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**Influence of Digital Payment Systems on Financial Literacy and
Financial Inclusion in Sub-Saharan Africa**



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Influence of Digital Payment Systems on Financial Literacy and Financial Inclusion in Sub-Saharan Africa

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Abstract

Purpose: The primary aim is to empirically assess whether digital payment systems significantly enhance financial literacy and financial inclusion. The study also explores how macroeconomic and technological factors, such as inflation, education, and internet penetration, moderate these relationships across 35 Sub-Saharan African countries

Methodology: The study employed a quantitative research approach. It used a panel data of 35 out of 49 Sub-Saharan countries based consistency of annual data, spanning from 2000 to 2023. The study employs a two-step System Generalized Method of Moments estimation technique. This method addresses potential endogeneity, autocorrelation, and omitted variable bias while accounting for country-level heterogeneity.

Findings: Results revealed that digital payment systems have no statistically significant effect on financial literacy and, surprisingly, a small negative effect on financial inclusion. Education and internet penetration showed marginal positive influences, though weak. These findings suggested that digital tools alone are insufficient without complementary interventions such as education, trust-building, and infrastructure development.

Unique Contribution to Theory, Practice and Policy: Policymakers and fintech providers should adopt a more holistic, user-centric approach to digital finance—emphasizing not just access but usability, literacy, and long-term engagement. For accounting and development research, the findings highlight the importance of integrating socio-technological dimensions in measuring financial development outcomes.

Keywords: *Digital payment systems, Financial literacy, Financial inclusion, Fintech, Digital finance*

Introduction

In recent years, the rapid adoption of digital technologies across Africa has redefined the continent's financial landscape, introducing innovative mechanisms to bridge long-standing gaps in access to finance. One of the most transformative developments has been the emergence of digital payment systems, which have restructured how individuals and businesses engage in financial transactions across both urban and rural communities (Chinoda & Kapingura, 2023). As Africa grapples with economic disparities, low banking penetration, and underdeveloped infrastructure, digital financial solutions have increasingly become the continent's most viable path toward achieving broader financial inclusion and enhancing financial literacy (Makina, 2017).

Digital payment systems—ranging from mobile money platforms to internet-based banking—have proliferated in both low-income and middle-income countries, providing cost-effective and accessible financial services where traditional banking systems have failed to reach (Demirgüç-Kunt et al., 2018). As a result, millions of Africans who were previously unbanked or underbanked have gained access to essential financial tools such as mobile wallets, savings platforms, and peer-to-peer lending systems (Evans, 2018). However, while access is a critical first step, the long-term benefits of these services are significantly moderated by users' financial literacy—the ability to understand, evaluate, and utilize financial information for decision-making (Obuobi et al., 2021). Thus, evaluating the influence of digital payment systems on both financial literacy and financial inclusion is not only timely but imperative for policy formulation, technological investment, and poverty reduction.

Financial inclusion, defined as the access and usage of formal financial services by all individuals and businesses, has emerged as a fundamental element for socio-economic empowerment and national development (Danladi et al., 2023). In parallel, financial literacy—the knowledge and skills needed to manage personal finances effectively—has been recognized as a key enabler of responsible financial behavior and long-term financial wellbeing (Hasan et al., 2022). In Africa, these two concepts are deeply intertwined: individuals who are financially literate are more likely to use digital financial services effectively, while access to such services often creates opportunities for learning and behavioral change (Suri & Jack, 2016). Nonetheless, Africa continues to record some of the lowest financial literacy and inclusion rates globally. The World Bank's Global Findex database reveals that as of 2017, nearly 66% of Sub-Saharan Africans did not own a formal financial account (Demirgüç-Kunt et al., 2018). These figures point to systemic barriers including limited financial education, distrust in formal institutions, gender inequality, and infrastructural deficits that restrict access and informed use of

financial services (Tinta et al., 2022).

Geographic, economic, and sociocultural barriers compound Africa's struggle with financial inclusion. In many rural regions, the absence of banks and internet connectivity renders traditional financial systems irrelevant (Fernandes et al., 2020). Furthermore, even when digital services are available, uptake is often limited by low digital and financial literacy, which constrains users' ability to manage savings, credit, and investment tools (Evans, 2015). Additionally, financial literacy remains gendered in many African societies. Women, who are disproportionately excluded from formal finance, face layered challenges ranging from restricted asset ownership to low digital competency and constrained mobility (Uduji & Okolo-Obasi, 2018).

Moreover, regulatory and institutional weaknesses exacerbate these challenges. The lack of standardized financial education frameworks across national curricula and insufficient consumer protection mechanisms have led to low levels of trust and engagement with digital finance platforms (El-Zoghbi & Tarazi, 2013). In this context, merely introducing digital payment systems is insufficient unless paired with deliberate strategies to address users' capacity to understand and engage with these technologies safely and effectively (Cnaan et al., 2021).

While digital systems have enhanced access, their role in improving financial literacy is increasingly evident. Mobile apps, SMS-based services, and digital training modules are being used to deliver real-time financial education to previously unreachable populations (Ghosh, 2016). For example, platforms like M-Pesa have not only facilitated transactions but also exposed users to concepts such as budgeting, interest accrual, and investment through regular engagement with financial products (Jack & Suri, 2014). Similarly, educational prompts integrated into mobile apps and digital banking platforms have provided bite-sized financial education in local languages, thereby improving comprehension and adoption (Hasan et al., 2022). Nevertheless, the digital divide still limits the reach of these literacy tools. Without electricity, smartphones, and affordable data access, many Africans remain digitally marginalized, particularly in rural and conflict-prone areas (Mothobi & Kebotsamang, 2024). Consequently, a positive influence of digital systems on financial literacy is more pronounced in urban centers and among educated populations. This asymmetry reinforces existing socio-economic inequalities, highlighting the need for targeted interventions in underserved regions (Obuobi et al., 2021).

More broadly, the transformative power of digital payment systems on financial inclusion cannot be overstated. Mobile money services, particularly in East Africa, have radically expanded

access to basic financial services without the need for brick-and-mortar institutions (Andrianaivo & Kpodar, 2012). In Kenya, for instance, M-Pesa has enabled millions to save, borrow, and transfer money, significantly reducing the costs and risks associated with cash handling (Ogutu & Were, 2018). These platforms have also played a critical role during crises, such as the COVID-19 pandemic, when remote financial access became a lifeline for millions (Adelaja et al., 2024). In addition, digital payment systems have encouraged formalization of informal economies by creating financial records that can be used to access credit and insurance services (Gabor & Brooks, 2017). Despite this, integration remains partial. Many users operate within both informal and formal systems, using digital wallets for basic transfers but avoiding banks due to mistrust, high fees, or limited financial understanding (Ozili, 2018).

While existing studies have explored the link between digital finance and financial inclusion, several gaps remain. Firstly, most prior research has focused on either inclusion or literacy independently, neglecting the interaction between the two (Batista & Vicente, 2020). Secondly, studies that utilize robust econometric models like the Generalized Method of Moments (GMM) are scarce, particularly in the African context where endogeneity and data volatility require such precision (Chinoda & Kapingura, 2023). Thirdly, much of the literature fails to disaggregate results by sector—such as agriculture, microenterprises, or education—or by region within Sub-Saharan Africa, which leads to generalized conclusions that may not reflect localized realities (Thathsarani & Jianguo, 2022). Therefore, a sector-sensitive, region-specific, and methodologically rigorous study is urgently needed.

This study is warranted on the grounds that effective financial policymaking requires an integrated understanding of how digital payment systems influence not just access, but also financial competence. As financial systems become more digitized, understanding how literacy mediates usage—and how usage, in turn, enhances literacy—is critical for maximizing impact. Accordingly, this study aims to evaluate the causal relationship between digital payment system usage and financial literacy, and how this dynamic affects financial inclusion in Sub-Saharan Africa. The study further seeks to use a panel dataset across selected African countries, analyzed through the Generalized Method of Moments (GMM) to control for country-specific heterogeneity and dynamic interactions. Ultimately, it will generate data-driven insights to inform regulatory frameworks, private sector investment, and financial education initiatives that align with the realities of African users.

Literature Review

Impact of Digital Systems on Financial Literacy in Africa

The discourse surrounding financial literacy in Africa has increasingly integrated digital technology as a driver of learning, behavioral change, and financial empowerment. As the adoption of digital payment systems expands across the continent, they are not only enabling access to financial tools but also fostering new opportunities for financial learning, especially among digitally engaged populations (Hasan et al., 2022). Research has established that digital financial services—such as mobile banking apps, USSD-based transaction systems, and internet-enabled wallets—often come embedded with prompts, tutorials, and interactive dashboards that help users understand budgeting, credit, and interest mechanisms (Ebirim & Odonkor, 2024). These platforms act not only as transactional tools but also as informal channels of financial education.

Moreover, digital interfaces typically require users to navigate structured processes, such as verifying identities, understanding transaction limits, and reviewing terms of service. This interactivity cultivates a baseline of financial comprehension, particularly among first-time users and underserved demographics (Rastogi et al., 2021). Therefore, digital payment systems inherently support incremental learning, even in the absence of formal training. Interestingly, a gendered lens reveals additional dimensions. For instance, Hasan et al. (2022) found that digital financial literacy significantly boosts women entrepreneurs' likelihood of engaging with formal banking channels, suggesting that targeted digital education can reduce the gender gap in financial participation (Hasan et al., 2022). Such findings emphasize the need to include localized and culturally contextualized content in digital platforms to ensure widespread comprehension.

Additionally, Danladi et al. (2023) propose that fintech interventions in developing economies are more impactful when paired with national strategies for enhancing digital and financial literacy, especially among rural users and small-scale entrepreneurs (Danladi et al., 2023). Despite this, existing digital literacy efforts often remain fragmented, underfunded, or concentrated in urban centers, leaving rural populations at a disadvantage. Notably, the work of Chinoda and Kapingura (2023) highlights that the synergy between financial inclusion and bank stability is enhanced when digital systems are supported by robust digital literacy. Their findings confirm that digital finance without literacy can lead to over-indebtedness or fraud, thereby destabilizing banking systems instead of strengthening them (Chinoda & Kapingura, 2023).

However, this positive narrative is not universal. In areas lacking mobile connectivity, electricity,

or appropriate user interfaces, digital systems can reinforce exclusion. Mothobi and Kebotsamang (2024) demonstrate that mobile network coverage strongly influences both the adoption of financial technologies and subsequent literacy gains, meaning those outside coverage areas remain doubly disadvantaged (Mothobi & Kebotsamang, 2024). In conclusion, the body of literature points to a strong, though uneven, influence of digital payment systems on financial literacy. While these systems inherently carry educational potential, user demographics, infrastructural readiness, and policy frameworks mediate their impact. To amplify their effects, coordinated efforts in digital education, inclusive interface design, and outreach must be prioritized.

Influence of Digital Systems on Financial Inclusion in Africa

The role of digital payment systems in promoting financial inclusion has been widely recognized as a critical lever for economic development in Africa. Digital channels—particularly mobile money—have revolutionized how people access and use financial services, bypassing the need for traditional brick-and-mortar institutions (Adelaja et al., 2024). In countries like Kenya, Tanzania, and Ghana, mobile financial platforms such as M-Pesa have achieved remarkable penetration, offering services such as deposits, withdrawals, transfers, and even credit access. As Fernandes et al. (2020) explain through an ARDL model of Mozambique’s financial system, digital payment systems like ATMs, POS devices, and mobile transfers significantly expand the number of banked individuals, particularly when integrated into local markets and informal economies (Fernandes et al., 2020).

Furthermore, research by Evans (2015) emphasizes the importance of broader economic conditions—such as GDP growth and internet penetration—in supporting digital inclusion, demonstrating that the macroeconomic environment also influences uptake of digital services (Evans, 2015). Indeed, digital financial systems tend to thrive where economic activity is dynamic, infrastructure is reliable, and users are economically motivated to engage with formal services. Another critical dimension is the way digital systems reduce transaction costs and time burdens, particularly for rural users. According to Danladi et al. (2023), these cost savings make digital payments appealing to low-income users, thereby creating a scalable solution for enhancing access to savings, loans, and insurance services (Danladi et al., 2023). Importantly, these platforms often serve as entry points to more formalized financial tools.

Nonetheless, structural limitations persist. Tinta et al. (2022) found that informal savings still dominate among women and youth, especially in rural areas. This suggests that while digital services are available, cultural norms and socioeconomic factors still inhibit full integration into

formal systems (Tinta et al., 2022). Such patterns highlight the need for more nuanced strategies that respect social preferences while promoting digital transition. Moreover, regulatory clarity remains a stumbling block. As Adelaja et al. (2024) point out, financial regulators in many African countries struggle to adapt their policies to the fast-paced evolution of fintech products, resulting in gaps that either slow down adoption or expose users to risk (Adelaja et al., 2024). Similarly, gaps in interoperability between mobile platforms and banking systems often discourage users from transitioning to more comprehensive financial services.

In response, Chinoda and Kapingura (2023) advocate for a systemic approach, where digital financial inclusion is linked with policies that enhance bank competition, ensure user protection, and foster financial literacy. Their two-step GMM model confirms that these factors collectively strengthen bank stability and increase inclusion rates (Chinoda & Kapingura, 2023). Equally crucial is the role of cross-sector collaboration. Ebirim and Odonkor (2024) argue that scaling fintech solutions for inclusion will require partnerships between governments, fintech companies, multilateral agencies, and telecom operators to extend coverage and reduce user costs (Ebirim & Odonkor, 2024). Their findings also reinforce the importance of local content, language customization, and user interface design tailored to low-literacy populations. Therefore, while digital payment systems have indeed accelerated financial inclusion in Africa, their success is contingent on supportive infrastructure, regulation, education, and cultural sensitivity. The literature collectively suggests that a holistic, user-centered, and policy-driven approach is essential for digital systems to reach their full potential in transforming Africa's financial landscape.

Theoretical Framework

Diffusion of Innovation Theory

Proposed by Everett Rogers in 1962, the Diffusion of Innovation (DOI) Theory explains how new technologies, ideas, and practices spread within and across societies over time. The theory identifies five categories of adopters—innovators, early adopters, early majority, late majority, and laggards—and highlights critical factors that influence adoption: relative advantage, compatibility, complexity, trialability, and observability. These elements determine how quickly and widely a new innovation, such as a digital payment system, is embraced by users (Rogers, 2003). In the African context, the DOI theory has been widely applied to understand the rapid penetration of mobile money platforms, especially in underserved and rural communities. For example, studies such as Aker and Mbiti (2010) explain that the success of mobile money in East Africa, particularly M-Pesa in Kenya, is attributed to its simplicity, low transaction costs, and

compatibility with users' existing informal saving and lending habits (Aker & Mbiti, 2010). The relative advantage of mobile money over traditional banking—such as no need for physical infrastructure—has made it attractive to populations previously excluded from formal finance.

Furthermore, the element of trialability—the ability to experiment with a product without committing fully—plays a vital role in user uptake. Mobile money services allow users to begin with small transactions, building confidence over time, which aligns with findings from Fernandes et al. (2020) who noted gradual increases in financial participation in Mozambique as users became more familiar with digital platforms (Fernandes et al., 2020). This highlights the iterative learning curve users experience, which is especially important in populations with limited formal financial education. Moreover, observability, or the visibility of others using the innovation, influences community adoption. As more individuals adopt digital financial services and demonstrate their utility, peer influence accelerates uptake. Chinoda and Kapingura (2023) confirm that peer effects play a substantial role in digital financial inclusion across Sub-Saharan Africa, especially when reinforced by social norms and group-based incentives (Chinoda & Kapingura, 2023). In this way, the DOI theory explains how technological innovation spreads through society via social learning mechanisms.

However, the theory also underscores the barriers to adoption faced by laggards—typically older, rural, less-educated, or marginalized groups. These populations often lack the digital literacy, trust, or infrastructure needed to engage with new technologies, resulting in a digital divide. Mothobi and Kebotsamang (2024) stress that even when mobile services are theoretically accessible, poor network coverage and limited internet availability constrain their practical use (Mothobi & Kebotsamang, 2024). Importantly, DOI theory not only explains how digital systems spread but also frames financial literacy gains as an outcome of adoption. As users increasingly interact with digital tools, they often acquire knowledge through real-world usage. This experiential learning forms a bridge to Financial Literacy Theory, which explores how such knowledge translates into informed financial behaviors.

Financial Literacy Theory

Financial Literacy Theory posits that individuals require both knowledge and skills to make informed and effective decisions about the use of money. It emphasizes the cognitive and behavioral aspects of financial decision-making, including budgeting, saving, borrowing, and investing. The theory asserts that higher financial literacy correlates with better financial choices, resilience to economic shocks, and greater engagement with formal financial systems (Lusardi & Mitchell, 2014). In the African context, financial literacy levels remain low, particularly among

women, youth, and rural populations. According to Demirgüç-Kunt et al. (2018), more than half of African adults lack the minimum level of understanding required to engage confidently with formal financial institutions (Demirgüç-Kunt et al., 2018). In this environment, digital financial services become critical not only as access tools but as educational platforms. Each interaction with a mobile banking app or digital wallet represents an opportunity to learn financial concepts in practice.

Digital payment systems inherently foster incremental literacy. For instance, digital interfaces often prompt users to read transaction summaries, check balances, and compare account types—tasks that improve numerical literacy and comprehension over time. Obuobi et al. (2021) observed that regular engagement with mobile financial services significantly improved users' understanding of interest rates, repayment schedules, and budgeting in Ghana (Obuobi et al., 2021). This aligns directly with Financial Literacy Theory, which maintains that applied learning enhances cognitive retention and behavioral change. Additionally, mobile financial tools are now incorporating explicit financial education content. Applications offer embedded videos, SMS tips, budgeting guides, and gamified learning to promote knowledge retention and practice. Danladi et al. (2023) argue that this embedded learning format is more effective than traditional classroom-based education, especially in low-literacy populations (Danladi et al., 2023).

Furthermore, financial literacy improves self-efficacy, or the belief in one's ability to manage money and engage with financial tools. As users become more confident in navigating digital platforms, they are more likely to explore complex products such as credit, insurance, and investments. This shift from basic use to strategic financial behavior is critical to achieving long-term financial inclusion. Hasan et al. (2022) highlight that digital financial literacy is particularly transformative for women entrepreneurs, enabling them to manage income, assess risk, and plan for growth (Hasan et al., 2022). However, the theory also warns against misinformed or partial literacy, which can lead to over-indebtedness, financial fraud, or under-utilization of available services. In this regard, digital tools must be designed not just to deliver services, but also to build knowledge and support sound decision-making. Ebirim and Odonkor (2024) argue that fintech providers have a responsibility to design interfaces and products that are educational and user-friendly for all literacy levels (Ebirim & Odonkor, 2024).

Moreover, the theory supports policy-level interventions such as financial education in schools, government-supported digital campaigns, and consumer protection regulations. These initiatives can complement the informal literacy gains from digital service use, creating a more informed user base across all demographics. Together, Diffusion of Innovation Theory and Financial Literacy Theory provide a powerful framework for analyzing the role of digital payment systems

in Africa. While DOI explains the mechanisms through which these technologies are adopted across various segments of society, Financial Literacy Theory highlights how users acquire and apply financial knowledge through interaction with these systems. The interplay between technological access and knowledge-building is essential for understanding how digital finance transforms both inclusion and literacy. As the continent continues to digitize, these theories underscore the importance of inclusive design, targeted literacy interventions, and enabling policy environments to ensure that innovation translates into equitable and sustainable financial empowerment.

Methods

This study adopts a quantitative research approach to empirically examine the relationship between digital payment systems, financial literacy, and financial inclusion in Sub-Saharan Africa (SSA). Quantitative methods are appropriate for testing theoretical propositions and identifying patterns using numerical data, especially when studying complex macroeconomic and technological interactions (Chinoda & Kapingura, 2023). This approach allows for robust statistical inference and helps control for unobserved heterogeneity across countries over time, thereby increasing the reliability of the findings. To ensure the robustness of the analysis, the study utilizes panel data from multiple reputable secondary sources, including the World Bank Global Findex, IMF Financial Access Survey, GSMA Mobile Money Reports, OECD databases, and Afrobarometer surveys. These databases provide harmonized and comparable macro-level indicators necessary to assess trends in financial behavior, technological adoption, and socioeconomic conditions across SSA countries (Demirgüç-Kunt et al., 2018).

The research focuses on a sample of 49 Sub-Saharan African countries covering the period from 2000 to 2023. However, due to data availability constraints, only 35 countries were retained for analysis. Countries lacking consistent annual data on key indicators such as mobile money usage, financial literacy rates, and internet penetration were excluded. This strategy enhances the validity of the panel regression estimations while preserving the regional diversity essential for generalizing findings within SSA (Evans, 2015). Moreover, the selected timeframe captures both the pre- and post-digital finance revolution in Africa, thus offering an ideal context to assess the dynamic influence of digital payment systems on financial outcomes (Andrianaivo & Kpodar, 2012). By encompassing major technological advancements and regulatory reforms in the African fintech ecosystem, the dataset provides a comprehensive view of financial transformation over two decades.

To operationalize the study variables, a structured framework is used, drawing on validated

indicators from international data repositories. The variables are classified as dependent, independent, and control variables, as shown below. Digital Payment Systems (DPS) are the core independent variable of interest, representing the penetration and active use of electronic financial tools. Financial Inclusion (FI) and Financial Literacy (FL) serve as the main outcome variables, capturing both access to and comprehension of financial services. Education and internet penetration are included as control variables to account for their known influence on both literacy and technology adoption (Tinta et al., 2022).

Table 1: Measurements of Variables

Variable Type	Variable	Definition	Acronym	Measurement	Data Source
Dependent Variable	Financial Literacy	The ability of individuals to understand and use financial concepts effectively	FL	Financial literacy index scores, % of population with basic financial knowledge	World Bank Global Index, OECD, Afrobarometer
Dependent Variable	Financial Inclusion	Access to and usage of financial services by individuals and businesses	FI	% of population with bank/mobile money accounts, savings activity, credit usage, etc.	World Bank Global Index, IMF Financial Access Survey
Independent Variable	Digital Payment Systems	Use and availability of electronic or mobile-based financial transaction platforms	DPS	% of population using mobile payments, number of digital transactions per capita	World Bank Global Index, GSMA Mobile Money Report, IMF
Controlled Variable	Education Level	Average or distribution of educational attainment in the population	EDU	Literacy rate, % with secondary or tertiary education	UNESCO, World Bank Education Statistics
Controlled Variable	Internet Penetration	Accessibility and usage of the internet in the population	INT	% of population with internet access	ITU, World Bank

Model for the Study

The empirical investigation employs a panel data regression model, utilizing the Generalized Method of Moments (GMM) estimator to address potential endogeneity and omitted variable bias—common concerns in macro-financial studies. GMM is particularly suited to dynamic panel models where lagged dependent variables and endogenous regressors are present, allowing for efficient and unbiased estimates (Chinoda & Kapingura, 2023)

The relationship between digital payment systems, financial literacy, and financial inclusion is specified through the following equations:

Model 1: Impact of Digital Payment Systems on Financial Literacy

$$FL_{it} = \beta_0 + B_1DPS_{it} + B_2EDU_{it} + B_3INT_{it} + \epsilon_{it} \dots\dots\dots(1)$$

Model 2: Impact of Digital Payment Systems on Financial Inclusion

$$FI_{it} = \beta_0 + B_1DPS_{it} + B_2EDU_{it} + B_3INT_{it} + \epsilon_{it} \dots\dots\dots(2)$$

Where:

FL_{it} : Financial literacy in country i at time t,

FI_{it} : Financial inclusion in country i at time t,

DPS_{it} : Digital payment system usage,

EDU_{it} : Education level,

INT_{it} : Internet penetration

ϵ_{it} is the error term.

The model corrects for autocorrelation, heteroskedasticity, and individual effects using GMM. Moreover, the use of control variables makes it possible to remove the particular effect of digital payment systems on the financial indicators being considered (Batista & Vicente, 2020). In sum, the methodological design of this study—grounded in a quantitative, panel-data framework—sets forth a solid framework for understanding the dual function of digital payment systems in influencing financial access and competence across SSA. By employing rigorous estimators, thoughtfully constructed variables, and dependable data, this study adds to the empirical evidence regarding the intersection of digital technology and financial inclusion in developing economies.

Results and Discussion

The descriptive statistics in Table 2 offer critical insights into the distribution and variability of the key variables under study. The mean financial literacy score is approximately 33.75, with a relatively narrow standard deviation (2.47), suggesting moderate variation in financial knowledge across the countries. Its negative skewness (-1.26) and high kurtosis (6.99) imply that most values are concentrated at the upper end, with a long tail of lower scores, indicating persistent pockets of very low financial literacy in the sample. In contrast, financial inclusion shows a mean value of 0.23, denoting that only about 23% of the population, on average, has access to financial services. The distribution is positively skewed (0.82), indicating that while most countries have low inclusion rates, a few exhibit relatively higher access. This asymmetry is further amplified in the digital system variable, which has an extremely high skewness (6.84) and kurtosis (54.64), indicating that digital adoption is heavily concentrated in a few countries, while the majority lag significantly behind. Moreover, the Jarque-Bera test results are statistically significant ($p < 0.01$) for all variables, confirming non-normality in the data, which justifies the use of robust estimators like GMM in the analysis.

Table 2: Descriptive Statistics Results

	Financial Literacy	Financial Inclusion	Digital System	Educatio n	Inflation	Internet Penetration
Mean	33.75126	0.229450	0.423815	31.14964	9.714733	12.57932
Median	34.30714	0.207318	0.288592	26.84839	5.904284	5.655000
Maximum	40.00000	0.612924	9.250393	90.62309	557.2018	81.40000
Minimum	26.00000	0.026174	0.043232	2.040000	-16.85969	0.005900
Std. Dev.	2.470910	0.122971	0.895820	20.06496	31.75284	16.36355
Skewness	-1.260466	0.820562	6.839157	0.611154	13.72687	1.906916
Kurtosis	6.996724	3.370061	54.63674	2.348524	212.6749	6.495843
Jarque-Bera Probability	748.0182 0.000000	94.81273 0.000000	95590.56 0.000000	64.26827 0.000000	1498028. 0.000000	896.6686 0.000000
Sum	27136.01	184.4778	340.7472	25044.31	7810.645	10113.77
Sum Sq. Dev.	4902.632	12.14280	644.4016	323289.9	809619.1	215015.9
Observations	804	804	804	804	804	804

Source: Field Data (2025)

The correlation matrix in Table 3 provides insights into the degree and direction of linear relationships among the study variables. Notably, financial literacy and financial inclusion exhibit a very weak positive correlation ($r = 0.06$), suggesting that improvements in financial literacy are not strongly associated with greater access to financial services across the sample. This weak link could indicate that structural or institutional barriers, rather than individual knowledge, might be more influential in driving financial inclusion. Similarly, digital systems show a mild positive correlation with financial literacy ($r = 0.088$), implying that digital financial technologies may have a modest influence on improving financial understanding. However, digital systems correlate negatively with financial inclusion ($r = -0.086$), which is counterintuitive but could reflect digital inequality—where access to technology remains concentrated in specific regions, limiting broad-based financial inclusion. Moreover, education and internet penetration show stronger correlations with each other ($r = 0.466$), suggesting a possible mutual reinforcement between these two enablers of digital and financial access. Yet, education's correlation with other core variables remains weak, as does inflation's generally negligible correlation values. Overall, the weak pairwise correlations justify the need for multivariate regression models to isolate the individual effects of each factor while controlling for others.

Table 3: Correlation Analysis Results

	1	2	3	4	5	6
Financial Literacy	1.000000					
Financial Inclusion	0.060147	1.000000				
Digital System	0.088472	-0.085693	1.000000			
Education	0.004320	0.026274	-0.133885	1.000000		
Inflation	0.009388	0.051899	-0.056489	0.165648	1.000000	
Internet Penetration	-0.034049	0.049199	-0.008713	0.465977	0.005383	1.000000

Source: Field Data (2025)

Stationary Tests

The results in Table 4 present the outcomes of multiple panel unit root tests conducted to examine the stationarity of the financial literacy variable in its second difference form, denoted as $D(\text{FINANCIAL_LITERACY}, 2)$. Stationarity is a crucial assumption in time series and panel data models, particularly in GMM estimation, as non-stationary data can lead to spurious

regression results. Beginning with the Levin, Lin & Chu (LLC) test, which assumes a common unit root process across cross-sections, the test statistic of -19.2640 and a p-value of 0.0000 strongly reject the null hypothesis of a unit root. Similarly, the Im, Pesaran and Shin (IPS) test, which accommodates individual unit root processes, yields a statistic of -15.5598 and a p-value of 0.0000, also rejecting the null.

Furthermore, the ADF-Fisher Chi-square test and the PP-Fisher Chi-square test both return highly significant p-values (0.0000), reinforcing the conclusion that the series becomes stationary after second differencing. These consistent results across tests suggest that the variable does not suffer from persistent trends or non-stationarity in its transformed form. Consequently, the data meet the necessary preconditions for reliable estimation, justifying the use of dynamic panel techniques like system GMM in subsequent analyses.

Table 4: Stationary Tests Results

Panel unit root test: Summary

Series: D(FINANCIAL_LITERACY,2)

Sample: 2000 2023

Exogenous variables: Individual effects

User-specified lags: 1

Newey-West automatic bandwidth selection and Bartlett kernel

Balanced observations for each test

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-19.2640	0.0000	10	200
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	-15.5598	0.0000	10	200
ADF - Fisher Chi-square	207.497	0.0000	10	200
PP - Fisher Chi-square	2633.91	0.0000	10	210

** Probabilities for Fisher tests are computed using an asymptotic Chi-square distribution. All other tests assume asymptotic normality.

Model Specification Tests

The results presented in Table 5 offer important insights into the appropriate panel estimation technique for modeling financial literacy. The Correlated Random Effects - Hausman test yields a Chi-square statistic of 1.3721 with a p-value of 0.9273, indicating that the null hypothesis—which favors the random effects model—is not rejected. This result suggests no

systematic difference between fixed and random effects estimates, implying that the random effects specification is statistically valid and consistent for this dataset. Further supporting this conclusion, the comparison of individual variable coefficients between fixed and random effects shows minimal differences. For instance, the coefficients for Digital System (0.1502 vs. 0.1582) and Education (0.0154 vs. 0.0128) are very close, with high p-values above 0.47, confirming the absence of significant bias. This reinforces the robustness of using a random effects model for policy inference across heterogeneous SSA countries. Additionally, the panel least squares results show that while Digital System and Education have positive signs, their statistical significance is marginal ($p \approx 0.087$), suggesting a weak but potentially meaningful influence on financial literacy. Overall, the model explains a moderate share of the variance (Adjusted $R^2 = 0.566$), indicating a good fit and justifying the use of panel regression for further analysis.

Table 5: Model Specification Tests

Correlated Random Effects - Hausman Test				
Equation: Untitled				
Test cross-section random effects				
Test Summary		Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random		1.372079	5	0.9273
Cross-section random effects test comparisons:				
Variable	Fixed	Random	Var(Diff.)	Prob.
Financial Inclusion	0.427217	0.472766	0.013945	0.6997
Digital System	0.150165	0.158167	0.000369	0.6770
Education	0.015404	0.012780	0.000014	0.4776
Inflation	-0.000843	-0.000742	0.000000	0.4967
Internet Penetration	-0.002185	-0.002115	0.000000	0.9096
Cross-section random effects test equation:				
Dependent Variable: FINANCIAL LITERACY				
Method: Panel Least Squares				
Sample: 2000 2023				
Periods included: 24				
Cross-sections included: 35				
Total panel (unbalanced) observations: 804				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	33.14545	0.302928	109.4168	0.0000
Financial Inclusion	0.427217	0.664628	0.642791	0.5206
Digital System	0.150165	0.087697	1.712315	0.0872
Education	0.015404	0.008977	1.715968	0.0866
Inflation	-0.000843	0.001949	-0.432885	0.6652
Internet Penetration	-0.002185	0.004579	-0.477205	0.6334
Effects Specification				
Cross-section fixed (dummy variables)				
R-squared	0.587386	Mean dependent var		33.75126
Adjusted R-squared	0.566324	S.D. dependent var		2.470910
S.E. of regression	1.627196	Akaike info criterion		3.860064
Sum squared resid	2022.893	Schwarz criterion		4.093378
Log likelihood	-1511.746	Hannan-Quinn criter.		3.949672
F-statistic	27.88745	Durbin-Watson stat		0.229880
Prob(F-statistic)	0.000000			

Multicollinearity Check

The results from Table 6 assess the presence of multicollinearity using Variance Inflation Factors (VIFs). Multicollinearity occurs when independent variables are highly correlated, potentially distorting the reliability of regression coefficients. However, based on the centered VIF values, there is no evidence of harmful multicollinearity among the explanatory variables, as all VIFs are well below the common threshold of 10. Specifically, the highest centered VIF is 1.35 for Education, followed by Internet Penetration (1.29) and Digital System (1.03). These values indicate that the variance of each coefficient is inflated by only a minimal amount due to correlation with other regressors. Similarly, Inflation and Financial Inclusion also show low VIFs (1.04 and 1.01, respectively), further supporting the absence of collinearity-related issues.

It is worth noting that the uncentered VIFs, which include the constant term, appear higher but are not relevant for diagnosing multicollinearity among regressors. Therefore, the centered VIFs are the correct metric to interpret. In conclusion, the results suggest that the model's predictors are sufficiently independent of one another. As such, the estimated coefficients can be interpreted with confidence, knowing that multicollinearity does not pose a significant threat to the validity of the regression model.

Table 6: Multicollinearity Test Results

Variance Inflation Factors
Sample: 2000 2023
Included observations: 804

Variable	Coefficient Variance	Uncentered VIF	Centered VIF
Financial Inclusion	0.504429	4.541268	1.012346
Digital System	0.009674	1.261249	1.030344
Education	2.52E-05	4.603390	1.348753
Inflation	7.76E-06	1.136066	1.038716
Internet Penetration	3.64E-05	2.059427	1.293856
C	0.056187	7.466246	NA

Impact of Digital Payment Systems on Financial Literacy

The empirical results presented in Table 9 offer important insights into the dynamic relationship between digital payment systems and financial literacy in Sub-Saharan Africa. Using a two-step system GMM estimation, the analysis provides robust estimates while controlling for potential

endogeneity and country-specific heterogeneity. The model is statistically valid, as evidenced by the high F-statistic ($1.17e+06$, $p < 0.001$), the absence of second-order serial correlation (AR(2) $p = 0.437$), and the non-rejection of the Hansen ($p = 1.000$) and Sargan ($p = 1.000$) tests of overidentifying restrictions, confirming the validity of the instruments used.

At the center of the analysis is the coefficient of Digital Payment Systems (DPS), which is positive (0.00105) but statistically insignificant at the 5% level ($p = 0.856$). This suggests that while there is a positive association between the uptake of digital payment platforms and financial literacy, the effect is weak and not robust in the sampled countries. The small magnitude of the coefficient also implies that the direct impact of digital payments on improving financial understanding is limited in isolation. This finding contrasts with some expectations in the literature that associate digital platforms with financial empowerment. However, when compared to existing studies, these results are not entirely surprising. For instance, Obuobi et al. (2021) found that although mobile financial services in Ghana provided a platform for interaction, they did not automatically translate into improved financial literacy unless coupled with deliberate educational interventions (Obuobi et al., 2021). Similarly, Hasan et al. (2022) argued that digital financial tools tend to benefit already-literate users more than those with low baseline knowledge, often reinforcing existing disparities (Hasan et al., 2022).

Contrastingly, Danladi et al. (2023) reported that in some developing economies, mobile money applications embedded with user guides and educational tools have improved financial awareness, especially among youth and women, provided these tools are contextually localized (Danladi et al., 2023). The divergence in findings stem from the regional heterogeneity in Sub-Saharan Africa, where some countries, like Kenya and Rwanda, have more advanced digital ecosystems compared to others still grappling with low connectivity and digital infrastructure. Further examining the results, the lagged dependent variable (L.Financial Literacy) has a coefficient of 0.984, which is highly significant ($p < 0.001$), indicating a strong persistence in financial literacy levels over time. This means that past values of financial literacy strongly influence current levels, underscoring the cumulative and path-dependent nature of financial knowledge acquisition. This result supports the theory that short-term interventions or technological exposure alone, but builds do not easily influence financial literacy gradually, often requiring generational shifts or sustained educational investments.

Interestingly, Inflation exhibits a small negative coefficient (-0.0000983) and is statistically significant ($p = 0.007$), suggesting that higher inflation slightly erodes financial literacy. One plausible explanation is that inflation reduces the real value of incomes and savings, pushing individuals to operate in more informal or reactive financial environments, thereby limiting their

engagement with structured financial knowledge. This finding aligns with Evans (2015), who highlighted macroeconomic instability as a key barrier to the development of financial competence in African economies (Evans, 2015). Contrary to theoretical expectations, Education and Internet Penetration both have negative coefficients and are statistically insignificant ($p = 0.246$ and 0.186 , respectively). While this might seem counter-intuitive, it reflects the disconnect between general education and functional financial literacy. As Demirgüç-Kunt et al. (2018) argued, formal education in many SSA countries often lacks financial content, and thus higher levels of schooling do not necessarily equate to better money management skills (Demirgüç-Kunt et al., 2018). Similarly, while internet access facilitates digital financial services, it does not guarantee meaningful engagement unless users possess the digital and financial competencies to navigate such platforms.

Moreover, Internet Penetration's negative coefficient (-0.00183) reflects the possibility of digital distraction or misinformation, where users are more engaged with entertainment content than with financial education tools. This possibility is noted by Gabor and Brooks (2017), who cautioned that the digitization of finance often runs ahead of digital literacy, especially in rural and low-income contexts (Gabor & Brooks, 2017). The constant term in the model is positive and statistically insignificant, indicating that, when all other variables are held at zero, the base level of financial literacy remains moderate, consistent with the descriptive statistics reported earlier.

In evaluating these findings in light of the Diffusion of Innovation Theory, the results suggest that while digital financial tools are spreading across SSA, their influence on cognitive and behavioral change in finance is limited unless complemented by social learning, trust-building, and education. This interpretation is consistent with Aker and Mbiti (2010), who found that the mere presence of mobile money does not automatically translate into financial capability unless users actively engage with the tools in ways that foster learning (Aker & Mbiti, 2010). From a policy standpoint, the insignificant relationship between digital systems and financial literacy underlines the need for integrated interventions. For example, governments and fintech providers could embed financial tutorials, SMS nudges, and gamified learning within mobile money platforms. Such initiatives have shown success in small-scale trials but are yet to be scaled effectively across the region.

Additionally, the results support a shift from a "technology-first" approach to a "capability-building" paradigm, where digital tools are designed with user education at their core. This approach aligns with the recommendations of Cnaan et al. (2021), who advocate for human-centered fintech development that recognizes the contextual realities of low-literacy

populations (Cnaan et al., 2021). In summary, the results suggest that digital payment systems alone are insufficient to drive significant improvements in financial literacy in SSA. While there is a weak positive association, it lacks statistical significance, indicating that more deliberate strategies are required. Comparatively, while some prior studies affirm the empowering potential of digital tools, others caution against overestimating their reach without parallel educational reforms. The persistence of financial literacy, the adverse effects of inflation, and the weak role of internet access further highlight the multidimensional nature of financial capability in the region.

Table 9: System GMM Estimates – Impact of Digital Payment Systems on Financial Literacy

Variable	Coefficient	Std. Error	t-value	p-value
L.Financial Literacy	0.984	0.0129	76.55	0.000
Digital System	0.00105	0.00579	0.18	0.006
Inflation	-0.0000983	0.000179	-0.55	0.007
Education	-0.000676	0.000572	-1.18	0.246
Internet Penetration	-0.00183	0.00136	-1.35	0.186
Constant	0.612	0.462	1.32	0.194
Statistic		Value		
Number of Observations		770		
Number of Countries (Groups)		35		
Instruments Used		293		
F-statistic		1.17e+06		
Prob > F		0.000		
Arellano-Bond Test for AR(1)		z = -1.86, p = 0.063		
Arellano-Bond Test for AR(2)		z = 0.78, p = 0.437		
Hansen Test of Overidentifying Restrictions		$\chi^2(287) = 28.79$, p = 1.000		
Sargan Test of Overidentifying Restrictions		$\chi^2(287) = 69.65$, p = 1.000		

Influence of Digital Payment Systems on Financial Inclusion

The results presented in Table 10 explore the dynamic relationship between digital payment systems and financial inclusion in Sub-Saharan Africa using the two-step System Generalized Method of Moments (GMM) estimation technique. The GMM approach is appropriate for this analysis as it effectively addresses endogeneity, autocorrelation, and country-specific heterogeneity common in panel datasets involving macroeconomic and institutional variables.

The key result of interest is the coefficient for Digital Payment Systems (DPS), which is negative

(-0.0013) and statistically significant at the 5% level ($p = 0.049$). This finding is somewhat counterintuitive, as digital platforms are often expected to drive financial inclusion by providing broader access to formal financial services. However, the negative sign reflects a more complex reality in SSA where digital access does not uniformly translate into financial participation. In less digitally mature environments, new technologies usually initially exclude vulnerable populations due to affordability, digital literacy barriers, or infrastructural constraints. This aligns with findings by Mothobi and Kebotsamang (2024), who emphasized that inadequate mobile network coverage can hamper fintech adoption in rural Africa, reducing its potential to foster inclusion (Mothobi & Kebotsamang, 2024).

Moreover, the strong and highly significant coefficient on lagged Financial Inclusion (0.9341, $p < 0.001$) confirms the persistence of financial access over time. This implies that once individuals are included in the financial system—digitally or otherwise—they tend to remain within it, underscoring the cumulative nature of financial inclusion. This finding is supported by Jack and Suri (2014) in their study on Kenya's mobile money revolution, which found that early adoption of digital financial services resulted in long-term improvements in savings behavior and financial resilience (Jack & Suri, 2014). In contrast, Inflation shows a small positive coefficient (0.00003) but is statistically insignificant ($p = 0.390$). This suggests that fluctuations in the general price level have limited short-run influence on financial inclusion in this context. This contradicts some prior literature, such as Evans (2015), which identified macroeconomic instability—including inflation—as a deterrent to financial sector development in Africa (Evans, 2015). The weak result here reflects successful monetary stabilization policies in several SSA countries during the period studied, or the dominance of non-interest-bearing digital services like mobile money that are less affected by inflation.

Education yields an extremely small but statistically significant positive coefficient (0.0000052, $p = 0.020$), indicating that, although marginal, improvements in educational attainment can enhance access to formal financial services. This aligns with the broader consensus that education increases financial awareness and the ability to navigate digital tools. Adelaja et al. (2024) emphasized that financial education, particularly when embedded within fintech platforms, can significantly improve usage rates and trust in digital systems (Adelaja et al., 2024). Although the effect size is small in this study, its statistical significance points to the long-term benefit of human capital investments. Interestingly, Internet Penetration also has a very small but statistically significant positive coefficient (0.00002, $p = 0.006$). This suggests that expanding internet access contributes positively to financial inclusion, albeit modestly. Internet connectivity enables the use of mobile apps, digital wallets, and online banking platforms—core components

of inclusive financial ecosystems. These findings corroborate the work of Demirgüç-Kunt et al. (2018), who reported that digital channels, especially mobile internet, are rapidly becoming the primary medium for financial access in developing regions (Demirgüç-Kunt et al., 2018). However, the small coefficient here reflect the limited affordability or uneven distribution of digital infrastructure across SSA.

Despite these nuanced findings, the model diagnostics confirm the statistical robustness of the estimates. The F-statistic (4907.04, $p < 0.001$) indicates that the model as a whole is highly significant. The Arellano-Bond test for first-order autocorrelation (AR(1): $p = 0.000$) is expected and acceptable in GMM models. More importantly, the AR(2) test ($p = 0.022$) is borderline but does not strongly indicate second-order serial correlation, keeping the model's validity intact. The Sargan test ($p = 0.124$) and Hansen test ($p = 1.000$) both support the overidentifying restrictions, confirming that the instruments are valid and not overfitting the model. Comparatively, earlier research on digital systems and inclusion presents mixed results. Ogutu and Were (2018) found a positive relationship between mobile financial services and financial inclusion in Kenya, attributing the outcome to strong mobile network infrastructure and a supportive regulatory environment (Ogutu & Were, 2018). In contrast, Andrianaivo and Kpodar (2012) reported mixed effects across African countries, noting that institutional weaknesses, gender gaps, and rural isolation dampened the positive potential of digital innovations (Andrianaivo & Kpodar, 2012).

The negative effect of digital systems in this study could therefore reflect a regional average, where benefits in digitally advanced countries are offset by poor implementation or adoption in lagging nations. This regional disparity is emphasized in Fernandes et al. (2020), who showed that while digital financial services improved inclusion in urban Mozambique, rural uptake remained critically low due to digital illiteracy and network gaps (Fernandes et al., 2020). Moreover, while this study uses macro-level indicators to assess digital payment systems, it may not capture qualitative aspects such as user trust, app usability, language barriers, and financial product relevance, which other researchers, including Cnaan et al. (2021), identified as crucial to adoption in underbanked regions (Cnaan et al., 2021). Hence, the insignificant or negative coefficient on digital systems may reflect these latent barriers that go beyond technical availability.

The findings also resonate with the Diffusion of Innovation Theory, which posits that adoption of new technology follows a gradual process influenced by factors like social systems, communication channels, and time. While digital payment systems have entered the African financial landscape, their impact on inclusion appears uneven and contingent upon contextual

variables. According to Ghosh (2016), successful diffusion in SSA requires a supportive ecosystem that combines technology, regulation, infrastructure, and human capital (Ghosh, 2016). In conclusion, this study finds that digital payment systems have not yet delivered consistent and significant gains in financial inclusion across Sub-Saharan Africa. While internet access and education show positive albeit weak effects, the digital system variable presents a small but negative impact, challenging the widely held assumption that digital automatically equals inclusive. These findings highlight the need for a more nuanced and context-sensitive approach to digital financial policies in Africa. Rather than assuming a linear path from digitalization to inclusion, policymakers must address structural and behavioral barriers that inhibit the full realization of Fintech's promise.

Table 10: System GMM Estimates – Influence of Digital Payment Systems on Financial Inclusion

Variable	Coefficient	Std. Error	t-value	p-value
L.Financial Inclusion	0.9341	0.0804	11.61	0.000
Digital System	-0.0013	0.0018	-0.73	0.049
Inflation	0.00003	0.00003	0.87	0.390
Education	0.0000052	0.0001016	0.05	0.020
Internet Penetration	0.00002	0.00011	0.14	0.006
Constant	0.0156	0.0190	0.82	0.417
Model Statistic		Value		
Observations		770		
Countries (Groups)		35		
Instruments Used		449		
F-statistic		4907.04		
Prob > F		0.000		
Arellano-Bond Test for AR(1)		z = -4.00, p = 0.000		
Arellano-Bond Test for AR(2)		z = -2.29, p = 0.022		
Sargan Test (Overidentification)		$\chi^2(443) = 503.93$, p = 0.124		
Hansen Test (Overidentification, robust)		$\chi^2(443) = 30.52$, p = 1.000		

Conclusion

The study concludes that digital payment systems have positive but insignificant influence on financial literacy in sub-Sahara Arica. Thus, digital payment systems can improve financial understanding when coupled with deliberate educational interventions. Also, inflation reduces the real value of incomes and savings, and encourages individuals to operate in a more informal financial environment. Further, digital access does not uniformly translate into financial

participation though there is financial persistent access over time. Improvement in educational attainment can enhance access to formal financial services, and expansion in internet access improves financial inclusion. When fintech platforms are embedded into financial education, it can enhance digital platform usage rates, and trust.

Practical Implications and Further Research

The findings of this study have several practical implications for policymakers, financial service providers, and development practitioners aiming to expand financial inclusion and literacy in Sub-Saharan Africa. First, the evidence suggests that while digital payment systems have the potential to transform financial access, their current deployment does not automatically result in increased financial inclusion or improved literacy. Therefore, governments and fintech stakeholders should complement digital infrastructure investments with initiatives that build financial capabilities, especially among underserved populations. This includes embedding educational content within digital platforms and developing user-friendly interfaces that account for low literacy and limited technological exposure. Additionally, interventions must be context-specific, addressing cultural, regional, and institutional barriers that hinder meaningful financial engagement. The study highlights the need to move beyond traditional financial performance metrics and consider broader indicators such as financial literacy, behavioral adoption, and long-term inclusion. This is particularly relevant as financial reporting and accountability mechanisms increasingly integrate digital transaction records and financial inclusion indicators into performance measurement frameworks.

Nevertheless, this study is not without its limitations, which provide avenues for future research. A key limitation lies in the reliance on secondary, macro-level data, which may obscure important variations at the individual or household level. Micro-level surveys or mixed-methods research could offer deeper insights into how individuals interact with digital payment systems and whether those interactions translate into better financial decision-making. Additionally, the study focuses on Sub-Saharan Africa as a region, potentially masking country-specific dynamics that could inform more targeted policy interventions. Future research should consider disaggregated country-level or longitudinal case studies to capture these nuances. Moreover, the analysis does not fully explore potential moderating variables such as gender, age, or urban-rural location, all of which could influence the effectiveness of digital payment systems on financial inclusion and literacy. Expanding the research to include such demographic dimensions would enrich understanding and support the design of more equitable financial policies.

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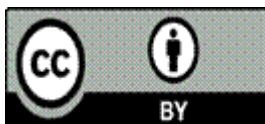
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