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Synergizing financial literacy and digital finance: A catalyst for financial inclusion among rural women in Kenya

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Abstract

This study investigates the synergistic effect of financial literacy and digital finance on the formal financial inclusion of rural women. While financial inclusion is recognized as a key driver of economic empowerment, many rural women in Kenya remain excluded from the formal financial sector. The proliferation of digital financial services presents a significant opportunity, but its full potential may be unrealized without a corresponding increase in financial knowledge. This research posits that the combination of financial literacy and access to digital financial tools creates a powerful catalyst, enabling rural women to not only access but also effectively utilize a wider range of formal financial products, such as savings accounts, credit, and insurance. Using a descriptive cross-sectional design, Partial Least Squares Structural Equation Modelling (PLS-SEM) and Chi-Square, we analyze data from a sample of 1000 rural women. The findings demonstrate that the interaction between financial literacy and digital finance has a stronger positive effect on formal financial inclusion than either factor in isolation. This research provides critical insights for policymakers and development organizations, highlighting the importance of integrated interventions that combine financial education with the promotion of digital financial services to genuinely empower rural women and bridge the financial inclusion gap.

Keywords:
Diffusion of innovation theory
Digital finance
Digital financial literacy
Digital literacy
Financial inclusion
Financial literacy.

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1. Introduction

Financial inclusion, a critical component of global development, has become a major policy objective for governments worldwide (Buch, 2017; Ozili, 2021). Defined by the World Bank (2018) as the access to affordable

and useful financial products and services, financial inclusion is instrumental in reducing poverty, mitigating economic inequality, and fostering sustainable economic growth. In developing and emerging economies, this has often meant bringing previously excluded populations, such as low-income and vulnerable groups, into the formal financial sector (Sowjanga, Kumar, & Reddy, 2015).

Globally, significant strides have been made in this area, with account ownership among adults reaching 76% in 2021, a remarkable 50% increase over a decade (Demirgüç-Kunt, Klapper, Singer, & Ansar, 2021). In Sub-Saharan Africa, the widespread adoption of mobile money platforms, such as M-Pesa in Kenya, has been a key driver of this progress. Kenya's financial inclusion index stands at 84.7% as of 2024, largely due to the proliferation of digital finance (FinAccess, 2021).

However, a closer look reveals persistent disparities. Despite the overall high numbers, a significant portion of the population, particularly women in rural areas, remains either partially or fully excluded from a meaningful range of financial products like savings, credit, and insurance. The FinAccess (2021) indicates that while counties like Kiambu have an impressive 96% inclusion rate, others like Bungoma and Migori lag significantly behind. This exclusion is often rooted in a combination of factors, including a lack of financial and digital literacy, limited access to technology, and prevailing socio-cultural norms (Gomber, Koch, & Siering, 2017; OECD, 2017).

This study therefore investigates the synergistic relationship between financial literacy and digital finance and its impact on the financial inclusion of rural women in Kenya. While digital finance provides the platform for access, financial literacy an individual's knowledge and awareness of financial products empowers them to make informed decisions and effectively use these services (Lyons & Kass-Hanna, 2021b). We argue that it is the interactive effect of these two factors that serves as a powerful catalyst for genuine financial inclusion, moving rural women beyond simple access to active and beneficial usage of formal financial services. This research aims to provide critical insights for policymakers and development practitioners seeking to design more effective, integrated interventions to achieve the financial inclusion goals outlined in Kenya's Vision 2030.

1.1. Definition of Financial Literacy, Digital Finance and Financial Inclusion

Different authors have defined the term financial literacy in different ways. Askar, Outtara, and Zhang (2020) defines financial literacy as the people's understanding of financial concepts, as well as their skills and ability to manage money and make informed financial decisions. On their part, Carlin and Robinson (2010) look at financial literacy as people's ability to make financial decisions in their own best short-term interests. Houston (2010) states that financial literacy is the awareness and knowledge of financial concepts and products needed for managing personal finance. Additionally, Hung, Parker, and Yoong (2009) defines financial literacy as the ability to use knowledge and skills to manage financial resources effectively from a lifetime of financial well-being. Additionally, Lyons and Kass-Hanna (2021a) definition sees financial literacy as an individual's or community's awareness and knowledge about available financial products and services and how best to access and use them. This definition is important because it refers not only to being aware and having knowledge about the digital financial products and services, but also includes the aspect of access and use which are very crucial for this study as it aims at analyzing how rural women can easily navigate digital platforms to access financial services and use them for their wellbeing (Hung et al., 2009).

Digital finance is defined as the delivery of traditional financial services through mobile phones, personal computers, the internet or cards that are linked to a reliable digital payment system (Ozili, 2021). For digital finance to be complete, there has to be a technological device which can be used to deliver the financial services. Digital finance therefore, includes all products, services, technology or infrastructure that enable individuals and communities to have access to payments, savings, and credit facilities through the internet without the need of visiting the bank or financial service provider (Gomber et al., 2017).

Digital finance is a means of extending financial services to the financially excluded and undeserved population in the community like women (Yang, Wu, & Huang, 2020). It facilitates payments via mobile devices which has been of great help to individuals, households and community at large in managing personal assets while at the same time providing more convenient access to finance and financial services thus greater financial inclusion. In rural areas, digital finance plays a major role of improving peoples (low income and poor) access to basic financial services leading to greater financial inclusion. Through digital finance, the underprivileged are able to transact and access basic financial services from the comfort of their homes making them financially included.

Financial inclusion on the other hand is the process of ensuring access to financial services and timely and adequate credit when needed by vulnerable groups like the weaker sections and low-income groups at an affordable cost (Sowjanga et al., 2015). It is the access to financial products and services which are affordable and useful and that meet the needs of transactions, payments, savings, credit and insurance delivered in a responsible and sustainable way (World Bank, 2018). Over the past decade, Kenya has made significant strides in financial inclusion. This is attributed to the rise of mobile money like Mpesa that made financial services accessible to millions of Kenyans. According to the FinAccess (2021) Kenya's financial inclusion index as measured by financial access at 84%.

1.2. Financial Literacy, Digital Finance and Financial Inclusion of Rural Women in Kenya

Women make up slightly more than half of the Kenyan population, with a majority of them residing in the rural areas providing farm labor (Mwangi, 2017). Therefore, the participation of majority of these rural Kenyan women in financial related contribution is minimal as compared to their male counterparts. According to Ellis, Manuel, and Blackden (2007) their minimal participation makes them least contributors in the financial sector and even appear reliant on men for financial contributions and decision making (Institute of Economic Affairs Kenya, 2008).

Hassan and Mugambi (2013) and Athane (2011) note that the financial roles conferred to men in Kenya appear more superior than those given to women giving them an opportunity to be the main beneficiaries of financial inclusion. Due to this most of them migrate to urban areas, leaving most women responsible for the running of the affairs at their rural homes and also making rural women most financially excluded (Mwangi, 2017).

These financial exclusion trickles down to increased poverty denying rural women opportunities for empowerment leading to a retarded economy (Gweyi, Ochieng, & Kamau, 2013). Eliminating this disparity through women financial inclusion would spur economic growth by reducing poverty and decreasing unemployment thereby destabilizing this status quo (Mwobobia, 2012).

Agbo and Isa (2017) define rural women as those who reside or live in the village or interior communities (a geographical area located outside urban areas or towns). They are women who have settled and developed a livelihood in the village. They play a major role of supporting their households and communities at large to generate income, achieve security and improve their overall wellbeing (Mwobobia, 2012). Rural women are important for transformational economic, environmental and social changes across the globe though more often than not are constrained in their roles by education and health care challenges (UN, 2022).

Rural women are mainly found in low skilled, low productivity and low paying jobs with long working hours coupled with poor working conditions (UN, 2022). These rural women more often than not have the same culture, religion and even vocation. Some of them are literate, some are semi-illiterate but most of them are illiterate limiting their equitable access to opportunities, resources and services (Agbo & Isa, 2017).

2. Literature Review

The key theories in this study are the Financial Literacy Theory (FLT) and the Diffusion Innovation Theory. Financial Literacy Theory proposed that individuals with higher financial literacy levels are usually better equipped to make informed financial decisions than those with low literacy levels. According to Lusardi and Mitchell (2014) these individuals are able to utilize financial products effectively thus achieving greater financial wellbeing. The diffusion Innovation Theory on the other hand states that "the adoption of a new product, service or idea is not an overnight phenomenon, it happens simultaneously across all people in a society" (Rogers, 1962).

These theories relate well when it comes to the joint effect of financial literacy and digital finance on financial inclusion among rural women in Kenya in the sense that people adopt and embrace technology and, in this case, digital finance differently. Before adoption of digital finance, there has to be some sort of stages in the sense that people need to be aware of digital finance, they must be persuaded that it's something worth trying which leads them into making a decision on whether to try it out or not. Therefore, for rural women to adopt digital finance, they require financial knowledge. Limited financial literacy can actually hinder or bar a rural woman from accessing financial services that would enable them to be financially included. With limited financial knowledge, it will be hard for a rural woman to understand, navigate and use digital financial services that are offered through mobile money or any other digital platform. A combination of financial literacy and digital finance is therefore, necessary for effective access and usage of formal financial services.

Past studies have examined the influence of financial literacy and digital finance on financial inclusion differently. Accordingly, Fanta and Mutsonziwa (2021) efforts to promote financial inclusion must be accompanied by financial literacy campaigns. Showkat, Nagina, Baba, and Yahya (2025) investigated the impact of financial literacy on women's economic empowerment particularly through the use of digital financial services using the structural equation modelling in Smart PLS 4. The study employed quantitative approach grounded in an extended Technology Acceptance Model (TAM) and the theory of planned behavior to analyze the relationships among financial literacy, digital financial services and economic empowerment among women on a sample of 386. The findings revealed that financial literacy significantly amplifies the benefits of digital financial services in promoting women empowerment. Therefore, there is a need to prioritize financial literacy initiatives within digital platforms to maximize their effectiveness.

Agarwalla, Barua, Jacob, and Varma (2013) and Organisation for Economic Co-operation and Development (OECD) (2013) questionnaire involving financial literacy, access to financial services and financial wellbeing were employed. The results of the study indicated that financial literacy helps in enhancing financial knowledge and in developing skills of individuals so that they can compare and choose the best finance-oriented products and services which in the end increase their access to banking services. The study further concluded that without access to banking services, financial literacy alone cannot enhance financial wellbeing among individuals. To fill this gap, the current study will focus on both financial literacy and access to digital finance as influencers of financial inclusion of rural women.

Askar et al. (2020) highlighted that financial literacy plays an important role in reducing poverty regardless of the financial measure used. Similarly, Ozili (2021) noted that financial literacy helps in enhancing financial knowledge and in developing skills of individuals so that they can compare and choose the best finance-oriented products and services which in the end increase their access to banking services. Without access to banking services, financial literacy alone cannot enhance financial wellbeing among individuals.

On the other hand, Amnas, Kumar, and Singh (2023) explored the potential of financial technology to promote financial inclusion. The study sought to understand why people use FinTech and how it affects their access to financial services by taking into account the mediating role of digital financial literacy and the moderating effect of perceived regulatory support. It used the partial least squares structural equation modelling (PLS-SEM) on a sample of 608 FinTech users in India. The research findings revealed that FinTech positively impacts financial inclusion making it easier for individuals to get into formal financial services. The study also indicated that trust and perceived security concerns are essential in promoting the utilization of FinTech services.

Uzoma, Nwankwo, and Okafor (2020) used data from 27 sub-Saharan African countries to investigate the relationship between Digital Finance that was measured by the share of people using ATMs and Financial Inclusion that was measured by actual use and quality of financial services. The actual use of financial services was measured using deposit accounts in commercial banks for every 1000 adults while. The findings indicated that there is a positive association between digital finance and financial inclusion. Further, Siddik and Kabiraj (2020) examined the influence of Digital Finance on Financial inclusion using data on 189 countries from 2004 to 2016. The measure of digital finance in the study was usage of ATMs which will contribute significantly to this study.

Widarwati, Solihin, and Nurmalasari (2022) investigated the effect of digital finance on financial inclusion on Indonesian Banking industry. Yearly data from the banking industry from the Indonesian Stock Exchange (IDX) 2013- 2019 with a sample of 6 banks were used. Digital finance was looked at in terms of internet banking and mobile banking and the average digital finance (ADF) measurement was used to measure the internet and mobile banking transactions. Panel data regression model was employed to test the hypothesis. The findings revealed that digital finance impacts financial inclusion through digital financial services that facilitate access to financial services. Therefore, increasing and decreasing internet banking and mobile banking influence credit penetration. More so, Kan and Sun (2022) investigated the impact of digital finance on innovation and research and development of technology. Financial data on technology based on SMEs on the growth enterprise market from 2013 – 2020 (China Growth Enterprise Market Listed Company data) was used. Fixed effect model was employed to test the impact of digital finance and financial flexibility on enterprise research and development investment from the external environment and the internal mechanisms. The findings revealed that digital finance through breadth of coverage, depth of use and degree of digitization has a positive impact on research and development investment of technological based SMEs.

Accordingly, Lakhouil and Segdali (2024) examined the impact of digital finance on financial inclusion in Morocco. The study adopted a quantitative methodology based on a sample of 454 individual bank customers. Data was analyzed using structural equation modelling to examine the relationship between digital finance and users' access, quality, use and financial wellbeing. The findings of the study revealed that digital finance significantly enhances user access and financial wellbeing facilitating financial inclusion. The study further highlights the importance of supporting financial innovation while ensuring consumer protection as well as inclusion of vulnerable populations. Additionally, Durai and Stella (2019) sought to analyze the impact of digital finance in bringing about financial inclusion among people. Digital finance according to the study included internet banking, mobile banking, mobile wallets, credit and debit cards. Financial inclusion on the other hand included convenience, adaptability, affordability, security, user friendly, and accurate timing. Well-structured questionnaires with multiple choice and Likert scale questions were used to get data that was analyzed using one way ANOVA to compare means. The study findings revealed that digital finance has a significant impact on financial inclusion in as much as it has some negative issues like security and affordability.

Shen, Hu, and Hueng (2018) analyzed the effect of financial literacy, digital financial product usage on financial inclusion using a cross-sectional research design on a sample of 218 individuals from different areas in China. Partial Least Squares (PLS) regression was employed to estimate the relationships. Questionnaires for measuring the different variables were used. Financial literacy variables included financial knowledge, financial skills, financial attitudes and ability to make sound judgements and decisions. These variables were measured based on education levels, income, commercial loans, credit card, shared and commercial insurance. Digital financial product usage was measured using internet consumer product, internet financial product, internet loan and crowdfunding. Financial inclusion was measured based on price inclusion, geographical inclusion and self-inclusion. The study suggested that improving financial literacy of residents and popularizing the internet usage can promote the usage of digital financial products and achieve the goal of advancing financial inclusion. The study considered digital financial product usage which is different from this study that will consider financial literacy, digital finance and financial inclusion.

The common feature of all the aforementioned research investigations is that financial inclusion is only possible if there is awareness of financial services which can be availed through digital finance. Therefore, a

financially included individual is one who is financially literate and has access to affordable digital financial services and is able to use them effectively to improve their financial wellbeing.

3. Conceptual Framework

To examine the influence of financial literacy and digital finance on financial inclusion of rural women in Kenya the study conceptualized the relationship that exist among the variables as shown in figure 1. The dependent variable in this study is financial inclusion while the independent variables are financial literacy and digital finance. Financial literacy which is measured through awareness of financial products, knowledge of financial products and financial behavior serves as a driver of financial inclusion. Digital finance that is measured by access to digital payment systems and usage of digital payment systems enhances financial inclusion. Therefore, an individual with higher financial literacy level and who is able to access and use digital payments systems is well able to access and use formal financial services effectively to make informed financial decisions.

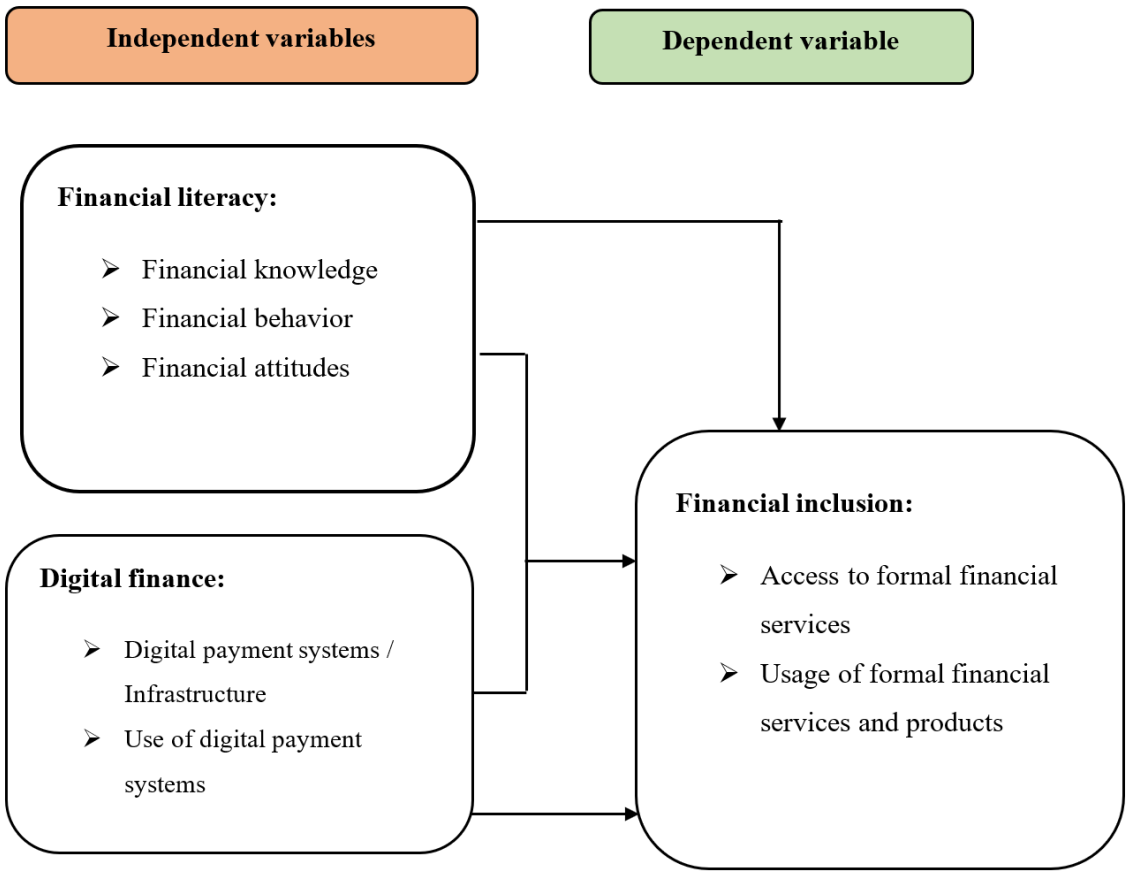

Figure 1. Conceptual framework.

Financial Inclusion as a dependent variable is measured by access to and usage of formal financial services. This is the ultimate goal of the conceptual framework. It represents the extent to which rural women, can access and use formal financial services. Rural women who are financially literate and have adopted digital finance are in a position to access formal financial services and use the financial services for their financial wellbeing thus getting into the financial inclusion bracket. Financial literacy and digital finance therefore (See Figure 1) enhances financial inclusion.

4. Methodology

The research design used to examine the relationship between financial literacy, digital finance and financial inclusion among rural women in Kenya in the year 2024 was the descriptive cross sectional research design since it facilitated the description of financial literacy and digital finance variables and their influence on financial inclusion of rural women.

The study targeted a population of 13.1`million rural women in Kenya. Multi stage sampling technique was used to purposively select rural women from the counties, then sub counties and finally the women were randomly selected from the wards giving a sample of 1000 as recommended by Organisation for Economic Co-operation and Development (OECD) (2021). However, due to lack of complete information the sample size was reduced to 961 rural women. The data for this research consists of primary data. Primary data was obtained using structured questionnaires adopted from the World Bank (2021) and the FINSCOPE questionnaires

modified to capture relevant information on financial literacy, digital finance and financial inclusion. The questionnaires were read out loudly to the respondents to capture aspects of financial literacy and financial inclusion. The collected data was then analyzed using Partial Least Squares Structural Equation Modelling (PLS-SEM) Technique and confirmed using Chi-square test of independence.

The analytic approach adopted involved a multi-step process. To begin with, descriptive cross-sectional research was chosen to describe the variables and their relationships. This was followed by a multi stage sampling technique to select a representative sample of rural women. Primary data was then collected using modified pre-existing questionnaires to ensure the reliability and validity of the data. Finally, descriptive statistics, PLS-SEM and Chi-Square was used to analyze the collected data and model the relationship between financial literacy and financial inclusion among rural women.

5. Results and Discussion

To determine whether financial literacy and digital finance influences financial inclusion of rural women, the study used descriptive analysis, the Partial Least Squares Structural Equation Modelling (PLS-SEM) and Chi-Square statistical methods.

5.1. Descriptive Results

The study computed a new variable called digital financial literacy by multiplying the indicators of financial literacy (financial Knowledge, financial behavior and financial attitude) by digital finance indicators (digital payment systems and usage of digital payment systems). This was informed by the study of Lyons and Kass-Hanna (2021a) that defined digital financial literacy as a combination of digital finance and financial literacy. Digital financial literacy therefore implies being "financially literate on digital platforms and being able to effectively use the available digital financial services". The study thus measured DFL by multiplying the metrics of both financial literacy and digital finance to get the digital financial literacy score. The actual scores were converted into percentages to represent the level of digital financial literacy in the regions. According to Ravikumar, Suresha, Prakash, Vazirani, and Krishna (2022) there is no consensus on metrics of DFL, therefore, the study defined a digitally financially literate women as one who scored a digital financial literacy score of at least 50%. The results are presented in Table 1.

Table 1. Regional scores for digital financial literacy.

Status region	Number of women	Maximum digital literacy score	Actual digital financial literacy score (%)	Digitally financially literate
Western	195	44	23.34 (53%)	✓
North Eastern	150	44	13.41 (30%)	✕
Coastal	149	44	19.50 (44%)	✕
Eastern	70	44	22.95 (52%)	✓
Nyanza	130	44	15.30 (35%)	✕
Rift Valley	177	44	18.37(42%)	✕
Central	90	44	21.80 (50%)	✓
Overall digital literacy	961	44	19.12 (43%)	✕

Note: ✓-Denotes that the regions scored at least 50% and above and are therefore considered digitally and financially literate.
✕-Denotes that the regions did not score at least 50% thus are not considered digitally and financially literate.

Regionally, Western region has the highest percentage (53%) of rural women who are digitally and financially literate followed by Eastern region with 52% and Central region with 50%. These fairly high scores are attributed to the reported regions high level of education and employment status that enable them to adopt and use digital finance easily as compared to other regions. Rift Valley, Nyanza and North Eastern regions with average digital financial literacy scores of 42%, 35% and 30% respectively are considered as having low digital financial literacy.

The regional statistics build up to the overall digital financial literacy score for rural women as shown in Table 1. The results reveal that rural women in Kenya have a digital financial literacy score of 19.12 signifying that only 43% of the rural women are digitally and financially literate. This could be attributed to limited access to digital finance, low levels of financial literacy, lack of exposure to digital finance services and training programs and socio-economic conditions among rural women in Kenya.

The study suggests that the level of digital financial literacy among rural women is crucial for the adoption and usage of digital financial services which is key for financial inclusion. This agrees with Ravikumar et al. (2022) who noted that DFL is a key requirement for the effective usage of digital financial services. Accordingly, rural women with moderate to low digital financial literacy may face challenges in accessing and benefiting from formal financial services. There is therefore a need for targeted intervention and programs that focus on basic digital skills training, financial awareness campaigns about digital financial services and improving access to technology which will ultimately improve digital literacy among rural women particularly in North Eastern and

Rift Valley regions of Kenya. This aligns with Morgan, Smith, and Taylor (2020) who opined that DFL is a very crucial component in education in this digital age.

5.2. Partial Least Squares Structural Equation Modelling Results

Using the Partial Least Squares Structural Equation Modeling (PLS-SEM) technique, the paper sought to find out the structural relationship between digital financial literacy and financial inclusion of rural women in Kenya. Digital Financial Literacy was measured by multiplying the metrics of both financial literacy and digital finance to get the digital literacy score (Table 1). The actual scores were converted into percentages to represent the level of digital financial literacy in the regions. Financial inclusion on the other hand was measured by the access and usage of formal financial services. To show the relationship between digital financial literacy and financial inclusion, PLS-SEM analytical methodology was used. The analysis was based on path coefficients standardized to range from -1 to +1 and R-squared that was interpreted according to Hair, Hult, Ringle, and Sarstedt (2022). The results are represented in Figure 2.

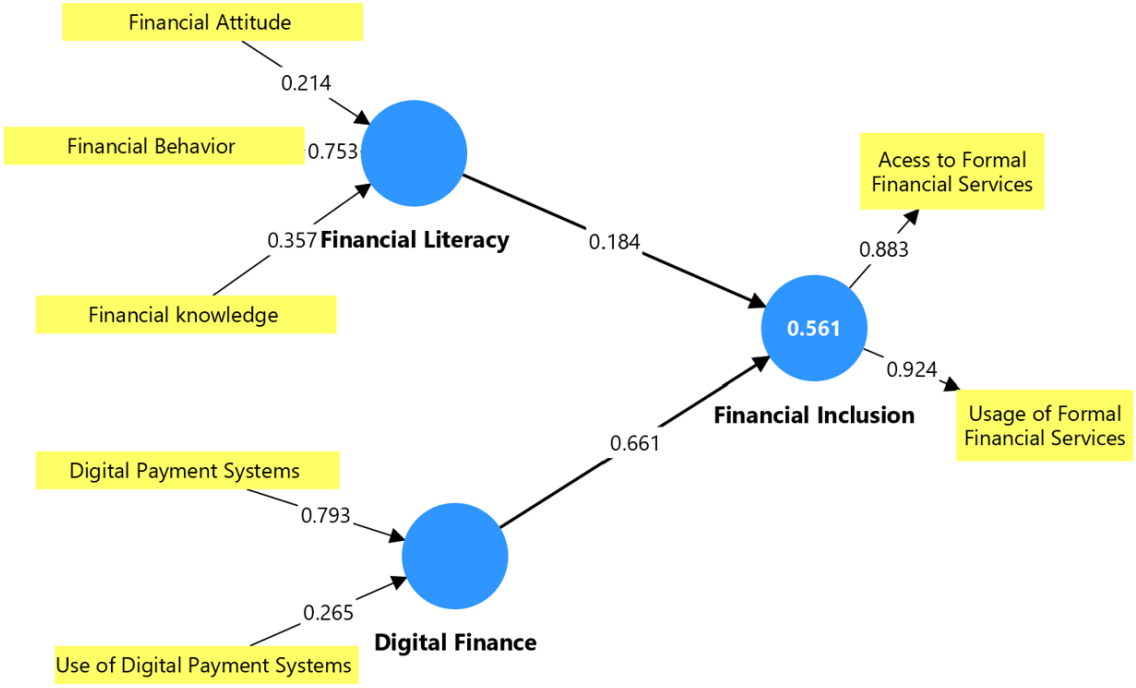

Figure 2. Digital financial literacy and financial inclusion.

Note: Blue circles represent the variables while the yellow rectangles represent the indicators of the variable. The number inside the blue circle represents the R-Squared. Black arrows represent the path coefficients.

5.2.1. Measurement Model (Outer)Interpretation

5.2.1.1. Financial Literacy

From Figure 2, it is observed that financial literacy is measured by financial behavior, financial knowledge and financial attitude. Financial behavior has a very strong positive path coefficient of 0.753. This suggests that financial behavior is a major and strong indicator of an individual's overall financial literacy. It implies that rural women's financial actions and habits are the most significant enablers of their financial literacy levels.

Additionally, financial knowledge also displays a positive path coefficient of 0.357 indicating a moderate positive relationship between an individual's financial knowledge and their financial literacy. The results infer that financial knowledge is a contributor to financial literacy and that rural women with greater financial knowledge tend to have higher financial literacy that would easily lead them into being financially included.

Financial attitude has a positive path coefficient of 0.214 indicating a relatively weak though positive relationship between financial attitudes and financial literacy. This suggests that while financial attitudes is a part of financial literacy, it is not the strongest component.

5.2.1.2. Digital Finance

Digital payment systems have a strong positive path coefficient of 0.793 indicating availability and existence of digital payment systems for rural women in Kenya is a major and strong indicator of the overall level of digital finance.

Usage of digital payment systems has a positive path coefficient of 0.265. This shows a weaker but positive relationship between usage of digital payment systems and digital finance. The results suggest that while usage of digital payment systems is part of digital finance, the availability of the digital payment systems is very crucial.

5.2.1.3. Financial Inclusion

Figure 2 reveals that access to formal financial services has an extremely strong positive path coefficient of 0.883. This means that a one unit increase in financial inclusion is associated with a 0.883 increase in access to formal financial services. This indicates that access to formal financial services is primarily a very strong component of financial inclusion.

Usage of formal financial services has an extremely strong positive path coefficient of 0.924 indicating that a one unit increase in financial inclusion is associated with a 0.965 increase in usage. The coefficient is closer to 1 meaning that the usage of formal financial services is almost a perfect indicator of financial inclusion among rural women in Kenya. This basically implies that usage of formal financial services is the most critical and dominant indicator of financial inclusion.

5.2.2. Structural (Inner) Model

The structural (inner) model interpretation was analyzed by considering path coefficients, R-squared, Cronbach's alpha, VIF and f2. The structural model is presented in Table 2.

Table 2. Digital financial literacy and financial inclusion structural model assessment.

Relationship	β	Cronbach's alpha (α)	VIF	f2	R2
Digital financial literacy and financial inclusion	0.661 0.184	0.930	1.161	0.857 0.066	0.560

Note: β = Denotes path coefficients; f2 = effect size; R2 = Coefficient of determination; VIF = Variance inflation factor.

5.2.2.1. Path Coefficients Interpretation

It can be observed that financial literacy and financial inclusion have a positive path coefficient of 0.184. This indicates a positive but weak relationship between the two variables. It implies that a one unit increase in financial literacy is associated with a 0.184 increase in financial inclusion holding digital finance constant. This basically means that while financial literacy does have a positive effect on financial inclusion, its direct impact is not as strong as the other variables. Therefore, for financial literacy to translate effectively into financial inclusion, other associated factors might be important.

Digital finance and financial inclusion have a positive path coefficient of 0.661 indicating that a one unit increase in digital finance is associated with a 0.661 increase in financial inclusion holding financial literacy constant. This shows a very strong positive relationship providing evidence that digital finance is a strong driver of financial inclusion.

5.2.2.2. R-Squared Interpretation

The R-squared value of financial inclusion is 0.561 indicating that 56.1% 56.1% of the variance in financial inclusion can be explained by the combined influence of financial literacy and digital finance. This suggests that financial literacy and digital finance are great predictors of financial inclusion as a significant proportion of the variation in financial inclusion can be attributed to financial literacy and digital finance. The rest of the 45.5% variations are explained by other factors.

The results imply that financial literacy and digital finance are both crucial drivers of financial inclusion. Rural women with higher levels of financial literacy are more likely to understand and utilize financial products and services, including digital services thereby enhancing financial inclusion. These results concur with Mohsin, Khan, and Patel (2024) study that highlights that improving financial literacy and access to digital finance is very essential for empowering rural women and for encouraging their active participation in the economy. Additionally, the results align with a study by Ozili (2018) which notes that individuals with higher levels of financial literacy are more likely to adopt and effectively use digital finance tools, leading to increased financial inclusion. Digital platforms, when paired with financial literacy training, can help rural populations, particularly women, manage their finances better and participate in the economy.

5.2.2.3. Cronbach's Alpha (α)

The Cronbach's alpha value is 0.930. This value is exceptionally high, well above the acceptable the threshold of 0.70. The value indicates excellent reliability, suggesting that the items used to measure the Digital Financial Literacy and Financial Inclusion were highly consistent and reliable.

5.2.2.4. VIF (Variance Inflation Factor)

The results reveal a VIF value of 1.161. The VIF value is very low, well below the commonly accepted threshold of 5 or 10. This indicates that there are no issues with multicollinearity in the model.

5.2.2.5. Cohen's f2 (Effect Size)

The study reveals an exceptionally high value of 0.857 exceeding the threshold for a large effect, indicating that digital financial literacy has a very substantial and powerful effect on financial inclusion.

In conclusion, it's important to note there is a strong and significant relationship between digital financial literacy and financial inclusion. This is well represented by β=0.661, α=0.930, VIF = 1.161 and an f2=0.857

that is very large. The model explains a significant portion of the variance in Financial Inclusion (R2=0.560) demonstrating that enhancing digital financial literacy is a critical pathway to promoting financial inclusion. Lack of or limited DFL is a major hindrance to the rational and effective usage of formal financial services. For rural women to effectively use formal financial services they must have adequate financial literacy coupled with digital finance. Both financial literacy and digital finance work in tandem allowing for financial inclusion. They are a prerequisite for access and usage of formal financial services.

5.3. Chi–Square Analysis of Digital Literacy and Financial Inclusion

A further examination on whether there was an association between rural women's digital financial literacy levels and their financial inclusion was carried out using Chi-square test of independence. Digital financial literacy was computed by multiplying the elements of financial literacy and digital finance. The data for the computed variable was later converted into categorical variables of rural women being digitally financially literate or digitally financially illiterate. The results are presented in Table 3.

Table 3. Categorical variables for digital financial literacy.

Region	Number of women	Maximum digital literacy score	Actual digital literacy score	Digitally financially literate	Digitally financially illiterate
Western	195	44	23.34	103	92
North Eastern	150	44	13.41	46	104
Coastal	149	44	19.50	66	83
Eastern	70	44	22.95	36	34
Nyanza	130	44	15.30	45	85
Rift Valley	177	44	18.37	74	103
Central	90	44	20.80	42	48
Total				412	549

From Table 3, it is observed that the total population of rural women under consideration is 961. Out of these 412 rural women were digitally and financially literate while 549 were digitally and financially illiterate.

Simultaneously, financial inclusion was measured by a combination of rural women's access to formal financial services and their usage of formal financial services. The data was converted into categorical variables indicating rural women as being financially included or financially excluded. The results are presented in Table 4.

Table 4. Categorical variables for financial inclusion.

Region	Total population	Maximum statistics	Financial inclusion index	Financially included	Financially excluded %
Western	195	10	5.14	100	95
North Eastern	150	10	2.94	44	106
Coastal	149	10	4.31	64	85
Eastern	70	10	3.86	27	43
Nyanza	130	10	3.28	43	87
Rift Valley	177	10	3.56	63	114
Central	90	10	3.58	32	58
Total	961			373	588

It is also observed that 373 of the rural women are financially included while 588 were financially excluded.

To determine whether the association between digital financial literacy among rural women and their financial inclusion is statistically significant, the study used the Chi-square test using the following steps;

Step 1: The paper formulated a hypothesis for the first objective;

H0: There is no significant association between digital financial literacy among rural women and their financial inclusion.

Ha: There is a significant association between digital literacy among rural women and their financial inclusion.

Step 2: The paper compared the overall observed counts from data with the expected counts as represented in Tables 5 and 6 respectively.

Table 5. Observed count for digital financial literacy and financial inclusion.

	Financial inclusion		Total
Digital financial literacy	**Financially included**	**Financially excluded**	
Digitally financially literate	309	103	412
Digitally financially illiterate	64	485	432
Total	373	558	961

From Table 5, it is observed that 309 rural women who were digitally and financially literate were financially included while 103 of the rural women who were digitally and financially literate were not financially included. Additionally, 64 rural women who were digitally and financially illiterate were found to be included while 485 rural women who were digitally and financially illiterate were financially excluded.

To compute the expected values from Table 5 an expected count formula can be used.

Expected Count = (Row Total * Column Total) / Grand Total

A cross tabulation of digital financial literacy and financial inclusion using SPPS, the results are presented in Table 6.

Table 6. Digital financial literacy and financial inclusion cross-tabulation.

Digital financial literacy * Financial inclusion cross-tabulation

			Financial inclusion		
			Financially included	**Financially excluded**	**Total**
Digital financial literacy	Digitally financially literate	Count	309	103	412
		Expected count	160	252	412.0
		% of total	32.2%	10.7%	42.9%
	Digitally financially illiterate	Count	64	485	549
		Expected count	213	336	549.0
		% of total	6.7%	50.5%	57.1%
Total		Count	373	588	961
		Expected count	373	588	961.0
		% of total	38.8%	61.2%	100.0%

The cross-tabulation as shown in table 6 reveal both the observed and the expected counts of rural women in regards to digital financial literacy and financial inclusion. The table reveals that the expected count of rural women who were digitally and financially literate and were financially included was 160 while those financially excluded yet they were digitally and financially literate were 252. For those rural women that were digitally and financially illiterate yet are financially included were 213 while those that were digitally and financially illiterate and are financially excluded, the expected count is 336.

Therefore, it is noted that the observed frequencies consistently deviate from the expected frequencies, strongly suggesting that digital financial literacy and financial inclusion are not independent. It shows that there is an association between digital literacy among rural women in Kenya and their financial inclusion.

Step 3: The study determined the degrees of Freedom.

df = (R - 1) * (C - 1) In this case, df = (2 - 1) * (2 - 1) = 1.

Step 4: The study then computed the Chi- square statistic using this formula.

$\chi^2 = \sum$ (Observed value – Expected value)^2/Expected value

$$\chi^2 = (309 - 160)^2/160 + (103 - 252)^2/252 + (64 - 213)^2/213 + (485 - 336)^2/336$$

$\chi^2 = 138.75 + 88.09 + 104.23 + 66.07$

$\chi^2 = 397.14$

Step 5: The study used SPSS software to make a decision on whether the chi – square value was statistically significant. The results are presented in Table 7.

Table 7. Chi-Square Test for Digital Financial Literacy and Financial Inclusion.

Chi-square tests

	Value	**df**	**Asymptotic significance (2-sided)**	**Exact sig. (2-sided)**	**Exact sig. (1-sided)**
Pearson chi-square	397.646[a]	1	0.000		
Continuity correction[b]	394.983	1	0.000		
Likelihood ratio	425.024	1	0.000		
Fisher's exact test				0.000	0.000
Linear-by-linear association	397.232	1	0.000		
N of valid cases	961				

Note: a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 159.91.
b. Computed only for a 2x2 table.

The results in Table 4.38 reveal a Pearson Chi-Square value (T-Statistic) of $\chi 2=397.64$ with a p-value of 0.000.

Step 6: Determine the critical value from the Chi – Square Critical value table.

The Critical Value at alpha level 0.05 and 0.01 at 1 degree of freedom:

$\alpha = 0.05$; df = 1 Chi Square = 3.841

$\alpha = 0.01$; df = 1 Chi Square = 6.635

Step 7: Interpretation

The Chi-square value of 397.64 is much larger than the critical value of 3.841 and 6.635 at $\alpha = 0.05$ and $\alpha = 0.01$ df = 1. Since the $\chi 2=397.64 >3.84$, $\chi 2=397.64 >6.635$, we reject the null hypothesis and accept the alternative hypothesis that there is a statistically significant association between digital financial literacy among rural women and their financial inclusion. The results imply that rural women who are financially literate and have adopted digital finance are digitally and financially literate making it easier for them to access and use formal financial services thus become financially included. This finding strongly supports the premise that digital financial literacy enhances financial inclusion for rural women in Kenya.

From the analysis, it was found out that digital financial literacy (both financial literacy and digital finance) work in tandem to shape the financial inclusion landscape among rural women in Kenya. Using the Partial Least Squares Structural Equation Modelling Technique, it was revealed that the joint effect of financial literacy and digital finance explains 54.4% of the variations in financial inclusion of rural women in Kenya. The Pearson Chi-Square value (T-Statistic) for digital financial literacy and financial inclusion was $\chi 2=397.64 >6.635$ with a p-value of .000 at $\alpha = 0.01$ indicating a statistically significant association between digital financial literacy and financial inclusion.

This suggests that digital financial literacy positively influences financial inclusion by promoting the adoption and usage of digital financial services among services. These findings are in agreement with the findings of Ozili (2018) who posits that individuals with higher levels of financial literacy are more likely to adopt and effectively use digital finance tools, leading to increased financial inclusion. Additionally, the findings agree with the study by Mohsin et al. (2024) who noted that the combination of financial literacy and digital finance can be a powerful driver of financial inclusion since digital platforms paired with some financial literacy training can easily help rural women manage their finances better enabling them to actively participate in the economy.

6. Discussion

The findings revealed a complex interplay between financial literacy and digital finance in influencing financial inclusion. The results reveal that rural women in Kenya have a digital financial literacy mean score of 19.12 signifying that only 43% of the rural women are digitally literate as compared to 57% who are digitally illiterate. This trend reflects across the seven regions as presented in Table 1. This could be attributed to access to digital finance, low levels of financial literacy, exposure to digital finance services and training programs and socioeconomic conditions among rural women in Kenya

From the analysis, the study found out that both financial literacy and digital finance work in tandem to shape the financial inclusion landscape among rural women in Kenya. Using the Partial Least Squares Structural Equation Modelling Technique, it was revealed that the joint effect of financial literacy and digital finance explains 56.1% of the variations in financial inclusion of rural women in Kenya. This suggests that financial literacy can positively influence financial inclusion by promoting the adoption and usage of digital financial services among rural women in Kenya. A high Chi – Square statistic ($\chi 2=397.64 >6.635$) also confirmed a statistically significant association between digital literacy and financial inclusion indicating that rural women who are financially literate and have adopted and use digital finance are likely to be financially included as compared to those who have not.

7. Conclusion and Recommendation

Based on the results of the analysis, there is a strong interconnection between financial literacy and digital finance where both play a pivotal role in determining the level of financial inclusion among rural women. This is well explained by the fact that the interaction of these factors explains a significant portion (56.1%) of the variation in financial inclusion outcomes. It indicates that enhanced financial education can empower rural women to utilize digital financial services more effectively thus promoting financial participation. Addressing both financial literacy and digital finance is crucial for effective financial inclusion.

For instance, Amnas et al. (2023) argue that individuals with a reasonable amount of financial literacy may face difficulties using FinTech services since they lack adequate digital financial literacy. Therefore, to effectively access and utilize formal financial services, there has to be financial literacy preceding adoption and usage of digital finance.

Targeted financial education programs specifically for rural women should be designed and implemented. The study recommends the development of community-based training programs that are tailored to different

regions while incorporating digital skills that will help demystify technology building confidence among rural women in Kenya enabling them to easily and freely interact with digital financial platforms effectively.

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