

**EFFECT OF SUSTAINABLE AGRICULTURE PRACTICES ON CROP
PRODUCTIVITY IN SMALLHOLDER FARMS IN
MATUGGA, WAKISO DISTRICT**

BY

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DECLARATION

I, **Lubega Hussein Jamil** hereby affirm that this research report is my original work and has not been submitted to this or any other academic institution for any award. All sources consulted have been duly acknowledged through appropriate citation

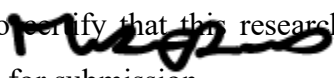
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APPROVAL

This is to certify that this research report was conducted under my supervision and is hereby approved for submission.



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Research Supervisor

DEDICATION

I Lubega Hussein Jamil, first and foremost I thank Allah for everything through this journey I dedicate this research report to all those that have been part of my journey directly and indirectly. To the one that offered guidance, encouragement and reminded through it all. To my family, thank you for being a constant source of strength. Your sacrifices, prayers and presence gave me the courage to push forward.

A special thanks to my love Naiwumbwe Shaminah, for the unwavering support rendered in all aspects of life during my studies. Your constant encouragement, belief and presence made the journey smooth and adorable. This achievement is as much yours as it is mine.

This work is a reflection of resilience growth and support that is often unsung. With gratitude and humility, I dedicate this milestone to you all

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LIST OF ACRONYMS/ABBREVIATIONS

AGRA:	Alliance for a Green Revolution in Africa
CAP:	Common Agricultural Policy
CVI:	Content Validity Index
HYVs:	High Yielding-Crop varieties
KII:	Key Informant Interviews
MAAIF:	Ministry of Agriculture, Animal Industry, and Fisheries
NARO:	National Agricultural Research Organization
PFT:	Production Function Theory
SPSS:	Statistical Package for Social Sciences
UBOS:	Uganda Bureau of Statistics

ABSTRACT

This study investigated the effect of sustainable agriculture practices on crop productivity in smallholder farms in Matugga, Wakiso District. The study was grounded on three objectives which included examine the effect of environmental sustainability practices on crop productivity in smallholder farms, the effect of economic viability practices on crop productivity in smallholder farms and the effect of social equity practices on crop productivity in smallholder farms in Matugga, Wakiso District. The study used a cross-sectional survey research design considering both quantitative and qualitative research approach. The study targeted 208 participants however, 170 participants responded back. Data was primarily collected using a questionnaire and interview guide. The study findings revealed that there was a weak and statistically insignificant positive correlation between environmental sustainability practices and crop productivity among smallholder farms in Matugga, Wakiso District ($r = .104$, $p = .185$). Then, regression analysis revealed environmental sustainability practices accounted for only 0.6% of the variance in crop productivity among smallholder farms in Matugga, Wakiso District (Adjusted R Square = .006). The results revealed a significant and moderate positive correlation between economic viability practices and crop productivity among smallholder farms in Matugga, Wakiso District ($r = .391$, $p < 0.01$) and the regression analysis revealed show that economic viability practices accounted for 14.8% of the variance in crop productivity among smallholder farms in Matugga, Wakiso District (Adjusted R Square = .148). Additionally, the results reveal a significant and moderately strong positive correlation between social equity practices and crop productivity among smallholder farms in Matugga, Wakiso District ($r = .525$, $p < 0.01$) and the regression analysis showed that social equity practices accounted for 27.1% of the variance in crop productivity among smallholder farms in Matugga, Wakiso District (Adjusted R Square = .271). It was recommended that efforts in this area should be complemented with interventions targeting key productivity drivers such as improving soil fertility, enhancing access to quality agricultural inputs, and mitigating climate variability impacts. The study recommended scaling up support for these practices through provision of affordable credit facilities, input subsidies, and improved access to modern irrigation

technologies. Then, the study also recommended strengthening the enforcement of fair labor standards, improving occupational safety measures, and promoting gender equity on farms.

CHAPTER ONE

GENERAL INTRODUCTION

1.1 Introduction

This study sought to examine the effect of sustainable agriculture practices on crop productivity in smallholder farms in Matugga, Wakiso District. Sustainable agriculture practices constitute the independent variable being operationalized by environmental sustainability, economic viability, and social equity while crop productivity is the dependent variable, which manifests in high crop yields, crop quality, crop diversity, and high profitability. The study specifically investigated how each of environmental sustainability, economic viability, and social equity has impacted on crop productivity. This chapter presents the study background, problem statement, research objectives, research questions, research hypotheses, conceptual framework, significance of the study, and the study scope.

1.2 Background to the study

This subsection presents the historical, theoretical, conceptual, geographical and contextual perspectives regarding sustainable agriculture practices and crop productivity in smallholder farms.

1.2.1 Historical background

The evolution of crop productivity has been marked by significant agricultural transformations particularly in Latin America. The 1963 Green Revolution introduced high-yielding crop varieties (HYVs), chemical fertilizers, and mechanized irrigation systems, which significantly boosted wheat and rice production in countries like Mexico (Nelson et al., 2019; Ritchie, 2017). While these advancements contributed to food security and modernized agriculture, they also led to challenges such as environmental degradation, soil depletion, and unequal access to benefits, particularly for smallholder farmers (Pingali, 2012). These experiences highlight the importance of balancing technological advancements with sustainable agricultural practices to ensure long-term productivity without ecological harm.

In Asia, the Green Revolution of the 1960s and 1970s had a transformative impact on food production, particularly in India and other developing nations (Gaud, 1968). The introduction of HYVs, combined with chemical inputs and advanced irrigation methods, led to remarkable increases in crop yields, significantly reducing food insecurity (Hazell, 2009). However, these advances also created concerns over soil fertility loss, increased dependence on synthetic

fertilizers, and widened disparities between large-scale commercial farmers and smallholders (Pingali, 2012). These challenges underscore the need for context-specific agricultural policies that support both productivity and environmental sustainability while ensuring equitable access to agricultural innovations.

In Europe, postwar agricultural transformation was largely driven by industrialization and policy reforms. The European Union's Common Agricultural Policy (CAP), reformed in the 1990s, sought to balance food security with sustainability through subsidies, cross-compliance regulations, and agri-environmental measures (Gollin et al., 2021; Richter, 2014). While CAP improved agricultural productivity and stabilized farmer incomes, it also led to overproduction, market distortions, and unequal subsidy distribution, necessitating further reforms to integrate climate resilience and biodiversity conservation (Matthews, 2018). The shift toward organic farming in the 2010s further reflects the continent's evolving commitment to sustainable agricultural practices, emphasizing the need for policies that support both environmental and economic objectives.

In Africa, agricultural transformation has been shaped by multiple historical events and policy interventions. The post-colonial period of the 1960s saw efforts to modernize agriculture, while the droughts and famines of the 1980s emphasized the need for sustainability-focused practices (Amadi & Anokwuru, 2017). The 2006 Alliance for a Green Revolution in Africa (AGRA), launched by the Bill & Melinda Gates Foundation and Rockefeller Foundation, aimed to improve yields and market access through enhanced seeds and fertilizers. While AGRA strengthened agricultural value chains, it also raised concerns about soil degradation and increased dependency on chemical inputs, highlighting the importance of holistic approaches that integrate sustainability with productivity (Schurman, 2018).

In East Africa, sustainable agricultural practices have evolved in response to environmental and economic challenges. The region has witnessed increasing efforts to promote conservation agriculture, with governments and development partners focusing on soil conservation, water management, and agroforestry to improve long-term productivity (Sikuku, 2025). The adoption of climate-smart agriculture, particularly in Kenya and Tanzania, has provided insights into the role of adaptive farming techniques in mitigating climate change effects (Makinde, 2024). However, challenges such as limited access to agricultural financing and market inefficiencies continue to hinder progress.

In Uganda, the Ministry of Agriculture, Animal Industry, and Fisheries (MAAIF) has actively promoted sustainable agricultural initiatives since the early 2000s. Efforts have been directed toward enhancing resource efficiency, ensuring fair pricing, and improving market access for smallholder farmers (Agwu et al., 2023). Farmers have adopted sustainable practices such as crop rotation and precision farming to enhance yields while prioritizing biodiversity protection and soil conservation to prevent land degradation. However, these measures alone have not guaranteed consistently high crop productivity (Ruppel et al., 2021). Additionally, the enforcement of fair labor practices under the Employment Act of 2006 and community engagement programs have aimed to foster inclusive agricultural growth, empowering Uganda's smallholder farmers (Banugire, 2022). These experiences demonstrate the necessity of comprehensive agricultural policies that integrate economic viability, environmental sustainability, and farmer welfare.

In Matugga, Wakiso District, agriculture remains a key economic activity, with many smallholder farmers relying on subsistence and small-scale commercial farming. The adoption of sustainable agricultural practices, such as agroforestry and organic farming, has been encouraged to enhance productivity while conserving soil fertility. However, farmers in Matugga face challenges such as erratic weather patterns, limited access to credit, and fluctuating market prices, which impact overall agricultural output (NARO, 2022-2023). Addressing these issues requires localized policy interventions that promote access to agricultural inputs, extension services, and climate-resilient farming techniques. Lessons from broader regional and global experiences underscore the need for context-specific agricultural models that align with local socio-economic and environmental conditions.

These historical and contemporary agricultural transformations provide critical insights for this study, reinforcing the importance of adopting balanced agricultural models that integrate productivity, sustainability, and inclusivity. By analyzing experiences across different regions, this study aims to contribute to the development of strategies that support long-term ecological and economic stability in Uganda, with a specific focus on Matugga in Wakiso District.

1.2.2 Theoretical background

This study was guided by two key theories of Production Function Theory (PFT) and Agroecological Theory, both of which provide distinct yet complementary perspectives on agricultural productivity. The Production Function Theory was introduced by Paul Douglas and Charles Cobb in 1928 to explain the relationship between input factors and production output (Douglas, 1928). The theory assumes that production depends on the quantity of inputs such as capital, labor, and land where increasing inputs leads to higher output, albeit with diminishing marginal returns (Cobb & Douglas, 1928).

Over time, scholars have expanded on PFT to incorporate additional factors influencing productivity. Solow (1957) integrated technological progress as a crucial determinant, acknowledging that beyond labor and capital, innovations drive output growth. Arrow et al. (1961) further refined the theory by introducing the concept of “learning by doing,” suggesting that productivity improves with experience. However, criticisms arose in the 1970s and 1980s when scholars like Schultz (1975) argued that PFT oversimplifies agricultural production by neglecting biological and environmental constraints. Hayami & Ruttan (1985) later introduced an induced innovation model, demonstrating that technological and economic conditions influence input combinations. More recently, Balk (2024) reaffirmed the theory’s relevance while noting that various scholars have modified its assumptions over time.

In this study, PFT helps analyze how resource-efficient farming practices affect crop yields in Matugga, Wakiso District. It assumes that agricultural output is primarily a function of input efficiency (Pal, 2023). However, PFT does not fully account for external factors like climate change, soil degradation, and pest infestations, which significantly affect farm productivity. The assumption of perfect substitutability between inputs (Binswanger & Deininger, 1997) and constant returns to scale makes the theory limited in addressing real-world agricultural variability.

To address these limitations, Agroecological Theory provides an alternative perspective. Developed in the 1980s by Miguel A. Altieri, the Agroecological Theory emphasizes the integration of ecological principles into agriculture to enhance sustainability (Altieri, 1983). It assumes that productivity is linked to biodiversity, natural resource cycling, and reduced dependence on synthetic inputs (Gliessman, 1998). Unlike PFT, which focuses on input-output

relationships, Agroecological Theory highlights environmental conservation and ecosystem interactions as key factors in agricultural productivity.

Scholars have expanded upon Altieri's work over time. Pretty (1995) argued that agroecology enhances resilience against climate change while fostering long-term soil fertility. Gliessman (2007) incorporated social and economic dimensions, emphasizing the role of traditional knowledge in sustainable agriculture. More recently, Altieri & Nicholls (2020) highlighted agroecology's potential to improve food security and economic stability for smallholder farmers. However, critics such as Giller et al. (2011) contend that the theory's reliance on low-input farming and traditional knowledge makes large-scale application challenging. Additionally, Wezel et al. (2020) note that transitioning from conventional to agroecological practices requires time and investment, which may limit its feasibility.

In this study, Agroecological Theory provides a framework for evaluating the impact of sustainable farming practices on productivity in Matugga, Wakiso District. By promoting soil health, reducing chemical dependence, and enhancing climate resilience, the theory supports the study's objective of assessing whether ecological farming contributes to long-term farm productivity.

The theories of Production Function Theory and Agroecological Theory were used because they offer complementary insights into agricultural productivity. PFT explains the role of resource efficiency in determining output levels, but its limitations particularly in accounting for environmental constraints necessitate a broader framework. Agroecological Theory compensates for this by emphasizing the role of ecological sustainability in shaping agricultural outcomes. Together, these theories provide a comprehensive lens through which to analyze how both input efficiency and ecological factors influence farm productivity.

1.2.3 Geographical background

Matugga is an urban Centre located in the central region of Uganda within Wakiso district, Kyadondo county, and Kyadondo north constituency. It lies in approximately 20 kilometers north of Kampala-Gulu highway, a major national transport corridor that links central Uganda to the northern part of the country. The town is geographically positioned at approximately 0°28' north latitude and 32°31' east longitude. Matugga experiences a tropical climate moderated by its relatively high altitude. Rainfall is with two district wet seasons March to May and September to

November. The dry seasons occur between December- February and June- August. Annual rainfall averages between 1,200 and 1,500 mm supporting both subsistence agriculture and urban vegetation. Temperatures are generally mild ranging from 18 to 28 degrees C which is conducive to human settlement and agricultural production.

1.2.4 Conceptual background

This subsection presents the definitions of the key variables of sustainable agriculture practices and crop productivity. Sustainable agriculture practices refer to the approach pertained to maintaining soil sustainability to help in securing future food production (Muhie, 2022). Raman (2024) also defines sustainable agriculture practices as an integrated system of three major goals- environmental, social, and, economic viability. According to Pozza and Field (2020), sustainable agriculture practices refer to the efforts of ensuring moderate consumption of non-renewable resources with nature and keeping future generations in mind. However, in this study, sustainable agriculture practices are the environmental sustainability practices, economic viability practices and social equity practices.

Environmental sustainability refers to the practices and strategies that are aimed at improving and maintaining soil health, reduce erosion, and promote soil fertility (Hurduzeu et al., 2022). But in this study, environmental sustainability was looked at in form of soil conservation and biodiversity conservation employed by smallholder farmers. Economic viability entails the ability of a business, enterprise, or farm to generate adequate profits and income to sustain itself over a period of time while ensuring the well-being of its key stakeholders (Amadi & Anokwuru, 2017). However, in this study economic viability was looked at in form of efficient resource use, market access and fair prices available to smallholder farmers. Social equity refers to just and fair treatment of all people taking part in the food chain, ensuring that all rights are respected, uphold fair labor practices, and communities benefit with consideration of promoting an inclusive and mutual respect (Klassen & Murphy, 2020). However, in this study, social equity was defined in terms of labor rights, fair labor practices and community engagement by smallholder farmers.

On the other hand, crop productivity refers to the ratio of crop yield to the inputs used in production (Tadele, 2017). It is also understood as the quantity of crops produced per unit area, such as tons per hectare, over a given period (Zhang et al., 2020). Akintayo et al. (2022) further define it as the total yield per measured unit, including considerations of quality. Jayne et al. (2021) emphasize that crop productivity encompasses not only output volume but also the

quality, variety, and resilience of agricultural enterprises. In this study, crop productivity was conceptualized as the quantity and quality of crop yield, crop diversity, and the profitability of the various crops planted. To ensure clarity, crop productivity was looked at in form of high crop yield, good crop quality, crop diversity and profitability.

1.2.4 Contextual background

Sustainable agriculture practices and crop productivity have become significant concerns in Uganda, particularly as the nation grapples with the challenges posed by climate change, soil degradation, and fluctuating market prices (Orjuela Pava, 2024). While various regions across Uganda are adopting sustainable practices to enhance agricultural productivity, the country as a whole faces difficulty in achieving consistent and high yields, especially for key crops like maize. In the central region, both urban and rural areas, agricultural activities are crucial to the economy, with smallholder farmers constituting the backbone of the sector (Muzira & Nambooze, 2024). Despite efforts to improve productivity through initiatives such as soil and biodiversity conservation, crop yields in many areas, including Matugga in Wakiso District, have remained stagnant or have experienced a decline.

They will be conducted in Matugga, Wakiso District, well known for its agricultural output, including both crop and livestock farming. With a population of over 20,864 smallholder farmers (UBOS, 2022), Matugga has long been recognized for its contributions to peri-urban agriculture. However, despite this reputation, crop productivity in the area has been concerning. For instance, maize yields in Matugga declined from an estimated 10,895 metric tons in 2021 to 9,942 tons in 2024. Furthermore, the yield per hectare for crops like maize has stagnated at around 0.96 metric tons per hectare, despite initiatives aimed at promoting soil and biodiversity conservation since 2016 (National Agricultural Research Organization Annual Report, 2022-2023).

Integrating labor rights with sustainable farming practices can boost productivity as well as improve equity and contribute to economic growth. Matugga characterizes of both rural and peri-urban areas with agricultural activities being the most apparent livelihood offering employment to over 68% of the inhabitants (MAAIF Agriculture Cluster Development Project Status Report, 2021). While resource use, market access, and fair pricing have been key in the apparent sustainable development realm, Matugga has a diverse range of crops including though not limited to maize, beans, bananas, sweet potatoes, and cassava whose yield and quality remain

unknown (World Bank, 2020). The MAAIF supposes to implement sustainable agricultural practices but over 87% of farm laborers work in an informal setting without contracts and benefits. Few statistics point to the crop yield in Matugga while diversity remains constrained to less than 10 commercial crops (NARO Annual Report, 2022-2023).

In Wakiso District, women make up to 63% of the agricultural workforce and remain challenged by wage disparities as they earn between 25-35% less than the male counterparts for similar tasks (UBOS, 2022). In a bid to increase crop productivity, child labor has been tapped which raises concern about the sustainable practices. Farmer cooperatives constitute 40% of smallholder farmers operating in Matugga whose mandate is to enable market accessibility and training but little is known about how such arrangements have impacted crop productivity (MAAIF Annual Performance Report, 2021/2022). Matugga has become highly urbanized which has threatened agricultural activities as they majority tend to switch from farming to other substitute income-generating activities (UBOS, 2022). The extent to which this affected crop productivity in the today's emphasis on sustainability remains a quest for further debate. It is upon this background that the researcher sought to investigate the effect of sustainable agriculture practices on crop productivity in smallholder farms in Matugga, Wakiso District.

1.3 Problem statement

The growing population in Matugga, Wakiso District, coupled with the reliance on smallholder farming, has placed significant pressure on the agricultural sector, especially in terms of crop productivity such as maize and beans (Touch et al., 2024). Smallholder farmers, who contribute largely to the region's crop yield, face several challenges, including the limited adoption of sustainable agriculture practices (Araya et al., 2024). Despite efforts by the Ministry of Agriculture, Animal Industry and Fisheries (MAAIF) and its partners to promote sustainable practices through the provision of training, inputs, and the creation of farmer cooperatives, crop productivity in Matugga has been on the decline (MAAIF,2020). For instance, maize yields dropped by 8.6% between 2021 and 2023 (NARO Annual Report, 2022-2023), and over 87% of smallholder farmers operate in informal setups, undermining their potential contributions to crop yield and quality (NARO, 2022-2023). Furthermore, while initiatives such as soil conservation and integration into core value chains have been put in place, the effects on crop yields, quality, and diversity remain limited (Yahyah, Kameri-Mbote & Kibugi, 2024). This persistent stagnation in crop productivity and quality threatens long-term food security and economic stability in the region. Thus, this study aimed to investigate the effect of sustainable agriculture practices on crop

productivity in smallholder farms in Matugga, with a focus on understanding the role of environmental, economic, and social factors in fostering better crop productivity.

1.4 Objectives of the Study

1.4.1 The general objective

The general objective of this study is to examine the effect of sustainable agriculture practices on crop productivity in smallholder farms in Matugga, Wakiso District.

1.4.2 Specific objectives

- i. To examine the effect of environmental sustainability practices on crop productivity in smallholder farms in Matugga, Wakiso District
- ii. To examine the effect of economic viability practices on crop productivity in smallholder farms in Matugga, Wakiso District
- iii. To examine the effect of social equity practices on crop productivity in smallholder farms in Matugga, Wakiso District

1.5 Research Questions

- i. What is the effect of environmental sustainability practices on crop productivity in smallholder farms in Matugga, Wakiso District?
- ii. What is the effect of economic viability practices on crop productivity in smallholder farms in Matugga, Wakiso District?
- iii. What is the effect of social equity practices on crop productivity in smallholder farms in Matugga, Wakiso District?

1.6 Research Hypotheses

- H_1 Environmental sustainability practices positively and significantly effects crop productivity in smallholder farm in Matugga, Wakiso District
- H_2 Economic viability practices positively and significantly effects crop productivity in smallholder farm in Matugga, Wakiso District
- H_3 Social equity practices positively and significantly effects crop productivity in smallholder farm in Matugga, Wakiso District

1.7 Scope of the Study

1.7.1 Content Scope

The study focused on the effect of sustainable agriculture practices on crop productivity in smallholder farms in Matugga, Wakiso District. The study specifically examined the effect of environmental sustainability, economic viability, and social equity on crop yields, crop quality, crop diversity, and high profitability.

1.7.2 Geographical Scope

The proposed study was carried out in Matugga which is found in Wakiso District, Central Uganda. Wakiso District borders Nakaseke to the north, Luweero to the northeast, Mukono to the east, Kalangala to the south across Lake at Victoria, Mpigi to the southwest, Mityana to the northwest. Matugga can be located approximately coordinates: 0°27'37.0" N latitude and 32°31'43.0" E longitude.

1.7.3 Time Scope

The study literature spanned five (5) years, from 2020 to 2025. This period encompasses the MAAIF Strategic Plan (2020/21 – 2024/25) with intentions of boosting agricultural product with sustainability kept in perspective.

1.8 Justification of the Study

This study is crucial as it addresses the gaps in the existing literature regarding sustainable agricultural practices in smallholder farming systems give that there is scarcity of information particularly in Matugga, Wakiso District. While different studies Tengapoe, Baddianaah & Yaradua, (2024), Singh (2024), Lakhier et al., (2024), Kathula (2023), Cyamweshi et al. (2022), Omotoso et al. (2020), Reganold and Wachter (2016) and Tilman et al. (2011) among others highlight the importance of soil and biodiversity conservation, resource efficiency, and market access, there is limited research that integrates these factors within the specific socio-economic and ecological context of smallholder farms. Most existing studies tend to focus on isolated factors such as environmental or economic aspects, overlooking the interconnectedness of these sustainability dimensions. Additionally, the lack of comprehensive studies on the long-term impacts of combined practices on crop productivity and resilience to market and climate fluctuations further underscores the need for further research. This study will provide context-specific insights into how sustainable farming practices can optimize productivity, enhance environmental conservation, and promote economic stability, social equity, and resilience in smallholder farming systems, contributing to the development of effective, scalable interventions.

This called for this study examining the effect of sustainable agriculture practices on crop productivity in smallholder farms in Matugga, Wakiso District

1.8 Significance of the Study

1.8.1 Management of smallholder farms

Managers of smallholder and larger farms in Uganda are expected to start appreciating the relevancy of adopting sustainable agricultural practices as a precondition for improving crop productivity. Also, findings of this particular study may further smallholder farms to assess and evaluate the strengths and weakness of their agricultural practices to devise viable strategies of improving the overall crop productivity.

1.8.2 Research and academicians

The study findings are expected to substantively contribute to the existing pool of knowledge by serving as an empirical point of reference regarding the global intellectual debate on the impact of sustainable agriculture practices on crop productivity in smallholder farms. The study's shortcomings and recommendations can guide future researchers in addressing contextual, conceptual, and methodological aspects of sustainable agricultural practices and crop yield in future studies.

1.8.3 Policy Makers

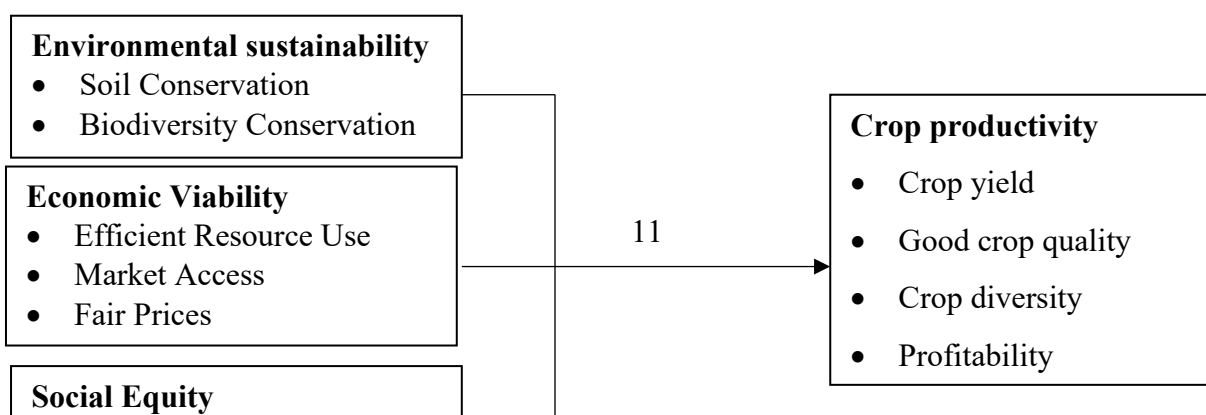
Policymakers may obtain some insights on the impact of sustainable agriculture practices on crop productivity in smallholder farms. In this realm, such policymakers will be informed about the various sustainably agricultural practices that should be adopted by smallholder farms in Matugga and other parts in Uganda. Other institutions will also benefit from understanding the impact that sustainable agricultural practices pause in boosting crop yields, crop quality, crop diversity, and high profitability.

1.9 Conceptual Framework

The framework shows conceptualized relationship between independent and dependent variable as presented in Figure.1 below.

IV: Sustainable agricultural practices

DV: Crop Productivity



Source: Developed by the Researcher

Figure. 1.1: Conceptual Framework

The conceptual framework is composed of the independent which was sustainable agricultural practices with three constructs of environmental sustainability, economic viability, and social equity that are hypothesized to influence the dependent variable which is crop production. This implies that with sustainable agricultural practices with its constructs influences the crop yield, crop quality, crop diversity and profitability.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

The chapter reviews all literature related to examine the effect of sustainable agriculture practices on crop productivity in smallholder farms in Matugga, Wakiso District. This chapter will have literature reviewed according to the study objectives, and shall comprise of three sections, namely, theoretical review, review of the related literature in accordance with the study objectives and the summary of the literature reviewed.

2.2 Theoretical Review

The research was guided by two theories of Production Function Theory (PFT) and the Agroecological Theory.

The Production Function Theory (PFT) was introduced by Paul Douglas and Charles Cobb in 1928 to explain the relationship between input factors and production output (Douglas, 1928). The theory assumes that production is a function of capital, labor, and other inputs, with a positive relationship between input usage and output. It further assumes diminishing marginal

returns, meaning that after a certain point, additional input yields a smaller increase in output (Cobb & Douglas, 1928).

Following its inception, the theory gained traction in economic and agricultural studies. In the 1950s, Solow (1957) extended the model by incorporating technological progress as a key determinant of productivity. His modification acknowledged that beyond labor and capital, technological improvements significantly influence output. Later, Arrow et al. (1961) introduced the concept of learning by doing, arguing that productivity increases with experience, refining the assumptions of PFT.

By the 1970s and 1980s, scholars like Schultz (1975) criticized the theory for oversimplifying agricultural production by ignoring biological and environmental constraints. Hayami & Ruttan (1985) introduced an induced innovation model, highlighting how input combinations evolve based on technological and economic conditions. More recently, Balk (2024) reaffirmed that while PFT remains relevant in productivity analysis, its assumptions have been variably addressed by different scholars over time.

In the context of Matugga, Wakiso District, the assumptions of PFT guide the analysis of how resource-efficient farming impacts crop yields. The theory suggests that farmers' output depends on the quantity and efficiency of inputs such as land, labor, and capital (Pal, 2023). However, it does not account for external factors like climate change, pest infestations, and soil degradation, necessitating alternative perspectives.

Critiques of PFT argue that its assumption of perfect substitutability between inputs is unrealistic in agriculture, where factors such as soil fertility and water availability are non-substitutable (Binswanger & Deininger, 1997). Furthermore, the theory assumes constant returns to scale, which does not reflect real-world agricultural variability. These limitations highlight the need for the Agroecological Theory to provide a more comprehensive understanding of sustainable agricultural practices.

The Agroecological Theory was developed in the 1980s by Miguel A. Altieri, emphasizing the integration of ecological principles into agricultural systems to enhance sustainability (Altieri, 1983). The theory assumes that farm productivity is linked to biodiversity, natural resource cycling, and reduced dependence on synthetic inputs such as chemical fertilizers and pesticides

(Gliessman, 1998). Unlike PFT, which focuses on input-output relationships, Agroecological Theory stresses the importance of environmental conservation and ecosystem interactions in agricultural productivity.

Over time, scholars have expanded upon Altieri's foundational work. In the 1990s, Pretty (1995) argued that agroecology supports resilience against climate change and fosters long-term soil fertility. Gliessman (2007) later refined the theory by incorporating social and economic dimensions, highlighting the role of traditional farming knowledge in sustainable agriculture. More recently, Altieri & Nicholls (2020) emphasized agroecology's potential to enhance food security and economic stability among smallholder farmers.

Critics of Agroecological Theory argue that its reliance on traditional knowledge and low-input farming makes large-scale application challenging (Giller et al., 2011). Additionally, the transition from conventional to agroecological practices requires time and investment, limiting its immediate feasibility (Wezel et al., 2020). Despite these limitations, the theory remains instrumental in analyzing how sustainable agriculture influences productivity.

In Matugga, Wakiso District, Agroecological Theory provides a framework for examining the benefits of ecological farming practices. By promoting soil health, reducing reliance on costly chemical inputs, and enhancing climate resilience, the theory aligns with the study's objective of assessing whether sustainable agricultural practices contribute to higher yields and long-term farm productivity.

2.3 Thematic Literature Review

2.3.1 Environmental Sustainability and Crop Productivity

According to Martinez-Mena et al., (2021), environmental sustainability includes, but are not limited to, such methods as terrace farming, mulching, and cover cropping—all practices that promote soil fertility with erosion control and better water retention. Most of these methods also have site-specific effects, and practical implementation often requires skilled management that weighs the benefits with associated trade-offs. These practices are crucial for sustainable agriculture and climate change adaptation, despite their potential to vary based on site conditions. Additionally, improved soil health from organic amendments such as composting and green manure was linked to enhanced crop resistance to diseases, resulting in better-quality produce. These results help define specific management practices to improve organic vegetable production and provide useful information and options for growers (Larkin, 2024). Such practices also

promote long-term sustainability by preserving soil structure, which is critical for maintaining high productivity over time. This highlights the importance of integrating soil conservation strategies into sustainable agriculture for improved livelihoods in Matugga.

Singh (2024) indicates that productivity in agriculture will only be sustainable if there is biodiversity. The general agro-ecological diversity via intercropping, agroforestry, and conservation of pollinators contribute towards better yields and quality. It ensures a minimum level of environmental stress, enhances the species variety and quality of habitat improvement for biodiversity conservation. Furthermore, Beillouin, et al. (2021) asserts that in areas where smallholder farmers practice these, crop diversity and profitability were reported to be higher because of increased ecosystem services such as natural pest control and soil fertility. In addition, the presence of beneficial organisms in biodiverse systems ensures resilience to environmental stressors, hence stabilizing yields. A study showed that farms with the conservation of natural vegetation and use of crop rotation were able to attain better quality marketable produce at higher values. Biodiversity conservation promotes ecological balance, which is crucial to sustain agricultural production and economic feasibility, hence a focal area for the smallholder system in Wakiso District.

Environmental sustainability plays a crucial role in enhancing crop productivity by ensuring the long-term viability of agricultural ecosystems. According to Tilman et al. (2011), sustainable agricultural practices, such as crop rotation and organic farming, improve soil health and fertility, leading to increased yields over time. Similarly, Pretty et al. (2018) argue that sustainable land management reduces soil erosion and enhances water retention, which is essential for stable crop production. In line with this, Rockström et al. (2017) emphasize that maintaining biodiversity within farming systems enhances ecosystem services such as pollination and pest control, which directly contribute to higher agricultural output. These findings suggest that incorporating sustainable practices, such as crop rotation and organic farming, into the smallholder farming systems of Matugga, Wakiso District, could lead to better soil health, increased crop yields, and a more stable agricultural environment for local farmers.

One of the fundamental aspects of environmental sustainability in agriculture is the reduction of chemical inputs, such as synthetic fertilizers and pesticides, which can degrade soil quality over time. Reganold and Wachter (2016) highlight that organic farming methods, which limit chemical use, foster microbial activity and soil organic matter, thus increasing productivity in the long run.

Similarly, Lal (2015) notes that conservation agriculture, which involves minimal soil disturbance, crop diversification, and permanent soil cover, significantly enhances nutrient cycling and soil structure, resulting in improved crop yields. Moreover, Altieri and Nicholls (2017) argue that agroecological practices that emphasize natural soil fertility management contribute to greater resilience against climate variability, ensuring sustainable agricultural productivity. This information is particularly relevant to smallholder farmers in Matugga, Wakiso District, as adopting organic farming and conservation agriculture could not only improve soil health but also provide long-term sustainable productivity and resilience against climate change.

Water conservation is another critical component of environmental sustainability that directly impacts crop productivity. According to Molden et al. (2010), efficient irrigation systems, such as drip and precision irrigation, significantly enhance water-use efficiency while minimizing wastage. This assertion is supported by Hoekstra and Mekonnen (2012), who reveal that optimizing water resources through sustainable irrigation practices improves crop yields while reducing pressure on freshwater sources. Additionally, Pimentel et al. (2004) assert that sustainable watershed management, including reforestation and wetland preservation, helps regulate water flow, preventing both drought and flooding, which can severely impact agricultural productivity. For smallholder farmers in Matugga, Wakiso District, adopting efficient irrigation systems and water conservation strategies would help mitigate water scarcity issues and contribute to consistent crop productivity even in the face of changing rainfall patterns.

Climate change mitigation efforts within the agricultural sector are integral to sustaining crop productivity. According to Rosenzweig et al. (2014), adopting climate-smart agricultural practices, such as integrating carbon sequestration techniques and diversifying crop varieties, enhances resilience to climate change while maintaining yield stability. Lobell et al. (2011) further elaborate that heat-tolerant and drought-resistant crops, developed through sustainable breeding techniques, have shown significant potential in countering the adverse effects of climate change on food production. Similarly, Vermeulen et al. (2012) argue that reducing greenhouse gas emissions from agriculture through sustainable livestock and soil management practices plays a vital role in maintaining environmental conditions conducive to crop growth. These practices, particularly the use of climate-smart agriculture and drought-resistant crops, could be particularly beneficial for smallholder farmers in Matugga, Wakiso District, to enhance resilience to climate variability and secure long-term productivity.

Agroforestry, an environmentally sustainable practice, also significantly impacts crop productivity by enhancing ecosystem functions. Garrity (2004) demonstrates that integrating trees into farming systems increases soil fertility through nitrogen fixation, leading to higher crop yields. Complementing this perspective, Jose (2009) notes that agroforestry systems provide shade and windbreaks, reducing crop stress and increasing overall farm productivity. Moreover, Smith et al. (2012) argue that multi-layered agroforestry approaches improve land-use efficiency while promoting biodiversity, which enhances natural pest control and pollination services. For farmers in Matugga, Wakiso District, integrating agroforestry into their farming systems could improve soil quality, reduce crop stress, and enhance ecosystem services, contributing to higher crop productivity.

Sustainable pest management practices also contribute to higher crop productivity by reducing dependency on synthetic pesticides while preserving beneficial organisms. Gurr et al. (2003) highlight that biological pest control methods, such as habitat manipulation and intercropping, effectively reduce pest populations without harming the environment. Echoing this view, Poppy et al. (2014) stress that integrated pest management (IPM) strategies help maintain ecological balance while minimizing chemical residues in food crops. Similarly, Kremen and Miles (2012) argue that organic pest management techniques enhance soil microbial diversity, which indirectly contributes to better plant health and yield sustainability. These pest management strategies are relevant for smallholder farmers in Matugga, Wakiso District, as they can improve crop health and sustainability while minimizing environmental impacts and chemical dependencies.

In summation, the reviewed literature has indicated that environmental sustainability through soil conservation and biodiversity conservation is inextricably linked to improved crop productivity. While it has been recorded in several studies that they accord higher yields, better quality, and more profitability, at a local level, which provides site-specific socio-economic and ecological conditions of Matugga, Wakiso District, there still exists a research gap. This also calls for further studies to test context-specific approaches that better combine environmental sustainability with smallholder farming for maximum productivity in a sustainable manner.

2.3.2 Economic Viability and Crop Productivity

Cyamweshi et al. (2022), assert that efficiency in resource use by small-scale farms is necessary for attaining sustainable crop production. Indeed, studies have shown that efficient use of resources, such as the use of drip irrigation to make efficient use of water, nutrient management

based on site-specific fertilization, improves productivity while reducing environmental impacts. A study by Awe et al. (2020), in fact revealed that farmers using efficient resource utilization were found to increase yields and profitability compared to traditional methods. The study found that farmers, despite their profit per hectare, were inefficient in resource allocation. It recommended that governments implement adequate policies to ensure farm input availability and educate farmers on efficient resource use, and that farmers should be educated on resource management. Efficient labor utilization, mechanization, and renewable energy adoption have further contributed to reducing production costs, thus improving profitability. These findings highlight the importance of adopting resource-efficient techniques to achieve high crop quality and diversity while maintaining environmental integrity.

Akintayo et al. (2022) asserts that access to the market is one of the major influencing factors on smallholder crop productivity. Their study pointed out that connectivity to markets ensures timely access to inputs, knowledge, and fair pricing opportunities, which improves crop yields and profitability. Poor market access, as revealed by the study, has been a significant negative influencing factor in agricultural productivity among smallholder farmers in Ekiti State, Nigeria. Smallholder farmers with access to cooperative marketing platforms were able to diversify crops and increase earnings due to better prices and reduced transaction costs (Cyamweshi, et al., 2022). Furthermore, direct access to urban markets enabled farmers to supply high-quality produce that meets consumer demand. Policies enhancing rural infrastructure, market information systems, and producer organizations are thus critical to bridging market gaps and boosting productivity in Matugga.

Sellare et al. (2020) affirms that fair pricing mechanisms go a long way in making smallholder farming profitable and sustainable. Indeed, the study established that farmers in some areas, by ensuring access to stable and fair prices, had more incentives to adopt sustainable practices such as crop diversification and organic farming, which better yielded higher quantities and qualities of produce. Their study confirmed that Fairtrade certification in Cote d'Ivoire economically benefited farmers and cooperative characteristics are correlated with certification outcomes, which have to be taken into consideration in order to avoid bias when evaluating sustainability standards in the small farm sector. Fair prices reduce volatility in incomes, enabling the farmer to reinvest into improvements in farms and labor productivity (Akintayo, et al., 2022). In that way, a positive circle is created wherein higher productivity comes with higher profitability and greater sustainability. These results underpin demands for policy intervention to intervene in the market

dynamics that ensure fair price for small-holder farmers.

Economic viability is a critical factor in determining the sustainability and productivity of agricultural systems. The relationship between economic viability and crop productivity has been well-documented in agricultural economics. According to Bathaei (2022), the economic viability of crop production is directly linked to farmers' ability to maximize their profit through cost-effective resource management and high-yielding practices. As farmers adopt modern agricultural technologies and sustainable practices, they often experience increased productivity, which contributes to their economic viability. In a study conducted by Shah, et al., (2020), it was found that economic viability in the form of input efficiency is key to boosting crop productivity. By optimizing inputs such as seeds, fertilizers, and labor, farmers can improve crop output while maintaining cost-efficiency. Additionally, Kathula (2023) argue that access to credit, training, and government support are critical to enhancing the economic viability of farmers, thus improving their productivity. These findings suggest that economic viability not only affects farmers' profitability but also plays a significant role in enhancing crop productivity by enabling better resource allocation. For smallholder farmers in Matugga, Wakiso District, integrating sustainable agricultural practices with efficient resource management, such as optimized input use, access to training, and credit facilities, could significantly boost productivity and improve their overall economic viability.

The economic viability of crop production also depends on market access and the profitability of crops. In this context, Lakhier et al., (2024) emphasize the importance of price incentives and market access in improving farmers' economic viability, which, in turn, boosts productivity. Their study found that the presence of stable markets and price incentives encourages farmers to invest in improved farming practices and technologies, which lead to higher productivity. Similarly, the work of Uddin and Mamun (2023) highlighted that market-oriented agricultural policies, such as price stabilization mechanisms, can enhance farmers' economic viability by ensuring that they receive fair compensation for their crops, which motivates them to adopt practices that improve crop yields. Moreover, the study by Quist and Xia (2024) supports this view, showing that when farmers have secure access to profitable markets, they are more likely to implement sustainable practices, thereby increasing crop productivity. Thus, economic viability is closely tied to external factors such as market conditions, which provide the necessary incentives for farmers to adopt productivity-enhancing practices. For smallholder farmers in Matugga, Wakiso District,

having access to stable markets and price incentives would motivate them to implement more sustainable farming practices that could lead to higher crop yields and improved profitability.

The link between economic viability and crop productivity is also influenced by technological advancements and resource use efficiency. According to Pandeya, Gyawali and Upadhaya, S. (2025), the adoption of precision farming technologies, such as GPS-guided machinery and drone monitoring, can significantly enhance both the economic viability of farming and crop productivity. These technologies enable farmers to use resources more efficiently, thereby reducing costs and increasing yields. In a similar vein, the research by Li (2022) demonstrated that the integration of smart farming technologies and digital tools into agricultural practices leads to more informed decision-making, which in turn improves crop yields and the overall economic viability of farming operations. Furthermore, Muzari, Gatsi and Muvhunzi (2012) highlighted that economic viability, supported by access to appropriate technology, can drive farmers to implement sustainable farming practices that maintain or improve soil health and crop productivity in the long term. These findings suggest that technological innovation plays a crucial role in enhancing both the economic viability and productivity of crops, reinforcing the importance of adopting new technologies in modern agricultural systems. In Matugga, Wakiso District, the introduction and adoption of precision farming technologies and digital tools could greatly improve the resource efficiency and productivity of smallholder farms, supporting both economic viability and long-term sustainability of agricultural practices.

The relationship between economic viability and crop productivity is well documented, mainly on efficient use of resources, market access, and fair prices. However, there is a deficiency in knowledge with respect to how such factors interact, particularly with the aspect of sustainability in smallholder systems of Matugga. Further research is needed regarding long-term economic impacts that these practices could have; building resilience against both market and climate fluctuations; and developing scalable interventions that could meet the needs of small-scale farmers in Wakiso District.

2.3.3 Social Equity and Crop Productivity

Labor rights form the backbone to crop productivity in smallholder farms, and fair wages, decent working conditions, and gender equity in the enforcement of labor rights have become associated with increased farmworker productivity and higher crop yields (Zhang, et al., 2020). Contrary to the popular misconception of low benefits from small-scale agriculture, the rate of return on labor

investment was found to be higher in the current study compared to non-farm jobs in the Hani terraced region of China. This explains why small-scale agriculture persists in mountainous areas. This is countered by the rise in non-farm wages and the necessity of part-time farmers to improve the quality of life. The terracing land can be maintained by encouraging development in industrial integration, improving the rise in local employment, and increasing farmer's incomes. Small-scale farmers who implemented these methods reported that the quality and variety of crops improved since workers were more involved and productive (Cyamweshi, et al., 2022). Labor rights protection was found to encourage the sharing of knowledge and innovation to build a continuous improvement culture within farm practices.

The adoption of fair labor practices has been shown to enhance smallholder farm productivity significantly, it has been demonstrated that providing training, ensuring safety, and promoting inclusivity resulted in better farm management and higher-quality produce (Gathala, et al., 2021). It was found out that conservation agriculture can significantly reduce labour and production costs by 40% and increase gross margins by 25% for smallholder farmers in the Eastern Gangetic Plains. Also, fair labor practices also reduce worker turnover and enhance farm profitability, as satisfied laborers are more committed to implementing sustainable practices. A study by Vanhuyse et al. (2021) found that that business planning and benchmarking had a positive, statistically significant, effect on financial performance, as do business size and knowledge acquisition, albeit to a lesser extent.

Community engagement has been identified as one of the key factors to enhance sustainable agricultural productivity (Pretty, et al., 2020). New social groups in particular geographic territories, led by farmers and land managers, improve environmental outcomes and agricultural productivity. Studies have also indicated that participatory approaches-for example, farmer cooperatives and community training programs-can assist smallholders share resources and knowledge, hence improving crop diversity and profitability (Christian, Obi, Zantsi, Mdoda, & Jiba, 2024). Farmers who reported being more active in any local network had better access to inputs, technology, and markets and hence higher yields and income.

Social equity plays a crucial role in determining the productivity of crops, particularly in developing countries where agricultural systems are closely linked to community structures and socio-economic disparities. According to Deininger et al. (2016), social equity in the form of equitable land distribution significantly influences agricultural productivity by ensuring that

smallholder farmers, particularly women and marginalized groups, have access to essential resources. The study found that when land tenure systems are equitable and inclusive, farmers can invest in long-term improvements to their land, such as soil health and irrigation systems, which ultimately increases crop yields. Similarly, Tengapoe, Baddianaah & Yaradua, (2024) highlighted that equitable access to agricultural inputs and services leads to increased agricultural productivity by empowering disadvantaged groups to adopt modern farming techniques. Furthermore, the work of Twumasi et al. (2022) suggests that when social equity is prioritized, farmers benefit from enhanced access to financial services, training, and markets, thereby improving their productivity and ensuring that economic benefits are more evenly distributed across the population. These studies demonstrate that social equity, particularly in terms of resource allocation and access, has a profound effect on crop productivity by empowering all members of society to engage fully in agricultural production. In Matugga, Wakiso District, promoting social equity through inclusive land distribution and ensuring equal access to agricultural resources such as training and financial services could empower smallholder farmers to implement sustainable farming practices, enhancing their crop productivity.

The role of social equity in improving crop productivity is also evident in gender-inclusive agricultural policies and practices. In many regions, women constitute the majority of agricultural labor, but they often face significant barriers to accessing resources such as land, credit, and agricultural training. According to Alston (2014), gender equity in agriculture can substantially enhance crop productivity by allowing women to access the same resources as men, which leads to improved farm management practices and greater yields. A study by Doss et al. (2018) further supports this argument, showing that when women have equal access to agricultural resources, they adopt more sustainable farming practices, resulting in higher productivity. Additionally, the research by Peterman et al. (2010) found that policies promoting gender equality in agriculture led to significant increases in productivity, particularly in crops such as maize and beans, which are staple foods in many developing countries. This body of work suggests that social equity, especially in terms of gender equality, directly contributes to enhanced agricultural productivity by empowering marginalized groups to use resources more efficiently. In Matugga, Wakiso District, promoting gender equity by ensuring that women have equal access to agricultural resources and training would likely encourage the adoption of sustainable farming practices, contributing to increased crop productivity.

Social equity also intersects with broader social justice issues, such as access to education, health, and infrastructure, all of which have indirect effects on crop productivity. A study by Llanto (2012) emphasized that improving social equity through investments in education and healthcare for rural communities results in a more skilled and healthier workforce, which contributes to better farm management and higher crop yields. This idea is supported by the findings of Omotoso et al. (2020), who argued that investing in social infrastructure, such as rural roads and schools, enhances the productivity of rural farming communities by improving access to markets, reducing transportation costs, and enabling better access to education and technology. Furthermore, the work of Fuglie (2011) highlighted that rural areas with better healthcare services experience lower levels of malnutrition, leading to better physical conditions for farmers and increased labor productivity. These studies underline that social equity extends beyond the direct provision of resources to farmers and includes investments in broader social factors that indirectly influence agricultural outcomes. In Matugga, Wakiso District, improving social equity through better access to education, healthcare, and infrastructure, such as rural roads and market access, could indirectly enhance crop productivity by ensuring a healthier, more skilled workforce that is able to implement sustainable agricultural practices more effectively.

The literature reviewed has identified social equity as the driving force behind sustainable crop productivity. Addressing labor rights, fair practices, and community engagement in smallholder systems can result in higher yields, better quality of produce, and increased profitability. Further research is needed to explore scalable frameworks that integrate social equity with environmental and economic dimensions of sustainability in Matugga, Wakiso District.

2.4 Summary of the Literature Review

The literature underlines that even as sustainable agricultural practices are increasingly becoming adopted worldwide, much more needs to be learned about adoption within smallholder farming systems. For instance, such studies combined soil and biodiversity conservation with efficient resource use and equitable labor practices in order to enhance productivity metrics, but uncertainty remains around scalability. Besides, market access and fair prices have been considered critical to economic viability, but in some regions, this has been limited by logistical issues, such as inadequate infrastructure and lack of farmer cooperatives. Besides, while the scales of community participation nurture knowledge sharing and collective resilience, these activities need more institutionalized programs and policy support if they are to be continued. One conspicuous lacuna in the literature is the general lack of comprehensive studies that assess

the long-term impact of combined practices on crop productivity. Most of the literature tends to isolate either environmental, economic, or social factors, thus not being able to present a holistic perspective. This fragmented approach overlooks the interconnectedness of sustainability dimensions, especially in smallholder contexts where resource limitations require integrated strategies. Besides, their interactions with each other on these practices are not well argued to show the dynamic effects of climate change, market and socio-political factors, hence leaving gaps in understanding how farmers can sustainably adapt. Besides, there is a need for more customized, inclusive, and context-specific frameworks to address such gaps; hence, the need for further research. In the long term, small-scale farming in Matugga, Wakiso District, should be pursued in a multidimensional approach that encompasses environmental conservation, economic stability, and social equity. The bridging of these knowledge gaps, therefore, enable policy and development agencies to develop effective programs that empower farmers while enhancing crop yields, diversity, quality, and profitability in a sustainable manner.

2.5 Conclusion

The reviewed literature underscores the critical role of environmental sustainability, economic viability, and social equity in enhancing crop productivity. While existing studies affirm the benefits of soil and biodiversity conservation, resource efficiency, market access, and fair labor practices, a significant research gap remains in understanding how these factors interact within the specific socio-economic and ecological conditions of smallholder farms in Matugga, Wakiso District. The lack of localized empirical evidence on the long-term economic impacts, resilience to market and climate fluctuations, and integrated sustainability approaches calls for further research. Therefore, this study was necessary to provide context-specific insights into how sustainable agriculture practices can optimize productivity while ensuring environmental conservation, economic stability, and social inclusion, ultimately contributing to the development of scalable interventions for smallholder farmers.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

The chapter presents the methodology for assessing the impact of sustainable agriculture practices on crop productivity in smallholder farms in Matugga, Wakiso District. Specifically, this chapter presents a details on the research approach, the research design, study population, sample size and techniques, data collection methods, data collection tools, data quality control measures, the data collection procedure, data processing and analysis, and the ethical consideration.

3.2 Research Design

Kumar (2018) defines a research design as a structure, strategy or plan of investigating a phenomenon. In this study, the researcher employed a cross-sectional design. As per Bell, Harley and Bryman (2022), a cross-sectional research design takes consideration of collecting data at a single point in time. Schoch (2020) further eludes that since this study entails collecting data only once at a given point in time, it saves both time and money. Furthermore, the study adopted a mixed methods research approach where both quantitative and qualitative research approaches will be considered. The quantitative approach enabled the collection of data that could be numerically measured and analyzed, whereas the qualitative approach was employed to capture rich, descriptive insights that could not be quantified (Mugenda & Mugenda, 2013). By integrating both approaches through a mixed-methods design, the study facilitated triangulation, ensuring that the strengths of one approach compensate limitations of the other. This methodological combination helped minimize biases that might arise from depending solely on either qualitative or quantitative data, thereby enhancing the robustness and reliability of the findings.

3.3 Study Population

According to Eyler (2020), a study population refers to the entire group from which a sample can be drawn. According to the 2024 National Population and Housing Census conducted by the Uganda Bureau of Statistics (UBOS), Matugga has an estimated population of 26,511 individuals. This study focused on key stakeholders involved in implementing sustainable agricultural practices in Matugga, categorized into three groups. First, Smallholder Farmers, including those engaged in crop farming (such as maize, beans, and cassava) and livestock rearing (including poultry, dairy, and piggery), were selected based on their active participation in

sustainable farming practices. Their inclusion was crucial as they are the primary adopters of agricultural sustainability initiatives. Second, Local Government Officials, comprising agricultural extension workers, production officers, and Community Development Officers (CDOs), were included due to their roles in providing technical support, ensuring crop and livestock health, and mobilizing communities for agricultural initiatives. Additionally, key local government leaders responsible for agricultural programs at the district and sub-county levels were involved to offer insights into policy implementation. Third, Ministry of Agriculture, Animal Industry, and Fisheries (MAAIF) Officials from relevant directorates such as Agricultural Extension Services and Animal Resources were engaged to provide perspectives on national policies, regulations, and frameworks guiding sustainable agriculture in Matugga. The inclusion of these categories was justified by their direct involvement in shaping, facilitating, and implementing sustainable agricultural practices, ensuring that the study captures a comprehensive understanding of the factors influencing agricultural sustainability in the region.

3.5 Sample size and sampling techniques

3.5.1 Sample Size

According to Eyler (2020), a sample refers to a representative threshold from a population. In this particular study, the researcher determined representativeness sample size but bearing in mind to have a manageable sample which would enable the researcher to obtain quality comprehensive findings. This study’s sample size constituted 208 participants out of 435 targeted participants which Agricultural Extension Workers (03), Production officer (01), MAAIF Officials (03) and Smallholder Farmers (201). Kumar (2018) asserted that sizeable sample helps in mitigating bias. The breakdown of the sample size as shown on Table 3.1.

Table 3. 1: Sample Size of the Study.

Category of Respondents	Population	Sample size	Sampling method
Agricultural Extension Workers	03	03	Purposive
Production Officer	01	01	Purposive
MAAIF Officials	03	03	Purposive
Smallholder Farmers	428	201	Simple random sampling
Total	435	208	

3.5.2 Sampling techniques

Sampling refers to a process of drawing a representative threshold of participants from a given population to engage in a study (Eyler, 2020). Sampling techniques entails the various ways and

means by which a study sample is drawn from a given population (Bell et al., 2022). This particular study employed both purposive and simple random sampling techniques.

5.5.2.1 Purposive sampling

Groh (2018) defines purposive sampling as a selection of a sample based on one's judgment with solemn consideration of their knowledgeable or experience regarding the study theme. The technique was employed on Agricultural Extension Workers, Production Officer and MAAIF Officials who are expected to possess a wealth of knowledge and experience regarding the effect of sustainable agriculture practices on crop productivity in smallholder farms in Matugga, Wakiso District. The researcher envisaged that with their level of awareness regarding the study theme, they were able to provide comprehensive insights.

5.5.2.2 Simple random sampling

According to Aguinis, Hill and Bailey (2021), simple random sampling refers to a sampling process where every individual in the population has an equal and independent chance to be selected to take part in the study. This technique was employed on smallholder farmers where every smallholder farmer in Matugga while have an equal chance of being selected in the study. The respondents were considered/selected basing on the person's willingness to take part in the study since participants are not forced to give information. This method limited bias by creating an opportunity for only willing member to be selected.

3.6 Data collection methods and instruments

This subsection presents the data collection methods and their respective data collection instruments:

3.6.1 In-depth interviews

The researcher conducted in-depth interviews with the key informants by asking open-ended questions to acquire the desired information. The researcher therefore, engaged in Key Informant Interviews (KII) with the selected key informants from the categories of Agricultural Extension Workers, Production Officer and MAAIF Officials. With this method, the researcher was able to obtain comprehensive insights about the study topic. This method also afforded the researcher an opportunity to paraphrase and rephrase the questions in solicitation for in-depth insights on the study theme (Tavory, 2020). In this case, therefore, the data collection instrument used was the interview guide to obtain qualitative data.

3.6.2 Survey method

The survey method was used to collect quantitative data from the respondents who are smallholder farmers. This method gives an opportunity to the respondents to express their opinions in a quick manner. The choice of this method was hinged on its high response rate given that it allows for quick and efficient coverage of a big population (Bell, et al., 2022). Under this method, the researcher used a questionnaire as the data collection tool containing close-ended questions to enable the generation of quantitative data.

3.6.3 Document review method

Thirdly, the researcher adopted the document review method to be able to obtain secondary data regarding sustainable agriculture practices and crop productivity in smallholder farms. The researcher reviewed and analyze a range of published and unpublished documents include Journals, district reports, Ministry report and dissertations about the research theme by making careful consultation of the documents. As recommended by Casey and Wong (2020), the researcher mined data related to the study theme and document detailed contextual meaning that speaks to the study objectives. Based on the recommendation by Dalglish et al. (2020), the researcher applied the READ approach in reviewing secondary sources of information where the R entails careful reading of the secondary materials; the E entails the extraction of the necessary and relevant data from the various materials reviewed; the A entails making critical analysis of the mined data; and, the D entails distilling the meanings to present findings in relation to the study theme. The researcher used a document review guide to collect secondary data as recommended (Karppinen & Moe, 2019).

3.7 Data Quality Control

The researcher ensured both reliability and validity of the data collection instruments as described below:

3.7.1 Validity (Quantitative data quality control)

According to Hayashi, Abib, and Hoppen (2019), a research tool's validity relates to its ability to collect the essential data. In essence, it refers to how well the analysis' findings match the topic under consideration. To verify whether the study variables accurately reflect the study theme, it was important to assess how relevant the research concepts contained in the research instruments were. The items were valid because the CVIs were above 0.7 as recommended by (Creswell, 2014). The following formula was used to calculate a content validity index:

$$\text{CVI} = \frac{\text{Number of items declared relevant/ valid}}{\text{Number of items}} * 100\%$$

Total number of items

Table 3.2: Validity Test of Tool

Construct		Total Items	Relevant Items	Irrelevant	CVI
Environmental	Sustainability Practices	10	08	02	.80
	Economic Viability Practices	15	12	03	.80
	Social Equity Practices	15	13	02	.87
	Crop productivity	12	10	02	.83

However, modifications were applied to the items deemed irrelevant in order to improve the tool's validity.

3.7.2 Reliability (Quantitative data quality control)

Both, Colomb and Williams (2018) define reliability as the consistency with which a research tool evaluates the variables for which it was designed. The researcher pre-tested the data gathering methods to ensure their reliability. To avoid prejudice, the pre-test was conducted from Mawokota in Mpigi District, not in Matugga, to avoid bias. Small samples of about fifteen (15) smallholder farm owners were approached to pre-test the questionnaire. To establish the level of reliability of the questionnaire, the researcher builds preliminary ratings from the pre-test responses using the Statistical Package for Social Sciences (SPSS). Hayashi et al. (2019) noted that a Cronbach Alpha of 0.70 or above indicates a greater level of reliability and tools were reliable because they scored above 0.70.

Table 3.3: Reliability Test of Tool

Construct	Item tested	Alpha values
Environmental Sustainability Practices	10	.712
Economic Viability Practices	15	.783
Social Equity Practices	15	.820
Crop productivity	12	.854

3.7.3 Validity and reliability for qualitative data

To ensure reliability and validity of the qualitative findings, the majority of the interviews were based on the research questions. Also, the researcher ensured that generalizations was constrained. External reliability was addressed by making the questions as simple and understandable as feasible, reducing the risk of misunderstandings. The interviews also took place in preferred locations such as offices, where they felt protected and secure. Furthermore, the researcher avoided leading questions because they might prevent the key informants from providing broad perspectives. The researcher also ensured to use probes in a bid to obtain the desired information. The researcher re-echoed the key informants' insights as shared while answering the interview guide questions. This requisitely confirmed the accuracy of the collected data in affirmation of the key informants' insights as shared during the prior interviews. To validate the interview guide, the researcher assessed the transferability and reflexivity of the study's findings.

3.8 Data analysis

The researcher made both quantitative and qualitative data analyses to derive meaning from the data collected as described below:

3.9.1. Quantitative data Analysis

Responses on environmental sustainability; economic viability, social equity, crop productivity will be descriptively analyzed using frequencies, percentages, mean, and standard deviation. As recommended by Hirvonen-Ere (2022), the researcher used the SPSS software to analyze the raw quantitative data. Data presentation was tabular and responses regarding study variables of environmental sustainability, economic viability, social equity and crop production were presented in form of frequencies, percentages, mean and standard deviation for each item in the questionnaires. Furthermore, Pearson correlations were run to ascertain the direction and degree of relationship between the constructs of environmental sustainability, economic viability, social equity and crop production. This technique was preferred because of its efficiency and being straight forward in giving results. For the Pearson correlations, the significance level was tested at ($p=0.01$). A multiple regression was also run to know how much constructs of (environmental sustainability, economic viability and social equity) predicts/effects the crop production. From the regression model, the study generated adjusted R square that explains combined predictability levels of all the constructs of the independent variable to the dependent variable. The level of significance for regression analysis was treated at ($p= .05$) and the ANOVA table was based on, to describe the best fit of the model.

3.9.2. Qualitative Data Analysis

The researcher ensured that all interviews are audio-recorded to facilitate accurate transcription. Data was analyzed using thematic analysis, which involves systematically organizing participants' statements and responses based on predefined study themes and emerging patterns to generate meaningful interpretations aligned with the research objectives (Sekaran, 2013). To accomplish this, the data was carefully coded, allowing for the identification of categories and recurring patterns across study variables. Responses were grouped into themes corresponding to each research objective, with subthemes emerging under each category. The perspectives shared by participants were interpreted to align with the relevant objectives, and key quotations, statements, and sentences were selected to authentically represent participants' sentiments within the study.

3.9 Ethical Considerations

Eyler (2020) describes ethical considerations as the principles that guide researchers' conduct throughout the study process. Scholars such as Brittain et al. (2020), Bailey and Trudy (2018), and Aguinis et al. (2021) stated that ethical considerations to consider may include dissemination of study findings, plagiarism testing, obtaining permission to conduct research, confidentiality, informed consent, privacy, safety, and pretesting of data collection tools, as explained below:

Informed Voluntary Consent: Obtaining informed consent from participants is a fundamental ethical requirement in research. Before engaging in the study, all potential participants were provided with a detailed explanation of the study's purpose, objectives, procedures, potential risks, and benefits. They were given ample time to review the information, ask questions, and seek clarification to ensure they fully understand what their participation entails. Only individuals who voluntarily agree to take part, without any form of coercion or undue influence, were included in the study. Additionally, participants were informed of their right to withdraw from the study at any stage without facing any negative consequences.

Anonymity: Anonymity of participants' identity was ensured with commitment that no identification information is recorded. This was emphasized by disguising participants' identification such as names.

Confidentiality: The researcher ensured that the data collected from both the respondents and key informants remain strictly confidential. This included the affirmation of the researcher's commitment not to share the ideas or responses provided with outside parties.

Information dissemination: At the completion of the final report, the researcher disseminated the authorized dissertation to the appropriate parties, including Wakiso District Agricultural Office, MAAIF, by sending a copy of the final deliverable to each of the main stakeholders in the study as indicated by Bailey and Trudy (2018).

Pilot pre-testing: The researcher conducted a pre-test of data collection instruments in a non-participating location to ascertain their validity and reliability (Eyler, 2020). The pre-test was conducted among smallholder farm owners in Mawokota.

Plagiarism test: After finishing the dissertation, the researcher determined the similarity index to estimate the degree of plagiarism in comparison with other published works (Aguinis et al., 2021). To accomplish this, the researcher uploaded the accepted dissertation document to the Turnitin online platform to compare and contrast the similarity index with other published research work.

Privacy and safety: To maintain privacy and safety, the researcher conducted interviews and distribute questionnaires in a private and secure area to reduce the likelihood of other parties knowing what was discussed while also ensuring privacy and safety for both the participant and the researcher.

Seek formal permission: According to Chen and Simons (2018), UMI gave the researcher with an introduction letter to utilize when requesting permission to collect data from the Wakiso District Agricultural Office and MAAIF. The researcher issued a copy of the letter to the hospital, and after authorization is obtained, the data collection exercise began.

CHAPTER FOUR

PRESENTATION, ANALYSIS AND DISCUSSION OF THE STUDY FINDINGS

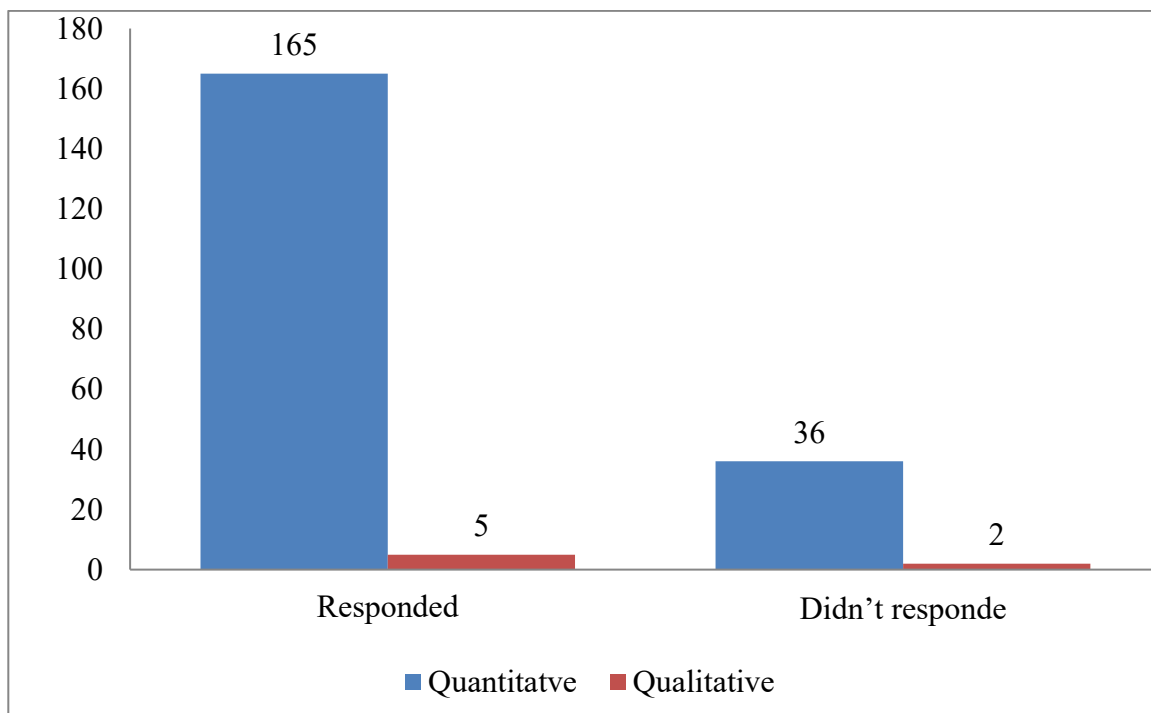
4.1 Introduction

This chapter presents, analyzes, and discusses the findings of the study. It begins with the descriptive statistics presenting the demographic characteristics of the respondents, followed by the results related to the key variables addressed in the study objectives of examining the effect of environmental sustainability practices on crop productivity in smallholder farms, the effect of economic viability practices on crop productivity in smallholder farms and the effect of social equity practices on crop productivity in smallholder farms in Matugga, Wakiso District.

4.2 Response Rate

The figure below shows the distribution of respondents who participated by providing feedback and those who did not

Figure 4.1: Showing the Response Rate



Source: Field data, 2025

As illustrated in Figure 4.1, out of the 201 targeted respondents for the quantitative survey, 165 (82.1%) participated, while 36 (17.9%) did not respond. For the qualitative data, 5 out of 7

targeted participants (71.4%) provided feedback, with 2 (28.6%) failing to do so. This overall response rate surpasses the 70% threshold recommended by the Guttmacher Institute (2006), reflecting a commendable and satisfactory level of participation.

4.3 Findings on the Bio-data of the respondents

The study collected respondents' bio-data to evaluate various factors, including gender, educational background, age, marital status, farm size under cultivation (in acres), primary source of livelihood, years of farming experience and type of crops mainly grown. The results were summarized using frequencies and percentages.

Table 4.1: Gender of Respondents

Category	Frequency	Percent
Male	79	47.9
Female	86	52.1
Total	165	100.0

Source: Field data, 2025

From Table 4.1, the findings reveal that the majority of respondents, accounting for 52.1%, were female, while 47.9% were male. This indicates a slight predominance of female participants in the study. The higher representation of women may be attributed to their active involvement in smallholder farming activities within Matugga, Wakiso District, where they play a central role in crop cultivation, land preparation, planting, weeding, and post-harvest handling. In many rural agricultural settings, women are key contributors to food production and household food security, making their participation in studies focused on crop productivity particularly significant.

Table 4.2: Education Level

Category	Frequency	Percent
No formal education	10	6.1
Primary level	49	29.7
Secondary level	40	24.2
Tertiary/College	46	27.9
University	20	12.1
Total	165	100.0

Source: Field data, 2025

As shown in Table 4.2, the findings indicate that the majority of respondents (29.7%) had attained primary education, followed closely by 27.9% who had reached tertiary or college level. Respondents with secondary education accounted for 24.2%, while 12.1% had completed university education. A smaller proportion, 6.1%, reported having no formal education. This results suggests that most smallholder farmers in Matugga, Wakiso District, possess at least basic formal education, with a considerable number having advanced to tertiary and university levels. The predominance of respondents with primary and secondary education reflects the typical educational attainment in rural farming communities, where access to higher education may be limited by financial constraints, household responsibilities, and the need to engage in farming activities at an early age. Nonetheless, the relatively high proportion of farmers with tertiary and university education is notable, as it implies a potential openness to adopting innovative farming techniques, understanding agricultural extension messages, and applying social equity practices aimed at improving crop productivity.

Table 4.3 Age Bracket of Respondents

Category	Frequency	Percent
Below 25 years	20	12.1
25–34 years	29	17.6
35–44 years	57	34.5
45–54 years	40	24.2
55 years and above	19	11.5
Total	165	100.0

Source: Field data, 2025

As presented in Table 4.3, the majority of respondents (34.5%) fell within the age bracket of 35–44 years, followed by 24.2% who were aged 45–54 years. Those in the 25–34 years category accounted for 17.6%, while 12.1% were below 25 years. The smallest proportion, 11.5%, comprised respondents aged 55 years and above. These findings indicate that a significant majority of the respondents (76.3%) were aged 35 years and above, reflecting a mature and experienced farming population in Matugga, Wakiso District. The predominance of individuals within the 35–44 years age group suggests that smallholder farming activities are largely undertaken by individuals in their most productive years, who are likely to make key decisions regarding the adoption of social equity practices such as equitable access to land, farm inputs,

extension services, and market opportunities, all of which can influence crop productivity. Furthermore, the substantial representation of older farmers, particularly those aged 45 years and above, implies that the study captured insights from individuals with extensive experience in agricultural practices and long-term exposure to the socio-economic challenges affecting smallholder farming. This enhances the reliability of the data regarding the effectiveness and impact of social equity practices on crop yields. In contrast, the relatively lower representation of respondents below 25 years may suggest limited involvement of youth in smallholder farming, possibly due to shifting interests towards education, urban employment, or non-agricultural economic activities.

Table 4.4: Marital Status of Respondents

Category	Frequency	Percent
Single	18	10.9
Married	133	80.6
Widowed	05	3.0
Divorced	09	5.5
Total	165	100.0

Source: Field data 2025

As indicated in Table 4.4, the majority of respondents 80.6% were married, while 10.9% were single. A smaller proportion of participants were widowed 3.0% and divorced 5.5%. These findings suggest that most smallholder farmers in Matugga, Wakiso District, are married individuals, reflecting the family-based nature of farming in rural settings where agricultural activities are often managed collectively by household members. The high percentage of married respondents may also imply that decisions related to social equity practices such as land ownership, access to farming resources, and benefit-sharing are likely influenced by family dynamics and joint household interests, which can affect crop productivity outcomes.

Table 4.5: Farm size under cultivation (in acres)

Category	Frequency	Percent
Less than 1 acre	35	21.2
1–2 acres	75	45.5
3–5 acres	46	27.9

More than 5 acres	09	5.5
Total	165	100.0

Source: Field data 2025

As shown in Table 4.5, the majority of respondents 45.5% cultivated farm sizes ranging from 1 to 2 acres. This was followed by 27.9% who farmed between 3 to 5 acres, while 21.2% operated on less than 1 acre. A small proportion, 5.5%, cultivated more than 5 acres of land. These findings indicate that smallholder farmers in Matugga, Wakiso District, predominantly manage modest-sized farms, with most cultivating between 1 and 2 acres. This reflects the typical smallholder farming structure common in Uganda, where limited land access and ownership constraints influence farm sizes. The significant proportion of farmers operating on 3–5 acres suggests that some households have access to relatively larger plots, which may afford them greater production capacity and diversification opportunities compared to those with smaller landholdings. The sizeable percentage 21.2% of respondents cultivating less than 1 acre highlights the challenge of land fragmentation and pressure on land resources, which can limit the ability to implement mechanization or large-scale agricultural practices. Conversely, the minority farming more than 5 acres represents a small segment likely to benefit from economies of scale in production and resource utilization. This distribution of farm sizes is crucial in understanding the potential impact of social equity practices such as fair access to agricultural inputs, extension services, and land tenure rights on crop productivity. Farmers with smaller landholdings may require tailored support to maximize productivity per unit area, while those with larger plots may need different strategies to optimize their farming potential.

Table 4.6: Primary source of livelihood

Category	Frequency	Percent
Farming	47	28.5
Business	59	35.8
Formal employment	25	15.2
Casual labor	34	20.6
Total	165	100.0

Source: Field data 2025

Results in Table 4.6 reveals that the primary source of livelihood for the respondents varied, with 35.8% engaged in business activities, followed by 28.5% relying on farming as their main source of income. Casual labor accounted for 20.6% of respondents, while 15.2% were engaged in

formal employment. These findings indicate that while farming remains a significant livelihood activity among smallholder farmers in Matugga, Wakiso District, a larger proportion of respondents derive their income from business ventures. This suggests a degree of livelihood diversification within the community, where farming is complemented or supplemented by other income-generating activities. The prominence of business as a primary livelihood could be attributed to the need for additional income sources to mitigate the risks and uncertainties associated with agriculture, such as fluctuating crop yields or market prices. The notable share of respondents involved in casual labor reflects the presence of informal work opportunities in the area, which may provide temporary or supplementary income but could also indicate vulnerability due to unstable earnings. Meanwhile, a smaller percentage engaged in formal employment suggests limited access to stable, salaried jobs within the local economy.

Table 4.7: Years of farming experience

Category	Frequency	Percent
Less than 2 years	15	28.5
2–5 years	50	35.8
6–10 years	45	15.2
More than 10 years	55	20.6
Total	165	100.0

Source: Field data 2025

Table 4.7 presents the distribution of respondents according to their years of farming experience. The largest group, comprising 35.8% of respondents, had between 2 to 5 years of farming experience. This was followed by 20.6% with more than 10 years of experience, and 15.2% who had farmed for 6 to 10 years. Notably, 28.5% of respondents had less than 2 years of farming experience. These findings suggest that the majority of smallholder farmers in Matugga, Wakiso District, possess moderate experience in farming, with most having between 2 to 5 years of engagement in agricultural activities. This level of experience may enable them to understand and implement social equity practices effectively, as they have had sufficient exposure to farming challenges and resource management. The considerable proportion of respondents with over 10 years of farming experience indicates a significant number of seasoned farmers who likely have deep knowledge of traditional and contemporary farming methods, as well as the social dynamics that affect equitable access to resources. Their insights are valuable for assessing the long-term impacts of social equity practices on crop productivity. Conversely, the substantial group with

less than 2 years of experience may represent newer entrants into farming who could benefit from targeted support, training, and capacity-building initiatives to enhance their productivity and integration into equitable farming systems.

Table 4.8: Type of crops mainly grown

Category	Frequency	Percent
Cereals (e.g., maize,)	12	7.3
Legumes (e.g., beans, groundnuts)	14	8.5
Vegetables (e.g., tomatoes, cabbages)	22	13.3
Root crops (e.g., cassava, sweet potatoes)	26	15.8
Mixed cropping	91	55.2
Total	165	100.0

Source: Field data 2025

Table 4.8 illustrates the types of crops predominantly grown by smallholder farmers in Matugga, Wakiso District. The majority of respondents (55.2%) practiced mixed cropping, growing a combination of different crops on their farms. Among those who focused on single crop types, root crops such as cassava and sweet potatoes were grown by 15.8%, vegetables by 13.3%, legumes like beans and groundnuts by 8.5%, and cereals such as maize by 7.3%. The prominence of mixed cropping indicates a diversified farming system among smallholder farmers, which can enhance food security, reduce risks associated with crop failure, and improve soil fertility. This approach may also reflect adaptive strategies to maximize productivity and resilience in the face of social and environmental challenges. The cultivation of root crops and vegetables by a notable proportion of farmers highlights the importance of these crops in the local diet and economy, as well as their potential contribution to year-round food availability and income generation. The smaller percentages of farmers growing cereals and legumes as sole crops may point to either limited land size or a strategic choice to focus on crops with specific market or nutritional value. This cropping pattern suggests that social equity practices promoting access to diverse inputs, extension services, and markets are essential for supporting mixed cropping systems and enhancing overall crop productivity among smallholder farmers in the area.

4.4 Empirical findings

The empirical findings of the study are organized according to the key themes derived from the study objectives. These themes include environmental sustainability practices, economic viability practices, and social equity practices, and their collective influence on crop productivity among smallholder farms in Matugga, Wakiso District.

4.4.1 The effect of environmental sustainability practices on crop productivity in smallholder farms in Matugga, Wakiso District.

The study's first objective focused on examining the effect of environmental sustainability practices on crop productivity in smallholder farms in Matugga, Wakiso District. To address this objective, both quantitative and qualitative data were collected. Quantitative data were summarized and presented using descriptive statistics, including frequencies, percentages, means, and standard deviations, to provide a clear picture of the patterns and trends associated with the study variables. Respondents rated their agreement with various statements, and the data were analyzed by comparing each item's mean to the overall grand mean to assess the level of consensus regarding the implementation of environmental sustainability practices. In addition, qualitative data were employed to complement the quantitative findings, offering deeper insights into the reasons, experiences, and contextual factors that shape the adoption and impact of these practices on crop productivity. This mixed-method approach enabled a more comprehensive understanding of how environmental sustainability practices influence agricultural outcomes in the study area. The descriptive statistics related to the effect of environmental sustainability practices on crop productivity in smallholder farms are presented in Table 4.9 below.

Table 4.9: Responses on environmental sustainability practices

<i>Statement</i>	<i>Min</i>	<i>Max</i>	<i>Mean</i>	<i>S.D</i>
Soil Conservation				
I regularly use organic manure or compost to improve soil fertility.	1	5	3.57	1.013
I practice crop rotation or intercropping to preserve soil health.	1	5	3.63	.932
I use mulching to retain soil moisture and reduce erosion.	2	5	3.87	.849
I construct terraces or contours to prevent soil erosion on slopes.	1	5	3.85	.878
I avoid over-tilling to maintain the structure of the soil.	1	5	3.64	.925
Biodiversity Conservation				
I maintain natural vegetation or trees on parts of my farm.	1	5	3.52	1.016
I avoid the use of harmful chemicals that could affect local species.	1	5	3.73	1.008
I allow beneficial insects and wildlife to thrive on my farm.	1	5	3.76	.930
I grow a variety of crops to support ecological balance.	2	5	3.89	.789
I am aware of the importance of conserving endangered plant species.	1	5	3.87	.852

Source: Field data, 2025

Table 4.9 presents an analysis of environmental sustainability practices adopted by smallholder farmers in Matugga, Wakiso District, focusing on two key areas: Soil Conservation and Biodiversity Conservation. The overall grand mean of 3.73 indicates a relatively high level of adoption of sustainable farming practices in the study area. This suggests that farmers in Matugga are generally conscious of environmentally sound agricultural methods, although variations exist across specific practices.

4.4.1.1 Soil Conservation Practices

The use of organic manure or compost yielded a mean score of 3.57 with a standard deviation of 1.013, indicating that this practice is moderately embraced among smallholder farmers. Although many farmers apply organic inputs to improve soil fertility, the score, being slightly below the grand mean, suggests that a portion of farmers remains reliant on chemical fertilizers or non-organic methods. This finding implies the need for enhanced farmer training in composting techniques and manure management to promote soil health while reducing dependence on synthetic fertilizers. This is supported by qualitative findings, as an Agricultural Extension Worker noted, *“Most farmers have appreciated the importance of organic manure, especially with rising costs of synthetic fertilizers. However, access to quality compost remains a challenge for many, particularly those with limited livestock resources or composting knowledge.”* (Agricultural Extension Worker – 01).

The practice of crop rotation and intercropping received a mean score of 3.63 (SD = 0.932), reflecting its relatively widespread use among farmers as a strategy to preserve soil fertility and manage pests. This score, being close to the grand mean, suggests that these practices are fairly common and valued in the region for their contribution to soil conservation. However, continued extension services and practical demonstrations are necessary to sustain and further enhance their adoption. In line with this, a Production Officer remarked, *“Farmers in this region have been sensitized on the benefits of crop rotation to break disease cycles and improve yields. Intercropping is particularly valued for maximizing land use efficiency.”* (Production Officer – 01).

Mulching to retain soil moisture scored the highest among soil conservation practices with a mean of 3.87 (SD = 0.849), indicating that this technique is widely practiced by farmers in the area. This suggests that farmers recognize the benefits of mulching in preventing moisture loss

and controlling soil erosion. However, there remains a need to ensure farmers have consistent access to affordable mulching materials to expand this practice across their farms. According to a MAAIF Official, *“During dry seasons, many farmers resort to mulching to preserve soil moisture, especially for vegetable and coffee plots. This practice has significantly reduced soil degradation in the area.”* (MAAIF Official – 02).

The construction of terraces or contours to prevent soil erosion reported a high mean score of 3.85 (SD = 0.878), demonstrating that this erosion control measure is widely implemented, particularly on sloped agricultural land. This underscores the importance of soil conservation structures in reducing runoff and maintaining soil integrity. These findings suggest the need for continued support from government and development partners to extend such infrastructural interventions to more farmers, especially those in erosion-prone zones. This view was echoed by an Agricultural Extension Worker who stated, *“In collaboration with extension workers, many farmers have been supported to terrace their farms to prevent run-off and soil loss, particularly in hilly parts of Matugga.”* (Agricultural Extension Worker – 02).

Then, the avoidance of over-tilling, with a mean score of 3.64 (SD = 0.925), reflects a moderate level of adherence to conservation tillage principles. This suggests that while some farmers are adopting reduced tillage to preserve soil structure, others continue to engage in deep plowing based on traditional beliefs about its productivity benefits. There is therefore an opportunity to promote conservation tillage practices through farmer field schools and awareness campaigns. This is reinforced by the comment of a Production Officer who observed, *“While no-till practices are being introduced, the complete shift is slow as some farmers prefer deep plowing believing it improves productivity.”* (Production Officer – 01).

4.4.1.2 Biodiversity Conservation Practices

The practice of maintaining natural vegetation or trees on farms attained a mean score of 3.52 with a standard deviation of 1.016, reflecting moderate adoption among smallholder farmers in Matugga, Wakiso District. This suggests that while some farmers actively preserve natural vegetation as part of their farming systems, others may clear trees to maximize land for cultivation or meet fuelwood needs. This variability highlights the need for carefully designed agroforestry interventions that promote tree planting without significantly reducing arable land, thereby balancing biodiversity conservation with food production needs. Supporting this, a MAAIF Official during interviews pointed , *“Farmers who practice agroforestry recognize the*

benefits of shade trees, but land limitations force some to clear trees for cultivation.” (MAAIF Official – 01).

Avoidance of harmful chemicals received a relatively high mean score of 3.73 (SD = 1.008), indicating an encouraging shift towards cautious agrochemical use to protect local biodiversity. Farmers appear increasingly aware of the risks associated with excessive pesticide and herbicide application on beneficial organisms and the wider environment. Nevertheless, some farmers may still misuse chemicals, especially when facing severe pest infestations in sensitive crops like vegetables. This calls for continuous farmer education and the promotion of organic and integrated pest management alternatives to further reduce chemical dependence. As noted by an Agricultural Extension Worker, *“Recent trainings on safe pesticide use have made farmers cautious. However, some still overapply due to pest fears, especially in vegetable production.”* (Agricultural Extension Worker – 01).

The encouragement of beneficial insects and wildlife on farms, reflected by a mean score of 3.76 (SD = 0.930), shows that many farmers allow species that support pollination and natural pest control to thrive. This practice enhances ecological functions essential for sustainable agriculture. The findings imply that initiatives such as apiculture (beekeeping) and integrated pest management (IPM) could be expanded to improve on-farm ecosystem services while offering additional income sources to farmers. This view was reinforced during interviews, where a Production Officer remarked, *“Bee-friendly farming has been promoted, with some farmers engaging in apiculture alongside crop farming, benefiting both yield and biodiversity.”* (Production Officer – 01).

Crop diversification emerged as the most widely practiced biodiversity conservation strategy, with the highest mean score of 3.89 (SD = 0.789). This reflects the strong adoption of growing multiple crop species to enhance food security and maintain ecological balance. The widespread acceptance of this practice underscores its importance in helping farmers mitigate risks related to market fluctuations, pests, and climate variability. Further support, particularly in providing access to diverse seed varieties and establishing reliable market linkages, could enhance the benefits of crop diversification for both sustainability and resilience. A MAAIF Official confirmed this by stating, *“Crop diversification helps farmers cope with market and climate risks. We’ve seen many shift to mixing cereals, legumes, and vegetables to spread risk.”* (MAAIF Official – 02).

Lastly, awareness regarding the conservation of endangered plant species received a high mean score of 3.87 (SD = 0.852), indicating that farmers recognize the importance of protecting rare and indigenous plant species. This heightened awareness presents an opportunity to translate knowledge into practical conservation actions, such as establishing seed banks or creating community-managed forests dedicated to preserving local flora. An Agricultural Extension Worker highlighted this development, noting that “*Through environmental education campaigns, farmers now recognize the importance of preserving indigenous species such as medicinal plants.*” (Agricultural Extension Worker – 03).

Table 4.10: Relationship between environmental sustainability practices and crop productivity in smallholder farms

		Environmental sustainability practices	crop productivity
Environmental sustainability practices	Pearson Correlation	1	.104
	Sig. (2-tailed)		.185
	N	165	165
Crop productivity	Pearson Correlation	.104	1
	Sig. (2-tailed)	.185	
	N	165	165

**. Correlation is significant at the 0.01 level (2-tailed).

The results in Table 4.10 indicate a weak and statistically insignificant positive correlation between environmental sustainability practices and crop productivity among smallholder farms in Matugga, Wakiso District ($r = .104$, $p = .185$). This suggests that while there is a slight positive relationship meaning that improvements in environmental sustainability practices could be associated with better crop productivity the strength of this relationship is minimal, and the effect is not statistically significant at the 0.01 level. The lack of a significant correlation implies that, within this study sample, the adoption of environmental sustainability practices alone may not have had a substantial direct impact on improving crop yields. This could be due to several contextual factors such as limited resources, inadequate implementation of sustainable practices, or other overriding influences like soil fertility, weather conditions, or access to inputs that more strongly determine crop productivity outcomes. Despite the weak relationship observed,

environmental sustainability remains important for long-term agricultural productivity and ecological balance. Therefore, while the direct effect on crop productivity may not be strongly evident in this study, promoting such practices could yield broader environmental and agricultural benefits over time.

Table 4.11: The effect of environmental sustainability practices on crop productivity

Regression Coefficients					
	Unstandardized Coefficients		Standardized Coefficients	T	Sig.
	B	Std. Error	Beta		
(Constant)	3.294	.330		9.972	.000
Environmental sustainability practices	.117	.088	.104	1.331	.185
Model Summary					
Adjusted R Square	.006				
ANOVA^b					
F	1.771				
Sig. (P)	.185^a				

Source: Field data, 2025

The results presented in Table 4.11 show that environmental sustainability practices accounted for only 0.6% of the variance in crop productivity among smallholder farms in Matugga, Wakiso District (Adjusted R Square = .006). This indicates that environmental sustainability practices, as measured in this study, are a very weak predictor of crop productivity, with 99.4% of the variance explained by other factors not included in this model. The overall model fit was not statistically significant, as evidenced by an F-value of 1.771 and a significance level of $p = .185$, which is greater than the conventional threshold of 0.05. This suggests that the regression model does not reliably predict crop productivity based on the environmental sustainability practices assessed.

Furthermore, the regression coefficients indicate that while the relationship between environmental sustainability practices and crop productivity is positive ($B = .117$), this effect is not statistically significant ($p = .185$). This means that improvements in environmental sustainability practices, according to this model, are not strongly or significantly associated with increases in crop productivity among the farmers surveyed. These findings imply that, although environmental sustainability practices are important for long-term ecological and agricultural

health, their immediate measurable effect on crop productivity in this context may be limited or overshadowed by other influential factors.

The findings from the current study revealed a generally positive but statistically weak relationship between environmental sustainability practices and crop productivity among smallholder farmers in Matugga, Wakiso District. These results suggest that although farmers in Matugga are adopting practices such as mulching, terracing, crop rotation, and biodiversity conservation, these practices have not yet translated into a significant measurable improvement in crop productivity in the short term. This finding is partly in disagreement with prior studies such as those by Martinez-Mena et al. (2021) and Larkin (2024), which assert that soil conservation methods like mulching, terracing, and composting improve soil fertility and water retention, leading to enhanced crop yields. However, the lack of significant correlation in the current study may reflect local constraints such as inconsistent application, resource limitations, or variations in farmer knowledge and skill levels in implementing these practices effectively.

The results also contrast somewhat with the findings of Singh (2024), who reported that biodiversity practices such as intercropping, agroforestry, and the conservation of beneficial organisms directly contribute to improved yields and agricultural profitability. In the Matugga context, while crop diversification and the encouragement of pollinators received high mean scores, these practices have not shown a strong measurable impact on crop productivity according to the regression and correlation analyses. This suggests that the ecological benefits of biodiversity conservation may not immediately reflect in yield improvements or that other overriding factors such as soil fertility, pest pressure, or climate variability exert stronger influences on crop output in this particular setting. These local dynamics highlight the complexity of translating sustainability practices into tangible productivity gains, as also noted by Beillouin et al. (2021), who emphasized that the effectiveness of biodiversity interventions often depends on site-specific ecological conditions.

Similarly, Tilman et al. (2011) and Pretty et al. (2018) underscored the long-term benefits of sustainable agricultural practices, arguing that soil conservation and biodiversity maintenance gradually enhance soil health, water retention, and crop stability. The weak association observed in the present study aligns with the notion that such benefits may require sustained application over several seasons before significant productivity effects become apparent. In Matugga, it is possible that farmers have only recently adopted these practices, or are implementing them

inconsistently, which could explain the lack of strong, immediate effects on crop yields. Moreover, environmental factors such as rainfall variability, soil nutrient levels, and pest outbreaks unmeasured in this study could have masked the potential benefits of these practices on productivity.

The findings also resonate with observations by Reganold and Wachter (2016) and Lal (2015), who noted that practices such as organic farming and conservation tillage improve crop yields over time by enhancing soil microbial activity and reducing degradation. In Matugga, however, the adoption of practices such as reduced tillage was moderate and many farmers reportedly still rely on traditional deep plowing methods due to cultural beliefs about soil preparation. This incomplete adoption of conservation practices may have limited the potential productivity benefits in the short term. In addition, the use of organic manure and compost, while moderately practiced remains constrained by challenges such as limited access to quality organic inputs, as highlighted by extension officers during interviews.

Water conservation practices, identified in prior studies by Molden et al. (2010) and Hoekstra and Mekonnen (2012) as crucial for yield stability, were not explicitly measured in this study, which could partly explain the weak observed relationship between sustainability practices and productivity. In the absence of advanced irrigation or water-saving techniques, the impact of soil and biodiversity practices alone may be insufficient to significantly enhance crop yields, especially during periods of erratic rainfall, which is a common challenge in the region.

The role of climate change adaptation, emphasized by scholars such as Rosenzweig et al. (2014) and Lobell et al. (2011), was also not a direct focus of this study but remains a critical factor influencing productivity outcomes. While Matugga farmers engage in some climate-resilient practices such as crop diversification and agroforestry, the full integration of climate-smart agriculture, including drought-resistant crop varieties and carbon sequestration practices, appears limited. This gap could account for the limited impact on productivity captured in the current study. Likewise, agroforestry practices, which Garrity (2004) and Jose (2009) identified as enhancing soil fertility and reducing crop stress, were moderately practiced, but may not yet be widespread or intensive enough to significantly affect yields.

Lastly, sustainable pest management, highlighted by Gurr et al. (2003) and Poppy et al. (2014) as essential for yield improvement, showed some promise in Matugga through the encouragement of

beneficial insects. However, extension officers noted that misuse of chemicals persists, undermining the potential benefits of biological control methods. The incomplete shift to integrated pest management (IPM) may thus limit the effectiveness of biodiversity conservation in enhancing productivity.

4.4.2 The effect of economic viability practices on crop productivity in smallholder farms Matugga, Wakiso District

The study’s second objective examined the effect of economic viability practices on crop productivity in smallholder farms in Matugga, Wakiso District. Both quantitative and qualitative data were collected to address this objective. For the quantitative data, descriptive statistics, including frequencies, percentages, means, and standard deviations, were employed to summarize and present information related to the adoption and impact of economic viability practices on farming outcomes. This provided a clear overview of the patterns and trends associated with the economic strategies utilized by smallholder farmers, such as access to credit, use of affordable inputs, cost management, and market engagement. Respondents were asked to rate their level of agreement with various statements, and the resulting data were analyzed using means and standard deviations to interpret the extent of practice adoption. Each item’s mean score was compared to the overall grand mean to assess whether farmers generally agreed or disagreed with the economic viability practices under investigation. Qualitative data were integrated to complement the quantitative results, offering deeper insights into the reasons, challenges, and contextual realities influencing farmers' economic decisions. This mixed-method approach provided a richer and more comprehensive understanding of how economic viability practices contribute to or hinder crop productivity among smallholder farmers in the area. The descriptive statistics on the effect of economic viability practices on crop productivity are presented in Table 4.12 below.

Table 4.12: Economic viability practices

<i>Statement</i>	<i>Min</i>	<i>Max</i>	<i>Mean</i>	<i>S.D</i>
<i>Efficient Resource Use</i>				
I use available water resources efficiently on my farm.	1	5	3.75	.954
I apply fertilizers and pesticides in recommended quantities to avoid wastage.	1	5	3.87	.859
I plan my farm operations to minimize costs and maximize output.	2	5	3.68	.974
I recycle or reuse agricultural inputs where possible to save costs.	1	5	3.74	.968
I seek knowledge or training on better resource use in farming.	1	5	3.53	.941
<i>Market Access</i>				
I have access to reliable markets to sell my produce.	1	5	3.81	.881
I am able to access market information regularly.	1	5	3.88	.875
I receive support (e.g., from cooperatives or NGOs) in reaching wider markets.	2	5	3.71	.870
Distance to the market does not hinder me from selling my produce.	1	5	3.65	1.016
I use mobile or digital platforms to market or sell my crops.	1	5	3.72	.949

Fair Prices

I receive fair prices for my agricultural produce.	1	5	3.79	.909
The prices I receive cover both my production costs and allow for profit.	1	5	3.75	.881
I am able to negotiate prices with buyers or middlemen.	2	5	3.85	.838
I am aware of the current market prices before selling my produce.	1	5	3.76	.930
There is price transparency in the markets where I sell my crops.	1	5	3.56	.952
GRAND MEAN			3.74	

Source: Field data, 2025

Table 4.12 presents findings on economic viability practices adopted by smallholder farmers in Matugga, Wakiso District, focusing on three thematic areas: Efficient Resource Use, Market Access, and Fair Prices. The overall grand mean of 3.74 suggests a high level of adoption of economically sustainable farming practices, indicating that farmers are increasingly integrating cost-effective and market-oriented strategies in their agricultural operations.

4.4.2.1 Efficient Resource Use Practices

The use of available water resources efficiently on farms recorded a mean score of 3.75 (SD = 0.954), indicating that most farmers are conscious of water conservation as a means of reducing input costs and ensuring sustainable production. This is critical in areas prone to erratic rainfall or water shortages. However, there is still room for improvement through farmer sensitization on modern irrigation technologies and water harvesting systems. As reported by an Agricultural Extension Worker during interview, *“Farmers are aware of water-saving practices, but many still rely on rain-fed agriculture due to limited access to irrigation equipment.”* (Agricultural Extension Worker – 01).

Application of fertilizers and pesticides in recommended quantities yielded a relatively high mean score of 3.87 (SD = 0.859), suggesting that farmers are cautious to avoid input wastage and unnecessary expenditure. This implies that extension services on input management have positively influenced farmer practices. Nonetheless, continued education on precision farming techniques could further optimize resource use. A MAAIF Official during interview affirmed, *“Recent training sessions have emphasized the economic benefits of proper input use, and farmers are gradually reducing over-application to cut costs.”* (MAAIF Official – 01).

Farm operation planning to minimize costs and maximize output had a mean score of 3.68 (SD = 0.974), reflecting moderate adherence to cost-saving farm management strategies. While some farmers effectively plan their activities to reduce unnecessary expenses, others lack formal budgeting skills. This points to the need for farm business management training. According to a Production Officer during interviews revealed that, *“Farmers who keep records and plan*

operations carefully report better returns, but many still operate without proper financial planning.” (Production Officer – 01).

Recycling or reusing agricultural inputs such as crop residues or containers scored a mean of 3.74 (SD = 0.968), indicating a fairly good practice of resource recovery to reduce production costs. However, this practice could be expanded by introducing innovations such as composting or bio-fertilizer production. An Agricultural Extension Worker noted, *“Some farmers reuse materials like sacks or apply crop residues as mulch, but there’s potential for more organized recycling initiatives.”* (Agricultural Extension Worker – 02).

Seeking knowledge or training on better resource use achieved a lower mean score of 3.53 (SD = 0.941), suggesting that although farmers recognize the importance of learning, constraints such as time, distance, or awareness of training opportunities may limit participation. This implies the necessity for easily accessible, locally tailored capacity-building programs. This was supported by interview results as stated by a MAAIF Official, *“While training programs exist, not all farmers can attend due to busy schedules or lack of information.”* (MAAIF Official – 02).

4.4.2.2 Market Access Practices

Access to reliable markets for selling produce was rated highly with a mean score of 3.81 (SD = 0.881), indicating that many farmers can reach buyers or market centers, which is essential for sustaining production profitability. Nonetheless, infrastructure development such as roads and storage facilities could enhance this further. A Production Officer during interview pointed out that, *“Market access has improved with better roads, but farmers still need cooperative marketing structures to bargain better prices.”* (Production Officer – 01).

Regular access to market information received the highest score under market access, with a mean of 3.88 (SD = 0.875), suggesting that farmers frequently obtain pricing and demand updates, potentially through radio, extension services, or peer networks. This enables informed decision-making when selling produce. However, digital platforms remain underutilized. According to interview results from Agricultural Extension Worker, *“Farmers increasingly rely on mobile phones and local radio for price information, though smartphone use for agribusiness apps is still limited.”* (Agricultural Extension Worker – 03).

Support in reaching wider markets (Mean = 3.71, SD = 0.870) implies that cooperatives and NGOs play an important role in improving market linkages, though not all farmers may have access to such services. Strengthening farmer group marketing and partnerships could bridge this gap. Additionally, as noted by a MAAIF Official during interview, *“NGOs and farmer cooperatives have facilitated market access, but smallholders outside such networks face difficulties.”* (MAAIF Official – 03).

Distance to market not being a hindrance was scored moderately at 3.65 (SD = 1.016), suggesting that for many farmers, proximity to market centers is not a significant barrier. Nonetheless, for some in remote locations, distance remains a challenge that requires better transport options. Additionally, a Production Officer during interview remarked, *“Some villages near Matugga town enjoy market closeness, but those further away struggle, especially during rainy seasons.”* (Production Officer – 03).

The use of mobile or digital platforms for marketing or selling produce had a mean of 3.72 (SD = 0.949), indicating that while some farmers have adopted technology-based marketing tools, digital literacy and access remain limiting factors for others. Expansion of training on mobile marketing and e-commerce platforms could improve this. An Agricultural Extension Worker during interviews stated, *“A few progressive farmers use WhatsApp groups to find buyers, but the majority still rely on physical market days.”* (Agricultural Extension Worker – 02).

4.4.2.3 Fair Pricing Practices

Receiving fair prices for agricultural produce registered a mean score of 3.79 (SD = 0.909), indicating that many farmers are happy with the returns they get for their output. However, price volatility remains a concern in some seasons. Similarly from the interview, a MAAIF Official pointed out, *“Price fluctuations occur, especially for perishable goods, but farmers report better prices when selling collectively.”* (MAAIF Official – 02).

Prices that cover both production costs and allow profit scored a mean of 3.75 (SD = 0.881), showing that most farmers perceive their farming enterprises as economically viable, although rising input costs could threaten this balance. This calls for interventions to reduce production expenses. From the interviews, a Production Officer commented, *“High fertilizer and pesticide prices are eating into profits, but bulk buying through cooperatives is helping some farmers cope.”* (Production Officer – 01).

The ability to negotiate prices scored (Mean = 3.85, SD = 0.838) shows that farmers feel empowered to bargain, possibly due to better information access or collective marketing approaches. This practice strengthens their market position and income potential. An Agricultural Extension Worker from the interviews, it was noted, *“Farmer groups have increased bargaining power, making it easier to demand better prices from traders.”* (Agricultural Extension Worker – 03).

Awareness of market prices before selling was rated at 3.76 (SD = 0.930), reflecting that most farmers research prevailing prices prior to transactions, thus avoiding exploitation by middlemen. This could be further enhanced through market information systems. Then from the interviews, a MAAIF Official remarked, *“Farmers check radio updates or call fellow farmers to verify prices before selling, reducing the risk of underpricing.”* (MAAIF Official – 01).

Lastly, price transparency in markets received a lower score of 3.56 (SD = 0.952), indicating that some farmers perceive market dealings as lacking clarity, possibly due to middlemen manipulation or insufficient regulation. This highlights the need for strengthening farmer-market governance structures. As expressed by a Production Officer during interviews, *“While transparency is improving in organized markets, farmers in informal setups still report price cheating by brokers.”* (Production Officer – 01).

Table 4.13: Relationship between economic viability practices and crop productivity in smallholder farms

		Economic viability practices	Crop productivity
Economic viability practices	Pearson Correlation	1	.391**
	Sig. (2-tailed)		.000
	N	165	165
Crop productivity	Pearson Correlation	.391**	1
	Sig. (2-tailed)	.000	
	N	165	165

** . Correlation is significant at the 0.01 level (2-tailed).

As presented in Table 4.13, the results reveal a significant and moderate positive correlation between economic viability practices and crop productivity among smallholder farms in Matugga, Wakiso District ($r = .391, p < 0.01$). This implies that improvements in the adoption of economic viability practices such as cost-effective resource use, access to affordable farming

inputs, proper financial management, and market-oriented production are associated with corresponding increases in crop productivity. The moderate strength of this relationship indicates that while economic viability practices are not the sole determinant of crop productivity, they play an important and statistically significant role in enhancing farm output. This suggests that smallholder farmers who implement sound economic practices are more likely to achieve higher yields and improved farm performance compared to those who do not prioritize these practices.

Table 4.14: The effect of economic viability practices on economic viability practices

Regression Coefficients					
	Unstandardized		Standardized	T	Sig.
	Coefficients		Coefficients		
	B	Std. Error	Beta		
(Constant)	1.972	.326		6.055	.000
Economic viability practices	.471	.087	.391	5.423	.000
Model Summary					
Adjusted R Square	.148				
ANOVA^b					
F	29.413				
Sig. (P)	.000^a				

Source: Field data, 2025

The results presented in Table 4.14 show that economic viability practices accounted for 14.8% of the variance in crop productivity among smallholder farms in Matugga, Wakiso District (Adjusted R Square = .148). This indicates that economic viability practices are a statistically significant predictor of crop productivity, although the majority (85.2%) of the variation in crop yields is explained by other factors not included in this model. The model's overall fit was confirmed by a statistically significant F-value ($F = 29.413, p = .000 < 0.05$), suggesting that the regression model is valid and reliably predicts the dependent variable crop productivity based on the independent variable economic viability practices.

The standardized Beta coefficient further revealed a positive and significant effect of economic viability practices on crop productivity (Beta = .391, $p = .000 < 0.05$). This implies that a one-unit improvement in the adoption of economic viability practices is associated with a .391 unit increase in crop productivity. These findings emphasize the importance of promoting economic

viability practices among smallholder farmers as a means to enhance crop yields. Interventions such as affordable credit facilities, input subsidies, and improved market access could therefore play a crucial role in improving the economic sustainability of farming activities and, by extension, crop productivity in Matugga, Wakiso District.

The findings of the current study reveal that economic viability practices have a statistically significant and positive influence on crop productivity among smallholder farmers in Matugga, Wakiso District. Specifically, practices such as efficient resource use, market access, and fair pricing mechanisms were associated with improved crop yields. These results are consistent with previous studies by Cyamweshi et al. (2022) and Awe et al. (2020), who emphasize that efficient utilization of resources, including water, fertilizers, and labor, enhances crop productivity while minimizing environmental and financial costs. Similarly, Akintayo et al. (2022) noted that smallholder farmers who adopted proper input management and labor-saving technologies experienced higher yields and profits. The current study's findings further affirm that most farmers are increasingly cautious in applying fertilizers and pesticides in recommended quantities to avoid wastage, and plan farm operations to minimize costs practices that are in line with global recommendations for sustainable agriculture. However, the study also revealed that training on resource use remains insufficient, suggesting a gap that needs to be addressed to fully realize the productivity benefits of economic viability practices.

In the context of market access, the results indicated that farmers' ability to reach reliable markets, access market information, and utilize mobile or digital platforms positively influenced crop productivity. This agrees with findings by Akintayo et al. (2022), who observed that smallholder farmers with better market connectivity enjoyed timely access to farm inputs and market information, leading to enhanced yields. Similarly, Cyamweshi et al. (2022) argued that cooperative marketing structures and improved rural infrastructure reduced transaction costs and allowed farmers to diversify production. The present study also found that while market access practices are fairly well adopted, challenges such as limited use of digital platforms and market distance barriers persist for some farmers. These challenges highlight areas where interventions, such as rural infrastructure development and digital literacy training, could enhance the economic viability and productivity outcomes of smallholder farming systems.

Regarding fair pricing practices, the findings demonstrated that the ability to negotiate prices, awareness of market prices, and perceived price fairness significantly contributed to farmers'

economic viability and productivity. This outcome is supported by the studies of Sellare et al. (2020) and Akintayo et al. (2022), who reported that fair and transparent pricing mechanisms empower farmers to invest in farm improvements, adopt sustainable practices, and ultimately increase yields. Fairtrade and stable market prices were also noted by Bathaei (2022) and Shah et al. (2020) as critical factors that motivate farmers to optimize input use and implement productivity-enhancing technologies. However, the present study revealed that some farmers still experience price transparency challenges, suggesting the need for stronger market governance and regulation to eliminate middlemen exploitation and ensure that price-setting processes are equitable and farmer-friendly.

Furthermore, the study regression analysis confirmed that economic viability practices accounted for a substantial proportion of the variance in crop productivity, indicating that while other factors also influence yields, economic viability plays a significant role. This finding aligns with assertions by Lakhiar et al. (2024) and Quist and Xia (2024), who highlighted that profitability, market incentives, and technology adoption are key to enhancing smallholder productivity. The literature and the present results collectively underscore the importance of supporting smallholder farmers with affordable credit, input subsidies, market development, and technology access to boost both economic viability and crop output. However, as noted in the review by Pandeya et al. (2025) and Li (2022), the integration of precision agriculture technologies could further amplify these benefits a direction that remains underutilized in Matugga but represents a promising area for future interventions.

4.4.3 The effect of social equity practices on crop productivity in smallholder farms in Matugga, Wakiso District.

The study's third objective examined the effect of social equity practices on crop productivity in smallholder farms in Matugga, Wakiso District. Both quantitative and qualitative data were collected to address this objective. For the quantitative data, descriptive statistics including frequencies, percentages, means, and standard deviations were used to summarize and present patterns related to the adoption of social equity practices and their influence on farming outcomes. This provided a clear understanding of how fairness in resource distribution, access to agricultural inputs, extension services, and decision-making opportunities affect crop productivity among smallholder farmers. Respondents were asked to rate their level of agreement with statements pertaining to social equity practices, and the resulting data were analyzed by comparing each item's mean to the overall grand mean to determine the extent of agreement or

disagreement with the stated practices and their perceived impact on crop productivity. Qualitative data were integrated to complement the quantitative findings, offering deeper insights into the underlying reasons, experiences, and contextual realities shaping the adoption and effectiveness of social equity practices in the farming community. This mixed-method approach enabled a more comprehensive understanding of the ways in which socially equitable practices contribute to or hinder crop productivity in Matugga, Wakiso District. The descriptive statistics related to the effect of social equity practices on crop productivity are presented in Table 4.15 below.

Table 4.15: Responses on social equity practices

<i>Statement</i>	<i>Min</i>	<i>Max</i>	<i>Mean</i>	<i>S.D</i>
<i>Labor Rights</i>				
I ensure that all workers on my farm are treated with dignity and respect.	1	5	3.85	.881
I am aware of the labor laws governing agricultural employment in Uganda.	1	5	3.79	.942
Workers on my farm are allowed to express their concerns freely.	1	5	3.61	.941
I do not allow child labor on my farm under any circumstances.	1	5	3.68	.981
All farm laborers are informed of their rights and responsibilities.	1	5	3.72	.923
<i>Fair Labor Practices</i>				
Workers on my farm receive fair and timely wages for their work.	1	5	3.68	.981
I provide safe and healthy working conditions for all farm workers.	1	5	3.56	.952
My farm allows reasonable working hours and rest periods for laborers.	1	5	3.76	.891
Both male and female workers are given equal opportunities on my farm.	1	5	3.88	.889
I regularly review and improve labor practices based on workers' feedback.	2	5	3.68	.911
<i>Community Engagement</i>				
I participate in local community meetings related to agriculture.	1	5	3.66	.960
I collaborate with neighbors or local groups for knowledge sharing on farming practices.	1	5	3.73	.957
I involve community members when making decisions about my farming operations.	1	5	3.82	.919
My farming activities do not negatively affect the surrounding community.	1	5	3.73	.898
I contribute to local initiatives or events that support agricultural development.	1	5	3.81	.845
GRAND MEAN			3.73	

Source: Field data, 2025

The study assessed how labor rights, fair labor practices, and community engagement influence crop productivity among smallholder farmers in Matugga, Wakiso District. The overall grand mean was 3.73, indicating a relatively high perception of social equity practices among the respondents. However, specific variations were noted across different items, suggesting room for improvement in certain aspects.

4.4.3.1 Labor Rights

Regarding the statement “I ensure that all workers on my farm are treated with dignity and respect” yielded a mean score of 3.85 (SD = 0.881), indicating that most farmers strongly acknowledge and prioritize respectful treatment of their labor force. This reflects a general recognition among farmers that when workers are treated with dignity, they are more likely to demonstrate commitment, reliability, and efficiency in their duties. A respectful work environment not only reduces labor disputes but also enhances laborers’ morale and productivity, contributing to improved crop yields and farm profitability. The importance of this practice lies in the potential to reduce turnover rates and retain experienced workers who can add value to farm operations over time. From the interviews, an Agricultural Extension Worker emphasized this by noting, *“Farmers are increasingly valuing laborers’ dignity, which has fostered loyalty and reduced turnover among farmhands. Some farmers who used to mistreat workers now report better harvest outcomes because workers stay longer and work harder knowing they are respected. This shift is slowly transforming the labor culture in the farming community”* (Agricultural Extension Worker – 01).

Regarding awareness of labor laws governing agricultural employment, a mean of 3.79 (SD = 0.942) was recorded, reflecting that a majority of farmers possess reasonable knowledge of labor regulations. This finding suggests that government sensitization programs and non-governmental initiatives have been effective in raising awareness. However, the persistence of certain labor violations in isolated cases implies the need for continuous legal literacy and enforcement measures. Improved understanding and adherence to labor laws can reduce disputes, minimize legal liabilities, and improve overall farm operations. As stated in the interviews, a MAAIF Official revealed, *“Our sensitization efforts have improved farmers’ knowledge of labor rights, but enforcement remains a challenge in some areas. Some farmers are aware of the laws but ignore them when labor is scarce or during peak harvest times. We need more community-level enforcement teams to monitor compliance regularly”* (MAAIF Official – 02).

On the issue of worker expression, the mean score of 3.61 (SD = 0.941) indicates moderate openness to laborer feedback, suggesting that while some farmers encourage dialogue with their workers, others maintain rigid authority structures that limit open communication. Such limitations can hinder the flow of valuable operational insights from workers, who often have practical knowledge about farm operations that can enhance efficiency and productivity. A more inclusive approach where laborers can freely express concerns or suggest improvements can

foster innovation and problem-solving on the farm. A Production Officer remarked in the interviews, *“Some farmers listen to laborers, but others dismiss their concerns, believing they undermine authority. This mindset is changing slowly as farmers realize that laborers can spot problems like pest outbreaks early. However, older farmers especially are reluctant to see workers as contributors beyond manual labor”* (Production Officer – 01).

The item on prohibition of child labor scored 3.68 (SD = 0.981), which reflects a generally positive stance against the exploitation of children in farm activities. This finding aligns with national and international advocacy for child rights and education. Prevention of child labor ensures that children attend school, contributing to a future skilled workforce that can drive the agricultural sector toward sustainability and innovation. Eliminating child labor also improves the farm's image, attracting partnerships with ethical buyers and certification bodies. According to an Agricultural Extension Worker interviewed, *“We have seen fewer cases of child labor since community campaigns against the practice intensified. Parents are beginning to understand that children belong in school, not in the field carrying heavy loads. However, during planting seasons, a few families still let older children help, especially when labor is expensive”* (Agricultural Extension Worker – 02).

For the statement “All farm laborers are informed of their rights and responsibilities” (mean = 3.72, SD = 0.923), the results suggest that many farmers make efforts to clarify job expectations and labor rights. However, gaps in thorough communication persist, which could lead to misunderstandings or exploitation. Effective dissemination of this information can reduce labor conflicts and foster mutual trust between farm owners and workers, ultimately boosting operational efficiency. A MAAIF Official noted in the interviews, *“Farmers distribute basic instructions, but full rights awareness is sometimes lacking. In many cases, laborers don’t know the exact working hours or what to do in case of injury. We are planning to provide simple, written guidelines to every farm so these gaps are filled”* (MAAIF Official – 02).

4.4.3.2 Fair Labor Practices

The provision of fair and timely wages recorded a mean score of 3.68 (SD = 0.981), suggesting a general level of satisfaction among farm workers regarding remuneration practices. Timely and fair compensation is critical as it sustains labor supply, reduces absenteeism, and maintains worker morale. Delays or inconsistencies in wage payment can lead to worker dissatisfaction, decreased productivity, and even labor strikes or abandonment of work. A Production Officer

stated in the interviews, *“Delayed payments were common in the past, but farmers now prioritize timely wage settlement to retain workers. They’ve learned from bad experiences where laborers left mid-season after payment delays. Some farmers even pay bonuses during peak periods to motivate extra effort”* (Production Officer – 01).

Ensuring safe and healthy working conditions scored 3.56 (SD = 0.952), indicating moderate attention to occupational safety measures. This is an area needing improvement, as inadequate safety practices can result in work-related injuries that reduce labor availability and productivity. Implementing proper safety procedures and providing protective gear would reduce accidents and improve worker well-being. An Agricultural Extension Worker lamented in the interviews, *“Some farmers ignore safety gear, viewing it as an extra cost, yet accidents reduce labor availability. We have seen cases of pesticide poisoning because sprayers weren’t provided with masks or gloves. Farmers need to understand that investing in safety saves money in the long run”* (Agricultural Extension Worker – 03).

Allowing reasonable working hours and rest periods had a mean score of 3.76 (SD = 0.891), suggesting that most farmers are increasingly mindful of balanced work schedules. Protecting workers from over-exertion reduces fatigue-related errors and injuries, enhancing labor efficiency. This practice is especially crucial during peak seasons when the temptation to extend work hours is high. A MAAIF Official affirmed in the interviews, *“Farmers are now mindful of labor fatigue, adjusting schedules during peak seasons. Some even provide refreshments and short breaks to keep workers energized. However, during planting and harvest rush, some smallholders still overwork laborers to beat weather deadlines”* (MAAIF Official – 03).

The item on gender equity recorded the highest mean score under this subcategory at 3.88 (SD = 0.889), indicating a progressive attitude toward the inclusion of both male and female laborers in farming activities. Gender-balanced labor practices ensure that farms fully utilize available human resources and foster empowerment among women in agricultural communities. An Agricultural Extension Worker proudly noted in the interviews, *“Women are increasingly involved in key farming tasks beyond weeding and harvesting. They now manage irrigation, planting, and even operate machinery. This change has boosted overall productivity as women’s potential is no longer overlooked”* (Agricultural Extension Worker – 01).

Regular review and improvement of labor practices based on worker feedback received a mean of 3.68 (SD = 0.911), showing that farmers are open to refining labor management. Structured feedback channels allow continuous adaptation to labor needs and challenges, enhancing operational efficiency and worker satisfaction. A Production Officer shared in the interviews, *“Feedback systems are informal but growing, especially in larger farms. Workers are now asked how tools or schedules can be improved. In some cases, these suggestions have reduced waste or saved time during harvesting”* (Production Officer – 01).

4.4.3.3 Community Engagement

Participation in community agricultural meetings had a mean score of 3.66 (SD = 0.960), indicating a moderate level of engagement with local agricultural networks. These forums are essential for knowledge sharing, collective problem-solving, and the dissemination of best farming practices, all of which can lead to improved productivity and resilience. A MAAIF Official commented in the interviews, *“While some farmers are active in these forums, others prioritize individual farm tasks over community involvement. They miss out on valuable training and updates about pest control or new seed varieties. We are encouraging more consistent attendance”* (MAAIF Official – 03).

Collaboration with neighbors for knowledge sharing scored a mean of 3.73 (SD = 0.957), suggesting that peer learning is fairly prevalent among farmers. Such collaborations can fill gaps left by limited agricultural extension services and enhance farm productivity through shared experiences and innovations. An Agricultural Extension Worker elaborated in the interviews, *“Neighbor-to-neighbor advice is the main source of farming innovations in the absence of formal training. Farmers copy each other’s composting techniques or pest traps, and this has reduced the spread of pests across farms. It’s a silent but powerful extension system”* (Agricultural Extension Worker – 03).

Involving community members in farm decisions scored 3.82 (SD = 0.919), reflecting a commendable level of inclusivity in decision-making processes. Such inclusivity reduces conflicts over shared resources such as water, grazing land, or access roads, ensuring harmonious farm operations and sustained productivity. A Production Officer reflected in the interviews, *“Decisions on shared resources like water use are increasingly discussed communally. This has reduced disputes and allowed farmers to organize collective irrigation or drainage systems, which benefit everyone in the area”* (Production Officer – 01).

The item on minimizing the negative effects of farming activities on the community recorded a mean of 3.73 (SD = 0.898), showing that farmers are becoming more conscious of the environmental and social impacts of their practices. Environmentally sustainable farming ensures long-term viability and maintains good relations with neighboring communities. A MAAIF Official noted in the interviews, *“Farmers are mindful of runoff and pesticide drift affecting neighbors. Some have built buffer zones or switched to less harmful sprays. This awareness has prevented conflicts and built trust within the community”* (MAAIF Official – 02).

Finally, contributing to local agricultural initiatives scored a high mean of 3.81 (SD = 0.845), suggesting a strong sense of community investment. Collective action in initiatives such as pest control or soil fertility programs can lead to broader agricultural improvements benefiting all farmers in the area. An Agricultural Extension Worker mentioned in the interviews, *“Farmers donate seeds or participate in communal planting, especially during government programs. These joint efforts have revived soil health in some villages and controlled pest outbreaks more effectively than individual actions”* (Agricultural Extension Worker – 03).

Table 4.16: Relationship between social equity practices and crop productivity in smallholder farms

		Social equity practices	crop productivity
Social equity practices	Pearson Correlation	1	.525**
	Sig. (2-tailed)		.000
	N	165	165
crop productivity	Pearson Correlation	.525**	1
	Sig. (2-tailed)	.000	
	N	165	165

** . Correlation is significant at the 0.01 level (2-tailed).

As presented in Table 4.16, the results reveal a significant and moderately strong positive correlation between social equity practices and crop productivity among smallholder farms in Matugga, Wakiso District ($r = .525$, $p < 0.01$). This indicates that as smallholder farmers adopt more equitable social practices such as fair access to land, agricultural inputs, extension services, credit facilities, and participation in decision-making processes there is a corresponding improvement in crop productivity levels. The relatively strong correlation suggests that social equity practices are a critical determinant of agricultural performance in the area. When farmers perceive that resources and opportunities are distributed fairly, they are more likely to be

motivated, empowered, and capable of applying improved farming methods, ultimately leading to higher yields and better overall farm output. These findings underscore the importance of promoting inclusive and fair agricultural policies and interventions that ensure all farmers regardless of gender, socio-economic status, or land ownership have equal access to the resources and support necessary for productive farming. Enhancing social equity within the farming community is therefore essential for boosting crop productivity and ensuring sustainable agricultural development in Matugga, Wakiso District.

Table 4.17: The effect of social equity practices on crop productivity in smallholder farms
Regression Coefficients

	Unstandardized		Standardized	T	Sig.
	Coefficients		Coefficients		
	B	Std. Error	Beta		
(Constant)	1.643	.266		6.168	.000
Social equity practices	.560	.071	.525	7.879	.000
Model Summary					
Adjusted R Square	.271				
ANOVA^b					
F	62.086				
Sig. (P)	.000^a				

Source: Field data, 2025

The results presented in Table 4.17 show that social equity practices accounted for 27.1% of the variance in crop productivity among smallholder farms in Matugga, Wakiso District (Adjusted R Square = .271). This indicates that the adoption of social equity practices such as fair access to agricultural resources, inputs, extension services, and decision-making processes is a substantial predictor of crop productivity. However, the remaining 72.9% of the variance is explained by other factors not captured in this model, such as environmental conditions, farming skills, or technological adoption. The overall goodness of fit for the model was confirmed by a highly significant F-value ($F = 62.086$, $p = .000 < 0.05$), suggesting that the regression model is statistically valid and reliably predicts the dependent variable crop productivity based on the independent variable social equity practices.

Using the standardized Beta coefficient, the results reveal a strong and positive effect of social equity practices on crop productivity (Beta = .525, $p = .000 < 0.05$). This implies that a one-unit improvement in the implementation of social equity practices is associated with a .525 unit increase in crop productivity. In contrast, the absence or poor implementation of equitable practices could hinder crop output and overall farm performance. These findings highlight the critical role that promoting social equity through inclusive policies, fair resource distribution, and equal participation opportunities can play in enhancing agricultural productivity among smallholder farmers in Matugga, Wakiso District.

The present study revealed that labor rights, including dignity, freedom of expression, awareness of labor laws, and the elimination of child labor, are positively practiced by smallholder farmers in Matugga, Wakiso District. This is reflected in high labor law awareness, indicating that farmers prioritize fair and humane treatment of laborers. These findings resonate well with those of Zhang et al. (2020), who assert that respect for labor rights directly enhances worker productivity and crop yields. In their study, farmers who upheld decent labor practices reported higher returns compared to those who neglected these rights. Similarly, Cyamweshi et al. (2022) indicated that protecting labor rights encourages knowledge sharing and continuous improvement in farming, thus fostering a culture of innovation and productivity on small farms. These earlier findings agree with the current results, confirming that labor dignity and legal protection are integral to productivity gains. However, while the current study notes improvement in labor rights observance, interview insights revealed lingering challenges in fully enforcing these standards, especially in peak seasons suggesting a partial gap in translating knowledge into consistent practice.

Regarding fair labor practices, the study identified moderate adherence to ensuring fair wages, safe working conditions and gender equity which align closely with Gathala et al. (2021) who emphasized that inclusive labor policies and safe environments promote better farm management and reduce labor turnover. The positive relationship between fair labor practices and productivity is also supported by Vanhuyse et al. (2021), who found that planned labor management enhances overall business and financial performance among smallholders. In this study, gender equity practices received the highest rating under fair labor, demonstrating a shift toward greater female participation in diverse farming tasks, consistent with global advocacy for gender equality in agriculture. Nonetheless, the relatively lower score on occupational safety suggests room for

improvement, as highlighted by interviewees who noted insufficient use of protective gear a shortfall that could risk worker health and reduce long-term productivity.

Community engagement practices were also positively rated, particularly in areas such as involving community members in farm decision-making and contributing to local agricultural initiatives. These results are in agreement with the work of Pretty et al. (2020) and Christian et al. (2024), who emphasized the importance of farmer cooperatives, community knowledge exchange, and participatory agricultural decision-making in enhancing farm resilience and productivity. The study underscores that when farmers participate actively in local networks and initiatives, they gain better access to resources, innovations, and market information factors that directly improve productivity. Nonetheless, the study also reflects gaps such as inconsistent participation in community agricultural meetings, suggesting that while collaboration is valued, individual farm pressures still limit broader engagement a finding echoed by previous scholars who called for structured incentives to enhance farmer involvement in community development activities.

The results further confirmed the importance of social equity practices, with a significant and strong positive relationship between social equity and crop productivity. Regression analysis showed that these practices of the variation in productivity, underscoring their substantial role in agricultural performance. These results strongly align with prior studies by Deininger et al. (2016) and Tengapoe et al. (2024), who concluded that equitable land and resource access significantly boost productivity, especially when marginalized groups are empowered. Moreover, gender-sensitive policies, as advocated by Alston (2014) and Doss et al. (2018), were evident in this study's high gender equity scores, suggesting that increased female inclusion is driving productivity improvements. However, the remaining unexplained variance (72.9%) highlights the influence of other factors like technological adoption and environmental variables, as previously noted by Fuglie (2011) and Omotoso et al. (2020), who argued for integrated social infrastructure improvements to fully realize productivity potential. In Matugga, the findings thus affirm that while social equity enhances crop productivity, comprehensive strategies involving health, education, and infrastructure are also necessary for sustained agricultural development.

CHAPTER FIVE

SUMMARY OF THE STUDY FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

The chapter offers a detailed summary of the study's key findings, as well as the conclusions drawn and recommendations proposed. The presentation is structured in accordance with the study objectives, which included examining the effect of environmental sustainability practices on crop productivity in smallholder farms, the effect of economic viability practices on crop productivity in smallholder farms and the effect of social equity practices on crop productivity in smallholder farms in Matugga, Wakiso District.

5.2 Summary of the study findings

The effect of environmental sustainability practices on crop productivity in smallholder farms in Matugga, Wakiso District.

The findings reveal that smallholder farmers in Matugga, Wakiso District, have generally adopted various environmental sustainability practices such as soil conservation techniques including the use of organic manure, crop rotation, mulching, terracing, and reduced tillage as well as biodiversity conservation measures like maintaining natural vegetation, minimizing harmful chemical use, encouraging beneficial insects and wildlife, practicing crop diversification, and preserving endangered plant species. While these practices are embraced to varying extents, some challenges remain, such as limited access to compost materials, land constraints for tree planting, and the slow transition to conservation tillage methods. Farmers also recognize the importance of agroecological approaches like intercropping and beekeeping, which support both farm productivity and ecological balance. However, the statistical analysis shows that these environmental sustainability practices have a minimal and statistically insignificant direct influence on crop productivity in the area, suggesting that other factors such as resource availability, soil fertility, climate variability, and access to agricultural inputs may play a more decisive role in determining yield outcomes. Despite the weak immediate impact on productivity, these practices remain crucial for ensuring the long-term sustainability and resilience of farming systems.

The effect of economic viability practices on crop productivity in smallholder farms in Matugga, Wakiso District

The findings indicate that smallholder farmers in Matugga, Wakiso District, have embraced various economic viability practices such as efficient use of resources, improved market access, and striving for fair pricing of their produce. These practices include water conservation, proper application of inputs, cost-effective farm operation planning, and recycling agricultural materials. However, challenges remain in areas like access to modern irrigation systems and farmer training on resource optimization. Market access practices, such as obtaining timely market information, reaching wider markets, and using digital platforms for selling, are moderately adopted, with infrastructure and digital literacy posing some limitations. Fair pricing practices, including price negotiation, awareness of prevailing market prices, and concerns about price transparency, also shape the economic environment for these farmers. Importantly, the statistical analysis shows a moderate and significant positive relationship between these economic viability practices and crop productivity, suggesting that adopting sound economic strategies contributes meaningfully to higher yields. While these practices do not entirely explain crop productivity variations, they play a crucial role in improving farm output, underscoring the need for interventions such as affordable credit, input subsidies, and enhanced market linkages to further support economic sustainability and productivity.

The effect of social equity practices on crop productivity in smallholder farms in Matugga, Wakiso District.

The findings reveal that social equity practices, including labor rights, fair labor conditions, and community engagement, are widely recognized and moderately implemented by smallholder farmers in Matugga, Wakiso District. Farmers generally treat laborers with dignity, respect labor laws, discourage child labor, and communicate workers' rights and responsibilities, though gaps in enforcement and awareness remain. Fair labor practices such as timely payment, safe working conditions, reasonable hours, gender equity, and feedback mechanisms are evident, but areas like occupational safety need further improvement. Community engagement is also fairly strong, with farmers participating in agricultural meetings, collaborating with neighbors, involving the community in decisions, minimizing negative impacts, and contributing to local initiatives. Statistical analysis indicates that these social equity practices significantly and positively influence crop productivity, suggesting that equitable treatment of labor and community participation enhance farmer motivation, resource sharing, and adoption of better farming methods, leading to improved yields. The results emphasize the importance of fostering inclusive,

fair, and participatory agricultural systems as a means of promoting sustainable farm performance and productivity.

5.3 Conclusions

The study concluded that while environmental sustainability practices are positively related to crop productivity, their influence is minimal and not statistically significant in predicting yield outcomes among smallholder farmers in Matugga, Wakiso District. This suggests that, although these practices are essential for maintaining long-term soil health, biodiversity, and ecological stability, their direct and immediate impact on crop productivity is limited. Other factors, such as soil fertility, access to quality inputs, weather conditions, and resource availability, likely play a more substantial role in determining productivity levels. Therefore, while promoting environmental sustainability remains vital for the resilience and future viability of farming systems, complementary interventions addressing these other critical determinants are necessary to enhance agricultural output effectively.

It was concluded that economic viability practices have a meaningful and statistically significant influence on crop productivity among smallholder farmers in Matugga, Wakiso District. This highlights the critical role that efficient resource utilization, affordable access to farming inputs, sound financial management, and market-oriented production strategies play in enhancing farm output. Farmers who actively adopt these practices are more likely to achieve better yields and overall farm performance compared to those who do not prioritize economic sustainability. These highlight the necessity for continued promotion of economic viability interventions, such as access to affordable credit, input subsidies, and improved market infrastructure, as essential drivers for boosting agricultural productivity and ensuring the long-term economic resilience of smallholder farming systems.

Lastly, it was concluded that social equity practices are a key driver of crop productivity among smallholder farmers in Matugga, Wakiso District. The adoption of equitable practices such as fair access to land, inputs, credit facilities, extension services, and inclusive decision-making processes significantly contributes to improved farm output. When farmers experience fairness in resource distribution and participation opportunities, they become more motivated, empowered, and better positioned to apply effective farming methods that enhance yields. These findings emphasize the necessity of promoting policies and interventions that uphold social equity in the agricultural sector, ensuring that all farmers regardless of gender, socio-economic status, or land

ownership benefit from equal support and opportunities. Strengthening social equity within farming communities is therefore essential for achieving sustainable agricultural development and maximizing productivity.

5.4 Recommendations

The following recommendations were put forward;

Given the minimal and statistically insignificant direct effect of environmental sustainability practices on crop productivity, the study recommends that efforts in this area should be complemented with interventions targeting key productivity drivers such as improving soil fertility, enhancing access to quality agricultural inputs, and mitigating climate variability impacts. Additionally, continuous farmer education on the long-term benefits of sustainable practices should be emphasized to ensure these measures contribute to resilience and productivity over time.

As economic viability practices have shown a moderate and significant positive impact on crop productivity, the study recommends scaling up support for these practices through provision of affordable credit facilities, input subsidies, and improved access to modern irrigation technologies. Furthermore, initiatives to enhance farmers' digital literacy and market information access should be prioritized to empower farmers to optimize market opportunities and improve profitability.

Since social equity practices significantly influence crop productivity, the study recommends strengthening the enforcement of fair labor standards, improving occupational safety measures, and promoting gender equity on farms. Additionally, fostering community-based agricultural networks and participatory decision-making can further enhance information sharing, resource pooling, and collective problem-solving, ultimately leading to higher crop yields and sustainable farming outcomes.

5.5 Areas for further research

The study pointed out the following areas for future study;

- i. Assessing the mediating role of agricultural input accessibility in the relationship between environmental sustainability practices and crop productivity among smallholder farmers

- ii. The effect of digital market platforms and infrastructure development on the economic viability and productivity of smallholder farms in Wakiso District
- iii. Investigating the role of occupational health and safety standards in enhancing labor productivity and crop yields in smallholder farming systems

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Appendences

Appendix I: Questionnaire for Smallholder Farms

Dear Respondent

I'm **Lubega Hussein Jamil**, a student at Uganda Martyrs University. As part of the requirements for the award of a Masters Degree in Development Studies, I am undertaking a study on the "*The effect of sustainable agriculture practices on crop productivity in smallholder farms in Matugga, Wakiso District*". As a stakeholder, you are hereby requested to participate in the study. Please feel free to participate in this academic study. Your views will be used for this purpose, considered confidential and with utmost privacy and confidentiality.

Thank you very much for your valuable time.

SECTION A: BIO-DATA OF RESPONDENT

1. Sex of respondent

- Male
- Female

2. Age of respondent:

- Below 25 years
- 25–34 years
- 35–44 years
- 45–54 years
- 55 years and above

3. Level of education:

- No formal education
- Primary level
- Secondary level
- Tertiary/College
- University

4. Marital status:

- Single
- Married
- Widowed
- Divorced

5. Farm size under cultivation (in acres):

- Less than 1 acre
- 1–2 acres
- 3–5 acres
- More than 5 acres

6. Primary source of livelihood:

- Farming
- Business
- Formal employment
- Casual labor
- Other (Specify): _____

7. Years of farming experience:

- Less than 2 years
- 2–5 years
- 6–10 years
- More than 10 years

8. Type of crops mainly grown:

- Cereals (e.g., maize)
- Legumes (e.g., beans, groundnuts)
- Vegetables (e.g., tomatoes, cabbages)
- Root crops (e.g., cassava, sweet potatoes)
- Mixed cropping

For Section B, C, D & E, respond by ticking only one option: (1-Strongly disagree, 2-Disagree, 3-Neutral, 4-Agree and 5-Strongly Agree). To show your level of agreement or disagreement with the items provided.

SECTION B: Environmental Sustainability Practices

Code	Item	Ranking				
		1	2	3	4	5
	Soil Conservation					
B1	I regularly use organic manure or compost to improve soil fertility.					
B2	I practice crop rotation or intercropping to preserve soil health.					
B3	I use mulching to retain soil moisture and reduce erosion.					
B4	I construct terraces or contours to prevent soil erosion on slopes.					
B5	I avoid over-tilling to maintain the structure of the soil.					
	Biodiversity Conservation					
B6	I maintain natural vegetation or trees on parts of my farm.					
B7	I avoid the use of harmful chemicals that could affect local species.					
B8	I allow beneficial insects and wildlife to thrive on my farm.					
D9	I grow a variety of crops to support ecological balance.					
D10	I am aware of the importance of conserving endangered plant species.					

SECTION C: Economic Viability Practices

Code	Item	Ranking				
		1	2	3	4	5
	Efficient Resource Use					
C1	I use available water resources efficiently on my farm.					
C2	I apply fertilizers and pesticides in recommended quantities to avoid wastage.					
C3	I plan my farm operations to minimize costs and maximize output.					
C4	I recycle or reuse agricultural inputs where possible to save costs.					
C5	I seek knowledge or training on better resource use in farming.					
	Market Access					
C6	I have access to reliable markets to sell my produce.					
C7	I am able to access market information regularly.					
C8	I receive support (e.g., from cooperatives or NGOs) in reaching wider markets.					
C9	Distance to the market does not hinder me from selling my produce.					
C10	I use mobile or digital platforms to market or sell my crops.					
	Fair Prices					
C11	I receive fair prices for my agricultural produce.					
C12	The prices I receive cover both my production costs and allow for profit.					
C13	I am able to negotiate prices with buyers or middlemen.					
C14	I am aware of the current market prices before selling my produce.					
C15	There is price transparency in the markets where I sell my crops.					

SECTION D: Social Equity Practices

Code	Item	Ranking				
		1	2	3	4	5
	Labor Rights					
D1	I ensure that all workers on my farm are treated with dignity and respect.					
D2	I am aware of the labor laws governing agricultural employment in Uganda.					
D3	Workers on my farm are allowed to express their concerns freely.					
D4	I do not allow child labor on my farm under any circumstances.					
D5	All farm laborers are informed of their rights and responsibilities.					
	Fair Labor Practices					
D6	Workers on my farm receive fair and timely wages for their work.					
D7	I provide safe and healthy working conditions for all farm workers.					
D8	My farm allows reasonable working hours and rest periods for laborers.					
D9	Both male and female workers are given equal opportunities on my farm.					
D10	I regularly review and improve labor practices based on workers' feedback.					
	Community Engagement					
D11	I participate in local community meetings related to agriculture.					
D12	I collaborate with neighbors or local groups for knowledge sharing on farming practices.					
D13	I involve community members when making decisions about my farming operations.					
D14	My farming activities do not negatively affect the surrounding community.					
D15	I contribute to local initiatives or events that support agricultural development.					

SECTION E: Crop Productivity in Smallholder Farms

Code	Item	Ranking				
		1	2	3	4	5
	Crop Yield					
E1	The use of sustainable agricultural practices has improved my crop yields.					
E2	My farm consistently produces enough crops to meet household and market needs.					
E3	My crop yields have increased over the past three seasons.					
	Good Crop Quality					
E4	My crops are of high quality and meet buyers' expectations.					
E5	Sustainable farming techniques have improved the quality of my produce.					
E6	I rarely experience issues related to crop defects or spoilage.					
	Crop Diversity					
E7	I grow a variety of crops on my farm each season.					
E8	Crop diversification has reduced my vulnerability to market and weather changes.					
E9	I include both food and cash crops in my farm production.					
	Profitability					
E10	My farm generates a reliable income from crop production.					
E11	Profits from my crops have improved due to sustainable farming practices.					
E12	I reinvest a portion of my profits into improving my farming operations.					

END: THANK YOU

Appendix II: Interview Guide

Study Title:

The Effect of Sustainable Agriculture Practices on Crop Productivity in Smallholder Farms in Matugga, Wakiso District

Target Participants

- i) Agricultural Extension Workers
- ii) District Production Officer
- iii) Officials from the Ministry of Agriculture, Animal Industry and Fisheries (MAAIF)

SECTION B: To examine the effect of environmental sustainability practices on crop productivity.

- 1) What environmental sustainability practices (e.g., soil conservation, biodiversity preservation, water harvesting) are currently promoted among smallholder farmers in Matugga?
- 2) How would you describe the level of adoption of these practices by farmers?
- 3) In your view, how have practices such as soil and biodiversity conservation impacted crop yield, quality, and diversity?
- 4) What barriers hinder farmers from implementing sustainable environmental practices?
- 5) What support (technical, financial, training) is available to promote these practices?

SECTION C: To examine the effect of economic viability practices on crop productivity.

- 1) What strategies are smallholder farmers using to ensure the efficient use of resources (e.g., land, water, seeds, fertilizer)?
- 2) How accessible are local and regional markets to these farmers?
- 3) What factors determine whether farmers receive fair prices for their produce?
- 4) Do you believe current economic practices are increasing or decreasing farmers' ability to maintain and improve crop productivity?
- 5) What is being done by government or NGOs to improve the economic sustainability of smallholder agriculture?

SECTION D: To examine the effect of social equity practices on crop productivity.

- 1) How are labor rights and fair labor practices upheld in smallholder farms?
- 2) Are there deliberate efforts to include women, youth, and marginalized groups in agricultural programs in Matugga?
- 3) How do you assess the level of community participation in agricultural decision-making and policy implementation?
- 4) In what ways do social equity practices affect productivity or the motivation of farming households?

SECTION E: Crop Productivity in Smallholder Farms

- 1) How would you describe the current status of crop productivity among smallholder farmers in Matugga?
- 2) What factors do you believe are contributing most significantly to high or low productivity?
- 3) How do sustainable agriculture practices compare with conventional ones in terms of crop yield, quality, and profitability?
- 4) Are there any particular crops or farming techniques that have shown exceptional productivity results in recent years?
- 5) What are your recommendations for improving crop productivity in smallholder farms through sustainable means?

END: THANK YOU