

**FINTECH SERVICES, FINANCIAL LITERACY AND FINANCIAL INCLUSION
AMONG RICE FARMERS IN MWEA IRRIGATION SCHEME, KIRINYAGA COUNTY**

BY

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**A DISSERTATION SUBMITTED IN PARTIAL FULFILMENT OF THE
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DECLARATION

I declare that this dissertation is my original work and has not been previously published or submitted elsewhere for award of a degree. I also declare that this contains no material written or published by other people except where due reference is made and author duly acknowledged.

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I do hereby confirm that I have examined the master's dissertation of

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ABSTRACT

Financial inclusion is a key driver of economic development, particularly for rural smallholder farmers who rely on agriculture for their livelihoods. In Mwea, Kirinyaga County, rice farmers face persistent financial exclusion due to limited access to formal credit, savings, and insurance services. Despite the increasing availability of financial technology (FinTech) solutions, such as digital payments, mobile credit, and digital insurance, adoption remains low. Barriers such as high transaction costs, distrust in financial institutions, low financial literacy, and inadequate digital infrastructure hinder farmers' ability to integrate FinTech into their financial activities. This study investigated the role of FinTech services in promoting financial inclusion and examined the moderating effect of financial literacy on FinTech adoption and usage among smallholder rice farmers in Mwea. The study targeted a population of 16,000 rice farmers in Mwea, Kirinyaga County, and employed a descriptive research. Using Krejcie and Morgan's (1970) formula, a sample of 390 farmers were selected through stratified random sampling to ensure a proportional and representative distribution across different farming zones. Data was collected using structured questionnaires, administered through face-to-face interviews to capture both quantitative and qualitative insights. Diagnostic tests assessed residual normality, homoscedasticity, linearity, and multicollinearity, ensuring statistical accuracy. Cronbach's alpha coefficient was used to measure the reliability of the research instrument, while test-retest reliability was used to verify consistency over time. Hierarchical linear regression analysis was used to analyse the data. Pearson correlation showed all four digital financial services positively and significantly correlated with financial inclusion, with digital insurance strongest ($r = 0.768$). Multiple regression indicated the services explained 71.9% of financial inclusion variance; digital payments and credit significantly predicted inclusion, while savings and insurance did not. Adding financial literacy as a moderator did not significantly improve the model, though the interaction between digital payments and financial literacy was marginally significant, suggesting a potential moderating effect needing further investigation.

Keywords: Financial Inclusion, FinTech Services, Financial Literacy, Technology Acceptance Model, Digital Payments, Digital Credit, Smallholder Farmers, Mwea, Kenya, Agricultural Finance.

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ACRONYMS AND ABBREVIATIONS

AFI – Alliance for Financial Inclusion

CBK – Central Bank of Kenya

FAS – Financial Access Survey

FII – Financial Inclusion Index

FSD – Financial Sector Deepening

IMF – International Monetary Fund

KBA – Kenya Bankers Association

KCB – Kenya Commercial Bank

KNBS – Kenya National Bureau of Statistics

MFI – Multidimensional Financial Inclusion

MSEs – Micro and Small Enterprises

SPSS – Statistical Package for the Social Sciences

UNDP – United Nations Development Programme

VIF – Variance Inflation Factor

TERMS AND DEFINITIONS

Financial Inclusion – The ability of individuals and businesses, especially those previously excluded, to access and use quality financial services such as credit, savings, insurance, and digital payments (Suri & Jack, 2016).

FinTech (Financial Technology) – The use of technology to enhance and automate financial services, including mobile banking, blockchain applications, and digital lending platforms (Ndung’u, 2019).

Electronic/Technology-Based Transaction Tools – Digital platforms that facilitate financial transactions, such as mobile money (M-Pesa, Airtel Money), online payment services (PayPal, Pesalink), and e-wallets (Evans & Schmalensee, 2017).

Digital Credit – Instant, collateral-free credit provided through mobile platforms, such as Tala, Branch, and M-Shwari (CBK, 2023).

E-Savings – Digital savings solutions that allow users to deposit and manage funds electronically, often via mobile phones (Mbiti & Weil, 2016).

Digital Insurance – Insurance services offered through digital platforms, enabling users to purchase policies, pay premiums, and file claims online (BFA Global, 2020).

Financial Literacy – The knowledge and skills required to make informed financial decisions, such as budgeting, saving, credit management, and investments (ICT Authority, 2022).

CHAPTER ONE

INTRODUCTION

1.0 Background to the Study

Access to financial services plays a critical role in economic development and poverty reduction worldwide. Financial inclusion enhances access to credit, promotes savings, and strengthens economic resilience, ultimately improving individuals' living standards and contributing to national development (Demirgüç-Kunt et al., 2018). Globalization and advancements in financial technology have expanded financial services to marginalized populations, reducing economic inequalities and increasing participation in economic activities (Ozili, 2023).

Financial inclusion varies across regions due to differences in economic structures, regulatory frameworks, and technological adoption. In the United Kingdom, a highly digitized financial system and a strong regulatory framework have enhanced financial access (Mishra et al., 2024). However, in many African countries, financial inclusion remains a challenge due to inadequate infrastructure, low financial literacy, and socio-economic disparities (Beck et al., 2019). Despite these challenges, Kenya has made notable progress through mobile money innovations such as M-Pesa, which has significantly improved access to financial services for previously unbanked populations (Suri & Jack, 2016). However, affordability, accessibility, and usability issues still hinder financial inclusion, particularly in rural areas where formal banking services are scarce (Parlasca et al., 2022).

Smallholder farmers in rural areas, particularly in developing economies like Kenya, face significant barriers to financial services. Agriculture remains a major economic activity in Kenya, yet many farmers struggle to access mainstream financial systems. This exclusion limits their ability to secure credit, manage savings, mitigate risks, and invest in agricultural productivity,

ultimately restricting economic growth (Jack & Suri, 2014). Although financial technology (FinTech) services have gained prominence in promoting financial inclusion, many rural farmers still lack access due to limited financial literacy, distrust in technology, and weak infrastructure (Rahaman et al., 2022).

Technological advancements such as mobile money, digital payment systems, and digital insurance have provided innovative solutions for expanding financial access. Kenya's M-Pesa has demonstrated the potential of FinTech to address rural financial needs (Ndung'u, 2019). However, many rice farmers in Mwea, Kirinyaga County, have yet to fully embrace these services due to challenges such as limited financial knowledge, inadequate digital infrastructure, and concerns over technology security (Parlasca et al., 2022). Addressing these barriers is crucial to enabling farmers to maximize the benefits of FinTech services and improve their financial well-being.

1.1.1 Fintech Services

Digital payment systems enable users to conduct secure transactions without relying on physical cash, reducing costs and enhancing efficiency. Mobile money services have revolutionized financial transactions by replacing conventional banking methods, particularly in regions with limited access to traditional financial institutions. Platforms such as M-Pesa, PayPal, and Alipay facilitate seamless financial transactions, eliminating geographical constraints and reducing dependency on physical banking infrastructure (Beck *et al.*, 2023). By enabling instant payments, digital payment platforms promote financial inclusion by bringing unbanked populations into the formal financial system. Businesses and individuals use these services to receive payments, pay bills, and transfer funds efficiently, minimizing transaction risks associated with cash-based

economies (Omar et al., 2023). However, challenges such as low financial literacy, lack of trust in digital platforms, and cybersecurity concerns hinder broader adoption (Adebayo et al., 2023).

Digital credit platforms offer quick and flexible access to loans, addressing the financial needs of individuals and businesses without requiring collateral. FinTech-driven microloan services provide alternative funding sources for those excluded from formal credit markets, allowing them to finance small businesses, personal expenses, or emergency needs (Raza et al., 2023). Digital lending platforms like M-Shwari, Tala, and Branch use technology-driven credit scoring models to assess borrowers' eligibility, bypassing the traditional reliance on credit histories. Access to digital credit improves economic opportunities by enabling timely investments in productive activities. However, the effectiveness of these services depends on financial literacy, as users must understand loan terms, interest rates, and repayment obligations to avoid excessive debt (Adjasi et al., 2023). Strengthening financial education and responsible borrowing practices can enhance the benefits of digital credit while mitigating risks associated with over-indebtedness (Mwaniki et al., 2024).

Digital savings platforms provide individuals with secure, convenient, and flexible saving options, eliminating the need for traditional brick-and-mortar banks. Mobile-based savings accounts allow users to store funds electronically, build financial resilience, and plan for future expenses (Mapanje et al., 2023). These platforms support financial inclusion by encouraging saving behaviors among populations that previously lacked access to formal savings mechanisms. Unlike conventional savings accounts that may require minimum balances or physical visits to banks, digital savings solutions offer ease of access and better financial management tools (Kivuva et al., 2024). Many digital savings platforms integrate automated saving features, goal-setting tools, and interest-earning accounts, which help individuals cultivate better financial habits

(Yitayih et al., 2023). Despite these benefits, barriers such as limited awareness, digital illiteracy, and security concerns prevent widespread adoption (Mwangi & Wambua, 2024).

Digital insurance solutions leverage technology to offer affordable and accessible insurance products, addressing the financial vulnerabilities of individuals and businesses. InsurTech firms provide innovative insurance models, such as pay-as-you-go insurance, microinsurance, and weather-indexed insurance, making coverage more adaptable to users' needs (Okeyo, 2023). These platforms use mobile applications and artificial intelligence to streamline policy enrollment, claims processing, and premium payments, reducing administrative burdens and costs (Kapaya et al., 2022). By mitigating financial risks associated with unforeseen events, digital insurance solutions enhance economic stability and resilience. However, many individuals remain hesitant to adopt digital insurance due to lack of awareness, misconceptions about insurance products, and challenges in understanding policy terms (Abdul et al., 2022). Financial literacy programs can play a crucial role in improving the uptake of digital insurance by educating users on risk management and the benefits of coverage (Hossain, 2023).

1.1.2 Financial Inclusion

Sikka (2024) defines financial inclusion as a condition where all individuals, particularly marginalized and low-income populations, gain access to financial resources, instruments, and products that are affordable, sustainable, and meet established standards. Firms drive financial innovation, which plays a crucial role in reducing poverty, fostering economic growth, and promoting social justice (Adjasi et al., 2023). Smallholder farmers, in particular, benefit from financial inclusion by gaining easier access to credit, savings, insurance, and payment systems, all of which enhance productivity and overall well-being (Hossain, 2023). Financial inclusion extends

beyond the mere availability of financial services; it also requires these services to be affordable, accessible, and actively utilized. Omar et al. (2023) identify several key barriers to financial inclusion, including high transaction costs, limited trust in financial institutions, and low financial literacy. These challenges persist in many rural areas where agriculture serves as the primary economic activity (Raza et al., 2023).

FinTech innovations have emerged as effective tools for expanding financial inclusion. Mobile money platforms such as M-Pesa have reduced transaction costs and broadened financial access, making it easier for individuals to conduct financial transactions without traditional banking infrastructure (Kapaya & Mmari, 2022). Digital credit services enable individuals and businesses to access funds quickly, which helps finance essential needs such as purchasing agricultural inputs and adopting modern technologies (Abdul-Rahaman & Abdulai, 2022). Additionally, digital insurance platforms protect users from financial losses caused by unpredictable risks such as climate change and extreme weather conditions (Okeyo, 2023).

Despite these advancements, financial inclusion does not solely depend on FinTech adoption. Users' financial literacy and the effectiveness of the legal and regulatory framework also determine the extent of financial inclusion. Financial literacy equips individuals with the knowledge and skills necessary for managing finances, which in turn improves their ability to use FinTech services effectively (Mapanje et al., 2023). A study conducted in Ghana's Ajumako Enyan-Assin district revealed that while farmers had limited financial literacy, they showed strong willingness to adopt and benefit from digital financial services (Mapanje et al., 2023). Financial exclusion remains a widespread issue in developing economies. Studies in Ghana highlight infrastructure deficiencies and regulatory obstacles as significant challenges to financial inclusion

(Hossain, 2023). Similarly, efforts to expand financial access through mobile banking in Tanzania have encountered low adoption rates, particularly in remote areas (Mutungi, 2023).

Access to finance directly impacts livelihoods and economic resilience by enabling individuals to save, borrow, and obtain insurance against risks and uncertainties. Financial inclusion allows individuals and businesses to tap into financial markets, expand their credit opportunities, and improve their financial stability (Kapaya & Mmari, 2022). As financial technologies continue to evolve, increasing digital literacy and strengthening regulatory frameworks was essential in ensuring sustainable financial inclusion and economic growth.

1.1.3 Fintech Services, Financial Literacy and Financial Inclusion

Financial literacy serves as a key determinant in improving financial access, particularly for rural agricultural communities (Omondi, 2024). Financial inclusion reflects an individual's or group's ability to manage diverse financial resources, including personal funds, budgeting, savings, credit, and investment instruments such as securities or fixed-income assets (Adjasi et al., 2023). Given the critical role of savings, credit, insurance, and investment in enhancing sustainable agricultural production, strengthening financial literacy can significantly benefit smallholder farmers by enabling them to make informed financial decisions (Mapanje et al., 2023).

Empirical studies highlight a positive relationship between financial literacy and access to financial services. A study in rural Kenya revealed that farmers who received financial literacy training were more likely to borrow through mobile payment platforms and use digital savings applications (Omar et al., 2023). Beyond enhancing financial service utilization, financial literacy fosters responsible financial behaviors such as budgeting and long-term planning, thereby reducing financial vulnerability among farmers. Additionally, improved financial knowledge encourages participation in cooperative savings and credit societies, strengthening financial solidarity and

enhancing access to collective funding (Hossain, 2023). Furthermore, financial literacy fosters trust in financial institutions and FinTech services, helping to address skepticism and encouraging wider adoption of financial products (Raza et al., 2023).

Financial literacy also serves as a protective mechanism against financial shocks, such as crop failures or market volatility. Farmers equipped with knowledge of risk management and diversification strategies are better positioned to navigate financial uncertainties and sustain market participation (Okeyo, 2023). Moreover, financial literacy helps curb financial mismanagement and fraudulent credit schemes, which are prevalent in rural areas (Mutungi, 2023). Research suggests that financial literacy serves as a primary enabler of digital financial transformation, particularly in rural areas. When farmers understand how to navigate financial systems, evaluate risks, and utilize digital services, they not only enhance their financial well-being but also contribute to broader economic and social development. Therefore, closing the financial literacy gap is essential in ensuring that FinTech services translate into meaningful financial inclusion for smallholder farmers.

Despite the increasing adoption of FinTech services in promoting financial inclusion, particularly among smallholder farmers, existing literature fails to adequately address the role of financial literacy as an interactive factor in this relationship. While studies have explored the impact of FinTech on financial access (Kapaya & Mmari, 2022) and the importance of financial literacy in financial decision-making (Omar et al., 2023), there remains a limited understanding of how financial literacy moderates or enhances the effectiveness of FinTech services in improving financial inclusion among farmers. Additionally, much of the available research has focused on urban populations or general financial consumers, with limited empirical evidence specific to rural agricultural communities. Given that smallholder farmers often face unique financial challenges,

including seasonal incomes, reliance on informal financial systems, and exposure to agricultural risks, it is crucial to examine how financial literacy influences their ability to adopt and benefit from FinTech solutions such as digital credit, mobile savings, and insurance.

1.1.4 Rice Farmers in Mwea Irrigation Scheme, Kirinyaga County

Mwea Irrigation Scheme, located in Kirinyaga South District, stands as the largest rice-growing zone, covering approximately 700 square kilometers. According to the Kenya National Bureau of Statistics (2019), Kirinyaga County has a population of 610,411, with the majority engaged in agriculture. The Mwea irrigation scheme supports over 30,000 acres of farmland, sustaining the livelihoods of many farmers. However, rice farmers in Mwea continue to struggle with financial exclusion. A survey by Kundy (2025) revealed that formal credit facilities largely fail to serve small-scale farmers due to stringent conditions such as collateral requirements, which many cannot meet. As a result, most farmers rely on unregulated lenders who charge exorbitant interest rates, worsening their financial burdens. This financial exclusion limits their access to modern farming inputs, such as fertilizers and advanced machinery, leading to low crop yields and reduced investment returns (Fan, 2025). A 2019 Kenya National Bureau of Statistics (KNBS) study found that only 40% of farmers in Kirinyaga County have access to formal financial services.

Mwea farmers face the challenge of the high cost of financial services. Despite efforts to make financial products more affordable, factors such as high transaction fees and hidden banking costs discourage farmers from using formal banking structures (Bwire, 2025). Although digital financial platforms offer an alternative, low levels of digital literacy prevent many farmers from utilizing them effectively (Wang, 2025). Many struggle to navigate mobile banking or online payment systems, effectively locking them out of financial technology. This exclusion restricts their ability to save, invest, or secure insurance for their crops, leaving them vulnerable to

economic shocks such as floods and droughts (Taye, 2025). According to KNBS data, financial exclusion creates significant income disparities, with financially included households earning 30% more than those without access to financial services. The combination of low financial literacy, high service costs, and limited digital adoption continues to widen the financial gap among rice farmers in Mwea.

1.2 Statement of the Problem

Financial inclusion plays a crucial role in enhancing economic growth and improving the livelihoods of rural populations, particularly for farmers in Mwea Irrigation Scheme, which is Kenya's largest rice-producing region. Access to financial services such as credit, savings, and insurance enables farmers to invest in modern agricultural technologies, manage risks, and enhance their productivity (Adjasi *et al.*, 2023; Hossain, 2023). Without inclusive financial systems, smallholder farmers struggle to access the necessary resources that could transform their agricultural practices and improve their income stability and food security. Given that rice farming is a key contributor to Kenya's agricultural economy, ensuring financial inclusion for farmers in Mwea is vital for both household well-being and national food sustainability.

Despite the benefits of financial inclusion, many rice farmers in Mwea remain financially excluded. According to Kenya National Bureau of Statistics (KNBS, 2019), only 40% of farmers in Kirinyaga County have access to formal financial services. The majority lack access to affordable credit, savings, and insurance, leaving them reliant on informal lenders who charge exorbitant interest rates (Kundy, 2025). High transaction costs, strict collateral requirements, and geographical barriers further limit their ability to access financial products (Fan, 2025). Additionally, while digital financial platforms such as mobile banking and digital credit could

bridge this gap, many farmers struggle with low digital and financial literacy, making it difficult to navigate fintech services effectively (Bwire, 2025; Wang, 2025). These financial constraints reduce their capacity to adopt modern farming technologies, resulting in low yields, decreased income, and economic vulnerability (Taye, 2025).

Studies from different regions have explored the relationship between financial inclusion, fintech adoption, and financial literacy. Research in Ghana found that low digital awareness and financial literacy hindered the adoption of fintech services among smallholder farmers (Adjasi et al., 2023). A study in Tanzania revealed that despite the expansion of mobile banking services, rural farmers faced challenges in usage due to limited digital literacy (Mutungi, 2023). In Nigeria, fintech adoption remained low due to mistrust in digital transactions and lack of awareness (Yitayih et al., 2023). Research in Bangladesh highlighted the role of financial literacy in enhancing financial inclusion, showing that better-informed farmers utilized fintech services more effectively (Kapaya & Mmari, 2022). Meanwhile, studies in Kenya found that mobile money platforms improved financial access, but rural farmers still faced challenges related to financial literacy and affordability (Omar et al., 2023). While these studies demonstrate the potential impact of fintech and financial literacy on financial inclusion, few have specifically examined Mwea's rice farmers, leaving a gap in understanding how these factors interact in this region.

This study aimed to fill this gap by investigating how financial literacy moderates the relationship between fintech services and financial inclusion among rice farmers in Mwea, Kirinyaga County. By exploring the extent to which financial literacy enhances fintech adoption and usage, the findings will provide valuable insights for policymakers, financial institutions, and development organizations. Understanding this interaction will help in designing targeted

interventions that not only promote fintech solutions but also empower farmers with financial knowledge, ensuring sustainable financial inclusion.

1.3 Objectives of the study

1.3.1 General objective

To investigate the role of fintech services and financial literacy in promoting financial inclusion among rice farmers in Mwea, Kirinyaga County

1.3.2 Specific Objectives

- i. To determine the effect of digital payment platforms on financial inclusion among rice farmers in Mwea, Kirinyaga County
- ii. To determine the effect of digital credit on financial inclusion among rice farmers in Mwea, Kirinyaga County
- iii. To evaluate the effect of digital savings on financial inclusion among rice farmers in Mwea, Kirinyaga County
- iv. To explore the effect of digital insurance platforms on financial inclusion among rice farmers in Mwea, Kirinyaga County
- v. To determine the moderating effect of financial literacy on the relationship between fintech services and financial inclusion among rice farmers in Mwea, Kirinyaga County

1.4 Research Questions

- i. How do digital payment platforms influence financial inclusion among rice farmers in Mwea, Kirinyaga County?
- ii. What is the impact of digital credit services on financial inclusion among rice farmers in Mwea, Kirinyaga County?

- iii. How do digital savings platforms contribute to financial inclusion among rice farmers in Mwea, Kirinyaga County?
- iv. In what ways do digital insurance platforms promote financial inclusion among rice farmers in Mwea, Kirinyaga County?
- v. What role does financial literacy play on the relationship between fintech services and financial inclusion among rice farmers in Mwea, Kirinyaga County?

1.5 Justification of the Study

Mwea, located in Kirinyaga County, is Kenya's largest rice-producing region and plays a significant role in food security and economic stability. Despite the growth of fintech services globally, financial exclusion remains a major challenge among Mwea's rice farmers due to limited access to formal financial products and low financial literacy. These constraints limit their ability to invest in modern farming technologies, manage financial risks, and enhance productivity, leaving them financially vulnerable. Existing literature highlights that fintech services, such as digital payments, credit, savings, and insurance, have the potential to transform smallholder farming economies. However, gaps remain in understanding the key determinants of fintech adoption and financial inclusion among Mwea's rice farmers, particularly the role of financial literacy. While studies in other regions have explored the impact of fintech and financial literacy on financial inclusion, empirical evidence from Mwea remains scarce.

This study sought to fill this gap by examining how financial literacy moderates the relationship between fintech services and financial inclusion among rice farmers in Mwea, Kirinyaga County. By identifying best practices, the study will provide policy recommendations that financial institutions, policymakers, and development stakeholders can implement to enhance financial access, promote fintech adoption, and improve the economic resilience of rural farmers.

1.6 Significance of the Study

This study will provide valuable insights for policymakers at both national and county levels, particularly in designing strategies to enhance financial inclusion among rural farmers. By identifying the barriers that limit fintech adoption and how financial literacy can moderate financial access, policymakers can develop targeted interventions to support farmers in accessing affordable financial services. The findings will also inform the implementation of government-backed rural financial literacy programs aimed at strengthening farmers' economic resilience.

Banks and financial institutions stand to benefit from this research by gaining a deeper understanding of the financial needs and behaviors of smallholder farmers. By addressing factors limiting fintech adoption, financial service providers can develop tailored digital products, such as mobile-based credit, savings, and insurance solutions, that cater specifically to the needs of Mwea's rice farmers. The study will also highlight risk-mitigation strategies that could encourage financial institutions to extend credit and insurance services to rural farmers with minimal default risks.

Rice farmers in Mwea, who face financial exclusion, will benefit from the study's recommendations on how to leverage fintech services for better financial management, risk mitigation, and investment in modern farming technologies. The study will provide insights into how financial literacy enhances farmers' ability to access, understand, and utilize digital financial services. This will contribute to improved agricultural productivity, increased incomes, and enhanced economic stability within the rural farming communities.

Development organizations and NGOs focusing on financial inclusion and rural development will find this study instrumental in designing effective intervention programs. By understanding the role of fintech and financial literacy in bridging the financial access gap, these organizations can implement training programs that equip farmers with digital financial skills. Additionally, the study will help development agencies advocate for policy changes and partnerships with financial service providers to expand rural fintech adoption.

This study will expand the body of knowledge on the intersection between fintech services, financial literacy, and financial inclusion in smallholder farming communities. By focusing on Mwea's rice farmers, it will provide empirical evidence on the role of financial literacy as a moderator in fintech adoption and financial inclusion. This will serve as a reference for future research in Kenya and other developing economies seeking to enhance financial inclusion through fintech solutions.

1.7 Scope of the Study

This study is concerned with; credit and financial technologies, savings and digital payment systems and insurance used by rice farmers in Mwea, Kirinyaga County. The moderating variable is financial literacy which will in turn focus on its impact on the usage of fintech services. The dependent variable is the level of financial liberalization with the sub-component of the accessibility, affordability and utilization of the financial services. The sampling is limited to rice farmers in Mwea Irrigation Scheme because it is recognized as the leading rice farming area in Kenya, to ensure that the research objectives are relevant and practical.

CHAPTER TWO

LITRATURE REVIEW

2.1 Introduction

This chapter discusses the theoretical and methodological underpinnings of the research, specifically regarding financial literacy, FinTech services, financial inclusion, and digital literacy. Hypotheses that are germane to the research are presented, literature concerning the study is reviewed and the study variables are defined. In the concluding part of the chapter, the author defines the areas of research that have not been explored adequately, and, therefore, serves as the foundation for the framework of the study.

2.2 Theoretical Review

2.2.1. Financial Literacy Theory

Huston (2010) formulated the Financial Literacy Theory whereby knowledge, skills, and attitudes play crucial roles while engaging in sound financial practices. This premise suggests that while financial literacy is based on knowledge, it also incorporates the practice of financial concepts. Huston affirmed that when a person is financially literate then he is in a position to make rational decisions, save and even plan his/her future. Other researchers like Lusardi and Mitchell (2014) have used this theory in identifying the correlation between financial literacy and retirement decisions and savings.

The greatest strength of this theory is that it has tried to look at the behavioral and cognitive class of financial decisions hence coming up with an all-weather explanation for the financial behavior. The theory has one major flaw that it does not take into consideration such factors as economic conditions or social restraints that may prevent a person from acting accordingly. In the current study, this theory has been used to elucidate on how increasing financial literacy empowers

people to use FinTech services appropriately. Through enhancing their knowledge of the relevant DFIs and digital financial products, the users can identify and enhance their savings, credit, investment, and associated services, thus promoting financial inclusion. This makes Financial Literacy Theory as a key framework in establishing the connection between education and technology in financial services.

2.2.2. The Technology Acceptance Model (TAM)

Davis (1989) introduced the Technology Acceptance Model (TAM): to understand the factors influencing technology adoption. The theory focuses on two key determinants: attitude towards the technology in terms of perceived ease of use and perceived usefulness. Perceived ease of use therefore defines the extent to which the users consider the technology to be easy to use while perceived usefulness defines the extent to which the users consider the technology to be useful in improving their performance.

This model has been applied in various works, such as Venkatesh and Bala (2008), to investigate the adoption of e-learning systems and mobile banking services. Its strength is its parsimony and its direct focus on the user, which has made it one of the most popular implementation intentions in the adoption of technology. However, TAM has limitations, one of which is its predisposition not to take account of external factors such as culture and society which do influence the use of technology. In the setting of this research, TAM help to evaluate the manner in which user perceiving FinTech service on the aspects of usability and usefulness of the service, which in turn affects adoption level. It assists to pinpoint factors that support and hinder the use of technology in addressing the needs of the financially excluded when implementing FinTech solutions.

2.2.3. Diffusion of Innovation Theory

Rogers (1962) developed the Diffusion of Innovation Theory can be defined as the process through which innovations are adopted by various people within a certain community. to explain how innovations spread across societies over time. The theory identifies five categories of adopters: uses the terms of innovators, early adopters, early majority, late majority, and laggards, and underlines the social factors affecting the adoption. The theory has been extensively used; Mahajan & Peterson (1985) employed the model to study the technology acceptance of agriculture, while recent studies incorporated the theory within the acceptance of the FinTech service.

The theory has its advantages in having a well-defined model for analyzing new technology adoption and its emphasis on social networks and communication channels. But, the theory fails to address individual-level factors such as financial literacy or system-level factors such as absence of infrastructure. In the current study, the Diffusion of Innovation Theory can be defined as the process through which innovations are adopted by various people within a certain community. is applied to understand how financial literacy can act as a catalyst in spreading FinTech services across different user groups. Through the analysis of adoption profiles, the research outlines techniques that can be used to promote an early adopter network effect, thereby enhancing FinTech usage and more specifically, financial inclusion.

2.2.4. Capability Approach Theory

The Capability Approach Theory is another liberal theory developed by Amartya Sen in 1980 to identify how people can improve their socio-economic well-being. It differs from other economic theories that focus on money or assets; this theory revolves around making people capable of attaining the things that they consider important in their lives. Robeyns (2005) used this theory to

explore poverty reduction strategies and noted that skills and opportunities are pivotal to attaining capability contents.

The strength of this theory lies in the fact that it does not focus solely on the accessibility of resources but also on the competence to use such resources. However, some criticism has pointed out that it pays less attention to factors such as structural/institutional issues like regulatory. In the current study, the Capability Approach Theory supports the aspect of financial literacy and its ability to enable individuals to use FinTech services. As the theory is concerned with improving users' abilities, like their ability to navigate online tools and make better financial decisions, it also offers a robust spectrum of the more significant concept of financial literacy and FinTech adoption at large.

2.3 Empirical Review

2.3.1. Digital Payment and Financial Inclusion

Iazzolino (2023) examines the analysis of digitizing G2P payments and its effects on financial inclusion in Europe. However, the study was focused on evaluating how digital payment platforms improve efficiency, transparency and financial inclusion of the vulnerable groups. Grounded in the Technology Acceptance Model (TAM):, the study explored how perceived ease of use influenced the adoption of G2P systems. Applying the descriptive research design, the study focused on European countries that adopted digital payments, utilizing the secondary sources like country reports. Analyzing the quantitative data by using descriptive and inferential statistics it was evidenced that G2P payment via digitization had enhanced the financial inclusion among the marginalized sector. The study suggested further extension of such schemes across Europe, stressing on ease in organisation to ensure equal opportunity.

According to Domingo and Teevan (2022), the EU has been an active participant in embracing and encouraging integrated digital payment platforms to increase financial access across African countries. The study adopted the Systems Theory of Financial Inclusion to capture the complex digital ecosystems. The study adopted case study research design to explore and analyse EU funded digital projects in Africa and involved the collection of qualitative data through interviews and project documentations. Hearings pointed to the impact of EU technical and financial assistance in reducing transaction costs and enhancing financial inclusion. In this study, continued EU investments in capacity development and regulation enhancements were deemed crucial to support such gains.

Choi et al. (2019) analyzed the role of payment platforms and other digital technologies in boosting productivity and financial inclusion in Africa. The study utilized the Diffusion of Innovation Theory can be defined as the process through which innovations are adopted by various people within a certain community. to explain the adoption of digital financial services. Using a cross-sectional research approach, the research study aimed at participating African countries that have adopted digital platforms, and data collection involved administering questionnaires and conducting interviews with policy makers. Regression analysis also revealed that digital payments have a positive and significant impact on credit access as well as on savings, especially in the case of the excluded. The study also recommended the enlargement of public-private partnerships to improve on the provision of financial services through digital platforms especially in the rural regions.

Ncube and de Beer (2024) explored the impact of digital trade and innovation in attaining the sustainable development goals (SDGs) in Africa. In this case, technology was used to focus on the enhancement of financial capability as espoused in the Capability Approach Theory. Cross-

sectional data were collected through surveys along with case studies of digital trade policies and strategies. Surveys were conducted among different groups of participants and the results of the analysis of the data obtained indicated that digital payment systems were of significant importance for the minimization of income inequality. Regarding digital trade policies, Clayton said that governments suggest that digital trade policies should be in the same line with financial inclusion practices to enhance efficiency of impact.

Kipchoge (2024) embarked on a research that sought to establish the link between digitalization and the financial performance of the microfinance banks in Nairobi Kenya. The objectives of the study were as follows: To assess the utilisation of digital payment systems and its effect on enhancing the operations, financial and inclusiveness of the banking system. In alignment with Resource-Based View (RBV) theoretical framework, the study adopted the descriptive research design to evaluate aspects of digital inclusion. The target population included Micro finance banks in Nairobi, and the participants were selected by simple random sampling. Questionnaires with a structured format were employed for data collection, and SPSS analysis was applied to establish patterns and correlation. The research highlighted the benefits of digital payments in boosting organizational productivity and customer engagement. The study also encouraged more investment in information technology for microfinance institutions.

Looking at the impact of digital financial services in the growth of SMEs, a study was conducted by Awinja and Fatoki in 2021 for the Kenyan context. The study also employed the Financial Inclusion Theory with reference to the part played by financial access in the development process. A correlational approach was used to test the hypothesis linking digital financial services with SME performance. The study involved 400 SMEs in Kenya, and the participants were chosen by employing random sampling. Questionnaires were used to gather data which were analyzed

using the Statistical Package for Social Sciences (SPSS). It was ascertained that through an analysis of mobile payment systems, namely, the mobile wallet, SME advancement and thus, access to financial services experienced a boost. Specific measures that were suggested by the study include the improvement of mobile payment solutions in relation to SME financing constraints.

2.3.2. Digital Credit and Financial Inclusion

In their cross-sectional qualitative and quantitative study, Khan, Subramanian, and Mutalib (2024) sought to examine the impact of the COVID-19 pandemic on consumers' experience of digital transformed FI. The findings centred on how digital credit platforms lowered the barriers to credit within the marginalized segment of the society particularly women. This research employed a cross-sectional study design based on the Resource-Based View Theory by collecting data from global financial institutions. Secondary data were obtained from reports and the results of statistical analysis in the form of correlation that showed a positive connection between the level of digital transformation and credit access. The analysis pointed out that digital credit platforms eliminated high transaction costs, thereby enhancing the financial sector's access for underserved clients. Suggestions included continued funding for the development of digital frameworks aimed at aiding disadvantaged populations coupled with expansion of financial access around the globe.

Frost, Gambacorta, and Valletti (2022) looked at how new platform-based business models such as digital credit systems promote financial inclusion in Europe. The type of research used in the study was Platform Theory aimed to explain how digital platforms lower the financial risk for the less fortunate communities. The study employed a descriptive research approach to address the research question by evaluating the functioning of these platforms, borrowing from the regulation measures adopted by the European Commission. The authors used secondary data collected from

the regulations and financial institutions to understand how platform algorithms help expand credit access. It was evident that platform-based models enhanced financial access while causing concerns on market control and privacy risks. The authors suggested extending the regulation to make access to the digital credit platforms equitable and address the possible negative consequences due to monopolistic tendencies.

A study by Olaoye, Zerihun, and Tabash (2024) investigated the impact of this mobile technology in expanding financial access as facilitated by digital credit. The purpose of the study was to evaluate the role of MFS in combating exclusion and promoting economic engagement of the disadvantaged customers. Grounded in the Diffusion of Innovation Theory can be defined as the process through which innovations are adopted by various people within a certain community., the research utilized a descriptive design to analyze data collected through surveys and financial reports. The study showed that with the help of credit providing through mobile phones, the costs of transaction and geographical distance limitations have decreased, leading to expanded access to financial services. However, issues like internet accessibility and the digital divide were still areas of concern. Consequently, a study to enhance the effectiveness of this form of credit recommended that governments should allocate resources in mobile infrastructure and financial literacy programs to facilitate mobile credit systems.

Similarly, Makore (2024) assessed the role of credit platforms with the help of Artificial Intelligence to generate access to credit facilities and the measures required to mitigate risks. Accordingly, adopting the Resource-Based View Theory, the research used a case-study methodology and gathered qualitative data from the interviews and reports on the AI-driven credit systems. Research revealed that AI addresses the credit scoring for people who are outside the formal financial system through the utilization of nontraditional data, thus enhancing financial

inclusion. However, some risks that were noted include algorithmic bias and data privacy issues. Proposals suggested included developing ethical standards for use of Artificial Intelligence, enhancing data privacy act, and disclosing algorithmic details to increase opportunities for use of AI in financial inclusion.

Wamuyu (2023) conducted a study on the role and impact of digital financial services, financial literacy, and financial inclusion of university students in Nairobi, Kenya. Building on Financial Literacy Theory, the analysis centered on how the moderating variable of financial literacy influenced the link between the independent variable of digital credit usage and the dependent variable of financial inclusion. The descriptive research design was employed to capture the usage characteristics of 400 students that were selected through random sampling. The data was collected through structured questionnaires and interviews and the analysis showed that digital credit platforms enhanced financial access among students. However, due to poor financial literacy, the population was not able to harness these services to the optimum. The study suggested the incorporation of financial literacy programmes into educational systems that would help to optimise decision-making and make digital credit tools more efficient.

Mbila (2024) evaluated the legal requirements for data protection in digital credit and its impact on financial inclusion in Kenya. The study sought to determine whether consumer protection in cases that involve digital lending platforms is sufficiently protected under current laws. Based on the Consumer Protection Theory, the study aimed to review legal instruments and conduct interviews with key participants in the digital lending environment with a qualitative research design. Identified issues included lack of rules governing lenders' data usage and shortcomings in consumer consent mechanisms in data protection laws. The paper established that 'shortcomings and weaknesses in the regulators' enforcement arm' weakened the confidence in

digital credit systems, hindering Fintech. Suggestions were made to enhance data protection legislation and increase enforcement procedures for increasing user trust and financial inclusion.

2.3.3. Digital savings and Financial Inclusion

Sabbaghi (2024) sought to evaluate the manner in which mobile money innovations deepen access to finance through savings and credit options. The specifics of the study were presented as the availability of digital financial services in Europe and the necessity to implement cost-efficient solutions for the less-provided population. In line with the Financial Inclusion Theory, this study employed an exploratory and descriptive methodology using secondary data on financial institutions. The studies showed that mobile money platforms positively impacted savings through savings increases of individuals with limited access to the banking sector. However, issues like digital literacy and limited access to the internet remained unaddressed. The study suggested that more resources should be spent to make the interfaces more user friendly and to extend the extent of mobile networks to fill these gaps.

Badre (2024) analyzed how neo-banks can enhance financial inclusiveness for North African migrants in Europe. In this study, the researcher sought to assess how digital savings products provided by neo-banks reduce financial challenges experienced by migrants. In line with the Capability Approach Theory, the study collected both quantitative and qualitative data through questionnaires and interviews with migrants. Studies showed that neo-banks provided affordable opportunities for savings and easy money transfers, which positively impacted the financial security of immigrants. The study also suggested efforts to enhance the legal mandates as well as policies that will oversee the digital banking development and also safeguard the migrant users from excessive exploitation.

In a related study, Nnaomah et al (2024) examined the effects of digital banking practices with a focus on savings. In the study, the Resource-Based View Theory was adopted to assess how digital banking resources enable financial accessibility. Qualitative case studies were employed to gather data from financial service providers and self-administrated questionnaires. It was revealed that through digital savings products, low-income earners were provided with safe and affordable modes of banking. However, the study also revealed that access to and use of information resources and technologies were influenced by socio-economic and geographical factors. Recommendations was the need to establish regional digital banking services that target customers who have been locked out of the traditional financial sector.

Haule (2024) study on the household financial management, perceived risks, usefulness of digital savings tools, and financial inclusion in assessing the user behavior, the study used a model known as the Technology Acceptance Model (TAM). The study employed the correlational research design, whereby data were gathered through structured questionnaires from low-income earners in Tanzania. According to the study, perceived usefulness was found to have a positive impact on digital savings adoption while perceived risks had a negative impact. Accordingly, awareness creation through a sustained campaign and physical security measures should be employed to reassure the users.

Specifically, Kisotu and S. Musau (2024) concentrated on digital savings platforms supporting women entrepreneurs. The specific objective of the study was to assess how digital banking supports women-led enterprises on their financial inclusion. Based on the Empowerment Theory, this study employed a descriptive research design to analyse data gathered from the quest and interviews conducted among women entrepreneurs. The study showed that digital savings platforms enhanced access to financial services, empowering businesses and their contribution to

the economy. To address the concerns, the study suggested policies that focused on increasing female literacy in money matters and use of other tools in the digital space.

In their research work titled ‘Digital Financial Services, Financial Literacy, and Financial Inclusion Among Youth in Nairobi City County, Kenya by W.V. Wamuyu (2023), the researcher sought to determine the effect of digital savings and financial literacy on financial inclusion among university students. The study employed the Financial Literacy Theory, comparing the effects of knowledge on the use of digital savings. This was a descriptive research, which employed questionnaires that were administered to 400 students. Consequently, the study uncovered findings that showed that improved financial literacy positively impacted the ability to use digital savings effectively; however, lack of awareness negatively impacted the adoption process. Others included suggesting the integration of financial literacy programs to schools to ensure proper use of such services.

2.3.4. Digital insurance and Financial Inclusion

In their study, Glavanits and Szabo (2024) examined the effects of FinTech on financial inclusiveness with an emphasis on digital insurance in Europe. The purpose of the research was to evaluate how innovative technologies in insurance eliminate access hurdles to vulnerable clients. Based on the Financial Intermediation Theory, the study employed a descriptive research design and collected data from financial documents, reports, and cases. In this sense, the study underscored that the digital insurance platforms made it easier to access the micro-insurance services among the low-income households. But again several countries had their regulations regarding these platforms hence restricting the expansion of these platforms in the European countries. The authors suggested the elimination of disparities in regulations to encourage the effective use of the digital insurance platform and improve consumer trust in the platforms.

Dos Santos and Lampis (2024) examined how digital insurance services can be integrated into smart city environment to tackle socio-economic divide. The research question was formulated with the aim of understanding how the use of digital platforms contributes to addressing the issue of financial exclusion within urban centres. This study adopted the Systems Theory and utilized a concurrent mixed-method research approach, which entailed surveying urban residents and conducting case studies of smart cities in Europe. The study identified that management of digital insurance platforms expanded coverage and facilitated financial safety nets for excluded cities' inhabitants, diminishing their exposure to financial risks. The study highlighted the need for improving digital literacy programs and cooperation between the government and private entities to address existing challenges related to these platforms.

Kouladoum and Wirajing (2022) explored how such platforms affect financial inclusion in Sub-Saharan Africa. The proposed study was also intended to assess the accessibility and relevancy of financial services delivered through technology. Based on the Technology Acceptance Model (TAM), the study employed a cross-sectional survey design and data was collected from mobile insurance platforms users. Research revealed that the provision of digital insurance services enabled more parity in financial security for low-income earners, particularly in rural regions. However, some of the challenges that have been noted are low internet fluency and inadequate mobile network connection. Proposals included increasing investments in digital platforms and conducting selective information campaigns.

Mhlanga (2025) investigated the nature of financial access in Sub-Saharan Africa with a specific emphasis on the take-up of digital insurance. The study applied the Capability Approach Theory to assess the effect of digital insurance on socio-economic well-being for vulnerable groups. A case study approach was used in this research, with data being obtained from interviews

and secondary sources. As pointed out in the study, the use of digital insurance platforms helped cushion the informal workers and the small-holder farmers against financial risks. However, challenges such as regulatory frameworks and infrastructure constraints slowed the uptake. The study recommended enhancing laws and policies and boosting partnerships between governments and private insurance firms for dealing with these challenges.

Mwangi (2024) examined the effects of technology literacy on financial inclusion in Kenya by focusing on other subcategories that fall under financial services, such as digital insurance. The aim was to understand the extent to which digital channels enhance financial inclusion for the previously excluded groups. The study used the Financial Intermediation Theory and adopted a descriptive research design with survey data collected from the rural and urban users of the digital payment systems. This study revealed that integrating digital insurance with mobile payment solutions plays a crucial role in enhancing financial inclusion by offering cheaper insurance products. Nevertheless, some problems like the distrust of digital systems as well as low awareness among the users were pointed out. Proposals also focused on the necessity of creating consumer awareness campaigns and improving the visibility of electronic insurance services.

Ebong & George (2021) examined how digital financial services including digital insurance contribute to financial inclusion in Kenya and Uganda. The review paper focused on how digital platforms cope with the threat of financial exclusion affecting the rural sector. The study was conducted using the Diffusion of Innovation Theory which relied on survey and interview data collected from users in remote locations; the design of the research was therefore correlational. The outcomes revealed that the offer of digital insurance was effective in enhancing the readiness of low-income members to recover from shocks in terms of their finances. Nevertheless, it was also noted that lack of internet, especially in some schools in the country, and

its expensive nature could also pose challenges. Some of the recommendations included the need to upgrade internet connectivity in rural regions and for telecom companies to engage with insurers to improve the provision of services.

2.3.5. Financial literacy, Fintech services and financial inclusion

In the study conducted by Panait, Apostu, Gigauri, and Confetto (2024), the authors explored the role of digitalization and FinTech service in improving financial inclusion in C&EE. To achieve the goal, the study proposed to investigate the relationship between financial literacy and the use of FinTech services for the target demographic. Operating on the premise of the Technology Acceptance Model (TAM), the study employed a quantitative research strategy and the use of regression analysis to model the relationship between financial literacy, digitalization, and financial inclusion. A survey of 2,000 patrons across different classes was conducted using questionnaires. Analysis revealed a positive and significant relationship between financial literacy and FinTech adoption, thus enhancing access to financial products. The study suggested the need to step up financial literacy efforts for adults in order to facilitate greater adoption of FinTech and hence, attach equal importance to it for broader financial inclusion.

In their study, Ferilli, Palmieri, and Miani (2024) discussed how FinTech has helped European banking sectors to enhance digital financial literacy and financial inclusion. The study aim was to evaluate the impact of financial literacy interventions in the reduction of the digital divide. Based on the analysis of the FIMT, this research adopted a descriptive approach, with data collected primarily from European banks and FinTech firms. Another rationale for the use of a specific sampling technique involved employing superior samples to target institutions that had adopted financial literacy programmes. The research findings revealed that FinTech innovations also supported the increased promotion of financial literacy, thus, boosting the availability of

financial services for individuals who had limited access to those services. However, inequalities in literacy levels made it difficult to access these services to all people. According to the study, these gaps should be closed through offering proper and specific coursework in European countries to promote equal access to financial literacy.

Liu and Li (2025)'s study explored the impact of FinTech solutions on financial accessibility within the African context with specific emphasis placed on mobile financial solutions and financial consciousness. Therefore, the study sought to assess the role of FinTech in reducing financial exclusion in the developing economies. Using the Diffusion of Innovation Theory, the study adopted a cross-sectional research design and collected data through interviews and questionnaires among FinTech users in 10 African countries. Research also showed that digital payments as well as savings solutions offered by FinTech companies enhanced access and usage of financial services among the previously underserved poor. However, the study revealed that the level of financial literacy was low, thus acting as a major hindrance to the adoption process. In his argument, the author proposed that FinTech firms should incorporate ways of offering financial literacy training to the users to maximise their interaction with the financial services, while at the same time, achieving long-term financial inclusion for the users.

Kounouwewa (2025) was a study that focused on examining the use of digital financial services with regard to SMEs financial inclusion in Africa. It sought to establish the problems that SMEs encounter when sourcing for finance and the dawning of FinTech solutions. Qualitative research utilising the Capability Approach Theory was implemented to analyse the effects that financial literacy has on the usage of FinTech services for SMEs. In this research, both qualitative and quantitative data were obtained through administering questionnaires to 300 SME owners and data from financial institutions. Findings showed that financial literacy was a significant factor in

the SMEs' ability to engage with and adopt FinTech services, including credit and savings applications. The study also suggested developing official financial literacy interventions for the SME owners in order to regulate how they manage the finances of their businesses and also in achieving the goal of accessing digital financial products.

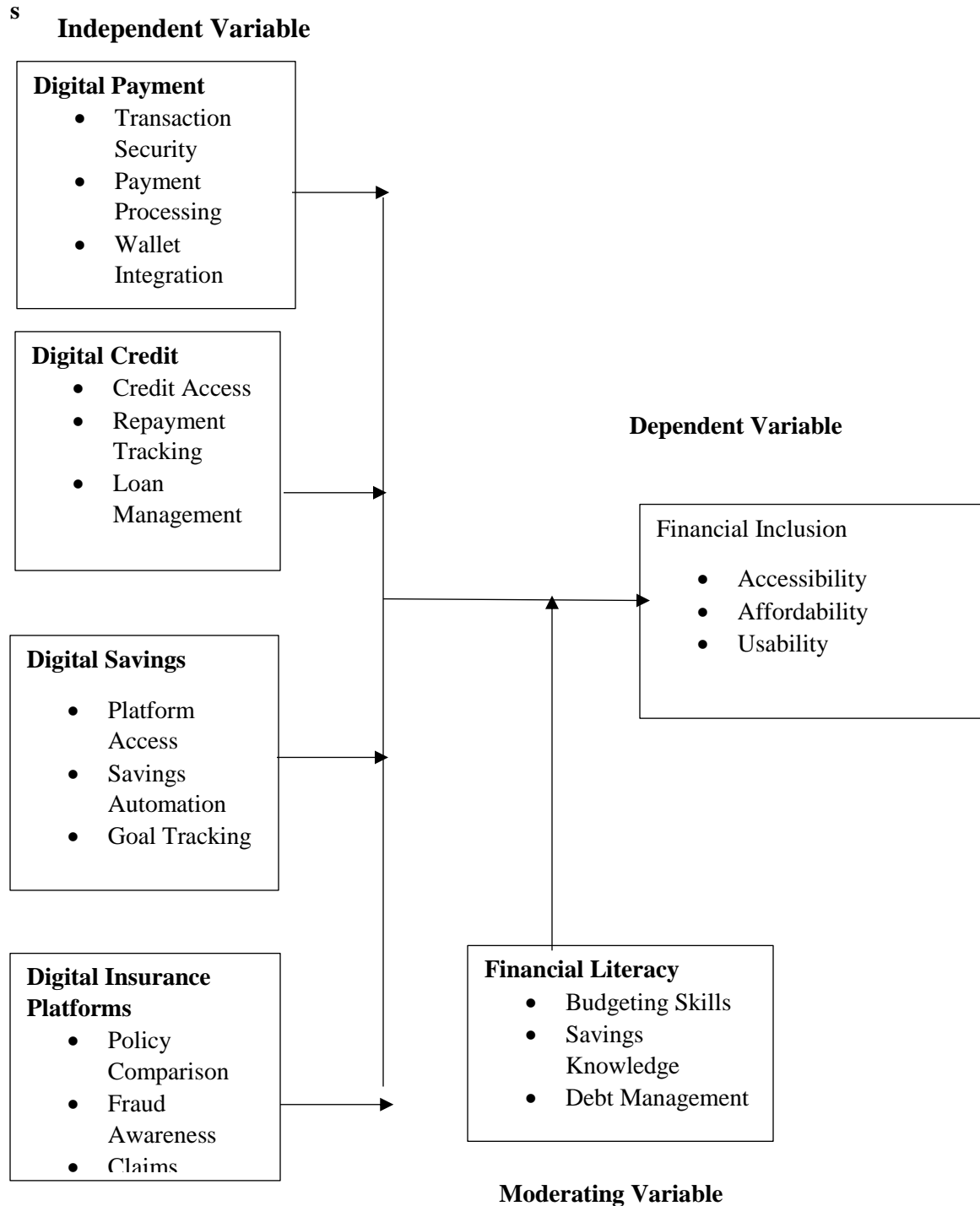
Adelaja, Umeorah, and Abikoye (2024) examined how the delivery of fin-tech services enhances financial literacy to help people in rural Kenya. In the study, the researchers aimed at evaluating the utility of FinTech platforms for the financially excluded populations. Using the Financial Behavior Theory, the study adopted a descriptive research design in which data was collected from 500 rural households through structured questionnaires. The study further showed that the Fintech platforms had increased financial access through enhancing the ease of transactions as well as providing saving and credit facilities. However, poor financial literacy among the users meant that the potential of these services was not fully tapped. The study suggested that it was crucial to incorporate financial literacy content in Fintech solutions to enhance user comprehension and continuous engagement.

Alkhwaldi (2024) further discussed how financial literacy and FinTech can enhance financial inclusion and quality life in Kenya. The study sought to establish the moderating role of financial literacy in the use of FinTech services especially in the rural settings. The study employed a cross-sectional survey design based on the Technology Adoption Model (TAM) and data from 150 participants were obtained through interviews and focus group discussions. The study revealed that financial literacy was directly related to the use of FinTech services, which empowered users to select better financial solutions, leading to a higher standard of living. Accordingly, the study suggested that governments and other stakeholders should focus on increasing the availability and

distribution of digital financial literacy programs in the rural regions of Kenya to foster the use of FinTech and encourage equitable economic growth.

2.4 Conceptual Framework

FIGURE 2.1
Conceptual Framework



2.5 Operationalization of Variables

This section expounds the sampling techniques and procedures that were employed to measure the four key variables namely financial literacy, FinTech services, financial inclusion, and digital literacy. These include variable definition, variable dimensions, indicators and measurement methods.

TABLE 2.1
Operationalization of Variables

Variable	Type	Indicator	Scale
Digital Payment	Independent Variable	Transaction Security Payment Processing Wallet Integration	Ordinal Scale
Digital Credit	Independent Variable	Credit Access Repayment Tracking Loan Management	Ordinal Scale
Digital Savings	Independent Variable	Platform Access Savings Automation Goal Tracking	Ordinal Scale
Digital Insurance Platforms	Independent Variable	Policy Comparison Fraud Awareness Claims Processing	Ordinal Scale
Financial Literacy	Moderating Variable	Budgeting Skills Savings Knowledge Debt Management	Ordinal Scale
Financial Inclusion	Dependent Variable	Accessibility Affordability Usability	Ordinal Scale

CHAPTER THREE

3.0 METHODOLOGY

3.1 Introduction

In this chapter, the method used in conducting the research to address the objectives of the study is explained. It describes the study's design, the population on which the research was conducted, the sampling techniques that was used, the instruments for collecting research data, and the ways in which the data was analyzed. Third, it considers the validity and reliability of the instruments and makes sure the results of the study are valid and reliable.

3.2 Research Design

According to Sekaran and Bougie (2016), a research design refers to the blueprint or framework for conducting a study, detailing the procedures necessary to obtain relevant information that helps solve the research problem. A good research design ensures that data collection is structured in a way that maximizes accuracy and minimizes bias, allowing researchers to make valid and reliable conclusions. This study adopts a descriptive research design, which is suitable for examining the correlation between FinTech services, financial literacy, and financial inclusion among rice farmers in Mwea, Kirinyaga County. Descriptive research aims to observe, describe, and document aspects of a situation as they naturally occur, without manipulating variables. This approach enables a comprehensive assessment of how digital payments, savings, credit, and insurance influence financial inclusion among smallholder farmers (Kapaya & Mmari, 2022).

Unlike experimental research, which involves controlled interventions, descriptive research allows for real-world analysis, making it ideal for studies focusing on financial behaviors and technology adoption in rural settings. Previous studies have successfully applied this approach

to analyze financial literacy, fintech usage, and economic decision-making among farmers, producing valuable insights for policymakers and financial institutions (Omar et al., 2023).

3.3 Target Population

The target population for this study was rice farmers within Mwea Irrigation Scheme in Kirinyaga County-Kenya and was made up of both large scale and small-hold farmers. The Mwea irrigation scheme supports over 30,000 acres of farmland with about 16000 registered farmers (KNBS, 2019), distributed in the locations as presented in Table 1 below.

TABLE 1
Distribution of Rice Farmers in Mwea Irrigation Scheme

Location	Number of Rice Farmers	Percentage
Thiba	3500	22%
Murinduko	2498	16%
Gathigiriri	1278	8%
Tebere	900	6%
Kangai	347	2%
Mutithi	2800	18%
Wamumu	1419	9%
Kimbimbi	1891	12%
Makima	1367	9%
Total	16000	100

3.4 Sample and Sampling Techniques

Sampling is a very important tool in any research that tries to make a representation of the study population and improve generalizability of the results. Since the target population is 16000 rice farmers, the required sample size was determined using Morgan and Krejcie's (1970) formula.

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

Where:

n = sample size

N = Target population

e = Error tolerance (0.05)

$$\begin{aligned} &= \frac{16000}{1 + 16000(0.05^2)} \\ &= \frac{1600}{41} \end{aligned}$$

$N=390$

Therefore, it is feasible to have a target population of 39 farmers to make the study's sample size large enough to be statistically significant and representative. Proportionality of the sample requires that number of samples collected in the 9 sites corresponds to the total number of rice farmers. The distribution is as follows:

TABLE 2

Sample Size		
Location	Number of Rice Farmers	Percentage
Thiba	86	22%
Murinduko	62	16%
Gathigiriri	31	8%
Tebere	23	6%
Kangai	8	2%
Mutithi	70	18%
Wamumu	35	9%
Kimbimbi	47	12%
Makima	35	9%
Total	390	100

This technique ensures that all the location is covered and the different geographical and economic status of rice farmers in Mwea are taken into consideration. Random sampling within each of the formed strata will helps to get rid of selection bias, which provides better results in terms of population representation.

3.5 Research Instrument

In this study, the researcher employed a structured questionnaire to collect both quantitative and qualitative data on the use of FinTech services, financial literacy, and financial inclusion among rice farmers in Mwea, Kirinyaga County. The questionnaire was designed to align each section with a specific research objective. The initial section gathers demographic and socio-economic

data, including age, gender, education level, and farming experience, which provide a basis for evaluation (Omar et al., 2023). Subsequent sections focus on digital payments, credit, savings, insurance, and financial literacy, utilizing Likert-scale items to assess farmers' perceptions, satisfaction, and attitudes. Additionally, open-ended questions capture unique insights and detailed responses specific to individual farmers (Mutungi, 2023). This structured approach standardizes data collection, facilitating easy coding and analysis. To enhance inclusivity, trained interviewers administer the questionnaire through face-to-face interviews, addressing potential literacy barriers and ensuring quota sampling is effectively implemented (Kapaya & Mmari, 2022). This methodology strengthens the reliability and validity of the data, ensuring it effectively supports the study's objectives.

3.6 The validity and reliability of the instrument

3.6.1 Validity of the instrument

To enhance the study's validity, experts in financial literacy, FinTech services, and rural financial inclusion will evaluate the structured questionnaire for content validity. Their feedback will determine whether the questions effectively align with the research objectives and accurately capture the variables under investigation (Kapaya & Mmari, 2022). Additionally, a pilot test involving 15 rice farmers from Mwea will assess the questionnaire's clarity and relevance (Mutungi, 2023). Based on the pilot test results, necessary modifications were made to ensure the instrument consistently provides accurate, relevant, and reliable data.

3.6.2 Reliability of the instrument

To assess criterion validity, the study will employ the test-retest method, where 15 respondents will complete the questionnaire twice, with a two-week interval between the surveys. The responses were analyzed to evaluate consistency, reliability, and stability over time (Omar et al.,

2023). Additionally, a reliability analysis was conducted using Cronbach's alpha coefficient to assess the internal consistency of the Likert-scale items. A reliability coefficient of 0.7 or higher was considered acceptable for ensuring the instrument's reliability. These measures will help minimize variations in responses, thereby enhancing the credibility of the findings and strengthening the study's methodological rigor (Kapaya & Mmari, 2022).

3.7 Data Collection Procedure

The study employed a quantitative data collection approach using structured questionnaires administered to rice farmers in Mwea, Kirinyaga County. The process involved obtaining the necessary approvals from regional administrative authorities and ethical committees (Kapaya & Mmari, 2022). Next, the research team trained enumerators to ensure accurate and consistent questionnaire administration (Mutungi, 2023). The study covered nine sites within the Mwea Irrigation Scheme: Thiba, Murinduko, Gathigiriri, Tebere, Kangai, Mutithi, Wamumu, Kimbimbi, and Makima (Kenya National Bureau of Statistics, 2019). A two-stage sampling approach was applied, with stratified random sampling used to select farmers and simple random sampling to identify participants within each location.

Enumerators administered the questionnaires either on paper or electronically, depending on convenience. Respondents were informed about the study's objectives, and their consent was obtained, with assurances of anonymity and confidentiality. To ensure accuracy, completed questionnaires were reviewed daily, and data collection will span two weeks. This systematic approach enhanced data reliability and suitability for analysis.

3.8 Data Processing and Analysis

In order to check validity and reliability of the findings of this study, data processing and analysis was done systematically. The collected data from the questionnaires was then processed to eliminate invalid information from valid databases omissions, inconsistent and incorrect responses (Omar et al., 2023). This included probing for omissions, operationalizing the qualitative responses, and transferring the data into a statistical analysis tool of Statistical Package for the Social Sciences (SPSS). To classify the research participants' demographic attributes, frequencies, means, and percentages were used and computed to present the study participants and their key demographic and socio-economic profiles as described by Kapaya and Mmari (2022). Tables, graphs and charts was the presentation format of the data considered easier and more efficient to formulate conclusions.

In order to determine the degree of connectivity between FinTech services, financial literacy, and financial inclusion, multiple regression analysis were used. In this research, hierarchical regression test was used to determine the moderating role of financial literacy on the nexus between fintech services and financial inclusion from the survey data based on the models below:

Unmoderated Model:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \varepsilon$$

Where: -

Y = Financial Inclusion

X₁ = Digital Payment

X₂ = Digital Credit

X_3 = Digital Savings

X_4 = Digital Insurance

β_0 = The Constant Term

β = Coefficient of independent variables

ε = Error term

Moderated Model:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 Z + \beta_6 X_1 * Z + \beta_7 X_2 * Z + \beta_8 X_3 * Z + \beta_9 X_4 * Z + \varepsilon$$

Where Z = Financial Literacy.

3.9 Diagnostic Tests

To ensure the accuracy and reliability of statistical analysis, this study conducted several diagnostic tests to verify key assumptions in regression analysis. These tests assessed normality, homoscedasticity, linearity, and multicollinearity, which are essential for valid and meaningful results.

3.9.1 Normality

Normality testing determines whether the data follows a normal distribution, which is a key assumption for many parametric statistical tests. Skewness and kurtosis statistics was used to assess the symmetry and peakness of the distribution. According to Myoung (2008), values between -1.0 and +1.0 indicate normal distribution. Additionally, the Kolmogorov-Smirnov (K-S) and Shapiro-Wilks (S-W) tests, as recommended by Hair et al. (2010), was applied to detect deviations from normality. If the test results are not statistically significant ($p > 0.05$), the data was

considered normally distributed (Field, 2009). Establishing normality is crucial since violations may affect the accuracy of statistical inferences.

3.9.2 Homoscedasticity

Homoscedasticity refers to the assumption that the variance of residuals remains constant across all levels of the independent variables. This condition is essential for ensuring that regression estimates are efficient and unbiased. To test for homoscedasticity, a scatter plot of standardized predicted values (ZPRED) against standardized residuals (ZRESID) was examined. The presence of a random, evenly spread pattern will confirm homoscedasticity, whereas a funnel-like shape may indicate heteroscedasticity, requiring potential corrective measures.

3.9.3 Linearity

Linearity testing ensures that there is a consistent, proportional relationship between independent and dependent variables. Regression models assume that changes in the independent variables correspond to predictable changes in the dependent variable. A scatter plot of standardized predicted values (ZPRED) against standardized residuals (ZRESID) was used to assess linearity. The F-statistic test will further confirm whether the relationship between variables is linear, ensuring the validity of regression analysis.

3.9.4 Multicollinearity

Multicollinearity occurs when independent variables in a regression model are highly correlated, making it difficult to determine their individual effects on the dependent variable. High multicollinearity inflates standard errors, reduces statistical significance, and can distort regression coefficients. To detect multicollinearity, the study will use the Variance Inflation Factor (VIF), as recommended by Field (2009). A VIF value exceeding 10 ($VIF > 10$) will indicate the presence of

multicollinearity, necessitating corrective actions such as variable removal or transformation to improve model accuracy.

CHAPTER FOUR

RESULTS AND DISCUSSION

4.1 Introduction

This chapter presents the preliminary findings obtained from the pilot project, followed by the comprehensive analysis of the full study's statistics, accompanied by a thorough discussion of the results of the research.

4.2 Questionnaire Response Rate

The study initially selected a sample of 390 respondents. A total of 198 questionnaires were received among the options provided. After conducting an initial investigation, a total of 31 incomplete questionnaires were deemed ineligible and subsequently excluded from the final study. Consequently, a sample size of 167 questionnaires remained for analysis and inclusion in the study. This accounted for 42.8% of the questionnaires that were initially issued. Rogelberg and Stanton (2007) propose that in the context of organizational-level investigations, a data collection rate that surpasses 35% is deemed satisfactory. Hence, the data gathering procedure employed in this study adhered to the specified criterion, thereby guaranteeing precision and mitigating any biases.

4.3 Background Information Results

Before establishing the role of fintech services and financial literacy in promoting financial inclusion among rice farmers in Mwea, Kirinyaga County, the descriptive statistics of the respondents were analysed in order to establish their level of understanding the aspects of the variables that relate to financial inclusion and financial literacy. For the present study, the descriptive results related to age, the educational qualification, the period of operation in the area. Results for the descriptive analysis are explained in the sub-sections below.

4.3.1 Distribution of the Respondents by Age

The study sought to determine the distribution of the respondents by their age. Establishing the age of respondents helps determine how different age groups adopt FinTech services and respond to financial literacy initiatives. Younger farmers often embrace digital tools faster, while older ones may prefer traditional methods, affecting the overall impact of financial inclusion strategies. By analyzing age, researchers can identify trends in technology use, financial behavior, and literacy levels. Including age as a variable strengthens the study's findings and enhances its relevance for promoting financial inclusion among rice farmers in Mwea, Kirinyaga County. The study findings are presented in Table 4.1 below;

TABLE 4.1

Distribution of Respondents by Age		
	Frequency	Percent
Below 30 years	37	22.2
Between 31 and 40 years	64	38.3
Between 41 and 50 years	46	27.5
above 50 years	19	11.5
Total	167	100.0

The findings as shown in Table 4.1 The age data shows that the majority of rice farmers in Mwea, Kirinyaga County, are between 31 and 40 years old, making up 38.3% of the total respondents. This age group likely represents farmers in their most active and economically productive years, which could influence both their openness to FinTech adoption and their financial literacy levels. The second largest group is 41 to 50 years at 27.5%, followed by those below 30 years at 22.2%. These younger farmers may be more tech-savvy and more likely to use mobile money or digital financial services. However, they might lack deep experience in farming or financial management.

Only 11.5% of respondents are above 50 years, suggesting fewer older farmers in the sample. This group may face more challenges in adopting FinTech solutions due to limited exposure or lower digital literacy.

4.3.2 Highest Educational Qualification

The study sought to establish the education level of respondents in order to examine its influence on the use of FinTech services and financial literacy among rice farmers in Mwea, Kirinyaga County. The findings revealed that education played a significant role in shaping respondents' understanding and adoption of digital financial services. Farmers with higher levels of education were more likely to access and effectively use mobile banking, digital payment platforms, and other FinTech tools. Additionally, respondents with formal education demonstrated a better grasp of basic financial concepts, suggesting a strong link between education and financial literacy. This facilitated informed decision-making regarding savings, credit, and investment options available through FinTech channels. The study further noted that differences in education levels influenced the degree of financial inclusion, with less educated farmers showing lower levels of engagement with formal financial systems. With this in mind, the study sought to assess the respondent's highest level of education whose results are shown in Table 4.2 below.

TABLE 4.2

Highest Educational Qualification

	Frequency	Percent
Form 4	5	3.0
Certificate	48	28.7
Diploma	97	58.1
Bachelors	17	10.2
Total	167	100.0

As the findings in Table 4.2 portray, majority of the respondents (58.1%, N = 97) had a diploma as their highest educational qualification, 28.7% (N = 48) had certificate as their highest qualification, 10.2% (N = 17) had bachelors as their highest educational qualification, while on 3.0% (N = 5) had form four as their highest educational qualification. This is an indication that most of the respondents had the necessary prerequisite knowledge to understand fintech services and one's ability to effectively understand the level of financial literacy which are necessary for the study.

4.3.3 Period in Rice Farming

There was need to know the period the women had operated the rice growing in the region. This was to gauge the respondents' understanding of the fintech services in the area. To achieve this, the respondents were asked to indicate the period the enterprise had operated in the area, and results are shown in Table 4.3 below.

TABLE 4.3
Period in Enterprise

	Frequency	Percent
Below 10 years	86	51.5
Above 10 years	81	48.5
Total	167	100.0

As demonstrated in Table 4.3 above, most of the rice farmers (51.5%, N = 86) had operated in the business for below 10 years, with the rest (48.5%, N = 81) operating for above 10 years. This seems to imply that almost half of the rice farmers has operated in the region for below and above 10 years indicating that the respondents understand the fintech services.

4.4 Descriptive Results on the Study of Variables

The research instrument was divided into two sub-sections for each of the research variable. The two sub-sections consisted of closed ended questions. These questions provided respondents with statements opinion to select from Likert scale. These questions were first analysed descriptively to isolate the latent features of their opinion on the microfinance services and the level of Financial Inclusion among rice farmers . The results for the analyses are explained in the sub-sections below.

4.4.1 Descriptive Results of Digital payments

The first objective of the study was to determine the effect of digital payments on financial inclusion among rice farmers in Mwea Irrigation Scheme. The respondents were asked to indicate their levels of agreement or disagreement with specific statements drawn from measures of this microfinance credit service measure. Table 4.4 shows the findings.

TABLE 4. 5**Descriptive Results of Digital Payments****Key:** SD = Strongly Disagree, D = Disagree, N = Neutral, A = Agree, SA = Strongly Agree

Statements	SD	D	N	A	SA	Mean	Std. Dev.
I feel confident that my transactions are secure when using digital payment platforms.	21.3%	14.5%	3.6%	42.5%	18.1%	3.21	1.45
Digital payment platforms effectively prevent fraud and unauthorized access.	21.3%	17.6%	2.7%	45.2%	13.1%	3.11	1.41
Payments made through digital platforms are processed quickly.	20.8%	18.1%	12.7%	44.8%	3.6%	2.92	1.26
I rarely experience delays when processing payments digitally.	20.4%	43.1%	2.7%	15.2%	18.6%	3.28	1.43
Digital payment platforms integrate easily with other digital wallets or accounts I	20.4%	62.2%	0.0%	17.4%	0.0%	3.14	1.26
I find it easy to transfer funds between my digital wallet and my bank account.	18.4%	12.2%	0.9%	44.5%	24.0%	3.37	1.47
Average						3.17	1.01

The study examined respondents' perceptions of digital payment platforms across various dimensions, including security, efficiency, ease of use, and integration with other financial services. The results revealed a mixed but generally moderate level of confidence in digital payments, with an overall average mean score of 3.17 and a standard deviation of 1.01, indicating varied opinions among respondents. A majority of respondents agreed that they felt confident about the security of digital transactions, with 42.5% agreeing and 18.1% strongly agreeing, yielding a mean of 3.21. However, a notable proportion (21.3%) strongly disagreed, suggesting concerns about security persist among some users. Similarly, while 45.2% agreed that digital platforms effectively prevent fraud, 38.9% disagreed or strongly disagreed, resulting in a slightly lower mean of 3.11.

Regarding transaction speed, 44.8% agreed that payments are processed quickly, but the high proportion of disagreement (38.9%) led to a lower mean of 2.92. Interestingly, 43.1% disagreed with the statement that they rarely experience delays, though 18.6% strongly agreed, indicating polarized experiences with payment reliability. When asked about integration with other digital accounts, 62.2% of respondents disagreed, and none strongly agreed, yielding a mean of 3.14. This suggests integration remains a challenge for many users. In contrast, fund transfer ease between digital wallets and bank accounts received stronger agreement, with 44.5% agreeing and 24.0% strongly agreeing, producing the highest mean score of 3.37. Overall, the findings indicate that while a significant proportion of farmers use and appreciate the convenience of digital payment systems, concerns remain around security, speed, and platform integration, highlighting the need for continued improvements and user education.

4.4.2 Descriptive Results of Digital credit

The second objective of the study was establishing the effect of digital credit on financial inclusion among rice farmers in Mwea. The respondents were again asked to indicate their levels of agreement or disagreement with specific statements drawn from measures of this digital credit. Descriptive statistics for the analysis are shown in Table 4.5 below.

TABLE 4.5**Descriptive Results of Digital Credit****Key:** SD = Strongly Disagree, D = Disagree, N = Neutral, A = Agree, SA = Strongly Agree

Statements	SD	D	N	A	SA	Mean	Std. Dev.
The necessity of saving money with microfinance organizations has been stressed to us.	20.4%	14.0%	5.4%	39.4%	20.8%	3.26	1.45
I find it easy to access loans through digital credit platforms.	20.4%	13.1%	5.0%	41.2%	20.4%	3.28	1.45
Digital credit platforms are accessible whenever I need funds.	21.3%	14.5%	3.6%	38.5%	22.2%	3.25	1.48
Digital credit platforms provide clear and timely reminders for loan repayments.	21.3%	14.9%	3.6%	40.7%	19.5%	3.22	1.46
I can easily track my repayment progress through digital platforms.	21.7%	16.7%	4.1%	42.1%	15.4%	3.12	1.43
The terms and conditions of digital credit loans are easy to understand.	21.3%	16.3%	4.5%	37.6%	20.4%	3.19	1.47
Average						3.22	1.24

The study assessed respondents' experiences and perceptions of digital credit platforms and microfinance services, focusing on accessibility, clarity, and support for financial behavior such as saving and loan repayment. The overall average mean score stood at 3.22, with a standard deviation of 1.24, suggesting moderately positive attitudes but with noticeable variability among respondents. Findings show that 60.2% of respondents agreed or strongly agreed that the necessity of saving money with microfinance organizations had been emphasized, resulting in a mean of 3.26. However, a significant 34.4% disagreed or strongly disagreed, indicating that the messaging may not have reached all groups consistently.

Regarding loan accessibility, 61.6% of respondents found it easy to access loans through digital platforms, producing the highest mean score (3.28) in this category. A similar proportion (60.7%)

agreed that digital credit platforms are accessible whenever funds are needed, reflecting generally positive user experiences with availability. In terms of loan management, 60.2% of respondents agreed or strongly agreed that platforms provide clear and timely reminders for repayments (mean 3.22), and 57.5% reported that they could easily track their repayment progress (mean 3.12). However, a significant number still expressed disagreement or uncertainty, pointing to room for improvement in platform usability and communication. When asked whether the terms and conditions of digital loans were easy to understand, 58% agreed or strongly agreed, resulting in a mean of 3.19. Nevertheless, the nearly 38% who disagreed or strongly disagreed suggest that loan documentation and communication may still be complex or unclear for a notable portion of users.

Overall, the results indicate that while digital credit services are generally accessible and moderately well-received, issues remain around the clarity of loan terms and the consistency of support features, such as reminders and repayment tracking. These findings underscore the need for improved financial education and more user-friendly platform interfaces to enhance financial inclusion.

4.4.3 Descriptive Results of Digital Savings

The third objective of the study was to analyse the effect of digital savings on financial inclusion among rice farmers in Mwea. The responses were evaluated on a Likert scale using the mean and the standard deviation. Descriptive statistics for the analysis are shown in Table 4.6 below.

TABLE 4.6
Descriptive Digital savings

Key: SD = Strongly Disagree, D = Disagree, N = Neutral, A = Agree, SA = Strongly Agree

Statements	SD	D	N	A	SA	Mean	Std. Dev.
Micro life insurance protects the firm from probable financial troubles by providing coverage against enterprise risk.	22.2%	14.9%	2.7%	29.4%	30.8%	3.31	1.57
I find it easy to access digital savings platforms.	20.4%	13.6%	4.1%	31.2%	30.8%	3.38	1.53
Digital savings platforms are accessible even in rural areas.	22.6%	15.4%	9.5%	24.0%	28.5%	3.20	1.55
Digital savings platforms allow me to save money automatically.	21.3%	19.0%	6.3%	27.1%	26.2%	3.18	1.52
I find automated savings features helpful for building financial stability.	25.3%	23.1%	5.4%	26.2%	19.9%	2.92	1.51
Digital savings platforms help me set and track my financial goals.	21.3%	12.2%	0.5%	29.0%	37.1%	3.48	1.58
Average						3.25	1.31

The study investigated respondents' perceptions of digital savings platforms and micro life insurance, focusing on accessibility, functionality, and their role in promoting financial stability. The overall average mean was 3.25 with a standard deviation of 1.31, indicating a moderate level of agreement with considerable variation in responses. A majority of respondents acknowledged that micro life insurance protects the enterprise from financial risk, with 60.2% agreeing or strongly agreeing, resulting in a mean of 3.31. However, a notable 37.1% disagreed or strongly disagreed, suggesting mixed awareness or trust in such insurance products.

Regarding digital savings, 62% of respondents found it easy to access these platforms, yielding a mean of 3.38, one of the highest scores in this category. Similarly, 57.5% agreed that digital savings platforms are accessible even in rural areas (mean 3.20), highlighting their reach and potential for financial inclusion. Automated saving features were less positively received.

Although 53.3% agreed that digital platforms allow for automatic saving (mean 3.18), only 46.1% found automated features helpful in building financial stability, with a lower mean of 2.92. This suggests that while automation exists, its usefulness may not be fully appreciated or understood.

The highest-rated item was the ability of digital savings platforms to help users set and track financial goals, with 66.1% agreeing or strongly agreeing and a mean score of 3.48. This indicates a strong appreciation for goal-setting features, which may foster better saving habits. However, this enthusiasm did not extend to motivation to save regularly, as 57.9% of respondents disagreed or strongly disagreed that goal-tracking features motivated them, resulting in the lowest mean of 2.48. Overall, the results show that while respondents recognize the utility of digital savings platforms and microinsurance in enhancing financial security, there is uneven uptake and limited motivation tied to certain features like automation and goal tracking. These findings point to the need for improved financial education and user-oriented design to fully harness the potential of digital savings tools among rice farmers in Mwea.

4.4.4 Descriptive Results of Digital Insurance

The fourth objective of the study was to establish the influence of digital insurance on financial inclusion among rice farmers in Mwea. Descriptive statistics for the analysis are shown in Table 4.7 below.

TABLE 4. 7**Descriptive Results of Digital insurance****Key:** SD = Strongly Disagree, D = Disagree, N = Neutral, A = Agree, SA = Strongly Agree

Statements	SD	D	N	A	SA	Mean	Std. Dev.
I find it easy to access digital insurance platforms.	22.2	19.9%	5.4%	21.7%	30.8%	3.19	1.58
Digital insurance services are available and accessible even in rural areas.	22.2	20.4%	10.4%	24.0%	23.1%	3.05	1.50
Digital insurance platforms automatically remind me about policy renewals and payments.	33.9	24.0%	16.7%	10.0%	15.4%	2.48	1.43
Automated notifications from digital insurance platforms help me manage my	31.7	25.3%	17.2%	11.3%	14.5%	2.51	1.40
Digital insurance platforms help me track the status and benefits of my insurance policies.	24.0	22.2%	9.0%	28.1%	16.7%	2.91	1.46
Tracking my insurance coverage and claims through digital platforms motivates me to maintain or increase my coverage.	22.2	18.6%	8.6%	34.4%	16.3%	3.04	1.44
Average						2.86	1.11

The study assessed respondents' perceptions of digital insurance platforms in terms of accessibility, automation, and motivation to manage insurance coverage. Respondents reported moderate ease of access, with 52.5% agreeing or strongly agreeing that they find it easy to access digital insurance platforms, resulting in a mean score of 3.19. Similarly, 47.1% agreed that digital insurance services are accessible even in rural areas, though a notable number remained neutral or disagreed, leading to a mean of 3.05.

Responses to automation features showed lower agreement. Only 25.4% agreed or strongly agreed that digital platforms automatically remind them about policy renewals and payments, with a mean of 2.48. Likewise, 25.8% found automated notifications helpful in managing their insurance,

reflected in a mean of 2.51. This suggests that automation features are either underdeveloped or underutilized by users. Regarding tracking and motivation, 44.8% agreed that digital platforms help them track their insurance status and benefits, yielding a mean of 2.91. Half of the respondents (50.7%) agreed that tracking coverage through digital platforms motivates them to maintain or increase their insurance, with a mean of 3.04. Despite some positive responses, the data reveal gaps in user engagement and platform effectiveness, particularly in automation and motivation functions.

4.4.5 Descriptive Results on Financial Literacy

The moderating variable of the study was financial literacy. Descriptive results of the variable are shown in Table 4.8 below.

Statements	SD	D	N	A	SA	Mean	Std. Dev.
I know how to prepare a budget for my farm's financial activities.	20.4%	19.0%	3.2%	22.6%	34.8%	3.32	1.59
I regularly track my expenses and income using a budget.	20.4%	14.0%	0.9%	33.9%	30.8%	3.40	1.53
I understand the importance of saving money for emergencies or future needs.	20.8%	12.2%	0.9%	35.3%	30.8%	3.42	1.53
I have adequate knowledge of different savings options available to me.	20.8%	12.7%	1.4%	43.4%	21.7%	3.32	1.47
I know how to manage debt responsibly to avoid financial stress.	21.3%	15.4%	4.1%	36.7%	22.6%	3.23	1.49
Average						3.29	1.31

The study explored the respondents' level of financial literacy with a focus on budgeting, saving, and debt management. The responses indicate a generally moderate level of financial awareness and practical application. A majority of respondents expressed confidence in their budgeting skills.

Specifically, 57.4% agreed or strongly agreed that they know how to prepare a budget for their farm's financial activities, resulting in a mean score of 3.32. Similarly, 64.7% reported that they regularly track income and expenses using a budget, with a slightly higher mean of 3.40. Understanding the importance of saving received strong agreement, with 66.1% of respondents affirming this statement, yielding the highest mean in the set at 3.42. This suggests that most farmers recognize the value of saving for emergencies or future needs. Awareness of savings options was also relatively high, as 65.1% agreed or strongly agreed that they have adequate knowledge of different saving methods, reflected in a mean score of 3.32.

In terms of debt management, 59.3% indicated they know how to manage debt responsibly to avoid financial stress, with a mean of 3.23. Although slightly lower than other items, the responses still point to a reasonable level of competence in handling credit. The findings suggest that while many respondents demonstrate awareness and practice of basic financial literacy concepts, particularly budgeting and saving, there remains a portion of the population with limited understanding or inconsistent application of these skills. Continued financial education could help bridge these gaps and promote more consistent financial management among rice farmers in Mwea.

4.4.5 Descriptive Results of Financial Inclusion among Rice Farmers

The dependent variable of the study was financial inclusion among rice farmers in Mwea. Descriptive statistics for the analysis are shown in Table 4.9 below.

TABLE 4. 9**Descriptive Results of Financial Inclusion among rice farmers****Key:** SD = Strongly Disagree, D = Disagree, N = Neutral, A = Agree, SA = Strongly Agree

Statements	SD	D	N	A	SA	Mean	Std. Dev.
I can easily access digital financial services in my area.	20.4%	19.0%	3.2%	22.6%	34.8%	3.32	1.59
Digital financial services are available to everyone in my community.	20.4%	14.0%	0.9%	33.9%	30.8%	3.40	1.53
The cost of using digital financial services is affordable for me.	20.8%	12.2%	0.9%	35.3%	30.8%	3.42	1.53
Transaction fees for digital financial services do not hinder my usage.	20.8%	12.7%	1.4%	43.4%	21.7%	3.32	1.47
I find digital financial platforms easy to use.	21.3%	15.4%	4.1%	36.7%	22.6%	3.23	1.49
Average						3.29	1.31

The study examined the accessibility, affordability, and usability of digital financial services among rice farmers in Mwea. The responses suggest a generally favorable perception, with some areas showing room for improvement. A significant portion of respondents (57.4%) agreed or strongly agreed that they can easily access digital financial services in their area, yielding a mean score of 3.32. A slightly higher percentage (64.7%) believed that such services are available to everyone in their community, reflected in a mean of 3.40. Affordability emerged as a strong point, with 66.1% of respondents agreeing that the cost of using digital financial services is within reach, the highest mean in this set at 3.42. Similarly, 65.1% indicated that transaction fees do not hinder their usage of these platforms, contributing to a mean score of 3.32. In terms of usability, 59.3% found digital financial platforms easy to use, though this item recorded the lowest mean score of 3.23. This suggests that while access and cost may not be significant barriers, some users may still

face challenges with user interface or digital literacy. The findings indicate that digital financial services are generally accessible and affordable for most farmers in Mwea, but initiatives to improve user experience and ease of use could further enhance adoption and impact.

4.5 Diagnostic Test Results

Before regressing data for analysis purposes, the data was checked to avoid violation of the assumptions of classical linear regression model as asserted by Hair *et al.* (2010). This was to ensure that the data yields best least square unbiased estimators (BLUE). According to Field (2000), the common tests that should be conducted are; normality, linearity, homoscedasticity and multicollinearity. These are explained in the sections below.

4.5.1 Normality Test

The present work utilized the Shapiro-Wilk test to assess the conformity of the regression residuals to a normal distribution. The null hypothesis posited for this test is that the residuals exhibit a normal distribution. The results on normality tests are shown in table 4.10 below.

TABLE 4. 10
Normality Test

	Shapiro-Wilk		
	Statistic	Df	Sig.
Digital payments	.311	167	.061
Digital credits	.490	167	.085
Digital savings	.297	167	.055
Digital insurance	.462	167	.076
Financial Inclusion	.431	167	.080

The results of the normality test indicated that all of the variables exhibited a p-value exceeding 5%. According to Hair *et al.* (2010), the p-values for the five predictor variables and the outcome

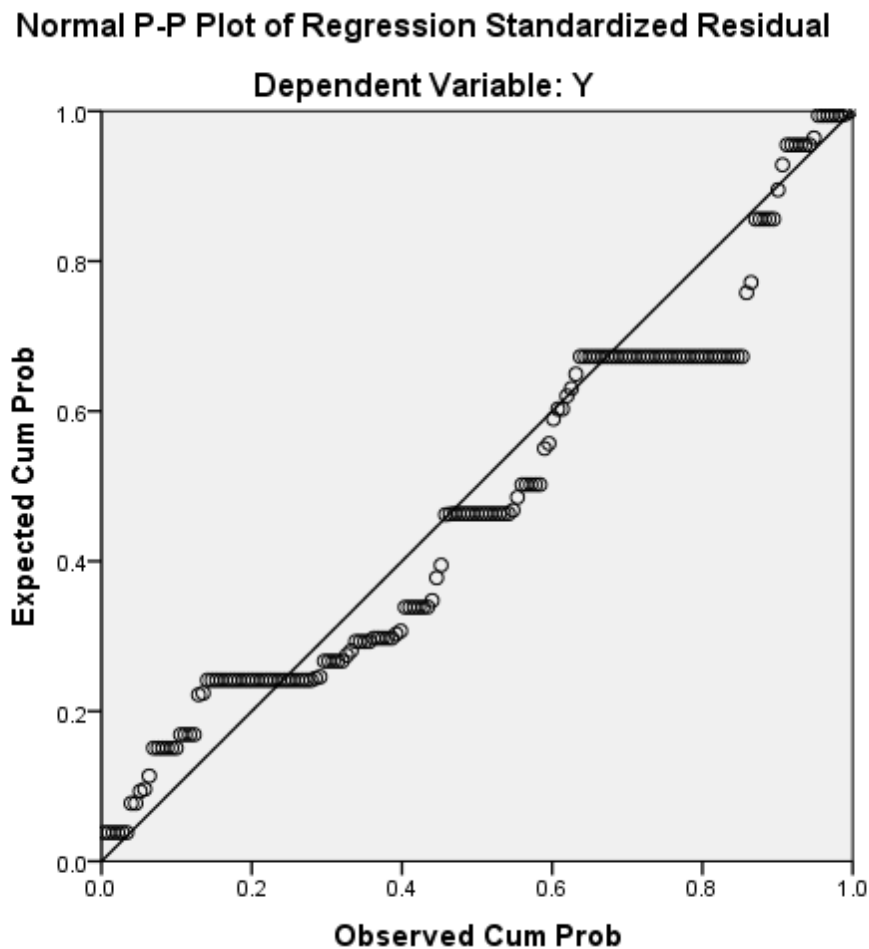
variable were determined to be higher than the chosen alpha threshold of 0.05. This suggests that the data was derived from a population that follows a normal distribution.

4.5.2 Linearity Test

The objective of the linearity test is to evaluate whether the data distribution of both the dependent and independent variables conforms to a linear pattern. Ensuring the fulfillment of the linearity assumption is of utmost importance as linear regression has been selected as the preferred regression technique.

FIGURE 4.1

P-P Plot



The data distribution displayed in Figure 4.1 has a positive linear trend, with the plots evenly distributed along the diagonal line. Based on the findings of the linearity test, it may be inferred that the regression model satisfies the linearity assumption, hence rendering it appropriate for

linear regression analysis. The aforementioned criterion was satisfied, so confirming the suitability of the model for producing the most accurate and impartial estimations.

4.5.3 Multicollinearity Test

In order to evaluate the presence of multicollinearity, the current study utilized the Variance Inflation Factor (VIF). The presence of multicollinearity is determined by evaluating the Variance Inflation Factor (VIF) value, which is regarded to be significant if it exceeds 10, as recommended by O'Brien (2007). The results of the multicollinearity test are presented in Table 4.11.

Table 4.11
Multicollinearity Test

Variable	Tolerance	VIF
Digital Payments	.246	4.068
Digital credits	.293	3.417
Digital savings	.253	3.946
Digital insurance	.262	3.816

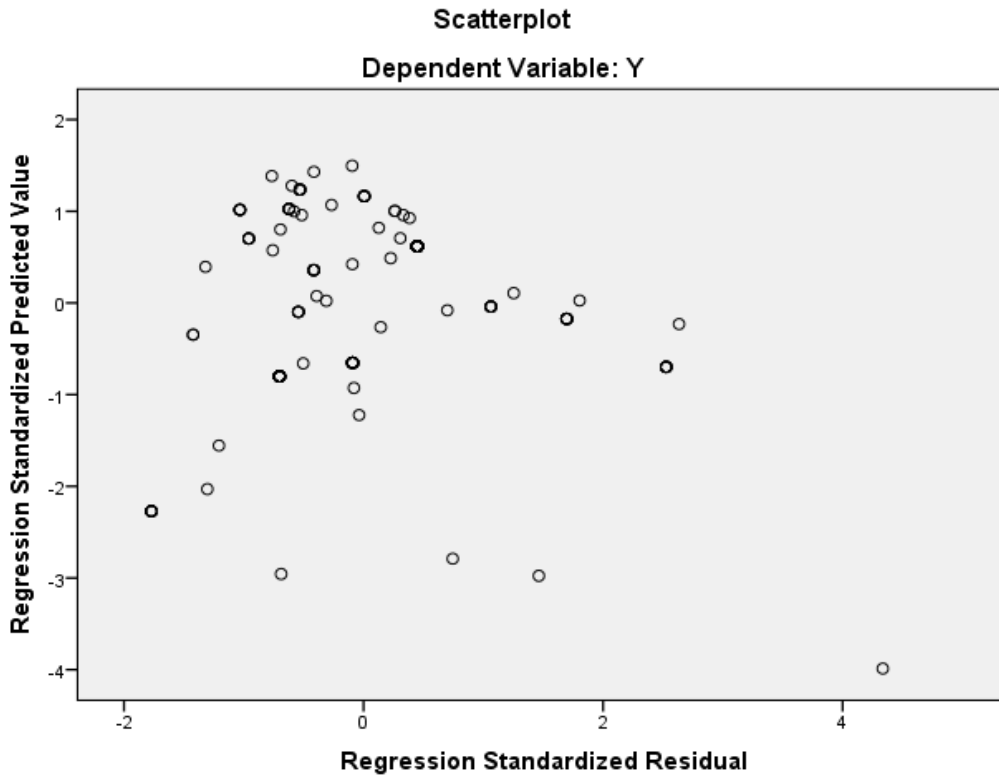
The Variance Inflation Factor (VIF) values for the independent variables were determined to be less than 10. According to O'Brien (2007), a Variance Inflation Factor (VIF) value of 10 or less indicates the absence of multicollinearity among the predictor variables.

4.5.4 Homoscedasticity Test

Homoscedasticity is a crucial assumption in statistical analysis, which asserts that there is an equality or similarity in variances among the groups being compared. The consideration of dissimilarities is an essential assumption in parametric statistical tests. Based on the data depicted in Figure 4.2, the scores demonstrate a stochastic distribution devoid of any identifiable structure along the horizontal axis. Tabachnick and Fidell (2007) posit that a homogeneous distribution of residuals and their variances is anticipated across all projected scores. Upon the confirmation of

the truthfulness of this assertion, the fundamental supposition is fulfilled, leading to the emergence of a scatter plot that displays a non-uniform arrangement. Therefore, the assumption has been fulfilled.

Figure 4.2
Homoscedasticity Test



4.6 Inferential Results

4.6.1 Correlational Results of Study Variables

The current study utilized correlation analysis to examine the relationships among a set of variables, following the recommendations outlined by Pallant (2010). A correlation coefficient of +1 indicates a perfect positive linear relationship between two variables, while a correlation coefficient of -1 signifies a perfect negative linear relationship. A correlation coefficient of zero signifies the lack of a linear association between the two variables. According to Pallant (2010), correlation coefficients can be classified into different categories based on their values.

Coefficients ranging from 0.0 to 0.19 are considered to exhibit a "very weak" correlation. Coefficients falling between 0.20 and 0.39 are classified as "weak" correlations. Coefficients ranging from 0.40 to 0.59 are categorized as "moderate" correlations. Coefficients falling between 0.60 and 0.79 are considered to exhibit a "strong" connection. Finally, coefficients ranging from 0.80 to 1.0 are classified as "very strong" correlations. Table 4.12 presents the results of the correlation analysis.

TABLE 4.12
Correlation among Study Variables

Variable		X_1	X_2	X_3	X_4	Y
X_1	Pearson Correlation	1				
	Sig. (2-tailed)					
X_2	Pearson Correlation	.393**	1			
	Sig.(2-tailed)	.000				
X_3	Pearson Correlation	.420**	.307**	1		
	Sig. (2-tailed)	.000	.000			
X_4	Pearson Correlation	.407**	.391**	.443**	1	
Y	Pearson Correlation	.719**	.585**	.654**	.768**	1
	Sig. (2-tailed)	.000	.000	.000	.000	

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

Sekaran (2000) asserts that correlation analysis serves as a valuable instrument for assessing the direction, amount, and statistical significance of correlations among variables within a research investigation. Sekaran (2003) posits that a positive correlation signifies that while one variable undergoes an augmentation, there exists a propensity for other variables to also exhibit an increase. On the contrary, a negative correlation denotes that an increase in one variable is typically accompanied by a drop in another variable. The findings presented in Table 4.12 reveal a

statistically significant association between the independent factors and the dependent variable (Y) within the scope of this research.

In particular, there is a positive and statistically significant correlation between the utilization of digital payments (X_1) and the financial inclusion among rice farmers ($r = 0.719$; $p = 0.00$). This suggests that with each unit increase in digital payments, there is a corresponding positive increase of 0.719 in the financial Inclusion among rice farmers. It is important to note that this correlation does not imply causation. Similarly, there is a positive and statistically significant association between the use of digital credit and the financial Inclusion among rice farmers ($r = 0.585$; $p = 0.00$). This means that for each unit increase in digital credits, there is a positive increase of 0.585 in the financial inclusion among rice farmers.

Additionally, the association between digital savings and financial inclusion among rice farmers is positive and significant ($r = 0.654$; $p = 0.00$) implying that for every unit increase in digital savings, there is a positive increase of 0.654 in financial Inclusion among rice farmers. Lastly, Table 4.12 shows that the association between digital insurance and Financial Inclusion among rice farmers is positive and significant ($r = 0.768$; $p = 0.00$). This implies that for every unit increase in digital insurance, there is a positive increase of 0.768 in financial inclusion among rice farmers.

4.6.2 Regression Results

Multiple regression analysis was employed in this study to establish the linear statistical association between the independent and dependent variables. Young (2014) asserts that the utilization of regression analysis facilitates the elucidation of the statistical association between variables, hence augmenting the study's capacity to draw meaningful findings and provide

recommendations. For the present study, hierarchical linear regression was run based on the predicted regression model. The results are shown in the sections below.

TABLE 4.13

Model Summary before Moderation

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.848 ^a	.719	.712	.47155

a. Predictors: (Constant), X₄, X₁, X₃, X₂

The regression model yielded indicates the proportion of the total variance in financial inclusion. This model summary shows that the multiple regression model has a strong relationship between the independent variables (X₁, X₂, X₃, X₄) and the dependent variable. The R value of 0.848 indicates a high positive correlation. The R Square value of 0.719 means that approximately 71.9% of the variance in the dependent variable is explained by the model. The analysis confirmed that the combined effect of digital payments, digital credit, digital savings, and digital insurance has a statistically significant influence on financial inclusion.

TABLE 4.14

ANOVA before Moderation

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	92.303	4	23.076	103.775	.000 ^b
	Residual	36.023	162	.222		
	Total	128.326	166			

a. Dependent Variable: Y

b. Predictors: (Constant), X₄, X₁, X₃, X₂

The results in table 4.14 indicate that the regression model accounted for a significant portion of the total variance in financial inclusion. The resulting F-statistic was 103.775, with a corresponding significance value (p-value) of 0.000. Since the p-value is less than the 0.05

threshold, the regression model is considered statistically significant. These findings demonstrate that digital payments, digital credit, digital savings, and digital insurance, taken together, have a significant predictive effect on financial inclusion among the sampled rice farmers.

Table 4.15 presents the regression coefficient values (beta values) for each of the elements of fintech service.

TABLE 4.15
Regression Coefficients before Moderation

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	-3.023	.369		-8.202	.000
	X ₁	1.225	.102	.678	12.048	.000
	X ₂	.424	.102	.311	4.154	.000
	X ₃	.030	.089	.025	.342	.733
	X ₄	-.066	.126	-.038	-.524	.601

a. Dependent Variable: Y

The regression results indicate that digital payments had a strong positive and statistically significant effect on financial inclusion (B = 1.225, t = 12.048, p < 0.001). This suggests that an increase in access to or usage of digital payment platforms, such as mobile money services or cashless payment systems, substantially enhances farmers' ability to participate in formal financial systems. This finding aligns with prior research by Ozili (2018), which emphasizes the pivotal role of digital transactions in extending financial services to underserved populations. Practically, this means that scaling up digital payment infrastructure in rural areas—through partnerships with mobile network operators and financial institutions—could significantly improve financial inclusion for smallholder farmers.

Digital credit also had a statistically significant and positive effect on financial inclusion ($B = 0.424$, $t = 4.154$, $p < 0.001$). This finding suggests that access to credit through digital platforms, such as M-Shwari or KCB M-PESA, enables farmers to better manage cash flow, invest in inputs, or respond to emergencies, thereby strengthening their engagement with the financial sector. According to Suri and Jack (2016), access to digital credit enhances economic resilience and encourages savings and productive investments. Policymakers should therefore prioritize partnerships with fintech providers that offer tailored digital credit products for agricultural activities, ensuring transparency in loan terms and minimizing predatory lending.

Conversely, digital savings platforms did not have a statistically significant effect on financial inclusion ($B = 0.030$, $t = 0.342$, $p = 0.733$). Although such platforms theoretically encourage consistent saving behavior and long-term financial planning, their limited impact in this context may stem from usability issues, lack of trust, or inadequate awareness among farmers. This result mirrors findings by Zins and Weill (2016), who note that financial literacy and behavioral barriers often limit the effectiveness of digital savings tools in rural settings. As a practical implication, financial service providers and development agencies should invest in user-friendly, low-cost savings solutions that include nudges or incentives, and pair them with financial literacy campaigns.

Digital insurance also did not significantly predict financial inclusion ($B = -0.066$, $t = -0.524$, $p = 0.601$), indicating that insurance services delivered through digital platforms may not yet be effectively integrated into the financial lives of rice farmers. This could be due to a lack of awareness, complexity of products, or poor claim experiences, which can erode trust. Cai et al. (2015) argue that microinsurance uptake remains low in many rural areas unless supported by subsidies or education efforts. As such, insurance companies and policy designers should simplify

insurance products, use mobile-based claims tracking, and educate farmers on the value of coverage against risks such as crop failure or illness.

The following sections show the results of the hierarchical linear regression analysis.

TABLE 4. 16

Model Summary after Moderation

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	R Square Change	Change Statistics			Sig. F Change
						F	df1	df2	
1	.848 ^a	.719	.712	.47155	.719	103.775	4	162	.000
2	.848 ^b	.720	.711	.47258	.001	.301	1	161	.584
3	.854 ^c	.730	.714	.46998	.010	1.446	4	157	.221

a. Predictors: (Constant), X₄, X₁, X₃, X₂

b. Predictors: (Constant), X₄, X₁, X₃, X₂, FL

c. Predictors: (Constant), X₄, X₁, X₃, X₂, FL, X_{2_FL}, X_{1_FL}, X_{3_FL}, X_{4_FL}

d. Dependent Variable: Y

The regression analysis revealed that digital financial services explain a significant portion of the variation in financial inclusion. The model achieved an R-squared value of 0.719, indicating that approximately 71.9% of the variability in financial inclusion can be accounted for by these four predictors. The adjusted R-squared value of 0.712 further confirms the model’s reliability, even after adjusting for the number of independent variables. The F-statistic of 103.775 and its p-value of 0.000 demonstrate that the regression model is statistically significant, affirming that the digital financial services jointly contribute meaningfully to explaining financial inclusion. These results are consistent with previous studies which emphasize that digital financial services are central to improving access and participation in formal financial systems (Ozili, 2018; Zins & Weill, 2016).

The introduction of financial literacy as an additional independent variable did not produce a significant improvement in model fit. The change in R-squared was negligible, moving from 0.719

to 0.720, and the corresponding F-change was not statistically significant ($p = 0.584$). This outcome suggests that financial literacy, on its own, may not directly enhance financial inclusion in a statistically meaningful way, possibly due to the already embedded literacy requirements involved in using digital platforms. This finding supports the argument that digital access and usage may sometimes compensate for formal financial education, as long as platforms are user-friendly and accessible (Demirgüç-Kunt et al., 2022).

Further analysis introduced interaction terms between financial literacy and each of the four digital financial services to explore whether financial literacy strengthens the impact of these services on financial inclusion. While the model's R-squared rose modestly to 0.730, this improvement was statistically insignificant ($p = 0.221$), implying that financial literacy does not significantly moderate the relationship between digital financial services and financial inclusion. This result indicates that although financial literacy remains an important personal competency, its ability to enhance or alter the effectiveness of digital tools may be limited in practical application without simultaneous infrastructure and behavioral interventions.

TABLE 4.17
ANOVA after Moderation

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	92.303	4	23.076	103.775	.000 ^b
	Residual	36.023	162	.222		
	Total	128.326	166			
2	Regression	92.370	5	18.474	82.722	.000 ^c
	Residual	35.956	161	.223		
	Total	128.326	166			
3	Regression	93.648	9	10.405	47.109	.000 ^d
	Residual	34.678	157	.221		
	Total	128.326	166			

a. Predictors: (Constant), X₄, X₁, X₃, X₂

- b. Predictors: (Constant), X₄, X₁, X₃, X₂, FL
- c. Predictors: (Constant), X₄, X₁, X₃, X₂, FL, X_{2_FL}, X_{1_FL}, X_{3_FL}, X_{4_FL}
- d. Dependent Variable: Y

The ANOVA results for the three regression models indicate a statistically significant overall model fit in each case, as evidenced by the F-values and associated p-values ($p < .001$). Model 1, which includes the four predictors (X₁, X₂, X₃, and X₄), explains a substantial proportion of the variance in the dependent variable Y, with an F-value of 103.775. The addition of the moderating variable financial literacy in Model 2 results in a slight increase in the regression sum of squares and maintains statistical significance, suggesting that financial literacy contributes additional explanatory power to the model. Model 3 incorporates interaction terms between financial literacy and the other predictors, which further increases the regression sum of squares, though with diminishing returns in terms of F-value reduction, reflecting a more complex model with additional predictors. The reduction in residual sum of squares across models indicates improved model fit with each successive model. These findings support the incremental explanatory contribution of FL and its interactions, warranting further examination of individual coefficients to interpret their practical significance.

TABLE 4.15
Regression Coefficients after Moderation

Model		Unstandardized Coefficients		Standardized	t	Sig.
		B	Std. Error	Coefficients Beta		
1	(Constant)	-3.023	.369		-8.202	.000
	X ₁	1.225	.102	.678	12.048	.000
	X ₂	.424	.102	.311	4.154	.000
	X ₃	.030	.089	.025	.342	.733
	X ₄	-.066	.126	-.038	-.524	.601
2	(Constant)	-3.196	.486		-6.583	.000
	X ₁	1.232	.103	.682	12.001	.000
	X ₂	.425	.102	.311	4.152	.000
	X ₃	.028	.089	.023	.319	.750
	X ₄	-.070	.127	-.040	-.551	.582
	FL	.037	.068	.023	.548	.584
3	(Constant)	-7.998	3.661		-2.184	.030
	X ₁	2.968	.918	1.643	3.234	.001
	X ₂	1.187	.874	.870	1.358	.176
	X ₃	.505	.961	.412	.526	.600
	X ₄	-1.948	1.192	-1.112	-1.634	.104
	FL	1.099	.826	.683	1.331	.185
	X ₁ _FL	-.385	.205	-1.400	-1.879	.062
	X ₂ _FL	-.167	.194	-.682	-.858	.392
	X ₃ _FL	-.110	.216	-.494	-.508	.612
X ₄ _FL	.419	.269	1.553	1.553	.122	

a. Dependent Variable: Y

In Model 1, digital payment has a strong positive and significant effect on financial inclusion, with a coefficient of 1.225 and a p-value less than .001. Digital credit also positively influences financial inclusion significantly, with a coefficient of 0.424 and a p-value below .001. Digital savings and digital insurance, however, do not have significant effects, with p-values of .733 and .601, respectively. The constant is significantly negative at -3.023. Model 2 adds financial literacy as a predictor. Digital payment and digital credit continue to show significant positive effects, with

coefficients of 1.232 and 0.425, respectively. Digital savings, digital insurance, and financial literacy do not significantly affect financial inclusion in this model, as their p-values exceed .05. The constant remains significantly negative at -3.196.

In Model 3, interaction terms between financial literacy and the digital financial services are included. Digital payment remains a significant positive predictor with a coefficient of 2.968 ($p = .001$). Other main effects, including digital credit, digital savings, digital insurance, and financial literacy, are not statistically significant. Among the interaction terms, the interaction between digital payment and financial literacy approaches significance ($p = .062$), indicating a possible moderating effect. The constant is -7.998 and significant at $p = .030$. Overall, digital payment consistently and strongly predicts financial inclusion, while financial literacy may moderate this relationship. Other digital services show no significant direct or moderating effects.

This study examined whether financial literacy moderates the relationship between various digital financial services and financial inclusion. The regression analysis showed that digital payment consistently has a strong and significant positive effect on financial inclusion across all models. Digital credit also positively influences financial inclusion, though to a lesser extent, while digital savings and digital insurance did not show significant direct effects. When financial literacy was introduced as a moderator, it did not have a significant direct effect on financial inclusion. However, the interaction between financial literacy and digital payment approached statistical significance, suggesting that financial literacy may enhance the positive impact of digital payment on financial inclusion. The other interaction terms between financial literacy and the remaining digital services were not significant.

CHAPTER FIVE

SUMMARY OF FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This chapter presents a comprehensive overview of the key findings derived from the study, while also aiming to formulate conclusions, offer practical recommendations, and propose avenues for future research based on the study's outcomes.

5.2 Summary of Findings

The study sought to investigate the role of fintech services and financial literacy in promoting financial inclusion among rice farmers in Mwea, Kirinyaga County. Specifically, it aimed to examine how the use of digital payment platforms influences financial inclusion, assess the impact of digital credit access, and explore the role of digital savings services in enhancing financial inclusion within the farming community. Additionally, the study sought to evaluate the contribution of digital insurance platforms to financial inclusion and determine whether financial literacy moderates the relationship between fintech services and financial inclusion among rice farmers.

Pearson correlation analysis revealed that all four digital financial services had a statistically significant and positive correlation with financial inclusion. Digital insurance had the strongest positive correlation ($r = 0.768$, $p < 0.01$), followed by digital payments ($r = 0.719$, $p < 0.01$), digital savings ($r = 0.654$, $p < 0.01$), and digital credit ($r = 0.585$, $p < 0.01$). These results suggested that as the uptake of these digital services increases, so does the level of financial inclusion among rice farmers.

The multiple regression analysis conducted before introducing the moderator showed that the model was statistically significant ($F(4,162) = 103.775, p < 0.001$), with an R^2 value of 0.719. This indicates that the four digital financial services collectively explained about 71.9% of the variance in financial inclusion. Individually, digital payments ($B = 1.225, p < 0.001$) and digital credit ($B = 0.424, p < 0.001$) had significant positive effects on financial inclusion. However, digital savings ($B = 0.030, p = 0.733$) and digital insurance ($B = -0.066, p = 0.601$) were not statistically significant predictors. This implies that while all services were positively associated with financial inclusion, only digital payments and credit had a substantial direct influence.

Upon introducing financial literacy as a moderating variable, the analysis revealed that its addition in Model 2 did not significantly improve the explanatory power of the model ($\Delta R^2 = 0.001, p = 0.584$), suggesting that financial literacy on its own did not significantly predict financial inclusion. In Model 3, where interaction terms between financial literacy and each digital financial service were included, the overall model saw a slight increase in R^2 to 0.730. However, this change was not statistically significant ($p = 0.221$). Among the interaction terms, only the interaction between digital payments and financial literacy ($B = -0.385, p = 0.062$) was marginally significant, hinting at a possible moderating effect worth further exploration. The other interaction terms were not statistically significant.

5.3 Conclusions

The study found that digital payments significantly influence financial inclusion among rice farmers. Through correlation and regression analysis, digital payments emerged as a strong and positive predictor. This implies that access to and use of digital payment systems—such as mobile money platforms, mobile banking, and other electronic funds transfer services—enable rice farmers to participate more actively in the formal financial ecosystem. Farmers are able to receive

payments for produce, pay for inputs, settle utility bills, and send or receive remittances seamlessly and securely. The convenience, speed, and lower transaction costs associated with digital payments reduce the reliance on cash-based transactions, which are often risky and inefficient. Moreover, digital payment systems provide transaction histories, which can be useful in credit scoring and future access to financial products. The significant relationship also reflects the increasing penetration of mobile technology and the receptiveness of farmers to adopt it for daily transactions.

The regression findings show that digital credit has a statistically significant positive effect on financial inclusion, suggesting that rice farmers who can access loans via mobile platforms are more likely to engage with the formal financial system. This access enables them to finance the purchase of farm inputs, manage household cash flow during lean seasons, and respond to emergencies without having to rely on informal lenders. Importantly, digital credit is often disbursed instantly and requires minimal paperwork, which enhances its appeal. The availability of short-term, low-value loans that are tailored to the farmers' needs supports a more inclusive financial environment. Therefore, while digital credit significantly contributes to financial inclusion, it must be accompanied by safeguards and responsible lending policies. Capacity-building initiatives that help farmers manage their borrowing responsibly would further maximize the benefits.

Although the correlation results indicated a positive relationship between digital savings and financial inclusion, the regression analysis did not find digital savings to be a statistically significant predictor. This suggests a nuanced relationship. On one hand, digital savings platforms provide farmers with secure and convenient avenues to store surplus income, plan for future expenses, and build resilience against financial shocks. These platforms often include mobile wallets or savings features within mobile banking apps, which do not require formal bank

accounts. In principle, they reduce the physical, psychological, and procedural barriers to saving. However, the insignificant effect in the regression analysis suggests that rice farmers may not be using digital savings tools extensively or strategically enough for these platforms to have a measurable impact on their overall financial inclusion. Factors such as low surplus income, lack of trust in digital savings products, and limited financial literacy may hinder active and sustained use. Furthermore, many digital savings tools may not offer attractive interest rates or incentives, thus reducing motivation.

The findings on digital insurance revealed a positive but statistically insignificant relationship with financial inclusion. This indicates that while there is a conceptual link between the availability of digital insurance and greater financial inclusion, its practical impact is still limited among rice farmers. Digital insurance offers protection against agricultural risks such as crop failure, pest infestations, drought, and floods—risks that significantly affect the livelihoods of smallholder farmers. By mitigating these risks, insurance can enhance financial stability and encourage investment in productivity-enhancing inputs. However, the study's findings suggest that digital insurance is not yet widely adopted or well understood among rice farmers, limiting its transformative potential. Factors such as low awareness, mistrust of insurers, limited product customization, and the perception that premiums are unaffordable contribute to this low uptake. In many cases, digital insurance is bundled with other products (such as loans or seed packages), which can obscure its value.

The findings show that financial literacy does not significantly moderate this relationship in a consistent or statistically meaningful way. This result is surprising given the theoretical expectation that individuals with greater financial knowledge are better equipped to understand and utilize financial products effectively. One possible explanation is that the level of financial

literacy among rice farmers may still be relatively low across the board, such that its moderating influence is not yet observable in practice. Additionally, digital financial services—especially mobile-based ones—are often designed to be user-friendly and intuitive, reducing the reliance on formal financial training. This might diminish the moderating effect of literacy. However, one interaction term between digital payments and financial literacy showed borderline significance, suggesting that in specific contexts, higher financial literacy might enhance the impact of some digital services

5.4 Recommendations

Given the significant positive impact of digital payments on financial inclusion, it is essential for stakeholders—including government, mobile network operators, and financial institutions—to invest in the necessary infrastructure to support these systems. Improving mobile network coverage in rural farming areas, increasing the number of mobile money agents, and ensuring consistent power supply will expand access. Additionally, financial institutions and FinTech firms should create incentives such as reduced transaction fees, loyalty points, or cash-back offers to encourage usage. Farmer cooperatives and SACCOs can also play a role by integrating digital payment platforms in their operations.

With digital credit found to significantly enhance financial inclusion, financial service providers should continue to innovate credit products that are tailored to the income cycles and risk profiles of smallholder rice farmers. However, this must be balanced with responsible lending practices to prevent over-indebtedness. This includes clear disclosure of interest rates, repayment terms, and fair recovery practices. Furthermore, training programs should be implemented to help farmers understand the costs and risks associated with digital credit. County governments and

agricultural extension services could collaborate with mobile lenders to deliver these educational interventions effectively.

Although digital savings showed an insignificant effect in the regression analysis, its potential as a financial inclusion driver remains strong. Financial institutions should design savings products that reflect the seasonal income flows of farmers such as harvest-linked savings, input-savings wallets, or goal-based saving plans. These products should offer user-friendly interfaces, competitive interest rates, and low minimum balance requirements. Moreover, sensitization campaigns should be carried out to increase awareness of the benefits of saving, particularly through digital platforms. Such campaigns can be delivered via radio, community meetings, or SMS-based platforms in local languages for better reach.

The uptake of digital insurance among rice farmers remains low, limiting its contribution to financial inclusion. Insurers should design crop and weather-based insurance products that are affordable and easy to understand. Bundling insurance with farm inputs or mobile loans should be accompanied by clear communication on coverage, premiums, and claims processes. Partnerships with agricultural cooperatives, NGOs, and government extension officers can help drive awareness and build trust. Additionally, use of satellite data and automated claims verification can speed up payouts, increasing confidence in digital insurance solutions among farmers.

While financial literacy did not significantly moderate the relationship between digital financial services and financial inclusion, it remains a critical enabler of informed and responsible usage. Stakeholders should embed financial literacy into broader training initiatives on agriculture, digital tools, and entrepreneurship. Topics should include budgeting, saving, borrowing, insurance, and digital security. These programs should use local languages and culturally relevant delivery

modes such as drama, community forums, or mobile audio messages. Public-private partnerships can be leveraged to fund and scale these programs, particularly targeting youth and women who are key actors in agriculture.

5.5 Suggestions for Further Research

While this study has shed light on the influence of financial technologies on financial inclusion among rice farmers in Mwea, there remain several potential areas for further exploration. One promising avenue would be to extend the study to other regions and farming communities engaged in crops such as maize, tea, coffee, or horticulture. Such comparative studies could help determine whether the patterns of FinTech adoption and financial inclusion observed in Mwea hold true in different agricultural and socio-economic settings across Kenya.

A longitudinal research approach would also be valuable. Unlike this cross-sectional study, longitudinal research could provide insights into how farmers' financial behavior evolves over time with continued exposure to FinTech services. This would help determine whether short-term improvements in financial access translate into sustained inclusion and economic empowerment. Another important area for further investigation is financial literacy. Although this study found financial literacy did not significantly moderate the relationship between FinTech and financial inclusion, future studies could explore which specific aspects of financial education are most impactful. Additionally, understanding how the mode of delivery—such as digital training, peer learning, or experiential workshops—affects financial knowledge and behavior would provide useful insights for development practitioners.

Exploring gender and age dynamics in FinTech adoption among smallholder farmers would also enrich the current body of knowledge. Investigating whether women and youth face

unique barriers or show different usage patterns could inform the design of more inclusive digital financial products. These demographic dimensions are especially important in rural communities where traditional norms may shape access and decision-making differently. Further research could also delve into the policy and institutional environment that supports or hinders digital financial inclusion. Analyzing how various counties structure their support for agricultural FinTech, or how national-level regulations influence uptake and innovation, would provide a deeper understanding of the enabling or limiting factors at play.

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Appendix A

Letter of Application to the Farmers: Permission to Conduct Research and Gather Data

Esther Wamuyu Gitonga

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Nairobi

To:

The Manager

Mwea Irrigation Farmers Association

Dear Sir/Madam,

Dear sir/Madam, I trust this letter will meet you knocking well. Hello, my name is Esther Wamuyu Gitonga and I am a Master's student at KCA University. I am currently undertaking a research study in specialty of my Master's degree titled "FinTech Services, Financial Literacy, and Financial Inclusion among Rice Farmers in Mwea, Kirinyaga County."

The study aims at exploring how digital payment platforms, credit, saving, and insurance can improve financial access by rice farmers. Taking into account the crucial functions of the Mwea Irrigation Farmers Association in assisting the farmers in the region, I humbly request your permission to conduct a survey among the members of your association.

This research will entail a survey where a sample of farmers was given questionnaires with set questions. The part of the study where the participants was involved was voluntary and all the data collected was treated with a high level of anonymity and shall only be used for academic purpose. Stringent measures was observed to avoid releasing any information that identifies the farmers or the association in question.

Your support shall be very useful in allowing me to undertake this study, and the results may help in developing strategies for improving the access to financial services and support systems to farmers in the region.

If you have any questions or need additional information, please do not hesitate to get in touch with me via +254733843715 or 2201520@students.kcau.ac.ke . I have also noted that I am willing to produce research authorization letters from my institution if required.

I appreciate the time you are willing to dedicate to my request. I eagerly await your positive response.

Yours sincerely,

Esther Wamuyu Gitonga

Master's Student

KCA University

Questionnaire

Questionnaire: A study on the uptake of FinTech Services, Level of Financial Literacy and Financial Access among Rice Farmers in Mwea Kirinyaga County

Section A: Demographic Information

1. Indicate your gender

Male

Female

2. Age

Below 30 years 31-40 years

41-50 years Above 50 years

3. Indicate your highest level of education

Form 4 Certificate

Diploma Bachelors

4. For how many years have you been participating in the cultivation of rice?

Less than 10 years

More than 10 years

Likert Scale Tables for Questionnaire

The scale is structured as follows: 1 represents Strongly Disagree, 2 represents Disagree, 3 represents Neutral, 4 represents Agree, and 5 represents Strongly Agree.

Digital Payment Services

Dimension	Statement	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Transaction Security	I feel confident that my transactions are secure when using digital payment platforms.					
	Digital payment platforms effectively prevent fraud and unauthorized access.					
Payment Processing	Payments made through digital platforms are processed quickly.					
	I rarely experience delays when processing payments digitally.					
Wallet Integration	Digital payment platforms integrate easily with other digital wallets or accounts I use.					
	I find it easy to transfer funds between my digital wallet and my bank account.					

Digital Credit Services

Dimension	Statement	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Credit Access	I find it easy to access loans through digital credit platforms.					
	Digital credit platforms are					

	accessible whenever I need funds.					
Repayment Tracking	Digital credit platforms provide clear and timely reminders for loan repayments.					
	I can easily track my repayment progress through digital platforms.					
Loan Management	The terms and conditions of digital credit loans are easy to understand.					
	Digital credit platforms offer flexibility in repayment options.					

Digital Savings Services

Dimension	Statement	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Platform Access	I find it easy to access digital savings platforms.					
	Digital savings platforms are accessible even in rural areas.					
Savings Automation	Digital savings platforms allow me to save money automatically.					
	I find automated savings features helpful for building financial stability.					

Goal Tracking	Digital savings platforms help me set and track my financial goals.					
	Goal tracking features on digital savings platforms motivate me to save regularly.					

Digital Insurance

Dimension	Statement	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Platform Access	I find it easy to access digital insurance platforms.					
	Digital insurance services are available and accessible even in rural areas.					
Savings Automation	Digital insurance platforms automatically remind me about policy renewals and payments.					
	Automated notifications from digital insurance platforms help me manage my insurance effectively.					
Goal Tracking	Digital insurance platforms help me track the status and benefits of my insurance policies.					
	Tracking my insurance coverage and claims through digital platforms motivates me to maintain or increase my coverage.					

Financial Literacy

Dimension	Statement	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Budgeting Skills	I know how to prepare a budget for my farm's financial activities.					
	I regularly track my expenses and income using a budget.					
Savings Knowledge	I understand the importance of saving money for emergencies or future needs.					
	I have adequate knowledge of different savings options available to me.					
Debt Management	I know how to manage debt responsibly to avoid financial stress.					
	I understand the terms and conditions of loans before taking them.					

Financial Inclusion

Dimension	Statement	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Accessibility	I can easily access digital financial services in my area.					
	Digital financial services are available to everyone in my community.					
Affordability	The cost of using digital financial services is affordable for me.					
	Transaction fees for digital financial services do not hinder my usage.					
Usability	I find digital financial platforms easy to use.					
	I receive adequate support when facing issues with digital financial services.					

