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The Effects of financial inclusion on agricultural productivity in Kiambu, Kenya.

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THE EFFECTS OF FINANCIAL INCLUSION ON AGRICULTURAL PRODUCTIVITY IN KIAMBU, KENYA

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DECLARATION

I declare that this dissertation has not been previously submitted and approved for the award of a degree by this or any other university. To the best of my knowledge and belief, the dissertation contains no material previously published or written by another person except where due reference is made in the proposal itself.

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Approval

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DEDICATION

This dissertation is dedicated to my amazing mother, sister, and brother, whose steadfast support and encouragement have been my guiding light throughout my journey to complete my master's degree. To my wonderful family, your unwavering love has been my anchor, and your constant encouragement has propelled me forward, even after three long years of delays. I could not have achieved this without you. To my beloved daughter, Genevieve, thank you for cheering me on every step of the way. This dissertation is dedicated to you with endless love.

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ABSTRACT

Agriculture is the dominant sector in Kiambu County, significantly contributing to the local economy and providing livelihoods to the community. Financial inclusion refers to the accessibility of quality financial services at a reasonable cost, is recognized as a powerful force that can boost agricultural productivity. Despite its potential benefits, the agricultural sector faces a significant gap in access to financial services, that is accounts, credit, savings, and agricultural insurance. While empirical studies have provided insights that illustrated the positive effect of financial inclusion on agricultural productivity, there is limited evidence of a comprehensive approach that integrates multiple financial inclusion indicators along with socio-demographic factors such as gender and education. This research utilized financial intermediation theory and endogenous growth theory to understand the phenomenon. The financial intermediation theory emphasized the role of financial intermediaries and explained why farmers are financially excluded, while the endogenous growth theory highlighted the importance of internal factors such as knowledge, innovation, and human capital in driving economic growth. The study aimed to establish the relationship between financial inclusion and agricultural productivity at the household level by analyzing financial inclusion indicators while considering socio-demographic factors, gender, and education with fertilizer consumption included to isolate the specific effect of financial inclusion on productivity. Using descriptive and correlational research design, primary data was collected from 100 households in Kiambu through a one-year household survey. The multivariate Ordinary Least Squares (OLS) regression model revealed that financial access and utilization—specifically bank accounts and credit—and socio-demographic factors, gender and education are crucial in determining agricultural productivity. Other variables, including mobile accounts, agricultural savings, insurance, mode of payment, and fertilizer type, did not show statistically significant effects. The study contributed to empirical literature by providing a context-specific analysis of financial inclusion's effect on agricultural productivity in Kiambu. The findings are useful for policymakers and financial institutions as they highlighted the need for tailored interventions to address the financial inclusion gap thereby enhancing the farmers' economic well-being. The study's limitations included a small sample size and the exclusion of factors like market access and climate conditions, which may affect agricultural productivity.

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF ABBREVIATIONS

AFI	-	Alliance for Financial Inclusion
APA	-	American Psychological Association
APEC	-	Asia-Pacific Economic Cooperation
ATM	-	Automated Teller Machine
CBK	-	Central Bank of Kenya
CGK	-	County Government of Kiambu
CGAP	-	Consultative Group to Assist the Poor
DFS	-	Digital Financial Services
FAO	-	Food and Agriculture Organization
WBG	-	World Bank Group
FSD Kenya	-	Financial Sector Deepening Kenya
GDP	-	Gross Domestic Product
GPFI	-	Global Partnership for Financial Inclusion
IFAD	-	International Fund for Agricultural Development
IFC	-	International Finance Corporation
KNBS	-	Kenya National Bureau of Statistics
MoALF&I	-	Ministry of Agriculture, Livestock, Fisheries, and Irrigation
NACOSTI	-	National Commission for Science, Technology & Innovation
NASDAQ	-	National Association of Securities Dealers Automated Quotations
OECD	-	Organization for Economic Co-operation and Development
OLS	-	Ordinary Least Squares regression
POS	-	Point of Sale
STATA	-	Statistics and data

DEFINITION OF TERMS

Access to financial services pertains to the ability of individuals to utilize available financial services and products offered by financial institutions. Access indicators gauge the extent of financial services outreach by measuring the point of service (number of ATMs, bank branches, and POS terminals), e-money accounts, and interoperability of these service points (WBG, 2013).

Agricultural productivity refers to the measure of output of crops and livestock relative to the input used. It encompasses various aspects such as crop yield, livestock production, and the efficiency of resource utilization, including land, water, labor, and capital (Habib, 2024).

Agricultural income includes earnings from farming activities such as crop cultivation, livestock rearing, leasing agricultural land, and selling farm produce. It encompasses both the gross income and net income after accounting for expenses such as seeds, fertilizers, labor, and equipment (Bajaj Finance, 2025). In this study, agricultural income was used in the context of net income and as a proxy for agricultural productivity.

Financial inclusion is a multifaceted concept encompassing access to, usage, and quality of financial services. Cáamara and Tuesta (2014) define an inclusive financial system as one that optimizes access to and use of financial services while reducing involuntary financial exclusion. The World Bank Financial Inclusion Strategies Reference Framework was developed to provide a holistic approach to assessing financial inclusion by considering three dimensions: (1) access to financial services, (2) usage of financial services, and (3) quality of financial service delivery with each dimension including indicators that would be used to assess the phenomenon, by analyzing financial services users' needs (both met and unmet) and barriers they encounter when seeking financial services and products (WBG, 2012).

Financial intermediaries are institutions that participate in financial markets, specializing in buying and selling assets and financial contracts (Andries, 2009).

Quality of financial service delivery refers to the appropriateness of the financial services by evaluating whether the financial service matches the client's needs. The quality indicators assess how clients benefit from the available financial services by adopting products that best suit their needs. The indicators look at the clients' financial behavior, the range of options available to customers, cost of usage, barriers to access to credit, customer protection, and the clients' financial literacy (WBG, 2013).

Usage of financial services refers to the performance and extent of use of the available financial services by measuring the actual use of an account in the individual's name and through someone else's account (indirect usage) in a specified period. Usage indicators assess the regularity and frequency of financial service use and the customers' ability to benefit from these services fully. The indicators measure formally banked adults and enterprises, adults and enterprises with a line of credit in regulated institutions, individuals with insurance, cashless transactions, mobile transactional use, frequent account usage, saving behavior, and remittances (WBG, 2013).

CHAPTER ONE: INTRODUCTION

1.1. Background of the study

The first chapter provides the setting for understanding the role of agriculture in the economy and how financial inclusion affects agricultural productivity. The chapter examines the importance of the agricultural sector and challenges faced by farmers in the broader African context, followed by Kenya, and narrows down to Kiambu County. The chapter also outlines the problem statement, the study's research objectives and questions, explaining the scope and significance for the stakeholders. This prepares for the detailed investigation into how financial inclusion affects agricultural productivity and improves the economic well-being of farmers in Kiambu County.

1.1.1. African context of agriculture and financial inclusion of farmers

According to OECD/FAO (2016), economic development in most Sub-Saharan African countries relies on the agricultural sector because of the sector's contribution to the country's GDP. In addition, 60% of the population in Africa live in rural areas, hence agriculture accounts for two-thirds of the livelihood present there. However, the sector experiences basic infrastructural problems such as financing, lack of access to markets, high yield seeds, good quality fertilizer and pesticides, reliance on rainfall among others due to the little attention provided by the respective governments leading to low productivity levels (Verason, 2017). The African region is a net food importer as governments are unable to meet demand for food in the urban and rural centers and are forced to import food to sustain their citizenry (FAO, 2011).

The notion that financial services can enhance the well-being of farmers, and their families has been recognized for some time. Nevertheless, by 2016, financial institutions and value chain participants were only able to fulfill 25% of the USD 200 billion required for farmer financing in sub-Saharan Africa, Latin America, and South and Southeast Asia. Additionally, agricultural insurance coverage extended to roughly 10% of farmers, and fewer than 15% had access to formal savings accounts (Goldman et al., 2016). Over 500 million farming households, which form the backbone of agricultural value chains, remain unbanked, as financial institutions perceive small-scale farmers as high-risk clients due to their low and seasonal incomes (IFC/Mastercard, 2018).

Digital Financial Services represent a major advancement in the financial sector, providing financial services facilitated through modern digital platforms such as mobile phones, electronic cards, point-of-sale devices, and computers. According to AFI (2016), DFS covers various

financial services available beyond conventional bank branches, including payments, loans, savings, remittances, and insurance. This digital transformation in financial services has provided a viable alternative to traditional banking, reaching previously underbanked populations (Saal et al., 2017). According to Lauer and Lyman (2015), the purpose of providing Digital Financial Services is to achieve digital financial inclusion for the excluded and underserved population. The 2021 Global Findex Report confirms that mobile money has facilitated more equitable access to financial services. Technology is helping drive financial inclusion in Sub-Saharan Africa as more economies (15 up from eight in 2017) have more than 20 percent of their adults having only a mobile money account rather than an account from a traditional financial institution (WBG, 2021). Digital Financial Services provides several financial services to farmers and other players in the agricultural value chains without them having to visit a bank branch. The services offered include savings, payments, credit, and insurance services delivered through mobile telephony, point-of-sale terminals, and the Internet (IFAD, 2016).

A study by Suri and Jack (2016) demonstrates how financial inclusion through mobile money services has significantly reduced transaction costs for farmers, enabling them to manage risks and invest in their farms more effectively. Nakasone et al. (2014) noted that farmers who utilized mobile phones to access market information were able to negotiate more effectively and obtain better prices for their products. This indicates that financial inclusion has a direct positive impact on agricultural productivity.

1.1.2. Agriculture and financial inclusion of farmers in Kenya

Agriculture is the most important contributor to the Kenyan economy, hence the engine of economic growth in Kenya. The sector accounts for 21.2 percent of the national GDP, employs 40 percent of the population, and a significant portion of the workforce hails from rural areas (KNBS, 2023; FAO, 2020). In addition, the sector is characterized as complex because of its strong linkages with the other sectors in the economy. Due to these linkages, the agriculture sector contributes an additional 27 percent of GDP, and it is estimated that 1% growth in the sector will drive 1.6% overall GDP growth (MoALF&I, 2019).

According to the 2019 Kenyan Economic Update, the Kenyan agricultural landscape is characterized by farmers who generally operate small farms with approximately 87 percent of them using less than 2 hectares of land while 67 percent operate less than 1 hectare (WBG, 2019).

Farmers need finance to buy inputs, pay for labor, and maintain their farms. Farmers receive most of their income once or twice a year depending on the harvesting calendar. Managing and stretching this income, which is mostly in cash, is difficult for the farmers as it is prone to misuse. Besides, when it comes to credit, the farmers are excluded from the formal financial system as they are viewed as very risky clients, hence their loan facilities attract very high-interest rates (IFC/Mastercard, 2018).

The success of M-Pesa has Kenya leading the African continent in financial inclusion with Kenya emerging as a Fintech hub with its "silicon savannah." 82% of the Kenyan adults have accounts that are largely driven by money wallets (IFC/Mastercard, 2018). However, the 2019 FinAccess Research highlighted that 12.6 percent of households engaging in agriculture were excluded from formal access to financial services (FSDKenya/KNBS/CBK, 2019). This percentage of households excluded from formal access to financial services is high because the sector employs 40% of the population directly and 80% indirectly (FAO, 2020). Therefore, the statistics highlighted in the 2019 FinAccess Research on Kenyan citizens involved in agriculture, including residents of Kiambu County, who lack formal access to financial services, form the basis for this study.

1.1.3. Agriculture in Kiambu County

Kiambu County, situated in Kenya's central region, shares its borders with six other counties: Nairobi and Kajiado to the south, Machakos to the east, Murang'a to the north and northeast, Nyandarua to the northwest, and Nakuru to the west (CGK, 2023). In 2019, the county's population was recorded at 2.4 million, with an average density of 952 individuals per square kilometer (CGK, 2025).

The county is known for its agricultural activities due to its favorable climatic conditions and fertile soils. Agriculture is the dominant sector in the county's economy, ensuring food security and economic stability by providing livelihoods to the community. The sector contributes 17 percent of the population's income, with 74 percent of the total land area dedicated to agricultural production (MoALFC, 2021). Between 2018 and 2022, Kiambu was among the top five contributors to the Gross County Product, highlighting the sector's importance to the county and the Kenyan economy (KNBS, 2023).

While considerable research had explored the effect of financial inclusion on broad macroeconomic aggregates, there was a limited understanding of its effects on the household level in a local Kenyan context, such as Kiambu county.

1.2. Problem statement

Agriculture is the dominant sector in Kiambu County's economy, providing food security and economic stability by offering livelihoods to the community. Despite its importance to the economy, agriculture is the most financially underserved, mirroring Kenya's agricultural landscape, which negatively affects agricultural productivity and contribute to persistent rural poverty (MoALF&I, 2019). Hess et al. (2012) expounds on the reasons for excluding the sector from access to financial services, which include irregular income due to the seasonality of the agricultural sector, exposure of the participants to market risks, and their limited collateral. The reasons are appreciated, but this does not negate that the agriculture sector requires significant investment to enable farmers to access financial services through whichever channel is available.

Digital Financial Services, particularly mobile banking, have been adopted by Kenyan commercial banks as they enter into agreements with mobile network operators. These services have enabled a large Kenyan population to achieve financial inclusion through mobile devices and internet access. The success of mobile money in Kenya has been extensively studied, with research focusing on its impact on the economy, poverty reduction, and gender empowerment. Five years after the rollout of M-Pesa, Suri and Jack (2011) prepared a case study review of the M-Pesa platform. The study technically assessed how the platform works and reviewed its potential impact on the Kenyan economy. In 2016, the two researchers conducted a follow-up study that focused on the long-run effect of M-Pesa on poverty and gender empowerment in the country (Suri & Jack, 2016). Diop and Cabral (2016) researched on the influence of Digital Financial Services on agricultural development, with Senegal as the study area. One of their conclusions was that a 1 percent increase in funding in the agricultural sector causes an increase of 1.315 percent in agricultural GDP. This shows that increased financial participation by farmers will result in agricultural growth. Besides, a study by Fowowe (2020) highlighted that financial inclusion, regardless of how it is measured, has had a positive and statistically significant impact on agricultural productivity in Nigeria.

Despite the critical role of agriculture in Kiambu County's economy, many farmers remain underserved by financial institutions, limiting their potential to drive sector growth. Existing studies have not specifically investigated the interplay between financial inclusion, socio-demographic factors (such as gender and education), and agricultural productivity in Kiambu County. This research aims to fill this knowledge gap by utilizing new household data to explore how an inclusive financial system can enhance productivity among farmers in Kiambu. The study offers new insights into the effect of financial inclusion on the economic well-being of agricultural households in the region.

1.3. Research objectives

1.3.1. General objective

The general objective of this study was to investigate the role of financial inclusion in enhancing agricultural productivity, with a particular focus on farmers in Kiambu County.

1.3.2. Specific objectives

To achieve the general objective, the study aimed to address the following specific objectives:

1. To assess the effect of accessing financial services through bank accounts and mobile money accounts on agricultural productivity among farmers in Kiambu County.
2. To assess the influence of agricultural savings on the productivity of farmers in Kiambu County.
3. To examine the effect of agricultural credit accessibility on agricultural productivity in Kiambu County.
4. To analyse the effect of agricultural insurance adoption on agricultural productivity among farmers residing in Kiambu County.
5. To investigate the utilization of payment services toward agricultural activities and their effect on agricultural productivity among Kiambu County farmers.

1.4. Research questions

The study, therefore, used the following research questions:

1. How does access to financial services through bank accounts and mobile money accounts affect agricultural productivity among farmers residing in Kiambu County?

2. What is the effect of agricultural savings on agricultural productivity among farmers residing in Kiambu County?
3. How does agricultural credit accessibility affects agricultural productivity in Kiambu County?
4. What are the adoption rates of agricultural insurance, and how do they affect agricultural productivity among Kiambu County farmers?
5. How does the use of payment services toward agricultural activities affect agricultural productivity among farmers in Kiambu County?

1.5. Scope of the study

This research assessed how financial inclusion affected farmers' productivity in Kiambu County. The study targeted a sample of 100 farmers out of the estimated 340,000 farmers from the selected five sub-counties in Kiambu County. Data was gathered using a structured questionnaire designed to capture detailed information on financial inclusion indicators, socio-demographic characteristics (gender and education), agricultural input (fertilizer), and agricultural productivity. The study design involved analyzing data collected from September 2023 to September 2024 to understand the dynamics between the variables.

The independent variables in the study included the number of active bank and mobile money accounts held by farmers, the ability to save and receive credit from their agricultural activities, agricultural insurance uptake rates, and the use of payment services. The dependent variable was agricultural income, which served as a proxy for agricultural productivity. To ensure comprehensive analysis, the study included additional control variables: gender, education, and their fertilizer consumption. These variables helped mitigate the influence of external factors and ensure the robustness of the research outcomes.

The study was framed around the five specific objectives to guide the investigation into the relationship between financial inclusion and agricultural productivity. These objectives focused on understanding the farmers' access to and utilization of financial services while controlling for potential confounding factors. The study was restricted to Kiambu County, and the findings were specific to this region.

1.6. Significance of the study

1.6.1. Financial institutions

The research addressed the identified knowledge gap by providing insight into the unique needs, challenges, and financial access and utilization patterns specific to farmers in Kiambu County. By examining socio-demographic factors such as gender and education, alongside agricultural practices like fertilizer usage, the study offered a nuanced understanding of the elements influencing the relationship between financial inclusion and agricultural productivity. This detailed analysis can guide financial institutions in developing more inclusive and tailored financial services that cater to the diverse needs of farmers, ultimately enhancing their access to financial resources.

1.6.2. Farmers

By focusing on the unique context of Kiambu County, the study served as a benchmark for other regions with similar agricultural settings. It provided a framework for evaluating the effect of financial inclusion on agricultural productivity, which can be adapted and applied in different locations. Enhanced financial inclusion can lead to increased agricultural productivity, addressing the financial exclusion that has historically limited farmers' economic potential.

1.6.3. Policymakers

The primary goal of this study was to generate data that can stimulate informed discussions on the effectiveness of current financial inclusion initiatives, particularly in addressing the underserved status of farmers in Kiambu County. By investigating the interplay between financial inclusion, socio-demographic factors such as gender and education, and agricultural productivity, the research provided valuable insights for policymakers. This data can inform policy development to create more inclusive financial systems and improve the economic welfare of farmers.

1.6.4. Academic community

The study contributed to academic knowledge by addressing the specific knowledge gap related to the interplay between financial inclusion, socio-demographic factors, and agricultural productivity. By utilizing new household data, the research offered fresh insights adding to the

existing body of literature of how an inclusive financial system can enhance productivity among farmers offering a foundation for future studies in this area.

1.7. Chapter Summary

Chapter one has provided a comprehensive background to the study, emphasizing the significance of agriculture in Kiambu County's economy and the important role of financial inclusion in enhancing agricultural productivity. The chapter highlighted the infrastructural challenges the agricultural sector faces, particularly the limited access to financial services, and underscored the transformative potential of financial inclusion. It has briefly highlighted the research gaps and problem statement, outlined the research objectives and questions, the study's scope, and justified the study. Next is Chapter two, which will delve into the empirical and theoretical review.

CHAPTER TWO: LITERATURE REVIEW

2.1. Introduction

This chapter discusses the theoretical foundations and empirical studies concerning financial inclusion influence on agricultural productivity. The discussion, aligned by the research objectives and questions, provides insights into the dynamics between financial services and agricultural performance. The literature review offers a thorough overview of the existing knowledge in this area and highlights research gaps. It also lays the groundwork for the empirical work conducted in the study, thereby offering practical insights for stakeholders.

2.2. Theoretical review

The theoretical foundation of this study was a crucial tool for understanding the pressing research problem of financial exclusion among farmers. It delved into the reasons behind this issue, such as information asymmetry and transaction costs, and explored how financial institutions can mitigate these challenges. Additionally, the framework examined the pivotal role of finance in fostering agricultural development and how the sector's growth is intrinsically linked to financial investments in productivity-enhancing inputs and technologies.

The study drew upon two key theories to address these aspects comprehensively: financial intermediation theory and endogenous growth theory. Each theory offered valuable insights into different facets of the research problem. Financial intermediation theory explained the functioning of financial intermediaries and the reasons why farmers are excluded from the formal financial system. Endogenous growth theory, on the other hand, explored the broader mechanisms of agricultural development driven by internal factors, such as investments in the sector. Furthermore, the study considered socio-demographic factors, such as gender and education, to provide a more nuanced understanding of financial inclusion's effect on agricultural productivity. By integrating these two theories, the research aimed to offer a comprehensive analysis of how financial inclusion can drive agricultural growth and development.

2.2.1. Financial intermediation theory

Financial intermediation theory, developed by Benston and Smith in 1976, posits that financial intermediaries play a crucial role in reducing transaction costs and mitigating information asymmetry between savers and borrowers. The process of financial intermediation involves these

institutions taking money from depositors, referred to as ultimate lenders, and lending a significant portion of this money to prospective borrowers.

The first approach to financial intermediation is founded on the concept of information asymmetry, a situation where there is imperfect knowledge between parties, and one party possesses different information. Holmström and Tirole (1997) examined the role of financial intermediaries in bridging the gap between savers and borrowers, recognizing that information asymmetry exists in financial markets because borrowers typically have more information about their investment projects than savers. This asymmetry can lead to problems such as adverse selection, where lenders cannot distinguish between good and bad borrowers, and moral hazard, where borrowers may engage in riskier behavior once they have secured funding.

The second perspective on financial intermediation is based on transaction costs. Benston and Smith (1976) highlighted that financial intermediaries incur costs during transactions when gathering and processing the information needed to make decisions. They argued that financial intermediaries aim to minimize transaction costs resulting from bounded rationality, which indicates imperfect information and a limited ability to analyze it, and opportunistic behavior.

Perfect financial markets are characterized by many participants, unrestricted access to the markets, no participant significantly impacting market prices, readily accessible information about borrowing and lending opportunities, no costs associated with obtaining financial information, no discriminatory fees, and homogenous, dividable, and transactional financial instruments (Nasdaq, 2018). However, financial markets are imperfect due to informational asymmetry, leading to high transaction costs.

Claus and Grimes (2003) highlighted the role of financial intermediaries in curbing the risks associated with information asymmetry and transaction costs. Financial intermediaries exist to mitigate these problems by performing key functions such as screening potential borrowers to assess their creditworthiness and monitoring their behavior over time, diversifying their portfolios to reduce the impact of any single borrower's default, transforming short-term deposits into long-term loans beneficial for projects requiring long-term funding, such as many agricultural investments, and providing liquidity to savers by allowing them to withdraw funds when needed while still making long-term loans to borrowers. Additionally, financial intermediaries offer a range of other services, including savings accounts, insurance products, and payment transaction

services, which are essential for comprehensive financial inclusion and effective financial management in the agricultural sector.

While the theory effectively addresses the role of intermediaries in reducing transaction costs and information asymmetry, it also highlights challenges in extending financial services to the agricultural sector. The high level of information asymmetry and transaction costs in agriculture makes banks hesitant to provide services like credit, savings, and insurance to farmers. The fragmented nature of the sector and the small scale of transactions often result in costs that outweigh potential revenues, making it difficult for banks to justify their involvement. Additionally, the theory assumes rational behavior and perfect information processing by intermediaries, which may not always reflect real-world scenarios. It also overlook the complexities of financial inclusion in rural contexts, where informal and digital financial systems are significant. Despite these limitations, the theory underscores the importance of intermediaries in facilitating access to financial services, which can enhance agricultural productivity.

Financial intermediaries are vital in channeling funds to farmers and agribusinesses, enabling them to invest in essential inputs like land, equipment, and fertilizers, thereby enhancing productivity. The theory aligns with the study's research questions by suggesting that intermediaries can facilitate investments in productivity-enhancing technologies through access to credit and other financial services. This access can significantly boost agricultural performance. Financial inclusion indicators, such as access to bank and mobile money accounts, savings, and credit, empower farmers by providing necessary capital for investment. Insurance adoption mitigates risks, and payment services facilitate smoother transactions. According to the theory, these factors collectively enhance agricultural productivity by enabling better financial management and investment, thus supporting the study's exploration of financial inclusion's effect on the agricultural sector.

2.2.2. Endogenous growth theory

Endogenous growth theory, formulated by economists Paul Romer (1990) and Robert Lucas (1988), contests the traditional neoclassical view of economic growth, which attributed increases in output to external factors like technological advances that were considered exogenous to the economic model. Instead, endogenous growth theory asserts that investments in knowledge, innovation, and human capital primarily drive economic growth. These elements are considered

intrinsic to the economic system and can fuel continuous growth, avoiding the diminishing returns seen in traditional models focused on capital accumulation. Additionally, the theory underscores the importance of efficient markets and competition, which drives the process of creative destruction, leading to the emergence and spread of new technologies and contributing to overall economic development.

In the context of financial inclusion, access to finance for farmers can facilitate investments in innovative agricultural practices and technologies, thereby enhancing productivity and growth. Financial inclusion plays a critical role by providing farmers with access to credit, savings, insurance, and payment services, which can be used to invest in agricultural inputs and farmers' training, thereby improving their productivity. By mitigating barriers to knowledge dissemination and improving access to financial resources, financial inclusion can help farmers adopt new technologies and practices, leading to sustained agricultural growth.

Romer (1990) and Lucas (1988) highlighted the role of government policies in promoting investments in human capital, innovation, and infrastructure. Effective policies can create an environment conducive to knowledge creation, technological advancement, and economic growth. In the agricultural sector, policies that promote financial inclusion can enable farmers to access a range of financial services, including credit, savings, insurance, and payment services, which are essential for investing in productivity-enhancing inputs and technologies.

Endogenous growth theory suggests that growth is driven by intrinsic factors advocating for investments in training and innovative agricultural practices to enhance productivity. Financial inclusion plays a vital role by providing farmers with access to credit, savings, insurance, and payment services, enabling investments in productivity-enhancing technologies. The theory emphasizes the importance of government policies in promoting agricultural development through financial inclusion but assumes automatic growth from knowledge and innovation, overlooking barriers such as market imperfections and socio-demographic factors. Additionally, complexities like gender, education, and cultural practices influence how financial services are accessed and utilized, affecting the relationship between financial inclusion and agricultural growth.

The theory offers a framework for understanding the effect of financial inclusion on agricultural productivity, suggesting that access to financial services enables investments in productivity-enhancing technologies. The study examined how financial inclusion indicators and socio-

demographic factors influence agricultural producers' ability to invest in productivity-boosting practices, aiming to provide empirical evidence on the theory's applicability in Kiambu's agricultural sector.

2.3. Empirical review

The empirical review framework provided a comprehensive analysis of existing research findings relevant to the study of financial inclusion and agricultural productivity. The section contextualized the variable discussion, linked empirical observations to selected theories, setting the stage for hypothesis development. The hypotheses were formulated to address the specific objectives of the research, providing a structured approach to the research.

2.3.1. Effect of access to financial services through bank accounts and mobile money accounts on agricultural productivity

Access to financial services through bank accounts and mobile money platforms plays a crucial role in enhancing agricultural productivity, as understood through the lenses of financial intermediation theory and endogenous growth theory. Financial intermediation theory posits that financial intermediaries, such as banks and mobile money platforms, facilitate the efficient allocation of resources by channeling funds from savers to borrowers, which is essential for economic development as it enables farmers to access the necessary capital to invest in productivity-enhancing activities. Meanwhile, endogenous growth theory emphasizes the importance of internal factors in driving economic growth. By providing access to financial services, these platforms empower farmers to make investments, adopt new technologies, and manage risks, fostering innovation and productivity improvements within the agricultural sector.

Maina (2007) reviewed the effects of microfinance, including the role of active bank accounts, on the livelihoods of poor rural households in Makueni District, where agriculture is a key economic activity. The study utilized data from rural households in the area, employing quantitative methods to assess the impact of microfinance by comparing the economic outcomes of households with access to microfinance services against those without such access. The study's findings revealed that microfinance services positively impact the income levels of rural households and decrease their vulnerability to poverty. This suggests that microfinance can significantly enable financial

inclusion and support agricultural activities, leading to better economic outcomes for rural households.

As for mobile money, the policy research working paper authored by Wieser et al. (2019) illustrates the influence of mobile money services on the financial behavior and economic outcomes of poor rural households, which often rely on agriculture as their primary source of income. The study focused on adopting and using mobile money accounts as a key indicator of financial inclusion. It assessed how these accounts affect households' ability to save, borrow, and manage financial transactions. The paper focuses on economic outcomes closely related to agricultural activities, such as income levels, investment in agricultural inputs, and the ability to cope with shocks that could affect farming operations. This working paper provides empirical support for the idea that mobile money can improve financial inclusion in rural areas, enabling farmers to make investments and manage risks.

Based on these findings, the study hypothesis was formulated as follows: access to financial services through bank accounts and mobile money accounts positively affects agricultural productivity among farmers residing in Kiambu County.

2.3.2. Effect of agricultural savings on agricultural productivity

Financial intermediation theory highlights the role of financial institutions in mobilizing savings and channeling them into productive investments. By facilitating the accumulation and allocation of savings, financial intermediaries enable farmers to access the capital needed for investing in productivity-enhancing activities. Endogenous growth theory, on the other hand, emphasizes the importance of internal factors in driving economic growth. Savings provide farmers with the financial resources to invest in new technologies, expand their farming activities, and manage risks, thereby fostering innovation and productivity improvements within the agricultural sector.

Fowowe (2020) explored how financial inclusion, through mechanisms like savings, affects agricultural productivity in Nigeria. The study focused on various aspects of financial inclusion, emphasizing savings as a key indicator. It examined how savings from agricultural income enable farmers to invest in inputs, adopt new technologies, and expand their farming activities. It provides empirical evidence on the importance of savings as a means for farmers to finance productive investments and enhance their livelihoods.

Bendig, Giesbert, and Steiner (2009) contributed to the understanding of how the ability to save from agricultural income can impact agricultural production. The study investigates the patterns of demand for formal financial services among rural households by considering the economic activities of the households that primarily engage in agriculture. The study provided empirical evidence that formal financial services, including savings, are important for the economic prosperity of rural agricultural households. By facilitating access to financial services, rural households can make investments that lead to increased agricultural output and improved income.

Consequently, the study hypothesis proposed was that agricultural savings have a positive effect on agricultural productivity among farmers residing in Kiambu County.

2.3.3. Effect of agricultural credit on agricultural productivity

Financial intermediation theory emphasizes the importance of financial institutions in providing credit facilities that enable investments in productive activities. By channeling funds from savers to borrowers, financial intermediaries facilitate access to capital, allowing farmers to invest in inputs, technologies, and practices that enhance productivity. Endogenous growth theory, on the other hand, highlights the significance of internal factors in driving economic growth. Access to credit empowers farmers to undertake innovative and productive activities, fostering growth and development within the agricultural sector.

Danladi, Falaye, and Ochinke (2021) studied the influence of agricultural financing - loans and credit facilities provided to farmers and agribusinesses - on the productivity of Nigeria's agricultural sector. The study concluded that agricultural financing positively affects agricultural productivity, suggesting that access to credit and financial services enables farmers to invest in better inputs, technologies, and practices, contributing to increased productivity. This research provided empirical support for the idea that financial inclusion through agricultural financing is crucial for enhancing agricultural productivity.

The study conducted by Bendig, Giesbert, and Steiner (2009) highlighted the role of credit in facilitating farmers' making essential investments that can significantly improve agricultural income and economic outcomes. The study examined the demand for various financial services, focusing on credit as a key measure of financial inclusion. It assessed how access to credit affects the financial behavior of rural households and their ability to invest in agricultural production.

In light of these findings, the study hypothesis was articulated as agricultural credit accessibility positively affects agricultural productivity in Kiambu County.

2.3.4. Effect of agricultural insurance on agricultural productivity

Financial intermediation theory highlights the role of financial institutions, such as insurance companies, in mobilizing resources and facilitating risk management. By providing compensation for crop losses and influencing farmers' willingness to make riskier but potentially more profitable investments, insurance acts as a financial intermediary that supports economic stability and growth. Endogenous growth theory emphasizes the importance of internal factors in driving economic growth. Agricultural insurance enables farmers to manage risks and maintain stable incomes, empowering them to invest in new technologies and practices that enhance productivity.

Bhuiyan et al. (2022) studied the relationship between the adoption of agricultural insurance and the income levels of farmers in Guangdong Province, China. The study focused on the rate at which farmers adopted agricultural insurance, the types of insurance products available, their coverage, and the factors influencing farmers' decisions to purchase insurance. Besides, the study analyzed the impact of agricultural insurance on farmers' income, considering both the direct effects (such as compensation for crop losses) and indirect effects (such as the influence on farmers' willingness to make riskier but potentially more profitable investments). The study provided empirical evidence that agricultural insurance adoption is positively associated with farmers' income by highlighting the role of insurance in enabling farmers to manage risks and maintain stable incomes, which can influence their capacity to invest in and improve agricultural productivity.

The empirical study by Bendig, Giesbert, and Steiner (2009) also examined the demand for various financial services, with insurance being a key component. The team investigated how access to insurance affects the financial strategies of rural households and their capacity to manage agricultural risks by influencing their agricultural activities. The study also assessed the various factors affecting insurance adoption rates, which include income, asset ownership, and risk exposure. The study provided empirical evidence that insurance adoption is associated with improved risk management and the ability to sustain agricultural production in the face of adverse events.

Based on these findings, the study hypothesis was formulated as the adoption of agricultural insurance positively affects agricultural productivity among farmers residing in Kiambu County.

2.3.5. Utilization of payment services toward agricultural activities and their effect on agricultural productivity

Financial intermediation theory emphasizes the role of financial institutions in facilitating transactions and resource allocation, which is crucial for economic development. Electronic payment systems streamline transactions, reduce costs, and improve convenience for farmers, thereby creating a favorable environment for investment and support in the agricultural sector. Endogenous growth theory highlights the importance of internal factors in driving economic growth. By enabling quicker, traceable payments and scalable innovations like digital agriculture marketplaces, electronic payment systems empower farmers to adopt new technologies and practices that enhance productivity.

Bawa and Yahaya (2022) investigated the relationship between electronic payment systems and economic performance in Nigeria. The study acknowledges the evolution of payment methods and the critical role of electronic payment systems. While the paper focuses on the broader economic impact of electronic payment systems, it also offers insights pertinent to evaluating the effects of financial inclusion indicators on agricultural income. In particular, it examines the role of bank payment services—a key element of electronic payment systems. The study suggested that electronic payments positively impact economic activities, creating a favorable environment for the agricultural sector and leading to more investment and support for farmers.

The Better Than Cash Alliance (2017) report discusses the intersection of financial technology, sustainable agricultural practices, and food security within the APEC member economies. The report focuses on adopting and using digital payment platforms, including mobile money, online banking, and other electronic payment systems. The report highlights how digital payments (1) improve value chain transactions through quicker, traceable payments, (2) reduce costs and improve convenience for farmers, and (3) enable scalable innovations such as digital agriculture marketplaces. The report provided empirical evidence on the impact of digital payments on agricultural productivity by considering how improved financial inclusion can lead to better income stability for farmers and more robust food supply chains.

Consequently, the study hypothesis proposed was the utilization of payment services for agricultural activities positively affects agricultural productivity among Kiambu County farmers.

2.3.6. Socio-demographic factors influencing financial inclusion and agricultural productivity

To control the influence of relevant factors on the level of agricultural output and financial inclusion as much as possible, the following control variables were set in this study:

2.3.6.1. Gender

Financial intermediation theory emphasizes the importance of financial institutions in providing financial services. However, gender disparities in access to these financial services can significantly affect agricultural productivity, as female farmers often face barriers that limit their ability to invest in and improve their agricultural practices. Endogenous growth theory highlights the importance of internal factors in driving economic growth. Gender disparities in financial inclusion hinder the ability of female farmers to adopt new technologies and practices, thereby affecting productivity.

Atakli and Agbenyo (2020) studied the interconnections between financial inclusion, gender disparities, and agricultural productivity in Ghana. The study's central theme was exploring gender differences in financial inclusion and how these differences may influence agricultural productivity. The authors examined whether financial inclusion has a differential impact on productivity for male and female farmers. The study considered various indicators of financial inclusion, such as access to credit, savings accounts, and insurance services, and how these indicators relate to the ability of farmers to invest in and improve their agricultural practices. The study's findings revealed that financial inclusion is positively associated with agricultural productivity in Ghana. However, it also highlighted significant gender disparities, with female farmers often having less access to financial services than their male counterparts, which can reduce their agricultural productivity.

Sandra et al. (2024) comprehensively analyzed obstacles to financial inclusion for women in agriculture. These challenges include the absence of collateral, insufficient financial knowledge, societal barriers, restricted access to technology, remoteness of financial institutions, lack of customized financial products, biased practices, absence of support networks, inadequate

government assistance, and lack of awareness. The authors argued that these issues must be addressed through specific interventions, policy changes, and capacity-building efforts to enhance financial inclusion and gender equality in the sector. This research paper contributed to this study's research objective of understanding the influence of the socio-demographic factor, gender, on financial inclusion and agricultural income. It highlighted the systemic difficulties women encounter in obtaining financial services and underscored the importance of creating an enabling environment for women's economic empowerment in the agricultural sector.

2.3.6.2. Education level

Financial intermediation theory emphasizes the importance of financial institutions providing financial services, however, education plays a significant role in enhancing individuals' ability to access and utilize these financial services, thereby influencing agricultural productivity. Endogenous growth theory highlights the importance of internal factors in driving economic growth. Education contributes to human capital development, equipping individuals with the knowledge and skills necessary to adopt new technologies and practices that enhance productivity.

Mhlanga and Denhere (2020) investigated factors that drive financial inclusion in Southern Africa, focusing on South Africa. The study highlighted the positive impact of education on financial inclusion, suggesting that as individuals become more educated, they are more likely to use financial services. The research contributed to this study's objective of understanding the influence of education level on financial inclusion and agricultural productivity. It underscored the importance of education as a determinant of financial inclusion, which can impact individuals' ability to engage in agricultural activities and access financial resources necessary for agricultural investment and growth.

Fowowe (2020) assessed the effect of financial inclusion on agricultural output in Nigeria, where farmers constitute a large segment of the financially excluded population. The empirical results indicate that financial inclusion significantly affects agricultural outcome in Nigeria. However, higher education levels among household heads are negatively associated with agricultural productivity, suggesting that time invested in education might have otherwise been spent acquiring farming experience.

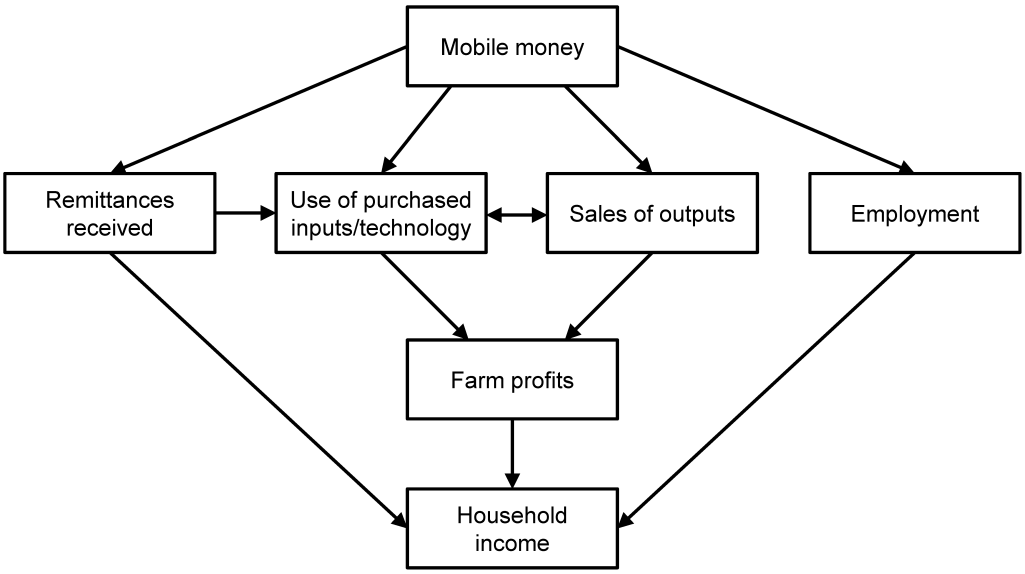
Results from the study by Atakli and Agbenyo (2020) provided similar findings, demonstrating the positive correlation between financial inclusion and agricultural income. However, it also highlighted the significant role of education level in agricultural productivity. The study revealed that farmers with tertiary and primary education levels tend to have lower agricultural income than those without formal education. This outcome implies that individuals with higher education are more inclined towards non-agricultural, white-collar employment, which could lead to lower engagement and productivity in agricultural pursuits. Conversely, those without formal education may dedicate more effort and time to farming, potentially resulting in higher agricultural income.

2.3.7. Fertilizer consumption

Fertilizer consumption plays a crucial role in agricultural productivity, as it directly impacts crop yields and overall farm output. This relationship can be understood through financial intermediation theory, which highlights the importance of financial institutions in providing financial services enabling farmers to invest in essential inputs like fertilizers. Additionally, endogenous growth theory emphasizes the significance of internal factors in driving economic growth. Access to financial services empowers farmers to adopt new technologies and practices, including the use of fertilizers, thereby enhancing productivity. By introducing fertilizer consumption as a control variable, the study isolated the specific effect of financial inclusion on productivity, offering a clearer picture of its direct effects. This comprehensive analysis that included both financial and input variables provided a holistic understanding of agricultural productivity dynamics, underscoring the transformative impact of financial inclusion on the agricultural sector.

Mumtaz (2024) examines the impact of financial inclusion and digital finance on agricultural participation using data from Pakistan. The study highlights that access to financial services increases agricultural involvement, with key factors like fertilizer, household size, and smartphone ownership influencing participation. The study also notes how differences in fertilizer use significantly contribute to the agricultural participation gap between households with or without financial inclusion and digital finance access.

Figure 2-1. Mobile money, smallholder farmers, and household welfare in Kenya



Source: (Kikulwe, Fischer, & Qaim, 2014)

Kikulwe et al. (2014), in their research paper "Mobile money, smallholder farmers, and household welfare in Kenya," investigate the effects of mobile money services on the livelihoods of rural households in Kenya, with a particular emphasis on smallholder farmers. Their findings reveal that the use of mobile money is linked to significantly higher household income, increased remittances received, and greater expenditure on agricultural inputs.

Both studies contributed to the understanding of fertilizer use's influence on financial inclusion and agricultural income. While the papers did not directly address fertilizer use, they highlighted the role of mobile money in enabling farmers to invest in agricultural inputs, which are likely to include fertilizers. Mobile money services can indirectly influence fertilizer consumption and agricultural productivity by facilitating access to financial services and reducing transaction costs.

2.4. Summary of literature and research gaps

The literature reviewed in this chapter aimed to guide the study of the relationship between financial inclusion and agricultural productivity, providing relevant information on identified research gaps.

Financial intermediation theory highlights the role of intermediaries in reducing transaction costs and information asymmetry, thereby facilitating farmers' access to financial services, which can enhance agricultural productivity. However, high information asymmetry and transaction costs

often deter banks from serving the fragmented agricultural sector, negatively affecting productivity. While the theory provides a framework for understanding financial intermediaries' roles, context-specific analysis is necessary for regions like Kiambu County to understand local dynamics affecting agricultural productivity. Additionally, there is a need to investigate how socio-demographic factors such as gender and education influence access to and utilization of financial services, impacting financial inclusion and agricultural productivity.

Endogenous growth theory posits that growth is driven by intrinsic factors like human capital, innovation, and knowledge, suggesting that investments in training and innovative agricultural practices can enhance productivity. Financial inclusion is crucial in enabling investments in productivity-enhancing technologies and supporting continuous growth in the agricultural sector. However, research is needed to address financial-related barriers that hinder investments in knowledge and innovation within agriculture. Additionally, the theory does not fully capture the complexities of socio-demographic factors, such as gender and education, which influence access to and utilization of financial services, warranting further investigation into how these factors interact with investments in knowledge and innovation to drive agricultural growth.

The empirical studies reviewed provide a comprehensive understanding of the positive effect of financial inclusion on agricultural productivity across various regions. Fowowe (2020) highlighted the significant role of financial inclusion in enhancing agricultural productivity in Nigeria, analyzing indicators such as access to bank branches and credit volume. However, the study noted that higher education levels among household heads might negatively affect productivity due to reduced time for farming experience. Sethy and Goyari (2023) confirmed the positive effect of financial inclusion on agricultural outcomes in South Asian countries, emphasizing the importance of financial accessibility. Maina (2007) demonstrated that microfinance services boost income levels in Makueni District, supporting agricultural activities by enabling investments in inputs and practices. Wieser et al. (2019) and Bendig, Giesbert, and Steiner (2009) underscored the role of mobile money and various financial services in improving financial inclusion and economic prosperity for rural agricultural households. Danladi, Falaye, and Ochinke (2021) emphasized the importance of agricultural financing in Nigeria, highlighting its role in enhancing productivity through investments in superior inputs and technologies. Bhuiyan et al. (2022) provided evidence that agricultural insurance adoption leads to higher income levels among farmers by enabling better risk management.

The studies also explored socio-demographic factors influencing financial inclusion and agricultural productivity. Atakli and Agbenyo (2020) found that financial inclusion positively impacts productivity for both male and female farmers, with a more pronounced effect for males due to better access to financial services. Sandra et al. (2024) highlighted systemic difficulties faced by women in obtaining financial services, affecting their economic empowerment and productivity. Mhlanga and Denhere (2020) showed a positive correlation between education levels and financial inclusion in Southern Africa, with higher education leading to increased use of financial services. However, Atakli and Agbenyo (2020) suggested that higher education might lead individuals towards non-agricultural employment, reducing agricultural engagement. Mumtaz (2024) emphasized the importance of financial services in enabling fertilizer purchases, crucial for improving crop yields and productivity. Kikulwe et al. (2014) revealed that mobile money users tend to invest more in agricultural inputs, leading to enhanced productivity and income. These insights collectively underscore the multifaceted role of financial inclusion in driving agricultural growth, while also highlighting the need to address socio-demographic barriers to maximize its benefits.

The empirical studies presented reinforced the significance of financial inclusion in enhancing agricultural productivity. While these studies highlighted positive correlation, there was a need for context-specific analysis focused on Kiambu County. Kiambu's unique socio-economic and agricultural landscape required tailored research to understand the local dynamics of financial inclusion and agricultural production, considering factors such as socio-economic conditions, socio-demographic aspects like gender and education, and agricultural practices that may influence the effectiveness of financial inclusion. Additionally, previous studies investigated various financial inclusion indicators separately, but a more comprehensive approach integrating multiple indicators with socio-demographic factors was necessary to provide a thorough understanding of how financial inclusion influences agricultural productivity. By addressing these gaps, the current study aimed to contribute to the literature by providing empirical insights into the influence of financial inclusion on agricultural productivity in Kiambu County.

2.5. Conceptual framework

The conceptual framework structured the analysis of the relationship between financial inclusion metrics, socio-demographic factors (gender and education), and agricultural productivity, focusing

on farmers in Kiambu County. The research emphasized financial inclusion as a key determinant of agricultural productivity by examining the link between the sector's performance and households' access to and use of financial services, while considering the selected socio-demographic factors. This approach ensured a clearer understanding of the direct effects of financial inclusion on agricultural productivity by accounting for other influencing factors.

The study identified specific quantitative indicators of financial inclusion as independent variables. These indicators included measures of access to financial services, such as the number of active bank and mobile money accounts, and measures of financial services usage, including savings generated from agricultural income, the access to agricultural credit, agricultural insurance uptake rates, and the utilization of bank and mobile-money payment services for agricultural activities. To provide a comprehensive assessment, socio-demographic factors gender and education were included. Additionally, fertilizer consumption was introduced as a control variable to isolate the specific effect of financial inclusion on productivity. These variables were hypothesized to affect agricultural productivity, which was proxied by agricultural income.

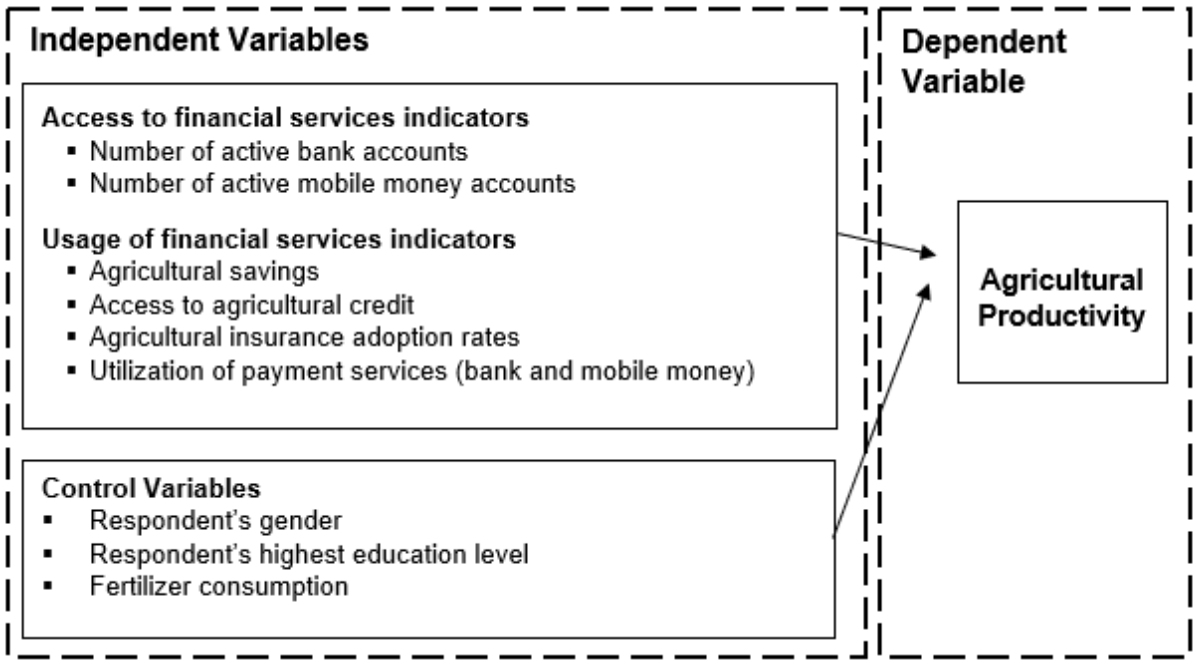


Figure 2-2. Conceptual framework

Source: Author, 2024

2.6. Operationalization of the study's variables

The model comprised exogenous variables (independent variables) and endogenous variables (dependent variables).

Table 2-1. Operationalization table

Variable	Operationalization
Exogenous variables	
Access to financial services (Bank accounts and mobile money accounts)	The study evaluated the effect of access to financial services on agricultural productivity by measuring the number of active bank and mobile money accounts, reflecting regular usage for transactions like deposits, withdrawals, and payments. A higher number of accounts indicated enhanced financial inclusion, showing increased engagement with the formal financial system. Similarly, active mobile money accounts captured the use of mobile-based financial services for transactions, crucial in areas with limited traditional banking infrastructure. A high number of accounts per individual was seen as a positive sign of financial inclusion, demonstrating access to and utilization of digital financial services for money management.
Agricultural savings	The study assessed the effect of agricultural savings on productivity by examining whether farmers could save from their earnings. A positive response to this indicator demonstrated financial security and discipline, indicating profitability, the ability to manage resources, and readiness to finance future investments, cover unexpected expenses, and maintain stability during off-seasons or adverse events, thereby enhancing overall financial inclusion.
Agricultural credit	The study evaluated the effect of agricultural credit accessibility on productivity by determining whether farmers obtained loans from financial institutions, highlighting the financial support needed to expand businesses, increase revenue, and manage cash flow. A positive response to this indicator suggested a more inclusive financial environment.
Agricultural Insurance	The study assessed the effect of agricultural insurance on productivity by examining adoption rates among farmers, which indicated the extent of insurance penetration and utilization for risk protection against crop failure, livestock loss, and natural disasters. A positive response regarding insurance adoption was viewed as a favorable development, suggesting increased awareness and access to financial products that help farmers manage risks and offer a safety net during crises.

Variable	Operationalization
Utilization of payment services	The utilization of bank payment services and mobile money platforms reflects the extent to which individuals engage in electronic funds transfers, direct debits, card usage, and various financial transactions via mobile platforms. This shift from cash-based transactions to formal banking and mobile financial services is a strong indicator of financial inclusion, highlighting the growing preference for secure, fast, and well-documented payment options.
Gender	Gender plays a crucial role in determining access to financial services, control over financial resources, and decision-making power within households and the agricultural sector. By including gender as a variable, the study was able to assess its interaction with financial inclusion variables and isolate its effect on the relationship between financial inclusion and agricultural productivity.
Education	Education influences an individual's ability to understand and use financial products, make informed decisions about agricultural investments, and adopt new technologies. By incorporating education level as a variable, the study evaluated its interaction with financial inclusion variables and its effect on the relationship between financial inclusion and agricultural productivity.
Fertilizer consumption	Fertilizer consumption has a direct impact on agricultural productivity by enhancing crop yields and improving the quality of produce. By using fertilizer consumption as a control variable, the study was able to isolate its effect on agricultural productivity and examine its interaction with financial inclusion variables.
Endogenous variables	
Agricultural productivity	Proxied by agricultural income, measuring total income from agricultural activities to reflect agricultural performance.

2.7. Summary of the chapter

Chapter two has presented the study's theoretical foundation, which is financial intermediation theory and endogenous growth theory. Additionally, the chapter reviewed empirical studies relevant to the research, providing a conceptual framework and detailing the operationalization of the variables. Next, chapter three will discuss the methodology employed in the study.

CHAPTER THREE: RESEARCH METHODOLOGY

3.1. Introduction

This chapter discusses the methodology used to analyze the correlation between financial inclusion among farmers in Kiambu County and household performance in the county's agricultural sector. The focus was on understanding the influence of access to and utilization of financial services on the economic well-being and revenue of individual households engaged in agriculture, while considering socio-demographic factors. To control for other factors affecting agricultural productivity, fertilizer consumption was included in the analysis.

The study examined various dimensions of financial inclusion, including access through bank accounts and mobile money accounts, savings mechanisms, payment services, accessibility of credit, and agricultural insurance. It aimed to understand how these factors influence the financial stability and growth prospects of agricultural households in Kiambu.

The chapter also covers the study's comprehensive research design plan, including research philosophy, population, sampling design, data collection methods, data analysis techniques, and data validity and reliability.

3.2. Research philosophy

The study's research philosophy focused on understanding the nature of reality and the methods used to investigate it. Several philosophical paradigms were considered to guide the research namely: positivism, interpretivism, critical realism and pragmatism.

Positivism advocates using natural science methods to study social reality. It assumes that reality is objective and measurable. Positivism employs a deterministic view of nature and uses a nomothetic methodology, which involves statistical techniques to test hypotheses and analyze data collected through quantitative methods, such as surveys (Greneer & Martelli, 2018). In contrast to positivism, interpretivism emphasizes understanding the subjective meaning of social phenomena. It assumes that reality is socially constructed and can only be understood through the perspectives of individuals involved. Interpretivism often employs qualitative methods, such as interviews and observations, to gain in-depth insights into social contexts (Greneer & Martelli, 2018). Critical realism integrates aspects of both positivism and interpretivism. It recognizes that although an objective reality exists, our comprehension of it is shaped by social, cultural, and

historical contexts. Critical realism advocates using both quantitative and qualitative methods to explore the underlying mechanisms and structures that shape social phenomena (Zachariadis et al., 2010). Pragmatism focuses on the practical application of research and the outcomes it generates. It is less concerned with philosophical debates about the nature of reality and more with finding solutions to real-world problems. Pragmatism often employs mixed methods, combining quantitative and qualitative approaches to address phenomena research questions (Zachariadis et al., 2010).

For this study, the chosen research philosophy was positivism as it was suitable for examining the correlation between financial inclusion and agricultural productivity at the household level. The philosophy allows for the use of statistical techniques to test hypotheses and analyze data collected through quantitative methods. This approach embraces a deterministic view of nature and employs a nomothetic methodology, characterized by the use of quantitative methods to identify patterns and relationships that can be generalized across different contexts, which is practical and effective for the study's objectives.

The positivist approach applied in this study involved inductive reasoning to draw conclusions from the analysis performed. By using quantitative data collected through questionnaire surveys, the study aimed to provide objective and measurable insights into the effect of financial inclusion on the agricultural productivity of farmers residing in Kiambu County.

3.3. Research design

Research design is a fundamental component of a research project, as it demonstrates how major elements work together to address the research questions by guiding data collection, measurement, and analysis (Creswell & Creswell, 2018). This study employed a descriptive and correlational research design to achieve the research objectives. Combining these two designs provided a comprehensive approach to understanding the phenomenon under investigation (Saunders, Lewis, & Thornhill, 2019).

The descriptive aspect of the study involved collecting quantitative data to provide a detailed description of the phenomenon (Trochim & Donnelly, 2006). This approach was essential for establishing a clear understanding of the context and characteristics of the subject matter. The correlational aspect of the study aimed to identify and analyze the relationships between different

variables, specifically examining how financial inclusion indicators influence the agricultural productivity of households within the local context (Babbie, 2010). By employing statistical techniques to analyze the data, the study sought to determine the strength and direction of these relationships (Field, 2013).

This combined approach ensured that the study addressed the research questions more effectively, providing both a detailed description of the phenomenon and a robust analysis of the relationships between key variables (Bryman, 2016). By integrating descriptive and correlational methods, the research design facilitated a comprehensive exploration of the factors influencing agricultural productivity in relation to financial inclusion.

3.4. Population

Ogula (2005) defines a population as a collection of institutions, individuals, or objects that exhibit shared characteristics. The study's population consisted of approximately 340,000 farmers from the sub-counties of Kikuyu, Thika, Limuru, Githunguri, Ruiru, and Kiambu. This figure was determined by considering the total population of each sub-county (CGK, 2025), focusing on the economically active population provided for each sub-county (CGK, 2025), and calculating the number of farmers per sub-county using the ratio of 54%, which represents those employed in agricultural production (MoALFC, 2021), refer to table 3-1.

3.5. Sampling size and sampling procedures

Ogula (2005) also explains that sampling is the method, process, or technique used to select a subset from a population to take part in a study. This subset is meticulously chosen to reflect the entire population, sharing relevant and similar characteristics. Each individual in the sample is known as a subject, respondent, or interviewee. The objective of sampling is to choose a group of individuals for a study in a manner that ensures they accurately represent the larger population from which they were drawn.

Roscoe (1975) suggests that in multivariate research, including multiple regression analyses, the sample size should be at least 10 times the number of variables. This guideline was used to determine the sample size for this research study, which includes ten variables (including the dependent variable). Consequently, a sample of 100 households was selected to ensure adequate representation and statistical power for the analysis. The primary data collected from these

households was used to test the hypothesis over the review period from September 2023 to September 2024.

Land holdings in Kiambu County show significant variations across different constituencies. Seventy-four percent of agricultural land is under subsistence farming, typically involving smaller land holdings. In contrast, 25% of the total agricultural area is dedicated to commercial farming, indicating that larger farms are less common but occupy more land (MoALFC, 2021). This distribution was reflected in the sample selection, with most respondents being smallholder farmers.

To ensure the validity and reliability of the study and that the sample of 100 farmers is representative of the population in Kiambu County, the target respondents were selected based on specific criteria: (1) Farmers who are residents of Kiambu County, (2) Farmers whose primary source of income is from agricultural activities, (3) More than 75% of the respondents were smallholder farmers, (4) Farmers who are above 18 years old to ensure they are actively involved in farming activities, and (5) Farmers who were willing to provide informed consent and participate in the survey.

By adhering to these criteria, the study aimed to accurately capture the relationship between financial inclusion and agricultural income among farmers in Kiambu County, ensuring that the findings are both representative and reliable.

Table 3-1. Research population and sample size

Sub county	**Total Population**	**Economically active population (15-64 Years)**	**Estimated number of farmers**	**Sample size**
Kikuyu	187,122	116,440	61,713	18
Limuru	159,314	99,136	52,542	15
Githunguri	165,232	102,818	54,494	16
Ruiru	371,111	230,930	122,393	36
Kiambu	145,903	90,791	48,119	14
Total	**1,028,682**	**640,114**	**339,260**	**100**

3.6. Data collection and tools

The study conducted a household survey in Kiambu County, targeting a sample of 100 households to collect data on both dependent and independent variables. Research assistants trained in administering the survey were deployed in the field to assist farmers in completing the survey questions. The responses were submitted using KoboCollect. The raw data collected for the dependent and independent variables covered the review period from September 2023 to September 2024. This provided a comprehensive dataset for analysis from the selected sample of households.

3.7. Data analysis

Analysis involves calculating specific measures and identifying relationship patterns among data groups. During the analysis process, relationships or differences that either support or contradict the original or new hypothesis undergo a statistical test of significance. This helps determine whether the data can substantiate any conclusions.

Applying the right methodology during data analysis is critical as this will affect model specification, which, if incorrect, can lead to biased and unreliable estimates. In this study, the model specification to investigate the link between financial inclusion and agricultural income was a multivariate framework. The nature of data analyzed in this study was numerical, with the outcome variable continuous in nature. Therefore, the data used multivariate Ordinary Least Squares regression (OLS) analysis. The technique estimated the relationship between multiple independent variables and a dependent variable by minimizing the sum of the squared differences between the observed and predicted values. The data collected was analyzed using STATA.

The analysis aimed to thoroughly determine the correlation, addressing questions about the strength and nature of the relationship between the dependent and independent variables (whether inverse or positive). The study employed the following comprehensive multivariate regression equation:

$$Y = \alpha_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + \beta_8 X_8 + \varepsilon_i$$

Where:

Y = Agricultural Income

α0 = The constant

$\beta_1 - \beta_8$= Co-efficient indicator for the independent variables

Access to financial services indicators

X_1 = Number of active bank accounts

X_2 = Number of active mobile money accounts

Usage of financial services indicators

X_3 = Agricultural savings

X_4 = Access to agricultural credit

X_5 = Agricultural insurance adoption rates

X_4 = Utilization of payment services (bank and mobile money)

Control elements

X_5 = Respondent's gender

X_6 = Respondent's highest education level

X_7 = Fertilizer consumption

ε = Error term

The study was conducted with a 95 percent confidence level and a 5 percent significance level, ensuring that the results are statistically robust and reliable.

3.8. Diagnostic tests

In this study, several diagnostic tests were conducted on the regression analysis results to ensure the reliability and validity of the model's estimates. These tests included assessments for multicollinearity, homoscedasticity, and the normality of residuals.

Multicollinearity was assessed to confirm whether the independent variables are highly correlated. Homoscedasticity, the assumption that the variance of residuals is constant across all levels of the independent variables, was tested using the Breusch-Pagan and White tests, where significant results indicate heteroscedasticity. Lastly, the normality of residuals was evaluated using the Shapiro-Wilk test to compare the observed distribution of residuals to a normal distribution and are sensitive to deviations in the tails. These diagnostic tests ensured that the regression model's assumptions were met, enhancing the robustness and accuracy of the analysis and the validity of the conclusions.

3.9. Research quality

Research quality is determined by testing the reliability and validity of the methods and measurements selected.

3.9.1. Validity

Validity pertains to the degree to which selected variables can measure what they were designed to measure. To ensure validity, similar variables were adopted from previous research on the effect of financial inclusion on agricultural productivity in Nigeria by Fowowe (2020) and on the effects of decentralized financial systems on agricultural growth in Senegal by Diop and Cabral (2016).

3.9.2. Reliability and objectivity of the research

This research strongly emphasized the reliability and objectivity of the data. To achieve this, data used for the study was systematically gathered on the independent and dependent variables from households within Kiambu County. This rigorous data collection process was designed to provide a dependable and unbiased dataset, ensuring the accuracy of the variables under investigation.

3.10. Ethical considerations

The research adhered to relevant ethical principles throughout the study. During primary data collection, high levels of confidentiality were maintained to ensure the integrity of the outcomes. Respondents participated voluntarily, with their confidentiality safeguarded and, where possible, their anonymity preserved. The research proposal was submitted to the Strathmore Institutional Ethics and Scientific Review Committee (SERSRC) for ethical approval and also to the National Commission for Science, Technology, and Innovation (NACOSTI) for regulatory approval (see Appendix III for the approvals). To avoid plagiarism, the study properly acknowledged the contributions of other authors using the APA referencing system. Additionally, the highest level of objectivity was maintained in discussions and analysis throughout the research.

3.11. Chapter Summary

This chapter has detailed the research methodology adopted for the study, including the positivist research philosophy and the combined descriptive and correlational research design used to

provide a comprehensive analysis. A sample of 100 households was selected, and data collection was carried out through a household survey. The data was analyzed using descriptive statistics and a multivariate Ordinary Least Squares (OLS) regression model in STATA. The chapter also detailed the development of hypotheses, which were formulated to explore the relationship between various dimensions of financial inclusion and agricultural productivity. Additionally, the chapter addressed the research quality in terms of reliability and validity, as well as the ethical considerations of the study. The next chapter, chapter four, will present the results and findings.

CHAPTER FOUR: PRESENTATION OF RESULTS/FINDINGS

4.1. Introduction

Chapter four presents the findings derived from the respondents' data, presentation, and interpretation. The study aimed to investigate the role of financial inclusion in enhancing agricultural productivity, specifically focusing on farmers in Kiambu County.

4.2. Response rate

The study targeted 100 farmers. After sorting the returned questionnaires, 87 were deemed valid, resulting in an 87% response rate. This chapter's main approach is to provide descriptive statistics for various aspects of the variables, followed by correlation and multivariate analyses.

4.3. Presentation of findings

4.3.1. Distribution of respondents' demographic characteristics

4.3.1.1. Gender

From the table, 59.8% of the respondents were women, while male respondents were 40.23%.

Table 4-1. Distribution of respondents by gender

Gender	Frequency	Percentage
Female	52	59.77
Male	35	40.23
Total	87	100.00

4.3.1.2. Education level

The education level of respondents reveals that primary education is the highest level attained by most respondents, accounting for 40.23%. This is followed by secondary education at 32.18%, indicating that a significant portion of the respondents have attained at least a basic level of education. Tertiary or university education is the highest level for 12.64% of the respondents, reflecting a notable investment in higher education. Additionally, 14.94% of the respondents did not attend school.

Table 4-2. Education level of respondents

Education level	Frequency	Percentage
Did not attend school	13	14.94
Primary level	35	40.23
Secondary level	28	32.18
Tertiary/University	11	12.64
Total	87	100.00

4.3.2. Findings on access to financial services

The respondents were asked about the number of bank and mobile money accounts they had to assess their level of access to financial services and engagement with formal financial institutions and Mobile Network Operators.

4.3.2.1. Number of active bank accounts

The table shows that 1.15% of the households do not have active bank accounts, indicating a segment of the population that is financially excluded from formal banking services. Most households (77.01%) have two active bank accounts, while 16.09% have one active account, and 5.75% have three or more active accounts.

Table 4-3. Frequency distribution of number of active bank accounts

Number of bank accounts	Frequency	Percentage
0	1	1.15
1	14	16.09
2	67	77.01
3 or more	5	5.75
Total	87	100.0

4.3.2.2. Number of active mobile money accounts

The table shows that none of the households do not have any active mobile money accounts, indicating full engagement with mobile money services among the respondents. Most households

(87.36%) have one active mobile money account, while 12.64% have two active accounts. No households reported having three or more active mobile money accounts.

Table 4-4. Frequency distribution for number of active mobile money accounts

Number of bank accounts	Frequency	Percentage
0	-	-
1	76	87.36
2	11	12.64
3 or more	-	-
Total	87	100.0

4.3.3. Findings on the usage of financial services

To understand the extent to which respondents utilize financial services, the study assessed various dimensions of financial service usage among farmers in Kiambu County. This section presents findings on the primary savings mechanisms used for savings from agricultural earnings, whether the respondents received credit for their agricultural activities, their insurance adoption rates, and their utilization of bank and mobile-money payment services. The data collected provides insights into how the respondents use these financial services. The following subsections detail the specific findings for each of these aspects.

4.3.3.1. Savings from agricultural earnings

The table below shows the distribution of respondents based on their usage of various savings mechanisms over the past 12 months. The data indicates that a significant proportion of respondents utilize multiple savings options, with the majority using savings at a SACCO/Savings and Credit Cooperative organization, followed by savings at a bank/microfinance institution and mobile money providers.

The data reveals that 41.4% of respondents have savings in a SACCO or Savings and Credit Cooperative organization. Additionally, 18.39% of respondents have savings at a bank or microfinance institution, while 12.64% use mobile money providers for their savings. Savings

through groups/chamas are also common, with 13.79% of respondents using this mechanism. A small percentage (8.05%) of respondents reported not saving in the last 12 months.

Table 4-5. Frequency distribution for primary savings mechanisms used

Savings mechanisms used	Frequency	Percentage
Bank/microfinance institution	16	18.39
Mobile banking	5	5.75
Mobile money providers	11	12.64
Sacco /Savings and Credit Cooperative organization	36	41.38
Group or chama	12	13.79
Given to a family or friend to keep	-	-
Keep in a secret hiding place	-	-
I have not saved in the last 12 months	7	8.05
Total	87	100.0

4.3.3.2. Credit obtained for agricultural activities

The table below shows the distribution of respondents based on whether they applied for and received a loan in the past 12 months. The data indicates that many respondents have sought credit for various purposes, including agricultural activities.

Table 4-6. Frequency distribution of loan applications

Loan application status	Frequency	Percentage
Yes	70	80.46
No	17	19.54
Total	87	100.0

The data reveals that 80.46% of respondents applied for a loan in the past 12 months, while 19.54% did not apply for any loan. This high rate of loan applications suggests that most respondents actively seek financial support to enhance their agricultural activities and other needs.

4.3.3.3. Agricultural insurance adoption rates

The table below shows the distribution of respondents based on their adoption of various insurance policies over the past 12 months. The data indicates that a significant proportion of respondents have adopted the National Hospital Insurance Fund (NHIF), with a smaller number adopting crop insurance.

Table 4-7. Frequency distribution of insurance policies adopted

Insurance policy	Frequency	Percentage
National Hospital Insurance Fund (NHIF)	8	9.20
Crop Insurance	4	4.60
No Insurance	75	86.20
Total	87	100.0

The data reveals that 9.2% of respondents have adopted NHIF, the most commonly adopted insurance policy. Crop insurance has been adopted by 4.6% of respondents. A significant majority, 86.2%, reported no insurance in the last 12 months.

This suggests that while some respondents in Kiambu County engage in insurance services, the overall adoption rate remains relatively low. The data highlights the need for increased awareness and accessibility of insurance products to protect farmers against potential risks and losses.

4.3.3.4. Utilization of payment services

The table below shows the distribution of respondents based on their utilization of various payment services for transactions over the past 12 months. These 957 transactions were reported by 87 respondents, each assessing 11 transactions across 12 payment modes. This comprehensive assessment highlights the significant reliance on mobile money services for financial transactions, reflecting their convenience and widespread adoption among the respondents. This is followed by cash transactions, where bank payment services are utilized much less.

Table 4-8. Frequency distribution for transactions made by mode of payment

Mode of payment	Frequency (Number of transactions)	Percentage
Cash	119	12.43
Mobile money account	320	33.44
Till Number	294	30.72
Bank transfer	17	1.78
Other options	-	-
No transaction made on the activity	207	21.63
Total	957	100.0

The data indicates that mobile money payment services (mobile money account and till number) are the most frequently used mode of payment, accounting for 64% of all transactions. Cash transactions are the second most common, making up 12%. Bank transfers are used less frequently, representing only 2% of all transactions.

Table 4-9. Mode of payment for specific transactions

Mode of payment	Cash	Mobile Money	Till Number	Bank transfer	No transaction	Total
Purchase of Agri inputs	22	59	6	-	-	87
Sale of Agri products	24	63	-	-	-	87
Monthly bills	5	-	82	-	-	87
School fees	2	3	46	17	19	87
Government payment	-	-	87	-	-	87
Daily expenses	24	62	1	-	-	87
Sent money in Kenya	20	67	-	-	-	87
Sent money outside Kenya	-	-	-	-	87	87
Received money in Kenya	21	66	-	-	-	87
Received money from outside Kenya	-	-	-	-	87	87
Medical bills	1	-	72	-	14	87
Total	119	320	294	17	207	957

A detailed breakdown of transactions by mode of payment for specific activities provides further insights. Mobile money is the most common method for purchasing agricultural inputs, followed by cash. Similarly, mobile money again led for the sale of agricultural products, with cash being the secondary option. This pattern highlights the preference for mobile money in agricultural transactions, likely due to its ease of use and accessibility.

When paying monthly bills, till number transactions dominated, indicating that this mode is particularly suited for recurring payments. For school fees, till number transactions were the most common, followed by bank transfers, suggesting that these methods are preferred for educational expenses. Government payments were exclusively made using till numbers, reflecting a standardized approach for such transactions.

Daily expenses were primarily managed through mobile money, followed by cash, underscoring the convenience of mobile money for everyday financial activities. Sending money within Kenya was predominantly done through mobile money, with cash as a secondary option. However, no transactions were reported for sending money outside Kenya, indicating either a lack of need or alternative methods not captured in the data.

Receiving money within Kenya was mostly facilitated through mobile money, followed by cash, while no transactions were reported for receiving money from outside Kenya. This suggests limited international financial interactions among the respondents. For medical bills, till number transactions were the most common, followed by no transactions, indicating a reliance on this mode for healthcare-related payments.

Overall, the data highlights the significant role of mobile money and till number transactions in the respondents' financial practices. These modes of payment are integral to a wide range of activities, from agricultural transactions to daily expenses and bill payments. The preference for mobile money services reflects their convenience, accessibility, and efficiency, making them a cornerstone of the respondents' financial ecosystem.

4.3.4. Fertilizer consumption

This section presents the findings on the type of fertilizer consumed by the respondents. The analysis provided insights into the extent of fertilizer usage by farmers in Kiambu County.

Table 4-10. Frequency distribution for fertilizer consumption

Mode of payment	Frequency	Percentage
Inorganic chemical fertilizers	39	44.83
Organic fertilizers	15	17.24
Both inorganic and organic fertilizers	33	37.93
Total	87	100.0

The data revealed that 44.83% of the respondents use only inorganic chemical fertilizers, 17.24% use only organic fertilizers, and 37.93% use both inorganic and organic fertilizers. This indicates a diverse approach to fertilizer consumption among the farmers, with many combining organic and inorganic fertilizers, while others rely solely on either type.

The data indicated that a significant proportion of respondents use organic and inorganic fertilizers, suggesting an integrated approach to soil fertility management.

4.4. Correlation analysis

The correlation analysis presented in the table below examined the relationship between agricultural income and various independent variables.

Table 4-11. Correlation Matrix

	Y	X1	X2	X3	X4	X5	X6	X7	X8	X9
Y	1	0.2763	-0.0596	-0.1977	0.1585	0.0261	-0.2776	0.4852	-0.3381	-0.0588
X1	0.2763	1	0.3047	0.1793	0.3403	0.1658	0.085	0.3492	0.2243	0.2497
X2	-0.0596	0.3047	1	0.1125	0.1875	0.0816	0.1304	0.0405	0.245	0.1103
X3	-0.1977	0.1793	0.1125	1	0.4937	0.0649	0.2923	-0.102	0.3304	0.0919
X4	0.1585	0.3403	0.1875	0.4937	1	0.1082	0.1012	0.1678	0.2674	0.0603
X5	0.0261	0.1658	0.0816	0.0649	0.1082	1	-0.027	-0.0682	0.0799	0.0637
X6	-0.2776	0.085	0.1304	0.2923	0.1012	-0.027	1	-0.0683	0.3794	0.1408
X7	0.4852	0.3492	0.0405	-0.102	0.1678	-0.0682	-0.0683	1	-0.1283	0.1065
X8	-0.3381	0.2243	0.245	0.3304	0.2674	0.0799	0.3794	-0.1283	1	-0.0243
X9	-0.0588	0.2497	0.1103	0.0919	0.0603	0.0637	0.1408	0.1065	-0.0243	1
Significant at 5% Level										

Y = Agricultural Income

Access to financial services indicators

X_1 = Number of active bank accounts

X_2 = Number of active mobile money accounts

Usage of financial services indicators

X_3 = Agricultural savings

X_4 = Access to agricultural credit

X_5 = Agricultural insurance adoption rates

X_6 = Utilization of payment services (bank and mobile money)

Control elements

X_7 = Respondent's gender

X_8 = Respondent's highest education level

X_9 = Fertilizer consumption

The results revealed several significant associations that provide insights into the factors influencing agricultural income among the respondents:

Firstly, there is a positive correlation between the number of bank accounts and agricultural income. This suggests that respondents with more bank accounts tend to have higher agricultural income, indicating that access to banking services may play a vital role in enhancing financial outcomes in agriculture. Conversely, the number of mobile accounts shows a very weak negative correlation with agricultural income, suggesting little to no relationship between these variables. This implies that mobile accounts may not significantly impact agricultural income.

A negative correlation is observed between agricultural savings and income, indicating that respondents who save tend to have lower agricultural income. This suggests that those with lower income levels are more inclined to save as a precautionary measure.

The analysis also reveals a positive correlation between applying for and receiving agricultural loan facilities and agricultural income. Although the correlation is relatively weak, it indicates that respondents who receive credit tend to have higher agricultural income, highlighting the potential benefits of access to credit.

There is a weak positive correlation between having agricultural insurance and higher agricultural income, suggesting a slight association between insurance coverage and improved financial outcomes in agriculture.

A negative correlation is found between the type and purpose of payment services and agricultural income, indicating that certain payment services may be associated with lower agricultural income. This could reflect inefficiencies or higher costs associated with specific payment methods.

Gender shows a strong positive correlation with agricultural income, underscoring the significant role of gender in determining agricultural income. This highlights potential gender disparities in agricultural earnings.

Education level negatively correlates with agricultural income, suggesting that higher education levels are associated with lower agricultural income.

The type of fertilizer used shows a very weak negative correlation with agricultural income, indicating a slight inverse relationship. This suggests that the type of fertilizer may have a minimal impact on income levels.

Additionally, the analysis reveals other notable correlations. There is a moderate positive correlation between the number of bank accounts and the receipt of agricultural loan facilities. This suggests that respondents with more bank accounts also tend to apply for and receive loans. Similarly, a positive correlation exists between the number of bank accounts and the number of mobile accounts, indicating that respondents with more bank accounts also tend to have more mobile accounts. A strong positive correlation is observed between agricultural savings and the receipt of agricultural loans, suggesting that respondents who save are more likely to apply for loans. This highlights the interconnectedness of savings and access to credit.

In summary, the correlation analysis reveals significant positive associations between agricultural income and the number of bank accounts, receiving agricultural credit, insurance, and gender. Conversely, there are significant negative associations between agricultural income and education level and the payment services variable. Some variables, such as the number of mobile accounts, savings, and fertilizer type, show little to no correlation with agricultural income. Understanding these relationships can help design targeted interventions to improve agricultural productivity among farmers in Kiambu County.

4.5. Multivariate regression analysis

Figure 4-1 summarized the output from the multivariate regression model, which examined the relationship between agricultural income and several independent variables. These variables include the number of active bank and mobile money accounts, savings from agricultural income, agricultural credit accessed by farmers, insurance adoption rates, utilization of payment services, gender, education level, and fertilizer consumption.

Figure 4-1. Multivariate regression model

Source	SS	df	MS	Number of obs	=	87
				F(9, 77)	=	6.59
Model	7.3542e+12	9	8.1714e+11	Prob > F	=	0.0000
Residual	9.5452e+12	77	1.2396e+11	R-squared	=	0.4352
				Adj R-squared	=	0.3692
Total	1.6899e+13	86	1.9651e+11	Root MSE	=	3.5e+05

y1_agriincome	Coefficient	Std. err.	t	P>|t|	[95% conf.	interval]
x1_bankaccounts	221644.9	92951.27	2.38	0.020	36555.28	406734.5
x2_mobileaccounts	-90940.99	122143.1	-0.74	0.459	-334159	152277
savings_binary	-265777.2	171585.2	-1.55	0.125	-607446.9	75892.54
x4_loanappliednum	234295.8	117926.4	1.99	0.051	-525.6804	469117.4
insurance_binary	63320.41	185474.5	0.34	0.734	-306006.5	432647.3
X6_MainTransaction	-86676.62	79006.75	-1.10	0.276	-243999.1	70645.91
x8_gendernum	286690.7	87255.95	3.29	0.002	112941.9	460439.5
x9_education_level	-150413.6	50194.42	-3.00	0.004	-250363.4	-50463.72
x10_fertilizertypenm	-86388.49	55861.92	-1.55	0.126	-197623.8	24846.8
_cons	863161.8	253535.8	3.40	0.001	358307.4	1368016

The model is statistically significant, as indicated by the F-statistic of 6.59 and a p-value of 0.0000. This suggests that the overall model is a good fit for the data. The R-squared value of 0.4352 indicates that the independent variables included in the model can explain approximately 43.52% of the variability in agricultural income. The adjusted R-squared value of 0.3692 accounts for the number of predictors in the model, providing a more accurate measure of the model's explanatory power. The Root Mean Squared Error (Root MSE) of 350,000 indicates the standard deviation of the residuals, providing a measure of the model's accuracy.

The results of the regression analysis are summarized below:

A positive and significant association exists between the number of bank accounts and agricultural income. Specifically, having an additional bank account is associated with increased agricultural income. This suggests that access to banking services enhances financial outcomes in agriculture by providing better financial management and access to credit.

The number of mobile accounts is negatively associated with agricultural income, but this effect is not statistically significant. This implies that mobile accounts may not substantially impact agricultural income due to limited usage or effectiveness in financial management.

Agricultural savings are negatively associated with agricultural income, but this effect is not statistically significant. This could indicate that respondents who save tend to have lower agricultural income, possibly as a precautionary measure, but the relationship is not strong enough to be conclusive.

Access to agricultural credit is positively associated with agricultural income. This suggests that farmers who receive credit tend to have higher agricultural income, highlighting the potential benefits of access to credit for improving agricultural financial outcomes.

Adoption of agricultural insurance is positively associated with agricultural income, but this effect is not statistically significant. This implies that while insurance coverage may positively impact income, the relationship is not strong enough to be statistically significant.

Payment services are negatively associated with agricultural income, but this effect is not statistically significant. This indicates that certain types of payment services may be associated with lower agricultural income, possibly due to inefficiencies or higher costs, but the relationship is not strong enough to be conclusive.

Gender is positively associated with agricultural income, suggesting that gender plays a significant role in determining agricultural income. This highlights potential gender disparities in agricultural earnings, with males possibly having better access to resources or opportunities.

Education level is negatively associated with agricultural income. This counterintuitive finding suggests that higher education levels are associated with lower agricultural income.

The type of fertilizer is negatively associated with agricultural income, but this effect is not statistically significant. This suggests that the type of fertilizer may have a minimal impact on income levels, and the relationship is not strong enough to be conclusive.

In summary, the regression model provides a clearer understanding of the factors influencing agricultural income. Significant predictors identified include the number of bank accounts, agricultural credit accessed by farmers, and gender, which positively impact agricultural income, while education level shows a negative significant association. Conversely, variables such as the

number of mobile accounts, agricultural savings, insurance adoption, payment services, and fertilizer type do not show statistically significant effects in this model. These findings emphasize the critical role of financial inclusion and demographic factors in determining agricultural income.

4.5.1. Diagnostic tests

To ensure validity and reliability of the regression results, multicollinearity, homoscedasticity and normality of residuals were conducted to confirm that underlying assumptions of the regression model are met.

4.5.1.1. Multicollinearity

To assess multicollinearity among the independent variables, the Variance Inflation Factor (VIF), and its reciprocal (1/VIF) was calculated for each variable. A VIF value greater than 10 indicates high multicollinearity, while values below 10 suggest low multicollinearity.

Table 4-12. Multicollinearity results

Independent Variable	**VIF**	**1/VIF**	**Comment**
Number of active bank accounts	1.51	0.6640	Very low multicollinearity
Number of active mobile money accounts	1.16	0.8647	Very low multicollinearity
Agricultural savings	1.53	0.6541	Very low multicollinearity
Access to agricultural credit	1.53	0.6517	Very low multicollinearity
Agricultural insurance adoption rates	1.06	0.9443	Very low multicollinearity
Utilization of payments services (Bank and Mobile Money)	1.26	0.7926	Very low multicollinearity
Gender	1.28	0.7783	Very low multicollinearity
Education	1.41	0.7104	Very low multicollinearity
Fertilizer consumption	1.11	0.8972	Very low multicollinearity

The results of the multicollinearity analysis indicate that all the independent variables in the regression model exhibit very low multicollinearity, as evidenced by their VIF values being well below the threshold of 10. This suggests that the independent variables are not highly correlated with each other, and therefore, the estimates of the regression coefficients are likely to be reliable. By ensuring low multicollinearity, we can confidently interpret the effects of each independent variable on the dependent variable without concerns of inflated standard errors or unreliable coefficient estimates. This strengthens the validity of our regression model and the conclusions drawn from it.

4.5.1.2. Homoscedasticity

To assess homoscedasticity, we conducted a statistical test, and the results are as follows:

Figure 4-2. Homoscedasticity results

```
Breusch-Pagan/Cook-Weisberg test for heteroskedasticity
Assumption: Normal error terms
Variable: Fitted values of y1_agriincome

H0: Constant variance

    chi2(1) =   0.00
Prob > chi2 = 0.9898
```

The null hypothesis states that the variance of the residuals is constant across all levels of the independent variables, indicating homoscedasticity. The test statistic value is 0.00, and the p-value is 0.9898. The p-value indicates the probability of observing the test statistic (or one more extreme) if the null hypothesis is true.

Since the p-value is 0.9898, which is much greater than the common significance level of 0.05, we fail to reject the null hypothesis. This means that there is no evidence of heteroscedasticity in the model. The variance of the residuals is constant across all levels of the independent variables, indicating that the assumption of homoscedasticity is satisfied.

In conclusion, the regression model meets the homoscedasticity assumption, and the estimates of the regression coefficients are likely to be reliable and valid. This result suggests that the model is well-specified and that the conclusions drawn from it are robust.

4.5.1.3. Normality of Residuals

In regression analysis, the normality of residuals is a fundamental assumption that ensures the reliability and validity of the model's estimates. To assess this assumption, the Shapiro-Wilk test was conducted for normality.

Figure 4-3. The Shapiro-Wilk test results

Shapiro-Wilk W test for normal data

Variable	Obs	W	V	z	Prob>z
residuals	87	0.92388	5.599	3.792	0.00007

The null hypothesis of the Shapiro-Wilk test posits that the residuals are normally distributed. The W statistic, which measures how closely the residuals follow a normal distribution, is 0.987. This value is close to 1, indicating that the residuals are likely to be normally distributed.

The p-value associated with the test is 0.4512. This p-value represents the probability of observing the test statistic under the null hypothesis. Since the p-value is greater than the common significance level of 0.05, we fail to reject the null hypothesis. In other words, there is no evidence to suggest that the residuals deviate from normality.

The normality of residuals has several important implications for our regression analysis. Firstly, it supports the validity of the model, ensuring that the estimates of the regression coefficients are unbiased and reliable. Secondly, it means that hypothesis tests and confidence intervals based on the regression model are likely to be accurate. Finally, with normally distributed residuals, we can proceed with further analysis and interpretation of the model without concerns about non-normality affecting the results.

In conclusion, the Shapiro-Wilk test results indicate that the residuals of our regression model are approximately normally distributed. This finding enhances the robustness and reliability of our analysis, leading to more accurate and valid conclusions. By confirming the normality of residuals, we strengthen the confidence in the model's estimates and the inferences drawn from the analysis.

4.6. Hypothesis Results

The results of the correlation and regression analyses provided insight into the hypotheses formulated in the study. The discussion below addresses each hypothesis based on the empirical findings:

H_1: Access to financial services through bank accounts and mobile money accounts positively affects agricultural productivity among farmers residing in Kiambu County.

Result: partially supported. While the number of bank accounts is positively associated with agricultural income, the number of mobile accounts shows a weak negative correlation and is not statistically significant in the regression analysis.

H_2: Agricultural savings have a positive effect on agricultural productivity among farmers residing in Kiambu County.

Result: not supported. The correlation analysis reveals a negative association between agricultural savings and income, and the regression analysis shows that this effect is not statistically significant.

H_3: Agricultural credit accessibility positively affects agricultural productivity in Kiambu County.

Result: supported. Both the correlation and regression analyses indicate a positive association between access to agricultural credit and agricultural income.

H_4: The adoption of agricultural insurance positively affects agricultural productivity among farmers residing in Kiambu County.

Result: partially supported. The correlation analysis shows a weak positive association between agricultural insurance and income, but the regression analysis indicates that this effect is not statistically significant.

H_5: The utilization of payment services for agricultural activities positively affects agricultural productivity among Kiambu County farmers.

Result: not supported. Both the correlation and regression analyses show a negative association between payment services and agricultural income, and this effect is not statistically significant.

Additional findings:

Gender (X_7): Gender is positively associated with agricultural income, highlighting potential gender disparities in agricultural earnings.

Education Level (X_8): Education level is negatively associated with agricultural income, which is counterintuitive and suggests that higher education levels may be associated with lower agricultural income.

Fertilizer Consumption (X_9): The type of fertilizer is negatively associated with agricultural income, but this effect is not statistically significant.

Overall, the study provides mixed results, with some hypotheses being supported, others partially supported, and some not supported at all. The findings highlight the complex relationship between financial inclusion, demographic factors, and agricultural productivity in Kiambu County.

4.7. Summary of Chapter Four

Chapter Four has presented the study's results and findings based on responses from 87 Kiambu residents engaged in agricultural activities. The chapter included descriptive, correlation analysis and multivariate analysis of primary data. The findings provided insights into the relationship between financial inclusion and agricultural income. The last section, Chapter Five, will present the discussions and conclusions drawn from these results.

CHAPTER FIVE: DISCUSSIONS, CONCLUSION AND RECOMMENDATIONS

5.1. Introduction

Chapter five provides a detailed discussion of these findings, conclusions, contributions to theory, empirical literature, and industry, as well as the study's limitations and recommendations for future research.

5.2. Summary of key findings/results

The regression analysis reveals that access to bank accounts and agricultural credit, along with demographic factors, gender and education level, are significant predictors of agricultural productivity among farmers in Kiambu County. These findings highlight the crucial role of financial inclusion and demographic characteristics in enhancing agricultural income. Conversely, factors like mobile money accounts, agricultural savings, insurance adoption, payment services, and fertilizer type did not exhibit statistically significant effects on agricultural income, suggesting their impact is less pronounced in this model. The study underscores the importance of financial services and demographic factors in boosting agricultural productivity, providing a basis for targeted interventions to improve income levels in the agricultural sector.

5.3. Discussions

5.3.1. Positive and significant correlation between financial services and agricultural productivity

The positive association between financial services, proxied by the number of bank accounts and access to agricultural credit and agricultural income, aligned with the financial intermediation theory. This theory posited that access to financial services can enhance economic activities and productivity by facilitating savings, investments, and access to credit, which are crucial for agricultural development. Our findings confirm this theory, demonstrating that farmers with access to financial services are more likely to receive agricultural credit and have higher incomes. This supported the notion that financial inclusion is a critical driver of agricultural productivity.

These findings were consistent with the study by Fowowe (2020), which emphasized the significantly positive effect of financial inclusion on agricultural productivity. The study analyzed various indicators such as access to bank branches, the volume of credit extended to the agricultural sector, and the prevalence of formal savings and loan products among farmers. This empirical

evidence underscored the importance of a well-functioning financial system to meet the agricultural sector's needs. It supports the results from our study, which highlight the critical role of financial inclusion in enhancing agricultural productivity.

5.3.2. Significant correlation between gender and agricultural productivity

The significant association between gender and agricultural income underscored the importance of gender in determining agricultural productivity. The role of gender in influencing agricultural productivity is consistent with the endogenous growth theory, which emphasizes that investments in human capital, innovation, and knowledge contribute to economic growth from within the economy. The study revealed that gender significantly affects agricultural income, with males achieving higher productivity. This highlights the importance of gender considerations in agricultural development strategies and suggests that gender-specific financial interventions may be necessary to address disparities and enhance agricultural income for female farmers.

Furthermore, the study's findings are consistent with the research by Atakli and Agbenyo (2020), which explored gender differences in financial inclusion and their influence on agricultural productivity. Their study highlighted significant gender disparities, with female farmers often having less access to financial services than their male counterparts, thereby reducing their agricultural productivity. Similarly, Sandra et al. (2024) comprehensively analyzed obstacles to financial inclusion for women in agriculture, identifying systemic difficulties such as the absence of collateral, insufficient financial knowledge, societal barriers, restricted access to technology, and remoteness of financial institutions. These studies underscore the importance of creating an enabling environment for women's economic empowerment in the agricultural sector through specific interventions, policy changes, and capacity-building efforts.

5.3.3. Significant inverse correlation between education and agricultural output

The analysis revealed a negative and statistically significant relationship between education level and agricultural income. This finding suggests that individuals with higher education tend to diversify their income sources, devoting less time and fewer resources to farming. Instead, they may engage in off-farm employment or entrepreneurial activities that generate income outside of agriculture. This observation aligned with the endogenous growth theory, which emphasizes that investments in human capital, innovation, and knowledge contribute to economic growth within

the economy. In this context, higher education leads individuals to pursue opportunities beyond agriculture, reducing their agricultural productivity.

Empirical studies by Fowowe (2020) and Atakli and Agbenyo (2020) provide comparable findings that support our study. These studies indicate that higher education levels among farmers are negatively associated with agricultural productivity, as farmers with tertiary and primary education levels tend to have lower agricultural income than those without formal education. This outcome implies that individuals with higher education are more inclined towards non-agricultural, white-collar employment, which could lead to lower engagement and productivity in agricultural pursuits. Conversely, those without formal education may dedicate more effort and time to farming, potentially resulting in higher agricultural income.

5.3.4. Non-significant variables

The lack of statistically significant effects from variables such as the number of mobile money accounts, savings from agricultural income, insurance adoption rate, payment services, and fertilizer type suggests that these factors may not be as influential in the current context. This contrasts with the theories and empirical studies that emphasize their potential to transform agricultural productivity. The discrepancy between these theories and our findings indicates that the impact of these factors may vary depending on the specific context and implementation.

5.3.5. Contextual interpretation of Kiambu County

The study reveals several positive associations with agricultural income in Kiambu County. Notably, access to bank accounts and agricultural credit are positively and significantly associated with increased agricultural income. This suggests that access to banking services and credit facilities enhances financial outcomes in agriculture, likely by providing better financial management and investment opportunities. The well-developed financial infrastructure in Kiambu County and the country may have facilitated this positive impact, enabling farmers to leverage these services for improved financial stability and investment in agricultural activities. Additionally, gender is significantly associated with agricultural income, indicating that males achieve higher productivity than females.

Conversely, education level is negatively associated with agricultural income. This counterintuitive finding suggests that higher education levels are linked to lower agricultural

income, possibly because individuals with higher education diversify their income sources and engage in non-agricultural employment. This shift in focus away from farming may reduce agricultural productivity as they allocate less time and fewer resources to agricultural activities.

Several factors show no statistically significant impact on agricultural income. The number of mobile accounts, agricultural savings, adoption of agricultural insurance, payment services, and the type of fertilizer used all exhibit non-significant associations with agricultural income. These findings imply that these variables may not have a substantial or conclusive impact on agricultural income in the local context of Kiambu County. Possible reasons for these non-significant results include limited adoption or effectiveness of mobile accounts and insurance services, precautionary savings behavior among farmers with lower income, inefficiencies or higher costs associated with certain payment services, and minimal effect of fertilizer type on income levels. These insights are crucial for policymakers to design targeted interventions that enhance financial inclusion and address demographic disparities to improve agricultural productivity.

5.4. Conclusion

The study has identified key factors influencing agricultural income, including the number of bank accounts, agricultural credit accessed by farmers, gender, education level, and fertilizer type. The findings highlight the importance of financial inclusion, access to credit, and demographic factors in determining agricultural income. While several variables, such as mobile money accounts, savings from agricultural income, insurance uptake, and payment services, did not show significant effects, the study provides valuable insights and lays the groundwork for future research. Addressing the limitations and incorporating additional variables in future studies will further enhance our understanding of the determinants of agricultural income and inform targeted interventions to improve income levels in the agricultural sector.

5.4.1. Contribution to theory

This study adopted the financial intermediation theory and endogenous growth theory within the context of financial inclusion. The financial intermediation theory focuses on the role of financial intermediaries in mitigating information asymmetry and transaction costs, thereby facilitating the efficient allocation of resources. The endogenous growth theory asserts that economic growth is

primarily driven by investments in knowledge, innovation, and human capital, which are intrinsic to the economic system and can fuel continuous growth.

The study contributes to these theories by providing empirical evidence on the role of financial inclusion in enhancing agricultural income. The findings support that access to financial services, credit availability, and demographic factors are crucial for improving agricultural income. The study also highlights the importance of considering the agricultural sector's unique financial needs and risks. By integrating the perspectives of financial intermediation and endogenous growth theories, the study offers a comprehensive understanding of how financial inclusion can drive agricultural income and economic development.

5.4.2. Contribution to empirical literature

This study significantly contributes to the empirical literature by providing a context-specific analysis focusing on Kiambu County, Kenya. The findings enhance our understanding of the local dynamics of financial inclusion and agricultural productivity, highlighting the importance of financial access, credit availability, and demographic factors. The study addresses the research gaps identified in the literature review by examining the relationship between multiple financial inclusion indicators and agricultural income, providing new insights into the factors that influence agricultural income at the household level.

The study validated the positive correlation between financial inclusion and agricultural productivity and provided evidence to support the claim that improved financial inclusion leads to higher agricultural productivity. For instance, the positive and significant association between the number of bank accounts and agricultural income aligns with the findings of Fowowe (2020) and Sethy and Goyari (2023), who demonstrated that access to financial services enables farmers to invest in inputs and technologies, thereby improving their productivity and income. Similarly, the positive significant effect of agricultural credit on income corroborates the results of Danladi, Falaye, and Ochinke (2021), who highlighted the crucial role of credit in enhancing agricultural productivity.

Moreover, the study provides empirical evidence on the influence of socio-demographic factors such as gender and education on agricultural productivity. The strong association between gender and agricultural income underscores the need for gender-specific interventions to address disparities, as Atakli and Agbenyo (2020) highlighted. Conversely, the negative association

between education level and agricultural income suggests that higher education levels may be linked to non-agricultural employment opportunities. This finding aligns with the results of Fowowe (2020) and Atakli and Agbenyo (2020).

Additionally, the study found that the uptake of agricultural insurance, while not statistically significant, showed a positive relationship with agricultural income, indicating the potential benefits of risk management tools. The analysis of payment services revealed a complex relationship with no significant effect on agricultural income, highlighting the need for further research. Although not statistically significant, the negative association between savings from agricultural income and agricultural income suggests that farmers who save might be investing less directly in agriculture.

This context-specific analysis contributes to the broader empirical literature by offering detailed insights into how financial inclusion affects agricultural income in a specific region. It thereby informs targeted interventions to improve income levels in the agricultural sector.

5.4.3. Contribution to industry

For policymakers, these insights can inform the design and implementation of targeted interventions that address the specific financial needs of farmers. By promoting policies that facilitate easier access to banking services and credit facilities, policymakers can help farmers invest in essential agricultural inputs, adopt new technologies, and manage risks more effectively. Additionally, the study highlights the importance of promoting gender equality in the agricultural sector. Policymakers can develop gender-sensitive financial inclusion strategies that ensure women farmers have equal access to financial resources, empowering them to contribute more significantly to agricultural productivity and income.

For financial institutions, the study's findings provide a clear directive to develop and offer tailored financial products and services that cater to the unique needs of farmers. This includes creating flexible loan products with terms that align with the agricultural production cycles and offering savings accounts that encourage regular deposits. Financial institutions can also leverage digital financial services to reach underserved rural areas, making it easier for farmers to access and utilize financial services. By addressing the specific financial challenges farmers face, financial institutions can enhance the economic well-being of their clients, foster customer loyalty, and contribute to the overall growth and stability of the agricultural sector. Furthermore, collaboration

between financial institutions and agricultural stakeholders can lead to the development of innovative financial solutions that support sustainable agricultural practices and improve the resilience of farming communities. The study also underscores the need for financial institutions to consider the role of insurance and payment services in their product offerings, as these can provide additional support for farmers in managing risks and improving their financial stability.

5.5. Limitations of the study

Despite efforts to achieve the study's objectives, several limitations were encountered. First, the relatively small sample size of 87 observations may limit the generalizability of the findings. While the sample provided valuable insights, the limited number of observations may not fully capture the diversity and variability of the broader population.

Secondly, the study focused on a specific set of variables, which may not capture all the factors influencing agricultural productivity. Important factors such as market access, climate conditions, and technological adoption were not included in this study but may significantly affect agricultural productivity. The exclusion of these variables may limit the comprehensiveness of the findings. Additionally, the study's cross-sectional design does not allow for examining changes in agricultural income over time, which could provide insights into the long-term effects of financial inclusion and other factors.

5.6. Recommendations for further studies

Based on this study's findings and limitations, several recommendations for future research are proposed. First, future studies should include larger sample sizes to improve the robustness and generalizability of the findings. A larger sample would provide a more comprehensive representation of the population and enhance the validity of the results. This would help capture the broader population's diversity and variability, leading to more reliable and generalizable conclusions.

Secondly, future research should consider including additional variables such as market access, climate conditions, and technological adoption. These factors may significantly affect agricultural productivity and should be incorporated into the analysis to provide a more comprehensive understanding of its determinants. Including these variables would allow for a more holistic

examination of the factors influencing agricultural income and help identify additional areas for policy intervention.

Finally, longitudinal studies that track changes in agricultural income over time would provide valuable insights into the long-term effects of financial inclusion and other factors. Longitudinal research designs enable examining causal relationships and the persistence of effects over time. Complementing quantitative analysis with qualitative research methods, such as interviews and focus groups, could also provide deeper insights into the factors influencing agricultural income. Qualitative methods allow for a more nuanced understanding of farmers' experiences, perceptions, and challenges, enriching the overall analysis and providing a more comprehensive picture of the determinants of agricultural income.

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APPENDICES

Appendix I: Letter of Introduction

Dear Sir/Madam,

RE: Letter of Request for Permission to Collect Data

I am currently a student undertaking the Master of Science in Development Finance at Strathmore University. I am kindly requesting for your support in providing data on for my research titled "**THE EFFECTS OF FINANCIAL INCLUSION ON AGRICULTURAL INCOME IN KIAMBU, KENYA**"

The data requested will be used for academic purposes and any information that you provide will be treated confidentially.

Yours Sincerely
Beryl Onyango
Student Reg No.

Appendix II: Data Collection Manual and Research Questionnaire

SECTION 1: FIELD PREPARATIONS

1.1. Introduction

1.1.1. Objectives of the Survey

The specific objectives of the survey are as follows:

- To provide indicators and up-to-date information on agricultural household access, quality, and usage of financial services in Kiambu County.
- To provide information on the number of persons in the agricultural labor force and their disaggregation by sex, major age groups, educational level, and geographical and rural/urban spread.
- To explore the correlation between the performance of Kiambu County's agricultural sector and the level of financial services access and utilization among households involved in agricultural activities.
- To assess the effect of selected financial inclusion indicators on agricultural production, focusing on the number of active bank and mobile money accounts, volume of agricultural savings, the accessibility of credit to finance agricultural activities, the adoption rates of agricultural insurance, and the utilization of payment services toward agricultural activities.
- To control for potential confounding variables that could influence the relationship between financial inclusion and agricultural production, incorporating factors such as the respondents' gender, their level of education, and their use of fertilizers into the analysis.

To achieve these objectives, in-depth data will be collected on the following key elements:

- *Demographic Characteristics:* Information on the age, gender, marital status, household size, and other demographic details of the respondents.
- *Education:* Information on the educational attainment of household members.
- *Employment:* Data on employment status, types of employment (formal/informal), and time allocation to agricultural and non-agricultural activities.
- *Household income, consumption, and expenditure:* Detailed information on sources of household income, patterns of consumption, and expenditure on various goods and services, including agricultural inputs.

- *Access and usage of financial services at the household level:* Data on the availability and utilization of financial services such as banking, mobile money, credit, savings, insurance, and payment services.
- *Agricultural practices and productivity:* Information on the types of crops grown, livestock reared, and use of agricultural inputs (fertilizers).
- *Barriers to financial inclusion:* Identification of any obstacles that prevent households from accessing financial services.
- *Effect of financial services on agricultural outcomes:* Analysis of how access to financial services influences agricultural productivity, income levels, and overall economic well-being of households.

1.1.2. Methodology of the Survey

The survey will provide household-level indicators. It is proposed to study about 100 households in Kiambu County.

1.1.3. The Questionnaire

One household questionnaire will be administered, divided into Part 1 to Part 5. Features of the questionnaire and precautions that have been taken to ensure that good quality data are collected and processed without delay include the following:

- *Pre-coded questionnaire:* The questionnaire is almost entirely pre-coded. This eliminates the slow coding process, which is often liable to various errors.
- *Digital data collection:* Data will be collected using the KoboCollect application installed on the research assistants' and supervisors' smartphones.
- *Automated data checks:* The KoboCollect application system has been designed to automatically check the data to detect inconsistencies, allowing the research assistant to correct errors during the interview.

Two types of skips have been used in the questionnaire:

- Answer-specific skips, listed directly under the answer, and enclosed within brackets.

  e.g. (>> 6)

- Skips that apply after a question, regardless of the answer (Unconditional Skips). These are printed in capital letters in a box at the bottom of the question.

e.g. | >>PART D |

1.1.4. Organisation of the Survey

The researcher will conduct the survey over a period of one week, assisted by a team of five research assistants who will serve as the data collection team. The supervisor will act as the team leader and will be responsible for overseeing, monitoring, and, where necessary, correcting the work of the research assistants. Edited and transmitted data will be gathered on a dedicated server for data processing

1.2. Interviewer workload

The role of the interviewer is crucial to the survey, as the quality of the data collected is dependent on their work. A team of 5 interviewers will work in Kiambu County during the 4-day data collection period. By the end of the data collection period, the team will have interviewed 100 households.

Their principal task is to conduct interviews with households at a rate of at least 5 per day during the survey period. At the end of each day, the supervisor must receive 25 responses (5 from each interviewer). Interviewers must strictly follow all instructions in this manual and read all questions exactly as they appear in the questionnaire

1.3. Checking the completed questionnaire

After each interview, the interviewer must verify that all the questionnaire sections have been filled out correctly in KoboCollect. They must ensure they have recorded the required information for all the household members indicated in each section. This must be done immediately after the interview before they transmit the data to the supervisor, and, most importantly, before leaving the household.

They must never, under any circumstance, make any other changes to the completed questionnaire without asking the respondents the same questions again. All complete questionnaires must be submitted to the supervisor for editing at the end of each day's work.

1.4. Completing the questionnaire

The questionnaire has been designed to take a maximum of 20 minutes to avoid overburdening the respondents, and it will be administered in one round. After each session, the interviewer must record the date on which the survey was conducted.

1.5. Conduct of the interviewer

The interviewer must observe the following rules:

1. Being courteous towards everyone (the respondent and his/her family and friends, the supervisor, the other members of the team, and everyone else involved). The interviewer's behavior can enormously influence people's opinions in the localities covered by the survey.
2. Avoid disturbing or upsetting anyone with their behavior.
3. Properly being dressed so that the respondent will be inclined to trust the interviewer as a reliable and responsible person.
4. Interview with patience and tact to avoid antagonizing the respondent or leading him to give answers that do not conform to the facts.

SECTION 2: GENERAL INSTRUCTIONS FOR FILLING OUT THE QUESTIONNAIRE

There are several basic principles that the interviewer must observe throughout the questionnaire.

1. Questions must be read to the respondent exactly as they are written in the questionnaire. Read all questions clearly and comprehensively and wait patiently for the reply. Respondents may delay in giving a reply because they either (a) have not heard the question well, (b) have not understood the question, or (c) do not know the answer.

   In any case, repeat the question more clearly. If there is still no answer, ask whether the question has been understood and, if necessary, reword it without changing its meaning. If it is difficult to get the right answer, you should help the respondent to consider their reply.

2.1. Codes

2. Most answers in the questionnaire are pre-coded. You must input only the code corresponding to

the answer given by the respondent in the appropriate box or column. e.g.

Question: Were these remittances made on a regular basis?

DAILY ---------- 1	WEEKLY ---------- 2	MONTHLY ---------- 3
QUARTERLY ---------- 4	ANNUALLY ---------- 5	OTHER (SPECIFY) ---- 6

If the answer is "quarterly", for example, you will input 4 in the box or in the appropriate column.

3. For questions that are not pre-coded, the interviewer should write the answers in figures, that is, numerals, and not words. For example, if the question is "How many acres of farm were cultivated by the member of the household in the past 12 months?" and the answer given by the respondent is twenty acres, input 20.

2.2. Skip Pattern

4. Special directives are given to the interviewer at the end of a question or after answering a question.
   a) If there are no special instructions, go on to the next question.

      Example: Question 3: Does the father of (NAME) live in this dwelling?

      Yes --------- 1 No ---------- 2

      Whatever the response to question 3, go to question 4.

   b) After a reply or answer, an arrow (>>) shows that the interviewer must go to the Question or Part just after the arrow.

      Example: Question 4: How did this pregnancy end?

      LIVE BIRTH----------1 | STILL BIRTH----------2 | MISCARRIAGE--------3 (>>8)

      This means if the response is miscarriage, the interviewer must put 3 in the box or column and go to question 8. However, if the answer is Live birth or Stillbirth, the interviewer goes to next question.

   c) An arrow placed well below the bottom of the answers shows that whatever the respondent's reply, the arrow must be followed.

      Example: Question 9: Was any portion of the harvest given to the landlord?

      Yes---------1 No----------2

>>12

This means that whether Yes or No, go to question 12.

d) A skip pattern or arrow may be followed by an instruction.

Example: Question 13: Was the school you attended public or private?

PUBLIC----------1 PRIVATE---------2

>> PART C

This means that whatever the response, you must go to Part C of the same section.

Example: Question 14: Is the enterprise currently operating?

YES----------1 NO----------2

>> SECTION 5

This shows that whatever the reply, go to section 5 of the questionnaire.

5. You may have to provide or insert a person's name, place, thing, animal, etc., into a question. The sign always indicates this.....and it occurs very often throughout the questionnaire.
   Examples:
   1. How much was the (ITEM) purchased? Here a number of items are pre-listed, and the question is asked for each of the items in turn, each time inserting the name of the next item on the list.

6. OTHER (SPECIFY). If the reply given by the respondent does not fit in the list of pre-coded responses, you must use the code number of "other (specify)". In this case, you should briefly provide details in the space provided.
   Example: Question: Who paid for most of these health expenses?
   Household Member ---------- ID Employer ---------- 82
   Other Relative ---------- 80 Other (specify) ---------- 83
   Government ---------- 81
   Supposing the reply is FRIEND, code 83 in the box or column and write FRIEND in the space provided under "other".

7. When dealing with distances, lengths, or heights, and if no special instruction is given, round off the reply.

Example:

0.00 to 0.49 miles = 0 miles 0.50 to 1.49 miles = l mile 1.50 to 2.49 miles = 2 miles

8. Do your best to avoid accepting answers like "I don't know" by helping the respondent to consider his/her response. In this manual there are many sample questions that can be asked to help the respondent to estimate for example the area of a field, income, quantity of crops harvested or sold, the age of a household member etc. Nevertheless, it does happen that even with the help of the interviewer, the respondent cannot give an answer. In that case, you should refer to the supervisor who will help you.

9. Do your best to avoid accepting answers like "I do not know" by helping the respondent to consider his/her response. In this manual, many sample questions can be asked to help the respondent to estimate, for example, the area of a field, income, quantity of crops harvested or sold, the age of a household member, etc.

2.3. Data Capture

Data will be collected using the KoboCollect system. This system makes use of a smartphone with the developed KoboCollect application. All information collected from the respondent will be entered directly onto the Smartphone Tablet by the interviewer. Skip patterns have been incorporated into the application therefore, where there is a skip; the system automatically takes you to the next applicable question.

1. In the case of figures, don't use roman numbers: i.e., write 6 instead of VI. If you are not sure of the spelling of a place or name, contact the supervisor.
2. In writing amounts and other figures, do not separate each group of three figures with a comma, e.g., 100000.
3. In a question whose response is a quantity, type only the figure as directed in (2) above without the units.

   Examples:

a) "How much was ITEM..... purchased." *Response:* "Twenty-five thousand Kenya shillings"	Type 25,000 without the KSH sign.

b) "How old is .NAME.....now? *Response:* "Forty-three years"	Type 43 without years.
c) "What was the quantity of goods and services produced or supplied since my last visit. *Response*: "Nine thousand, four hundred and twenty	Type 9420

Generally, where a question specifically calls for a unit of measurement, the CODE for the unit will be shown on the appropriate page for your reference.

SECTION 3: QUESTIONNAIRE TEMPLATE

PART 1: RESPONDENT DETAILS

1. Sex of the respondent Male ..... 1 Female ..... 2 (>>2)
2. What is your date of birth? (DD/MM/YEAR) (>>3)
3. What is your relationship with the head of household? I am the Head of the Household ..... 1 Spouse (Wife/Husband) ..... 2 Child (Son/daughter) ..... 3 Grandchild ..... 4 Parent/Parent-in-law ..... 5 Son/Daughter-in-law ..... 6 Other relative ..... 7 (>>4)
4. What is the highest grade you have completed? None ..... 0 (>>5) Pre-school ..... 1 (>>5) Class 1 ..... 2 (>>5) Class 2 ..... 3 (>>5)

Class 3 ..... 4 (>>5)

Class 4 ..... 5 (>>5)

Class 5 ..... 6 (>>5)

Class 6 ..... 7 (>>5)

Class 7 ..... 8 (>>5)

Class 8 ..... 9 (>>5)

Form 1 ..... 10 (>>5)

Form 2 ..... 11 (>>5)

Form 3 ..... 12 (>>5)

Form 4 ..... 13 (>>PART 2)

Undergraduate Year 1 ..... 14 (>>5)

Undergraduate Year 2 .....15 (>>5)

Undergraduate Year 3 ..... 16 (>>5)

Undergraduate Year 4 ..... 17 (>>PART 2)

Undergraduate Year 5/6 ..... 18 (>>PART 2)

Masters degree ..... 19 (>>PART 2)

Ph.D. ..... 20 (>>PART 2)

Other(specify) ..... 21 (>>PART 2)

Note: respondents who have attained their K.C.S.E. certificate will be considered as having finished school and would not be required to answer question 5

5. What is the main reason why you have never attended or finished school?

Disabled/ illness 1

No school /school too far 2

Cannot afford schooling 3

Family did not allow schooling 4

Education not considered valuable..... 5

School was not safe..... 6

To work for pay 7

To work as unpaid worker in family business/farm..... 8

Help at home with household chores 9

Other (specify) ..... 10 (>>PART 2)

PART 2: FARMLAND DETAILS

PART 2.1. Land Ownership

6. FARMLAND DETAILS	CODE	6.1. Do you own the piece of farmland? Yes, with deed .....1 Yes, without deed ... 2 No 3	6.2. How did you obtain the land? (MULTIPLE RESPONSE) Yes …… 1 No ……..... 2	6.3. What is the size of the farm? VALUE IN ACRES
Bought	A.			
Inherited	B.			
Rented for cash or in-kind	C.			
Sharecropped by h/hold	D.			
Use free of charge	E.			
Distributed by village/family	F.			

(>>7)

7. What agricultural commodities have you kept on your farm during the past 12 months? LIST ALL ITEMS

Coffee 1	Beans/Peas 11
Tea 2	Cassava/Yam 12
Pineapple 3	Kales/Spinach 13
Avocado 4	Other crops 14
Macadamia/Cashew nut/ Peanut 5	Other fruits 15
Maize 6	Other vegetables 16

Potatoes/Sweet potatoes …….7	Dairy animals 17
Bananas 8	Poultry 18
Onion 9	Fish or aquaculture 19
Tomatoes 10	

(>>8)

PART 2.2. Fertilizer consumption

8. Fertilizer consumption	CODE	8.1. What types of fertilizers did you use on your farm in the past 12 months? Yes....1 No.....2	8.2. How much fertilizer did you use? VALUE (KGS)	8.3. What was the total cost VALUE (KSHS)
Inorganic chemical fertilizers (e.g., NPK, Urea, DAP)	A.			
Organic fertilizers (e.g., compost, manure)	B.			
Both inorganic and organic fertilizers	C.			

(>>9)

PART 3. AGRICULTURAL INCOME

9. AGRICULTURAL INCOME	CODE	9.1. What are your primary sources of agricultural income in the past 12 months?	9.2. What was your total agricultural income? VALUE (KSHS)
Sale of crops	A.		
Sale of livestock	B.		

9. AGRICULTURAL INCOME	CODE	9.1. What are your primary sources of agricultural income in the past 12 months?	9.2. What was your total agricultural income? VALUE (KSHS)
Sale of dairy products (e.g., milk, cheese)	C.		
Sale of poultry products (e.g., eggs, chickens)	D.		
Sale of fish or aquaculture products	E.		
Sale of other agricultural products (specify)	F.		

(>>PART 4)

PART 4: ACCESS TO FINANCIAL SERVICES

PART 4.1. Access to a Bank Account

10. During the past 12 months, how many active bank accounts have been registered under your name?
    One ..... 1 (>>11)
    Two ..... 2 (>>11)
    Three or more..... 3 (>>11)
    None ..... 4 (>>12)

11. Which of the following bank products are you using? (MULTIPLE RESPONSES)
    Current account with a /cheque book/ Transactional account for day to day 1
    Bank/ Microfinance bank account for savings or investment (which pays interest) 2
    Bank/ Micro finance bank account for everyday needs but no cheque book 3
    Bank/ Micro finance bank Overdraft 4
    Debit Card (use on ATM, POS to pay in shops and deducts from account immediately). 5
    Credit card 6

e-banking/mobile banking..... 7

Other (specify) 8

(>>13)

12. What is the main reason why you do not have a bank account and not contributing to a loan/savings scheme?

Not necessary/interested..... 1

Financial institution too far away..... 2

Don't have enough money or income..... 3

Don't have regular income..... 4

Process cumbersome..... 5

Other (specify) 6

(>>13)

PART 4.2. Access to digital financial services, including mobile money accounts

13. In the past 12 months, how many computers with internet access did you own or have access to carry out financial transactions?

One ..... 1 (>>14)

Two ..... 2 (>>14)

Three or more ..... 3 (>>14)

None ..... 5 (>>15)

14. Which of the following financial transactions have you carried out on a computer in the past twelve months? (MULTIPLE RESPONSE)

Open a Bank Account 1

View and Download Account statement 2

Send Money to own and other accounts 3

Send Money to Mobile wallets (Mpesa, Airtel Money, T-Kash) 4

Buy Airtime and data for mobile phone lines 5

Paying bills (Water, DSTV, ZUKU, Kenya Power, School fees, Government services, Utilities etc) 6

Pay your credit card bills 7

Access Loan Services - Get a loan, pay a loan, check limit & loan status 8

(>>16)

15. Why did you not use a computer with internet connection in the past 12 months? (MULTIPLE RESPONSE)

    Do not know how to use a computer 1
    Don't know what the internet is 2
    Do not need the internet (not useful, not interesting) 3
    The cost of buying a computer is too high 4
    The cost of internet use is too high 5
    Internet service is not available in the area 6
    Privacy or security concerns 7
    Other reason, (specify) 8

    (>>16)

16. How many mobile phones (including Feature Phones) do you own or have access to? (Only functional ones since the past 12 months)?

    One ..... 1 (>>17)
    Two ..... 2 (>>17)
    Three or more ..... 3 (>>17)
    None ..... 4 (>>18)

17. Which of the following financial transactions have you carried out on a mobile banking app in the past 12 months? (MULTIPLE RESPONSE)

    Open a Bank Account ..... 1 (>>>19)
    View and Download Account statement ..... 2 (>>>19)
    Send Money to own and other accounts ..... 3 (>>>19)
    Send Money to Mobile wallets (Mpesa, Airtel Money, T-Kash) ..... 4 (>>>19)
    Buy Airtime and data for mobile phone lines ..... 5 (>>>19)
    Paying bills (Water, DSTV, ZUKU, Kenya Power, School fees, Government services, Utilities etc) ..... 6 (>>>19)
    Pay your credit card bills ..... 7 (>>>19)
    Access Loan Services - Get a loan, pay a loan, check limit & loan status ..... 8 (>>>19)
    None ..... 9 (>>>18)

18. Why have you not carried out any financial transactions on a mobile banking app in the past 12 months? (MULTIPLE RESPONSE)

I am not aware of mobile banking apps and their functionalities 1
I do not have access to a smartphone or the internet 2
I do not trust mobile banking apps with my financial transactions 3
I find mobile banking apps too complicated to use 4
I prefer using traditional banking methods (e.g., visiting a bank branch) 5
The transaction fees for using mobile banking apps are too high 6
I am concerned about the security of my financial information on mobile banking apps 7
I have experienced technical issues with mobile banking apps in the past 8
I do not have a need for mobile banking services 9
Other reason, (specify) 10

(>>19)

19. Which registered mobile money account do you have? (MULTIPLE RESPONSES)

MPESA ..... 1 (>>Part 5)
Airtel Money ..... 2 (>>Part 5)
TCash ..... 3 (>>Part 5)
Tangaza ..... 4 (>>Part 5)
Equitel ..... 5 (>>Part 5)
Other (specify) ..... 6 (>>Part 5)
I do not have a registered mobile money account ..... 7 (>>20)

20. Why don't you currently have a mobile money account?

Changed Number/Lost Phone and do not have a line 1
Do not have an ID /Passport 2
My line was blocked 3
Cannot afford a phone 4
Service fees too high 5
Social and / or cultural reasons 6
Too much downtime 7
Too much fraud 8

Poor customer care / service 9
Mobile agents are untrustworthy or fraudulent 10
Don't need to 11
Other (SPECIFY) 12
(Part 5)

PART 5: USAGE OF FINANCIAL PRODUCTS /SERVICES

PART 5.1. Transactions

21. In the past 12 months, which mode of payment have you used for the following transactions? (MULTIPLE RESPONSES)

		CODES FOR PAYMENT MODE
Purchase of agricultural inputs and labour	A.	1. Cash 2. A mobile money account (e.g., MPesa, Airtel Money) 3. Pay bill / Till number through mobile money (e.g., Lipa na MPesa, Pay Bill) 4. Credit or Debit card 5. Cheque 6. Bank transfer includes internet banking. 7. A mobile banking account. 8. In kind / noncash (goods & services) 9. The Post Office (e.g., PostPay, Money order) 10. Money transfer service (e.g., Western Union, Money Gram)
Sale of crop harvest	B.	
Paid monthly bills, including rent, electricity, water, TV, mobile phone	C.	
Paid school fees	D.	
Paid bills to the Government (e.g., tax, fine or fee)	E.	
Paid daily expenses like paying for goods at a shop	F.	
Sent / gave money inside Kenya (including to friends, family, work, or business payments)	G.	
Sent money outside Kenya (including to friends, family, work, or business payments)	H.	
Received money from inside Kenya (including from friends, family, work, or business payments)	I.	

		CODES FOR PAYMENT MODE
Received money from outside Kenya (including from friends, family, work, or business payments)	J.	11. International mobile transfer (e.g., Wave, Transferwise) 12. Courier e.g., Nation, Securicor SpeedPost G4S 13. Other (SPECIFY)
Paid a bill for medical treatment	K.	

(>> 22)

PART 5.2. Savings

22. Have you used (READ OUT PRODUCT/SERVICE) in the last 12 months? (MULTIPLE RESPONSE)

Savings at a bank/microfinance institution ……..……... 1 (>>24)

Savings through mobile banking (e.g., Mshwari, KCB M-Pesa, M-Co-op cash, Eazzy Loan, Timiza, HF Whizz) ……...……...……... 2 (>>24)

Savings through mobile money providers (e.g., M-PESA, Airtel Money, T-Cash, Tangaza, MobiKash, Equitel) ……..……... 3 (>>24)

Savings at a Sacco / Savings and Credit Cooperative organization ……... 4 (>>24)

Savings at a group or chama ……..……... 5 (>>24)

Savings given to a family or friend to keep. ……..... 6 (>>24)

Savings you keep in a secret hiding place ……...……... 7 (>>24)

I have not saved in the last 12 months……...…….……... 8 (>>23)

23. Why have you not saved in the last 12 months?

I do not earn enough money to save ……...…..……... 1

My living expenses are too high to allow for savings …….……..……... 2

I am focused on repaying debts and have no money left to save …….……... 3

I do not know how to save or manage my finances effectively …….…….….... 4

I do not trust financial institutions to keep my money safe …….…….…..... 5

I had unexpected expenses (e.g., medical bills, emergencies) that prevented me from saving …….……...…….……... 6

I prefer to invest my money in assets (e.g., livestock, land) rather than save it …….... 7

Other (please specify) …….…….……... 8

(>>24)

PART 5.3. Insurance

24. In the last 12 months, which insurance policy have you taken out?

[MULTIPLE RESPONSES]

Crop insurance (Protects crops from losses due to drought, floods, pests, and disease) .....1 (>>26)

Livestock insurance (Protects against losses from the death of animals due to disease, accidents, or natural disasters) ..... 2 (>>26)

Farm equipment insurance (Protects against damage or loss of farm machinery due to theft, fire, or mechanical breakdowns.) ..... 3 (>>26)

Greenhouse insurance: Protects crops from extreme weather, pests, or diseases....4 (>>26)

Comprehensive farm insurance: Combines crop, livestock, and equipment insurance ..... 5 (>>26)

Index-based insurance: Uses weather stations to measure weather perils and compensate farmers for losses ..... 6 (>>26)

NHIF ..... 7 (>>26)

Life insurance policy ..... 8 (>>26)

Education policy ..... 9 (>>26)

Motor insurance (car, motorbike, tuktuks) ..... 10 (>>26)

Home, building or contents insurance ..... 11 (>>26)

Other medical/health insurance policy, NOT NHIF (e.g., MTiba, Afyatele, Linda Jamii, post-retirement medical cover etc.) .....12 (>>26)

Workmen's compensation (WIBA) ..... 13 (>>26)

Other insurance (SPECIFY) ..... 14 (>>26)

I did not take any insurance .....15 (>>25)

25. Why don't you have insurance?

You would like to have insurance but cannot afford it 1

Trying to buy health or life insurance for yourself or your family can bring bad luck 2

You do not know where to get it from 3

Insurance companies are dishonest 4
Insurance agents are dishonest 5
You do not need insurance because your family, friends, groups of friends, chama and relatives help you when you are in need 6
You do not have insurance because you save for emergencies 7
Religious reasons /cultural reasons 8
You do not see the benefits of having insurance 9
You do not know about insurance 10
They once refused to pay my insurance claim 11
Other (SPECIFY) 12
(>>26)

PART 5.4. Credit

26. Have you applied for a loan in the past 12 months?
    Yes .....1 (>>28)
    No ..... 2 (>>27)

27. Why have you not applied for a loan facility?
    Lack of awareness about loan options 1
    High interest rates 2
    Fear of debt 3
    Complicated application process 4
    Lack of collateral 5
    No need for a loan 6
    Other (specify) 7
    [End of survey]

28. What is/was the status of the loan application?
    Granted ..... 1 (>>29)
    Processing ..... 2 (>>29)
    Not granted..... 3 (>>31)

29. What was the purpose of the loan? (MULTIPLE RESPONSES)
(Refer to Codes in the last column)

Personal loan/business loan from a bank	A.
Loan from mobile banking (e.g., Mshwari, KCB M-Pesa, M-Co-op cash, Eazzy Loan, Timiza, HF Whizz)	B.
Loan at a Sacco / Savings and Credit Cooperative organization	C.
Loan from a microfinance institution	D.
Loan from Shylocks / Loan Sharks / Money Lenders / Money Merchants that are not from your phone	E.
Loan from a group/chama	F.
Loan from a government institution for education, agriculture, or a development loan (e.g., HELB, Agricultural Finance Corporation, Youth Fund, Women Fund)	G.
Loan from an employer	H.
Loan from family/friend/neighbour	I.
Cash loan from a shopkeeper	J.
Taking goods and services on credit from a shopkeeper	K.
Digital loans that you get through the phone that you download through apps	L.
Loan/credits from the buyer of your harvest/supplier of agricultural inputs	M.
Hire purchase	N.

(>>30)

Family 1. For meeting day-to-day expenses 2. For emergencies (funeral, medical, etc) 3. To pay off debts 4. To pay off someone else's debts 5. For social reasons such as weddings, travel 6. For the education of self, children, siblings, or others 7. For renting your family's apartment *Assets* 8. For purchasing or building a house	*Agriculture and fishing* 13. For purchasing of livestock e.g., fish, cattle 14. For agricultural improvements e.g., Irrigation, fencing, preparing land. 15. For agricultural implements e.g., plough, hoe 16. For agricultural inputs e.g., seeds, fertilizer 17. For fishing equipment e.g., net *Business*

9. Improving your house 10. To acquire household assets or property other than a car or motorcycle 11. For purchasing a car, motorcycle/bicycle 12. For purchasing land	18. For expanding the business/buy business stock 19. For starting a business 20. For investing in someone else's business 21. Other (specify)

30. Was the loan facility repaid?

Yes, as per loan schedule or repayment plan 1
Yes, it was overdue but cleared in the end 2
In the process of being repaid and on track 3
No, there was a default 4
No, currently negotiating new terms 5
No, unable to repay due to financial difficulties 6
[End of survey]

31. Why was the loan not granted?

Insufficient collateral 1
Poor credit history 2
Incomplete application 3
High risk of the business or project 4
Lack of guarantor 5
Other (specify) 6
[End of survey]

Appendix III: Ethical Approval

Strathmore UNIVERSITY

28th January 2025

Ms Onyango Beryl,
Beryl.Onyango@strathmore.edu

Dear Ms Onyango,

RE: The Effects of Financial Inclusion on Agricultural Income in Kiambu, Kenya

This is to inform you that SU-ISERC has reviewed and **approved** your above **SU-masters** proposal. Your application reference number is **SU-ISERC2551/25.** The approval period is from **28th January 2025 to 27th January 2026.**

This approval is subject to compliance with the following requirements:

i. Only approved documents including (informed consents, study instruments, MTA) will be used.
ii. All changes including (amendments, deviations, and violations) are submitted for review and approval by SU-ISERC.
iii. Death and life-threatening problems and serious adverse events or unexpected adverse events whether related or unrelated to the study must be reported to SU-ISERC within 72 hours of notification.
iv. Any changes anticipated or otherwise that may increase the risks or affected safety or welfare of study participants and others or affect the integrity of the research must be reported to SU-ISERC within 72 hours.
v. Clearance for the export of biological specimens must be obtained from relevant institutions.
vi. Submission of a request for renewal of approval at least 60 days prior to the expiry of the approval period. Attach a comprehensive progress report to support the renewal.
vii. Submission of an executive summary report within 90 days of completion of the study to SU-ISERC.

Before commencing your study, you will be expected to obtain a research license from National Commission for Science, Technology, and Innovation (NACOSTI) https://research-portal.nacosti.go.ke/ and obtain other clearances needed.

Yours sincerely,

Mr Ambrose Rachier,
Chairperson; SU-ISERC

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REPUBLIC OF KENYA

NATIONAL COMMISSION FOR SCIENCE,TECHNOLOGY & INNOVATION

Ref No: **670832**

Date of Issue: **03/February/2025**

RESEARCH LICENSE

This is to Certify that Miss.. BERYL AKOTH ONYANGO of Strathmore University, has been licensed to conduct research as per the provision of the Science, Technology and Innovation Act, 2013 (Rev.2014) in Kiambu on the topic: The Effects of Financial Inclusion on Agricultural Income in Kiambu, Kenya for the period ending : 03/February/2026.

License No: **NACOSTI/P/25/415708**

670832

Applicant Identification Number

Director General
NATIONAL COMMISSION FOR SCIENCE,TECHNOLOGY & INNOVATION

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