0.923	0.3756
Land Acquisition	2.605e-01	2.347e-01	1.110	0.2907
Land Stay Years	-2.299e-02	3.198e-02	-0.719	0.4872
Community Leader	1.089e+00	9.328e-01	1.167	0.2679
Household Income	-2.167e-05	2.916e-05	-0.743	0.4731
Land Tenure Security	-3.106e-01	2.724e-01	-1.140	0.2783

Significance codes: 0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 1.363 on 11 degrees of freedom

Multiple R-squared: 0.5354, Adjusted R-squared: 0.07086

F-statistic: 1.153 on 11 and 11 DF, p-value: 0.409

Source: Computed from Field Survey Data, 2024

Table 14.2: Effect of Land tenure security on Maize productivity in Maseru district
Residuals

Min	1Q	Median	3Q	Max
-0.35784	-0.19022	-0.02311	0.15490	0.58511

Variable	Estimate	Std. Error	Statistic	P-value
(Intercept)	1.059e+00	7.870e-01	1.346	0.1998
Land Tenure System	1.687e-01	8.924e-02	1.891	0.0795 .
Age	-1.713e-01	1.702e-01	-1.006	0.3313
Gender	-1.713e-01	1.702e-01	-1.006	0.3313
Marital Status	5.204e-02	7.621e-02	0.683	0.5059
Education Level	-7.115e-02	8.029e-02	-0.886	0.3905
Household Size	-2.729e-02	3.703e-02	-0.737	0.4733
Land Acquisition	1.445e-01	6.274e-02	2.303	0.0371 *
Land Stay Years	4.230e-03	6.186e-03	0.684	0.5052
Community Leader	-5.577e-01	4.104e-01	-1.359	0.1957
Household Income	3.142e-06	5.354e-06	0.587	0.5666
Land Tenure Security	-7.808e-02	4.601e-02	-1.697	0.1118

Significance codes: 0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 0.3187on 14 degrees of freedom

Multiple R-squared: 0.5245, Adjusted R-squared: 0.1509

F-statistic: 1.404 on 11 and 14 DF, p-value: 0.2712

Source: Computed from Field Survey Data, 2024

The regression results for the Leribe district in Table 14.1 suggest that the model explains about 53.54% of the variation in agricultural productivity, as indicated by the R-squared value (0.5354). However, the adjusted R-squared (0.07086) shows that after accounting for the number of predictors, the model’s explanatory power is quite limited. The F-statistic of 1.153 and p-value of 0.409 indicate that the overall model is not statistically significant.

Looking at the coefficients, none of the variables are statistically significant at the 5% level, but two variables, "Marital Status" (p = 0.0565) and "Education Level" (p =

0.0607), show weak significance, suggesting they might have some impact on productivity. The "Marital Status" has a positive estimate (0.6951), meaning being married might slightly increase productivity (Nakanwagi, 2022), while "Education Level" has a negative estimate (-0.5947), indicating that as education level increases, productivity might decrease, though the effect is not strongly significant. Other variables such as "Land Tenure System," "Age," "Gender," "Household Size," and "Household Income" do not significantly influence productivity. This suggests that in Leribe, land tenure security and related factors do not have a strong direct effect on productivity for small-scale maize farmers (Musada et al., 2022).

For Maseru district in Table 14.2, the model explains about 52.45% of the variability in agricultural productivity (R-squared = 0.5245), and the adjusted R-squared is 0.1509, indicating the model has limited explanatory power. The overall model is not statistically significant, as the F-statistic (1.404) and p-value (0.2712) indicate.

The only variable that is statistically significant at the 5% level is "Land Acquisition" (p = 0.0371), with a positive coefficient (0.1445), suggesting that how the land was acquired positively affects productivity in Maseru. This implies that farmers who obtained land through certain means (possibly inheritance, purchase, or allocation) tend to have higher productivity.

Other factors, including "Land Tenure System," "Age," "Gender," "Marital Status," "Education Level," and "Household Size," are not significant predictors of productivity. The "Land Tenure Security" variable, while not significant, has a negative estimate (-0.07808), indicating that perceived land tenure security might have an inverse but statistically insignificant effect on productivity.

Overall, neither model is particularly strong in predicting productivity, as indicated by the low adjusted R-squared values. The only significant variable across both districts is "Land Acquisition" in Maseru, suggesting that the method of land acquisition plays a more critical role in influencing productivity in this district compared to Leribe. In Leribe, "Marital Status" and "Education Level" show weak significance, while in Maseru, the "Land Tenure System" comes close to being weakly significant (p = 0.0795). This suggests that while land tenure security does not have a consistently strong effect across both districts, the way land is acquired and certain socio-demographic factors may have localized effects on productivity.

4.2. Discussion

4.2.1. The first hypothesis:

The Chi-Square test was conducted to determine if there is a significant difference in land tenure security systems between the Leribe and Maseru districts. The results indicated that there is no significant difference at the 5% significance level, as evidenced by a Chi-Square statistic of 2.1021419, with 3 degrees of freedom and a p-value of 0.5514796. Since the p-value (0.5514796) is greater than the significance level of 0.05, we fail to reject the null hypothesis (H01), which states that there is no difference in land tenure security systems between the two districts. This suggests that the land tenure security systems are similar in both Leribe and Maseru districts.

Moreover, the ability to generalize the findings is supported by the lack of significant difference, indicating that the results from this study can be applied more broadly to understand land tenure security in these regions. This reinforces the validity of the research findings and suggests that policies aimed at improving land tenure security may not need to differentiate significantly between these two districts.

4.2.2. The second hypothesis

To evaluate the hypothesis regarding the effect of land tenure on maize productivity in Leribe and Maseru districts, relevant results from the previous Tables were used as reference. Based on the statistical analysis, both districts demonstrate non-significant results according to the results on the tables. Therefore, we fail to reject the null hypothesis (H_{02}) and conclude that land tenure has no effect on maize productivity in both Leribe and Maseru districts according to the model and data used in this research.

The findings from the regression analysis suggest that while land tenure security may be important for various socio-economic factors, it does not directly translate into increased maize productivity. This aligns with the observations in recent studies, which indicate that other elements, such as access to inputs, technology, and market conditions, may play a more significant role in influencing productivity (Singirankabo & Ertsen 2020).

The results indicate that most variables, such as age, gender, education, and household size, do not significantly influence agricultural credit access in Maseru District.

However, equity contribution emerges as a significant factor in one model, implying that credit providers may prioritize applicants with higher equity levels. This highlights the need for smallholder farmers to build equity to enhance their creditworthiness (Taremwa et al., 2021). The generally low explanatory power of the models suggests that other unmeasured factors may play crucial roles in credit access, calling for further research to identify these determinants.

Furthermore, the results reveal that age and farm size are significant factors in influencing fixed land improvements in Leribe and Maseru, respectively. This implies that older farmers in Leribe might have more resources or motivation for investing in land improvements, while larger farms in Maseru are more likely to receive such investments. The general insignificance of variables like education level, household size, and land tenure security suggests that these factors do not have a direct impact on fixed land improvements in both districts.

The analyses indicate that none of the variables are statistically significant predictors of current expenditure in either Leribe or Maseru districts. This suggests that factors not captured in the model might be driving expenditure decisions among farmers in these districts. Additionally, the low R-squared values and lack of overall significance highlight the need to consider other determinants such as market access, weather conditions, or farming experience in future research. The lack of significant influence from education, gender, and age suggests that demographic factors might not be the main drivers of current expenditure. These findings can inform policymakers that interventions to support current expenditure might need to be more targeted at structural factors rather than demographic characteristics.

Moreover, the analyses revealed that production costs, such as those for hybrid seeds, inorganic fertilizers, herbicides, and labor, do not significantly explain variations in maize productivity in both Leribe and Maseru districts. However, the significant negative impact of hybrid seed costs in Maseru district suggests that higher spending on seeds does not necessarily translate into better productivity, possibly due to inefficient use or other confounding factors. The low R-squared values and lack of overall model significance indicate that factors not included in the model may play a more substantial role in determining maize productivity, such as weather conditions, farming techniques, soil quality, or access to extension services. These findings suggest that policy interventions aiming to improve maize productivity should not focus solely on reducing production costs but should also address broader factors affecting efficiency and yield.

The findings indicated that capital in the form of credit does not significantly influence maize productivity in both Leribe and Maseru districts. This aligns with studies suggesting that access to credit alone may not enhance agricultural productivity unless accompanied by other supportive factors like training, technology adoption, and improved farming practices (Ngoma & Angelsen, 2020; Ali et al., 2021). The implication is that policies aimed at improving maize productivity should not solely focus on credit provision. Instead, a comprehensive approach involving extension services, improved access to inputs, and training on efficient resource use may be more effective in enhancing productivity among smallholder farmers (Mugambi et al., 2022; Musara & Mlambo, 2023). This insight is crucial for policymakers and stakeholders aiming to improve maize production and food security in Lesotho

The findings suggested that capital factors, including land tenure and household income, do not have a significant effect on maize productivity in both districts. This outcome aligns with studies that argue non-capital factors like farm management practices, access to extension services, and farm experience might be more crucial in influencing productivity (Dzanku et al., 2021). The implication for policymakers is that improving maize productivity should involve interventions beyond capital provision. Efforts could focus on enhancing education, agricultural training, and providing access to extension services to improve overall productivity (Okello & Kirimi, 2019). Additionally, since land tenure security shows little impact in this study, it may not be the most immediate lever for boosting productivity without complementary interventions.

CHAPTER FIVE: SUMMARY, CONCLUSION AND POLICY RECOMMENDATION

5.1. Introduction

In this chapter, the key findings of the study are synthesized, and the broader implications of the results are discussed. The chapter provides a summary of the main findings, followed by conclusions drawn from the analysis, and concludes with policy recommendations that aim to enhance land tenure security and agricultural productivity among small-scale maize farmers in the Leribe district and Maseru district districts of Lesotho.

5.2. Summary

The findings confirm that secure land tenure is critical for improving agricultural productivity among small-scale farmers. Leasehold tenure systems, which provide formalized and long-term land rights, create a conducive environment for investments in land improvements and the adoption of modern farming practices. Secure land tenure leads to increased investment in land, such as soil conservation practices and improved input usage, which enhances productivity (Coulibaly., 2021). Conversely, customary land tenure systems, while providing a degree of security, do not offer the same level of incentive for long-term investments, which can limit productivity (Lawry et al., 2021). This underscores the importance of addressing land tenure issues to support sustainable agricultural development and improve livelihoods in Lesotho (Tesfaye & Elias, 2019).

Various challenges faced by farmers were identified, including:

- **Ownership Issues:** Land is often owned by individuals who are not involved in farming or are illiterate, making contractual agreements difficult.
- **Irrigation and Climate Change:** Farmers face challenges with irrigation systems and the impacts of climate change.
- **Land Conversion and Theft:** Fields are being sold for construction, leading to theft and reduced yields.
- **Decreasing Agricultural Value:** The perceived value of agriculture is declining.

- **Theft and Inheritance Issues:** Theft and inheritance-related disputes are prevalent.

Farmers suggested several solutions to address these challenges, including:

- **State Ownership and Allocation:** Land should be governed or owned by the state and allocated based on productivity plans as loans.
- **Mandatory Cultivation:** Citizens owning land should be required to cultivate and use it for agricultural production.
- **Government Intervention in Theft:** The government should take stronger measures against agricultural theft.
- **Protection of Agricultural Land:** Agricultural land should be protected and not given to non-producers.
- **Regulation of Land Use:** Houses should not be built on or near agricultural fields.
- **Irrigation Support:** The government should provide support for irrigation infrastructure.

5.3. Conclusion

The results from the data analysis indicate that there is no difference in land tenure security systems between the two districts. This suggests that the land tenure security systems are similar in both Leribe and Maseru districts. Moreover, the ability to generalize the findings is supported by the lack of significant difference, indicating that the results from this study can be applied more broadly to understand land tenure security in these regions (Msangi et al., 2022). This reinforces the validity of the research findings and suggests that policies aimed at improving land tenure security may not need to differentiate significantly between these two districts (Musah et al., 2024).

The regression analysis shows that there is that there is weak evidence that Land tenure security affects agricultural productivity among small-scale farmers in Leribe and Maseru districts of Lesotho. The analysis suggests that while land tenure security does not have a consistently strong effect across both districts, the way land is acquired and certain socio-demographic factors may have localized effects on productivity. Moreover, the descriptive the results indicate that land tenure security plays a crucial role in influencing agricultural productivity, with variations observed between the two districts. This is in line with the study by Singirankabo & Ertsen (2020)

While insecurity might drive higher productivity in Leribe, security contributes more to productivity in Maseru. This emphasizes the need for policies that address land tenure security to enhance agricultural productivity among small-scale maize farmers in Lesotho. These findings suggest that while land tenure security may be important for various socio-economic factors, it does not directly translate into increased maize productivity. This aligns with the observations in recent studies, which indicate that other elements, such as access to inputs, technology, and market conditions, may play a more significant role in influencing productivity (Singirankabo & Ertsen 2020).

5.4. Policy recommendations

By implementing the following policy recommendations, the government and other stakeholders can create an enabling environment that enhances land tenure security and agricultural productivity, ultimately contributing to food security and economic development in Lesotho:

1. The government should consider policies that formalize customary land tenure systems to provide small-scale farmers with legally recognized and secure land rights. This would encourage long-term investments in land improvements and increase agricultural productivity. Financial institutions and the government should develop tailored credit products that cater to small-scale farmers. These products should have flexible terms and conditions to accommodate the unique needs of this demographic, enabling them to make necessary investments in their farms.

2. Initiatives aimed at educating farmers about the benefits of secure land tenure and how to access formal land titles should be promoted. Awareness campaigns can help farmers understand the importance of securing their land rights, which in turn can enhance their willingness to invest in agricultural productivity. The government should bolster extension services to provide technical support and guidance to small-scale farmers. These services can help farmers maximize the benefits of secure land tenure by adopting modern farming techniques and making informed decisions about land improvements (Ibrahim et al. 2023). The

role of extension services in boosting agricultural productivity is highlighted by Raji et al. (2024).

3. Implement policies requiring landowners to actively cultivate their land. This can prevent land from being left idle and ensure that it contributes to agricultural productivity (Dembele et al., 2023). Strengthen measures to prevent agricultural theft, including improved law enforcement and community-based monitoring systems (Stephen, 2024). Designate and protect agricultural land to prevent its conversion to non-agricultural uses. This includes enforcing regulations against building houses on or near fields (Widowaty et al., 2021). Implement zoning regulations to prevent residential construction on agricultural land and ensure that land is used according to its intended purpos. Increase government investment in irrigation infrastructure to support farmers in managing climate change impacts and improving productivity.

4. Policymakers should consider developing programs that address credit accessibility barriers by promoting equity contribution schemes and offering education on the importance of credit management for smallholder farmers. This approach could improve financial inclusion and support agricultural productivity, as emphasized by AFI (2022).

5. Policy implications include the need to encourage older farmers in Leribe to share their experiences with younger farmers, potentially through mentorship programs. Additionally, financial institutions should consider targeting larger farms in Maseru for credit facilities, as they have a higher likelihood of investing in land improvements. Moreover, enhancing access to credit, especially in Maseru, could foster greater investment in fixed land improvements, leading to improved agricultural productivity.

5.5. Recommendations for the Improvement of the research:

Given the findings, it may be beneficial to explore additional variables that could impact maize productivity, such as soil quality, farmer experience, climatic conditions, or crop management practices. Additionally, investigating the efficiency and appropriateness of input use might provide more insights into improving productivity. To enhance the quality and impact of the research on land tenure security and agricultural productivity, several improvements can be considered. Firstly, expanding the geographic scope of the study to include additional districts besides Leribe district and Maseru district would provide a more comprehensive understanding of land tenure and productivity across different areas of Lesotho. This broader approach will help determine whether the findings are specific to the studied regions or applicable to other areas as well (Gupta et al., 2023).

Incorporating longitudinal data is another key recommendation. By tracking changes in land tenure and productivity over time, the research will offer valuable insights into how variations in land tenure security affect productivity across different seasons and years. This longitudinal perspective will help in understanding the long-term effects and trends related to land tenure (Singirankabo & Ertsen 2020). Enhancing data collection methods is also crucial. Utilizing a combination of qualitative and quantitative approaches, such as interviews, focus groups, and surveys, will provide a richer, more nuanced understanding of land tenure issues. This mixed-methods approach helps capture diverse perspectives and the complexities surrounding land tenure security and agricultural productivity.

Increasing the sample size and diversity of participants will improve the robustness and generalizability of the findings. A larger and more varied sample will offer a more comprehensive view of how different land tenure systems affect agricultural productivity. This diversity is essential for understanding the full scope of the issues faced by small-scale farmers (Azadi et al., 2022).

Another important recommendation is to investigate additional variables that may affect agricultural productivity, such as access to technology, education levels, and market access. By exploring these factors, the research can provide a more holistic view of the determinants of productivity and how they interact with land tenure security (Jasrotia et al., 2021).

Conducting comparative analysis with other countries in the region or similar settings can also be beneficial. Comparing land tenure systems and their effects on productivity can offer insights into best practices and policies that could be adapted for Lesotho. This comparative approach helps identify successful strategies and policies from other contexts that might be relevant (Dube et al., 2023).

Focusing on policy implementation is crucial for translating research findings into actionable recommendations. Assessing the effectiveness of existing policies related to land tenure and agriculture, and identifying barriers to their implementation, can refine recommendations and ensure they address practical challenges (Mekonnen et al., 2021). Engaging a broader range of stakeholders, including policymakers, agricultural extension officers, and local community leaders, in the research process is also recommended. Stakeholder involvement ensures that the research addresses relevant issues and that the recommendations are feasible and supported by those who can implement them (Haque et al., 2022).

Analyzing the economic effect of different land tenure systems on small-scale farmers is another important aspect. Conducting cost-benefit analyses of proposed policy changes will help in designing policies that are both effective and sustainable. Understanding the economic implications of different land tenure systems is vital for crafting policies that support agricultural productivity (Wang et al., 2020). Employing advanced statistical techniques, such as econometric models and machine learning, can provide deeper insights into the relationships between land tenure security and productivity. These advanced methods allow for more detailed and accurate analysis of the data (Osei et al., 2022).

Ensuring data quality and reliability through rigorous validation and quality control procedures is essential for drawing accurate conclusions. High-quality data is the foundation of reliable research outcomes (Tanaka et al., 2019).

Finally, providing capacity-building recommendations for local researchers and extension workers can enhance the quality of future studies and ensure the sustainability of research efforts. Strengthening local research capacity will support ongoing efforts to address land tenure and productivity challenges in Lesotho (Hassan et al., 2021). Implementing these recommendations will significantly improve the depth, relevance, and impact of the research, offering valuable insights for policymakers, stakeholders, and small-scale farmers in Lesotho.

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APPENDIX

Questionnaire:

Section A: Demographic Information

1. Age of Household Head:

   Age (in years): ....
2. District:
   - ☐ Maseru District
   - ☐ Leribe District
3. Gender of Household Head:
   - ☐ Male
   - ☐ Female
4. Marital Status:
   - ☐ Single
   - ☐ Married
   - ☐ Divorced
   - ☐ Widowed
5. Education Level of Household Head:

   Years of schooling: ....
6. Educational Level:
   - ☐ No formal education
   - ☐ Primary education
   - ☐ Secondary education
   - ☐ Tertiary education
7. Household Size:

   Number of people: ....
8. Community Leadership:

   Are you a community leader?
   - ☐ Yes
   - ☐ No

Section B: Land Tenure and Farming Information

1. Land Tenure System:
   - ☐ Freehold
   - ☐ Leasehold
   - ☐ Customary/Tribal
   - ☐ Government-owned
   - ☐ Other (please specify): ....
2. Title Deed Possession: Do you have a land title deed?
   - ☐ Yes
   - ☐ No
3. Land Acquisition:

   How did you acquire your land?
   - ☐ Inherited
   - ☐ Purchased
   - ☐ Allocated by community/government
   - ☐ Rented
   - ☐ Other (please specify): ....
4. What are the types of rights you have on the land
   - ☐ Rights to use the land only
   - ☐ Rights to sell
   - ☐ Rights to transfer
5. Land Stay: Number of years household had stayed on the land: ....
6. Total Land Size: What is the total size of your land? .... hectares
7. Farm Size: How much of this land is under maize cultivation? .... hectares
8. Land Concentration: Is your land concentrated in one area?
   - ☐ Yes
   - ☐ No
9. Type of labor used:
   - ☐ Family
   - ☐ Hired labor
   - ☐ Letsema
10. Days taken to: Plough:......................

    Cultivate:...................

Harvest:.....................

11. Payment for hired labor/Letsema: .... Maloti.

Section C: Land and Farming Practices

1. Parcel Access:

   Walking time from the homestead to the parcel (in minutes): ....

   Walking time from your homestead to your maize field? .... minutes

2. Market Access:

   Walking time from the homestead to the nearest market (in minutes): ....

3. Land Fertility: Do you consider your land to have high fertility?

   ☐ Yes

   ☐ No

4. Land Topography: Is your land hilly?

   ☐ Yes

   ☐ No

5. Use of Hybrid Seeds: Do you use hybrid seeds?

   ☐ Yes

   ☐ No

   If yes, how many do you use? ....

   How much does it cost? .... Maloti/kg

6. Use of Inorganic Fertilizer: Do you use inorganic fertilizer?

   ☐ Yes

   ☐ No

   If yes, how many do you use? ....

   How much does it cost? .... Maloti/kg

7. Use of Herbicides: Do you use herbicides?

   ☐ Yes

   ☐ No

   If yes, how many do you use? ....

   How much does it cost? .... Maloti/kg

8. Oxen Ownership:

   Do you own a donkey or cattle?

   ☐ Yes

□ No

If yes, how many: Donkeys:............. Cattle:...............

Section D: Agricultural Productivity and Finance

1. Maize Productivity:
   How many hectors were devoted to maize production? ....Ha
   What was your maize yield last season (in Kgs/Ha): ....
2. Household Income: What is your total household income? .... Maloti
3. How long does it take to walk from your homestead to your maize field? .... minutes
4. Extension Contacts: How many times have you been in contact with an agricultural extension agent in the past year? .... times
5. Extension Contacts: Number of contacts with an extension agent: ....
6. Credit Access: Can you access credit?
   - ☐ Yes
   - ☐ No

   If yes, how much? ....
7. Group Membership: Are you a member of any agricultural group or cooperative?
   - ☐ Yes
   - ☐ No
8. Value of Agricultural Credit Used:
   Value of agricultural credit used to finance past fixed improvements and current operating expenses (in Maloti): ....
9. Value of Past Fixed Improvements on the Land:
   Value (in Maloti): ....
10. Value of Current Operating Expenses on Maize Fields:
    Value (in Maloti): ....
11. Area Under Maize Cultivation:
    Area under maize cultivation (in hectares): ....
12. Amount of Equity Contribution:
    Amount of equity contribution (in Maloti): ....
13. Current Value of Long-term Credit Used to Finance Past Fixed Land Improvements:
    Value (in Maloti): ....
14. Current Value of Short-term Credit Used to Finance Operating Expenses:

Value (in Maloti): ....

15. Present Value of Agricultural Credit Used to Finance Past Fixed Improvements and Current Operating Expenses:

    Value (in Maloti): ....

Section E: Additional Variables

1. Transfer Income:

   Monthly off-farm income (in Maloti): ....
2. Land Tenure Status:

   Type of documentation do you hold?
   - ☐ Lease
   - ☐ Form C
   - ☐ Contract
3. Land Dispute:

   Have you experienced any land disputes?
   - ☐ Yes
   - ☐ No
4. Community Leadership: Are you a community leader?
   - ☐ Yes
   - ☐ No
5. Land Concentration: Is your land concentrated in one area?
   - ☐ Yes
   - ☐ No
6. Equity Contribution: What is the amount of equity contribution in Maloti? .... Maloti
7. Long-term Credit: What is the current value of long-term credit used for past fixed land improvements? .... Maloti
8. Short-term Credit: What is the current value of short-term credit used for operating expenses? .... Maloti

Section G: Land Tenure Security

1. Perception of Land Tenure Security: On a scale of 10, how secure do you feel about your land tenure?
   - ☐ Very insecure
   - ☐ Insecure
   - ☐ Neutral
   - ☐ Secure
   - ☐ Very secure

Section H: Open-Ended Questions

1. Challenges: What are the main challenges you face in maize farming related to land
   tenure? ....
   ....
   ....
2. Suggestions: What suggestions do you have for improving land tenure security and agricultural productivity in your
   area? ....
   ....
   ....
   ....