**The influence of digital finance on financial inclusion: A case study of rural women in Kenya**

**Abstract**

This study investigates the transformative influence of digital finance on the financial inclusion of rural women in Kenya. Despite rural women being the backbone of the rural economy, they often face significant barriers to accessing traditional banking services, including geographical distance, lack of collateral, and socio-cultural norms. The advent of digital financial services (DFS), such as mobile money (M-Pesa), micro-lending platforms (M-Shwari), and digital savings groups, have the potential to overcome these obstacles and significantly enhance their financial participation. This research employs a cross-sectional descriptive design on a sample of 1000 rural Kenyan women purposively selected. Using the partial Least Squares Structural Equation Model (PLS SEM) and the chi-Square test of independence the study established the relationship that exists between adoption and usage if digital payment systems and access and usage of formal financial services. The findings indicate a strong positive relationship between the use of digital financial systems and increased financial inclusion among rural Kenyan women. The study highlights that digital finance not only provides a convenient and secure way to save and transact but also serves as a gateway to formal financial services and entrepreneurial opportunities. The study emphasizes the need for targeted policies and digital literacy programs to ensure that this digital revolution effectively and equitably empowers rural women, bringing them into the financial inclusion bracket.

**Key words:** *Digital Finance, Digital Financial Services, FinTech, Financial Inclusion, Digital Divide, digital Key.*

## Introduction

Financial inclusion has become a key concern for governments globally and a core pillar of global development, as recognized by the G20 (Buch, 2017). This is because a lack of access to financial services for vulnerable and low-income groups can hinder economic growth and exacerbate inequality (Demirguc-Kunt & Levine, 2008; Widarwati et al., 2022). Financial inclusion involves providing affordable and useful financial products and services, such as credit, savings, and insurance, to bring excluded populations into the formal financial sector (Sowjanga et al., 2015; World Bank, 2018). The aim is to reduce poverty and inequality while fostering economic development.

Over the past decade, significant progress has been made in increasing financial inclusion worldwide. According to the World Bank’s Global Findex survey (2021), adult account ownership has risen to 76% globally and 71% in developing economies. While countries like the USA and South Africa have high rates of financial inclusion at 95% and 91% respectively, regions such as South Asia lag behind with a 68% rate. Even within countries with high overall inclusion, disparities exist. In Kenya, despite a high overall financial inclusion rate of 84%, significant segments of the population remain partially or fully excluded, particularly women in rural areas (FinAccess Survey Report, 2021; FinAccess Deep Dives Report, 2023).

To address these persistent gaps, policymakers are increasingly turning to digital finance as a driver for financial inclusion. Digital finance leverages technology, such as mobile phones and computers, to extend financial services to the unbanked and underserved populations, reducing costs and providing more convenient access (Asian Development Bank, 2016; Gibson et al., 2015; Yang et al., 2020). However, the effectiveness of digital finance is challenged by barriers like low financial and digital literacy, particularly among rural women (Ozili, 2018; OECD, 2017). These challenges are compounded by a lack of access to digital technologies, gender biases, and sociocultural norms, all of which hinder women's ability to utilize digital financial services and achieve full financial inclusion.

# Literature Review

* 1. **Conceptual Review**

Ozili (2020) defines digital finance 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. For digital finance to be complete, a technological device has to 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 et al., 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.

Digital Financial Services are financial services delivered through alternative delivery channels like mobile phones, personal computer, internet, cards linked to a reliable digital payment system (Yang et al. 2020). These services can be delivered through bank led models like those provided through mobile phones including e-mobile am mobile money. They can also be delivered through non-bank led models like internet and telecommunication providers (Gibson et al., 2015). All these financial services rely on digital technology for their delivery and use by customers otherwise called Fintech.

Fintech according to Ozili (2018) is the delivery of financial and banking services through modern technological innovation. It uses software, mobile applications, and other technologies created to improve and automate traditional forms of finance for businesses and consumers. Fintech is used to improve and automate the delivery and use of financial services. For instance, a Fintech provider, uses a technology platform, whether online or offline, to provide new financial services or to improve the delivery of existing financial service for their customers (Arner et al., 2015). This basically means that new financial services or existing financial services are made accessible through technology that can be connected to the internet or not.

Internet technology on the other hand is an enabler of Fintech, and refers to the ability of the Internet to transmit information and data through different systems (Ozili 2018). It is basically the ability of the bank to incorporate internet via technological innovation to interact with its customers. On its own, internet technology does not qualify to be Fintech as other services and information other than financial services can be accessed. For it to be Fintech, it must have the concept of financial services being accessed and delivered using technology.

Financial inclusion 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 (The 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 survey report (2021), Kenya’s financial inclusion index as measured by financial access at 84%.

**2.2 Theoretical Review**

The key theory in this study is the Diffusion Innovation Theory that states that the adoption of innovation follows a common pattern over time. The theory describes how, why, and at what rate new ideas and technologies spread through a given social system. Accordingly, the diffusion of innovations is seen as occurring in five stages namely; knowledge where people become aware of the innovation and begin to gather information about it, persuasion where they form attitudes towards the innovation and begin to influence others, decision stage where they decide whether to adopt the innovation or reject it, implementation stage where they put the innovation into use and confirmation stage where the results of the adoption are evaluated.

This theory relates well with the objective of adoption of digital finance in influencing financial inclusion among rural women. Basically, you find 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. This then is followed by an evaluation of the digital product. For instance, before an individual tries out any mobile banking transaction like transferring money from their bank account to another person, they must have started off by embracing the sending money option that is available on Mpesa. This then gives them confidence to further embrace and adopt mobile banking thus draw nearer to being financially included.

**2.3 Empirical Review**

Widarwati *et al.,* (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. This corresponds with Kan and Sun (2022) who 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.

Aljabri and Sohail (2012) investigated factors affecting mobile banking adoption in Saudi Arabia. All adult individuals residing in Saudi Arabia who were conveniently sampled to a sample size of 330 actual mobile banking users, who were used for data collection. 2-part self-administered questionnaires where the first part captured demographic characteristics and usage while the 2nd part captured information on constructs affecting mobile banking adoption like relative advantage, complexity, compatibility, observability, triability and perceived risk. As a baseline, the study used the Diffusion of Innovation Theory. The findings recommended that banks need to focus on communicating information that emphasize the relative advantage and usefulness of mobile banking compared to other banking channels like the use of ATM or physical presence. The use of diffusion of innovation theory informed the use of the theory in this study.,

Shen et al. (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 suggests 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.

Uzoma *et al.*, (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. These findings were in line with those of Siddik and Kabiraj (2020), who examined the influence of Digital Finance on Financial inclusion using data on 189 countries from 2004 to 2016. The measure of digital finance that included usage of ATMs will contribute significantly to this study.

Al-Smadi (2022) investigated the association between digital finance and financial inclusion in the Middle East and North Africa (MENA) region using secondary data from the World Development Indicators database and the International Monetary Fund’s Financial Access Survey covering 189 countries. The study measured financial inclusion using access, availability and usage of financial services while digital finance was measured by the number of ATMs. The results of the study revealed that digital finance enhances access to, availability of and use of financial services in MENA region and overall financial level. The findings of the study relates with Ma (2022) study that examined the effect of digital finance on economic development. The study employed data from 31 provinces in inland China from 2013 – 2021 which was obtained from Peking University China digital Financial Inclusion Index and China Statistical yearbook. A two way fixed effect model estimation and a moderating effect analysis was used to determine whether digital finance affected economic development. The study noted that digital finance contributes to economic development by attracting foreign direct investment and optimizing the industrial structure.

Tiony (2023) used secondary data to examine the expansion of digital financial services in Kenya and their impact on financial inclusion. Digital financial services were measured using indicators like mobile money service uptake and usage of digital financial services. Financial inclusion was indicated by account ownership, use of financial services, credit availability and insurance coverage. Both regression and descriptive analysis of existing data was done and it was found that adoption of digital financial services especially mobile money platforms like Mpesa have grown substantially increasing access to banking services, formal savings and credit facilities. The operationalization of digital financial services as uptake of mobile service and usage of digital financial services contribute largely to this study.

# Conceptual Framework

To examine the influence of 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 variable is digital finance.

**INDEPENDENT VARIABLES**

**DEPENDENT VARIABLE**

**Digital Finance:**

* Digital payment systems / infrastructure
* Use of digital systems

**Financial Inclusion:**

* Access to formal financial services
* Usage of formal financial services and products

Figure 1 Conceptual Framework - Adopted from Bire et al. (2019)

Additionally, digital finance which is measured by digital payment systems, and the use of digital systems acts as a facilitator of financial inclusion. The availability and use of digital payment systems and infrastructure are crucial for expanding access to and usage of formal financial services in rural areas promoting financial inclusion among rural women. Digital finance reduces barriers to distance, time and cost making financial services more accessible for rural women.

# 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 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 Global Findex database (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

# RESULTS AND DISCUSSION

**5.1 Descriptive Results**

Digital finance was operationalized using a modified Alliance for Financial Inclusion (AFI) 2016 measure. It was measured using two key indicators; access or ownership of digital payment systems and usage of the digital payment systems. Rural women were asked a total of twelve (12) questions; 5 questions addressing the ownership of digital payment systems and 7 questions on the usage of the digital payment systems. An Average Digital Finance (ADF) score was then computed as the sum of digital payment systems (5) and the usage of digital payment systems (7) components. Each component was given equal weighting. This measure was informed by Ozili (2018) and Widarwati et al. (2022) who used the ADF score in determining the impact of digital finance on financial inclusion. The average digital finance score therefore ranged from 0 to 12 where higher scores indicated greater confidence in using digital financial services that contributes to a positive attitude towards formal financial services (Lyons & Kass-Hanna 2021). Accordingly, the study set a minimum target score on digital finance and defined it as scoring at least 8 out of 12 points according to OECD/INFE (2020).

To get a better understanding of the measures of digital finance among rural women in Kenya, rural women were asked specific questions relating ownership and usage of digital payment systems. The results on the ownership of digital payment systems are presented in Table 1.

**Table 1: Ownership of Digital Payment Systems**

|  |  |
| --- | --- |
| Digital Payment Systems | **Overall Ownership Status %** |
| Mobile-Device- | **70.27** |
| Mobile-Money-Account | **66.14** |
| Account in a Formal Institution | **30.21** |
| ATM Card | **17.12** |

**Source: Authors Research Data**

The findings reveal that a significant (70.27%) of rural women in Kenya own a mobile device, indicating a strong foundation for digital payment adoption. A large majority (66.14%) of rural women have mobile money accounts, which highlights the widespread use of mobile money in the region. On the other hand, account ownership in formal financial institutions is lower (30.21%), suggesting a potential preference or greater accessibility for mobile money solutions. Additionally, ATM card ownership is the lowest (17.12%), which could be linked to the lower formal institution account ownership and the prevalence of mobile money suggesting a potential gap in access to traditional banking services. The high mobile device ownership as well as the mobile money account ownership from the results underscores its importance as an enabler for digital payment adoption which enhances financial inclusion among rural women in Kenya.

The study therefore found out that among the rural women in Kenya, ownership of a mobile phone and a mobile money account go hand in hand. This is an indication that most of the rural women who had a mobile phone also had mobile money. Mobile money is a dominant form of digital payment system which is likely due to its accessibility and convenience. These findings concur with UN women (2021) report that stated that 50.2% of women in rural areas in Kenya owned mobile phones, most of which have mobile money accounts. This information is very important as it provides insights into access to technology and financial service which are crucial for financial inclusion of rural women.

Subsequently rural women answered specific questions on the usage of digital payment systems, another determinant of digital finance and the results are presented in Table 2.

**Table 2: Usage of Digital Payment Systems**

|  |  |
| --- | --- |
| Digital Payment Systems | **Overall Mean** |
| Mobile money | **59.17** |
| Bank Account | **20.09** |
| ATM Card | **13.36** |

**Source: Authors Research Data**

The findings reveal how rural women in the different regions use digital payment systems. For instance, more than half (59.17%) of the rural women used mobile money accounts to transact which highlights the widespread adoption of mobile money as a primary transaction method as compared to bank accounts. Additionally, the results reveal that only 20.09% of rural women in Kenya use bank accounts for transactions, indicating a preference for or greater accessibility of mobile money. There is also a very low usage of ATM Cards at 13.36%, that further emphasizes the reliance on mobile money over traditional banking methods.

Conclusively, this study results imply that mobile money is the primary driver of digital transactions among rural women in Kenya which is attributed to its accessibility, convenience, and lower barriers to entry compared to traditional banking. More so, the low usage of bank accounts by rural women in Kenya points to potential challenges the women could be facing related to access, affordability, or trust in formal banking institutions which also leads to their being excluded financially.

These findings imply that adoption and usage of mobile money accounts to transact among the rural women in Kenya is higher as compared to the uptake of the other digital financial systems. These results concur with the study by Tiony (2023) on adoption of digital financial services which revealed that adoption of digital financial services especially mobile money platforms like Mpesa had grown substantially increasing access to banking services, formal savings and credit facilities. Additionally, Bosire (2012) in her study noted that M-PESA provided access to financial services to over 70 percent of the Kenyan adult population by enabling over 15 million Kenyans to have access to a formal financial system.

The overall digital finance score of the 961 respondents as presented in Table 3

**Table 3: Overall Score for Digital Finance Adoption**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Descriptive Statistics** | | | | | |
|  | **Number of Women** | **Maximum Score** | **Threshold** | **Actual Score** | **Adoption Level (%)** |
| Digital Finance Score | 961 | 12 | 8 (67%) | **6.609** | 🞪 |

🞪-denotes that the rural women do not meet the digital finance threshold and therefore are declared having not adopted Fintech

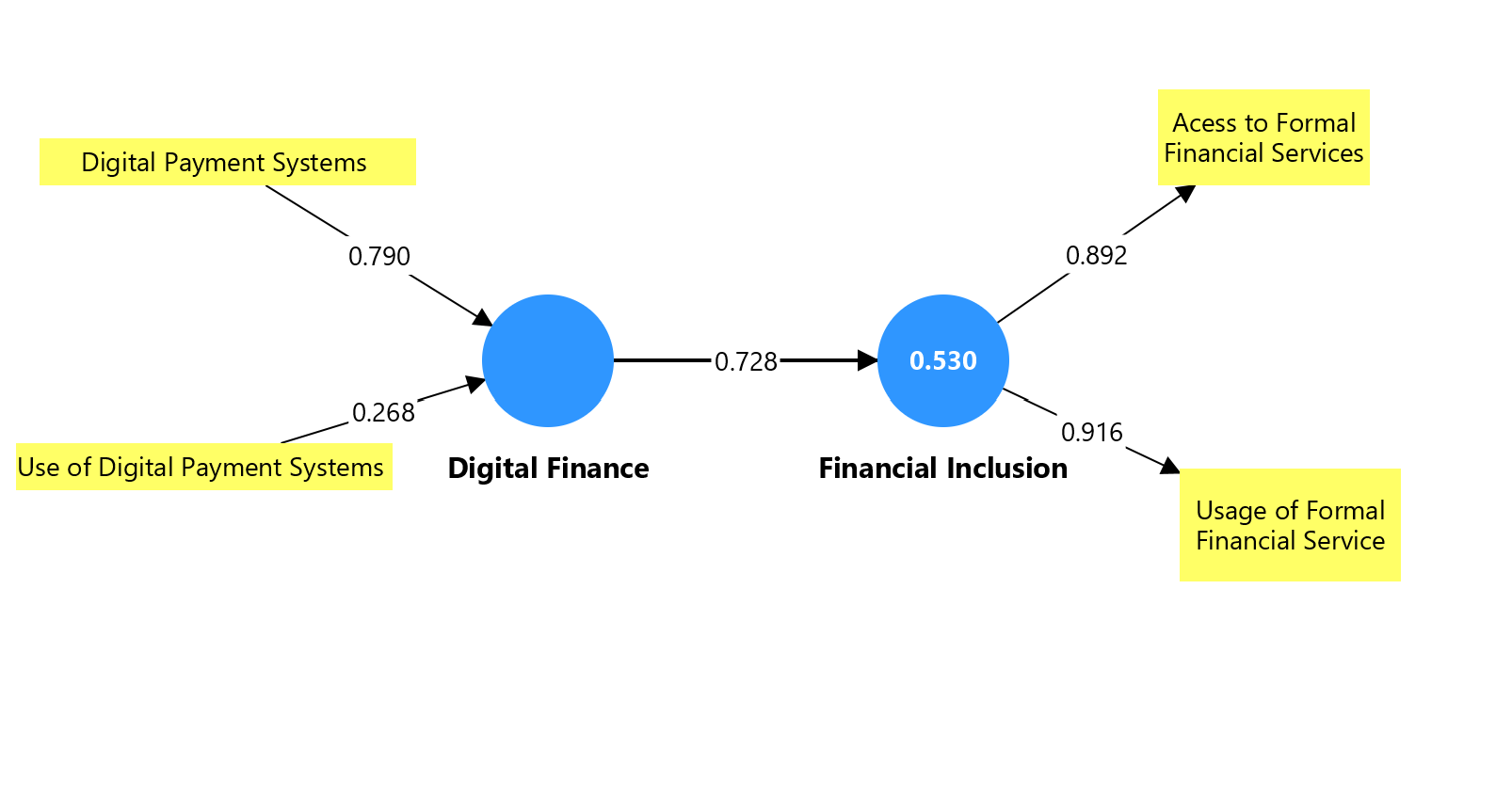
**Source: Authors Research Data**

The results show that average digital finance score of rural women in Kenya was 6.609. This score is below the threshold of 8, indicating that rural women in Kenya have not adopted digital finance significantly. The low levels of adoption and usage of digital finance could be as a result of the low financial literacy levels that inhibit the adoption and usage of digital finance. These results concur with Shen et al. (2018) study that noted that there is low uptake of digital financial services among many people and hence the need to popularize the same if the goal of advancing financial inclusion is to be achieved. Digital finance enhances financial inclusion, and when the digital finance score is low, then it impacts financial inclusion negatively. This agrees with Al-Smadi (2022) study that investigated the association between digital finance and financial inclusion and revealed that digital finance enhances access to, availability of and use of financial services thus enabling financial inclusion.

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**5.2 PLS-SEM Analysis of Digital Finance and Financial Inclusion of Rural Women in Kenya**

The study sought to establish the influence of digital finance on financial inclusion of rural women in Kenya using the PLS (Partial Least Squares Structural Equation Modeling) technique. Digital finance was measured using digital payment services and use of digital payment services. The measure of financial inclusion as the dependent variable was access to formal financial services and usage of formal financial services. To show the relationship between digital finance 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. The findings are represented in Figure 2.



**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.

**Figure 2: Digital Finance and Financial Inclusion (Source: Authors Research Data)**

The results in figure 2 were interpreted based on measurement (outer) model and structural (inner) model according to Hair et al. (2022) and Wold (1982).

1. **Interpretation of Results**

**Digital finance**

The PLS results reveal digital finance is measured by digital payment systems and usage of digital payment systems.

Digital payment systems have a strong positive path coefficient of 0.790 indicating that the availability of digital payment systems to 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 0.268. 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. This could imply that while digital payment systems exist, their actual usage by rural women is not as widespread leading to the low coefficient. Therefore, efforts should be put in place to ensure that rural women not only have access to digital payment systems, but also are made aware of how to effectively use them to get the formal financial services. These findings concur with those of Demirgüç-Kunt et al. (2018) and World Bank (2017) who noted that mobile money and digital payments are the primary entry points as well as the driving forces for digital finance especially in developing countries. In addition to this, Suri and Jack (2014) in reference to Mpesa in Kenya highlighted that access and usage of mobile money greatly improved rural women’s financial resilience and welfare since it dealt with geographical barriers to traditional bank branches as well as security concerns that came with carrying cash.

**Financial Inclusion**

Access to formal financial services has a very strong positive path coefficient of 0.816 indicating 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 0.965. 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 higher financial inclusion is strongly associated with greater uptake and utilization of formal financial services.

1. **Structural Model Interpretation**

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 4.

**Table 4: Digital Finance and Financial Inclusion Structural Model Assessment**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Relationship | β | Cronbach’s Alpha (α) | VIF | f2 | R2 |
| Digital Finance and Financial Inclusion | 0.728 | 0.780 | 1.000 | 1.129 | 0.530 |

**Note:** β = denotes path coefficients; f2 = effect size; R2 = Coefficient of determination; VIF = Variance Inflation Factor

**Source: Authors Research Data**

**Path Coefficients**

From the results, it’s observed that between digital finance and financial inclusion, there is a significant positive path coefficient of 0.728. This means that a one unit increase in digital finance is associated with a 0.728 increase in financial inclusion. This suggests that high levels of digital finance among rural women in Kenya are significant drivers of financial inclusion. The results implies that digital finance is an enabler of financial inclusion and that rural women who have embraced digital finance and are able to use digital financial services for their financial wellbeing are likely to be financially included. Therefore, promoting and expanding digital finance among rural women is a highly effective strategy for increasing financial inclusion. The finding aligns with Ozili (2018) who from a comprehensive review concluded that fintech and digital financial services enable financial access and usage leading to greater financial inclusion. This is also in line with Banga (2019) who argued that with digital finance, there is reduced transaction cost, increased speed in accessing financial services as well as expanded reach for the underserved population.

**R-Squared Interpretation**

The R-squared value as observed in this model is 0.530, meaning that 53% of the variance in financial inclusion can be explained by digital finance. This demonstrates that digital finance is a key explanatory variable for financial inclusion. It’s a driver to financial inclusion and can effectively serve as a bridge to financial inclusion for rural women through digital payment systems. Financial institutions therefore, should invest in digital financial infrastructure and services so as to have significant returns when it comes to financial inclusion outcomes for rural women.

However, in as much as digital finance is a crucial factor that influences financial inclusion, there are other determinants 47% that explain the variance in financial inclusion of rural women. These findings agree with those of Klapper et al. (2016), Grohmann et al. (2017), and Couture et al. (2019) who emphasized that no single factor can explain financial inclusion, it is influenced by a convergence of other complementary factors. Therefore, it is important to examine other factors that influence financial inclusion other than digital finance.

**Cronbach's Alpha (α)**

The Cronbach’s alpha value is 0.780. This value is well above the acceptable threshold of 0.70 indicating that the items used to measure digital finance and financial inclusion were highly reliable and internally consisted.

**VIF (Variance Inflation Factor)**

The results reveal a VIF value of 1.000. VIF is a measure used to detect multicollinearity when two or more independent variables are highly correlated. A VIF value of 1.000 is exceptionally good as it indicates that there is no multicollinearity. A VIF value of 1 implies that digital finance is not correlated with any other predictors in the model. As a general rule, a VIF of 5 or 10 is considered the upper limit, with any values above this threshold suggesting a multicollinearity problem.

**Cohen's f2 (Effect Size)**

The study reveals an exceptionally high value of 1.129. The value of 1.129 is exceptionally high. Following Cohen's (1988) guidelines, an f2 of 0.02 is a small effect, 0.15 is a medium effect, and 0.35 is a large effect. The value of 1.129 far exceeds the threshold for a large effect, indicating that digital finance has a very substantial and powerful effect on financial inclusion.

In summary, the results from Table 4 provide strong evidence for a robust and significant relationship between digital finance and financial inclusion. The path coefficient (β=0.728) and the R-squared value (0.530) indicate that digital finance is a powerful predictor, explaining over half of the variance in Financial Inclusion. Furthermore, the large effect size (f2=1.129) confirms the practical significance of this relationship. The reliability of the measurement scale (α=0.780) and the absence of multicollinearity (VIF = 1.000) further validate the integrity of these findings.

**5.3 Chi-Square Analysis of Digital Finance and Financial Inclusion**

A further examination of influence of digital finance on financial inclusion of rural women in Kenya was carried out to establish whether there was an association between rural women’s digital finance levels and their financial inclusion. To show whether there was an association, the study carried out Chi-square test of independence to compare the categorical variables. Digital finance was measured by a combination of rural women’s ownership of digital payment systems and their usage of digital payments systems.

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

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

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

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

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

**Table 5: Overall Observation Count for Digital Finance and Financial Inclusion**

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Financial Inclusion** | | **Total** |
| **Digital Finance** | Financially Included | Financially Excluded |  |
| Adopted FinTech | 300 | 229 | 529 |
| Not Adopted FinTech | 73 | 359 | 432 |
| **Total** | 373 | 558 | 961 |

**Source: Authors Research Data**

From table 5, it is observed that 300 rural women had adopted Fintech and were financially included while 229 of the rural women who had adopted fintech were not financially included. Additionally, 73 rural women who had not adopted fintech were found to be included while 359 who had not adopted fintech were financially exclude.

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

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

However, the study computed a cross tabulation of digital finance and financial inclusion using SPPS, the results are presented in Table 6.

**Table 6: Digital Finance and Financial Inclusion Cross-tabulation**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Digital Finance \* Financial Inclusion Cross-tabulation** | | | | | |
|  | | | Financial Inclusion | | Total |
| Financially Included | Financially Excluded |
| Digital Finance | Adopted Fintech | Count | 300 | 229 | 529 |
| Expected Count | 205 | 324 | 529 |
| % of Total | 31.2% | 23.8% | 55.0% |
| Not adopted Fintech | Count | 73 | 359 | 432 |
| Expected Count | 168 | 264 | 432.0 |
| % of Total | 7.6% | 37.4% | 45.0% |
| Total | | Count | 373 | 588 | 961 |
| Expected Count | 373 | 588 | 961.0 |
| % of Total | 38.8% | 61.2% | 100.0% |

**Source: Authors Research Data**

The cross-tabulation as shown in table 6 reveal both the observed and the expected counts of rural women in regards to digital finance and financial inclusion. The table reveals that the expected count of rural women who have adopted fintech and are financially included is 205 while those financially excluded yet they have adopted fintech is 324. For those that have not adopted fintech yet are financially included are 168 while those that have not adopted fintech and are financially excluded, the expected count is 264.

Therefore, the study notes that the observed frequencies consistently deviate from the expected frequencies, strongly suggesting that digital finance adoption and financial inclusion are not independent. It shows that there is an association between adoption of digital finance 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;

χ2 = ∑ (Observed value – Expected value)2/Expected value

χ² = + + +

χ² = 44.02 + 27.85 + 53.72 + 34.18

χ² = 159.77

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 Results for Digital Finance and Financial Inclusion**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Chi-Square Tests** | | | | | |
|  | Value | df | Asymptotic Significance (2-sided) | Exact Sig. (2-sided) | Exact Sig. (1-sided) |
| Pearson Chi-Square | 158.715a | 1 | .000 |  |  |
| Continuity Correctionb | 157.043 | 1 | .000 |  |  |
| Likelihood Ratio | 167.440 | 1 | .000 |  |  |
| Fisher's Exact Test |  |  |  | .000 | .000 |
| Linear-by-Linear Association | 158.550 | 1 | .000 |  |  |
| N of Valid Cases | 961 |  |  |  |  |
| a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 167.68. | | | | | |
| b. Computed only for a 2x2 table | | | | | |

**Source: Authors Research Data**

The results in Table 7 reveal a Pearson Chi-Square value (T-Statistic) of χ2=158.715 with a p-value of .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:

α = 0.05; df = 1 Chi Square = 3.841

α = 0.01; df = 1 Chi Square = 6.635

Step 7: Interpretation

The Chi-square value of 158.715 is much larger than the critical value of 3.841 and 6.635 at α = 0.05 and α = 0.01 df = 1. Since the χ2=158.715 >3.84, χ2=158.715 >6.635, we reject the null hypothesis and accept the alternative hypothesis that there is a statistically significant association between digital finance among rural women and their financial inclusion. This basically implies that digital finance enhances financial. Therefore, the results confirms that rural women who have adopted and use digital finance are likely to access formal financial services thus financially included as opposed to those who have not adopted digital finance.

The statistical significance of these results supports the notion that there is a meaningful relationship between digital finance and financial inclusion among rural women in Kenya. These results agree with those of Durai and Stella (2019) who noted that financial inclusion is achieved through the adoption of digital finance as digital finance has the potential of providing affordable, and convenient financial services. These findings correspond with Widarwati et al. (2022), who opined that digital finance impacts financial inclusion through digital financial services that facilitate access to financial services thus financial inclusion.

It is therefore evident from the PLS-SEM results (R-squared value 0.530) as well as the Chi-Square test of independence (χ2=158.715 >6.635) confirm that digital finance is crucial for financial inclusion. These results underscore the importance of encouraging the adoption and usage of digital finance as a key strategy to enhance financial inclusion among rural women

# Discussion

On the influence of digital finance and financial inclusion of rural women, the study revealed that digital finance is a potential route to achieving and enhancing financial inclusion, offering opportunities for extended access and usage of financial services for rural women in Kenya. Even so, from the data collected it is evident that rural women displayed low levels of adoption and usage of digital finance. This was well represented by a mean of 6.6 falling short of the digital finance threshold of 8 out of 12.

On the ownership of digital payment systems, the study findings demonstrated that more than 60% of the rural women owned a mobile device and had a mobile money account. Contrary to this, only 30.21% owned an account in a formal financial institution and 17.12% had an ATM card an indication of the low uptake of digital financial services among the rural women in Kenya.

Over and above that, the study demonstrated that more than half (59.2%) of the rural women used mobile money accounts to transact as compared to 20.1% who used bank accounts and only 13.4% who transacted using the ATM cards.

The results reveal that digital finance has the potential to enhance financial inclusion by offering increased access and usage of financial services for rural women in Kenya. It suggests that the availability, adoption and usage of digital payment systems and services impact the overall digital finance levels positively promoting financial inclusion among the rural women

More so, results from the PLS-SEM gave an R-square of 51.6% implying that digital finance is a key driver of financial inclusion. This was confirmed by the Chi-Square test statistic (χ2=158.715 >3.84) that revealed a statistically significant association between digital finance and financial inclusion of rural women in Kenya.

More rural women owned a mobile devise and had a mobile money account but very few owned an account in a formal financial institution limiting their ability to be financially included. This imply that adoption and usage of mobile money accounts to transact among rural women in Kenya was higher as compared to the uptake of other digital financial systems.

# **CONCLUSION AND** RECOMMENDATIONS

Based on the results of the analysis, it can be concluded that digital finance has an effect on financial inclusion of rural women in Kenya. The study also confirmed that digital finance and financial inclusion were significantly related. This implies that the adoption and usage of digital financial services creates the potential to make financial services available to a wider range of consumers through elimination of traditional access barriers thus promoting financial inclusion

With the identified low fintech adoption in most regions, mobile network operators (MNOs) and fintech companies, should strive to enhance digital infrastructure and accessibility. They should develop financial products that are tailored to rural women's needs for ease of adoption and usage; having user friendly platforms that simplify access to and usage of formal financial services. Mobile network operators (MNOs) should invest in mobile network expansion as well as offer affordable internet access to accommodate the rural women population

Disclaimer (Artificial intelligence)

Option 1:

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc.) and text-to-image generators have been used during the writing or editing of this manuscript.

Option 2:

Author(s) hereby declare that generative AI technologies such as Large Language Models, etc. have been used during the writing or editing of manuscripts. This explanation will include the name, version, model, and source of the generative AI technology and as well as all input prompts provided to the generative AI technology

Details of the AI usage are given below:

1.

2.

3.

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