



DIGITAL FINANCIAL INCLUSION AND POVERTY REDUCTION IN NIGERIA: THE MEDIATING ROLE OF MICROFINANCE DEVELOPMENT

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Abstract

This study examines the impact of digital financial inclusion on poverty reduction in Nigeria, with particular emphasis on the mediating role of microfinance institutions in enhancing inclusive financial outcomes. Using annual time series data spanning 1990 to 2024, the study employs the Autoregressive Distributed Lag model as the baseline estimation technique, while Fully Modified Ordinary Least Squares and Dynamic Ordinary Least Squares are applied as robustness checks to validate the stability of the results. The findings indicate that digital financial inclusion significantly contributes to poverty reduction in Nigeria. Key indicators like automated teller machine penetration, mobile money services, mobile banking, and electronic banking exhibit positive and statistically significant effects by improving access to financial services, reducing transaction costs, and expanding household participation in the formal financial system. The results further show that microfinance institutions play a crucial complementary role by deepening financial outreach at the grassroots level. Interaction effects reveal that microfinance strengthens the effectiveness of digital financial inclusion instruments in reducing poverty. However, macroeconomic instability, particularly inflation, exchange rate volatility, and high interest rates emerges as a major constraint, significantly weakening the poverty-reducing effects of financial inclusion by eroding purchasing power and limiting credit access. The study concludes that digital financial inclusion, when supported by strong microfinance systems and macroeconomic stability, serves as a powerful mechanism for poverty reduction in Nigeria. Consequently, the study recommends policies aimed at expanding digital financial infrastructure, strengthening microfinance institutions, and ensuring macroeconomic stability as pathways toward sustainable poverty alleviation and inclusive economic development.

Keywords: Poverty reduction, digital financial inclusion, microfinance

1. INTRODUCTION

Poverty reduction has remained one of the most critical development challenges confronting Nigeria despite the country's abundant natural and human resources. Over the years, successive governments have implemented several poverty alleviation programmes aimed at improving living standards, promoting employment generation, and enhancing economic welfare; however, poverty incidence remains persistently high across many regions of the country. According to the National Bureau of Statistics, about 63 per cent of Nigerians, representing approximately 133



million people, were classified as multidimensionally poor in 2022, reflecting severe deprivations in health, education, sanitation, housing, and living standards (NBS, 2022). Similarly, the World Bank noted that rising inflation, unemployment, food insecurity, and weak economic growth have continued to worsen poverty conditions, particularly within rural communities where poverty incidence remains significantly higher than in urban areas (World Bank, 2025). The persistence of poverty in Nigeria has been linked to structural economic weaknesses, corruption, poor governance, inadequate infrastructural development, limited access to quality education and healthcare services, and macroeconomic instability (Sen, 1999). Furthermore, the widening inequality gap and limited access to financial services have constrained inclusive growth and reduced opportunities for sustainable livelihoods among vulnerable populations. Consequently, reducing poverty has become central to Nigeria's development agenda and the achievement of the Sustainable Development Goals, particularly SDG 1, which focuses on ending poverty in all its forms by 2030.

Poverty remains one of the most persistent socio-economic challenges confronting Nigeria despite decades of economic reforms, poverty alleviation programmes, and abundant natural resources. A significant proportion of the population still lacks adequate access to income, healthcare, education, decent housing, and employment opportunities, particularly in rural communities where economic exclusion remains severe. In recent years, the emergence of digital financial inclusion through mobile banking, internet banking, fintech innovations, point-of-sale transactions, agent banking, and mobile money services has increasingly been viewed as a viable pathway for improving economic participation and reducing poverty among financially excluded populations. The growing penetration of mobile phones and digital payment systems has expanded access to financial services beyond conventional banking institutions, thereby creating opportunities for savings mobilisation, entrepreneurship development, business expansion, and improved household welfare (Kelikume, 2021; Wale-Awe & Evans, 2023). This development has become particularly important in Nigeria where a large proportion of the population operates within the informal sector and remains outside the traditional banking system. Nevertheless, the effectiveness of digital financial inclusion in reducing poverty continues to generate considerable debate due to structural and institutional challenges confronting the Nigerian economy. While digital financial services possess the potential to enhance financial accessibility and inclusive growth, issues such as poor digital infrastructure, cyber insecurity, unstable electricity supply, low financial literacy, network failures, high transaction costs, and limited internet penetration in rural areas continue to constrain their effectiveness (Udom et al., 2025; Udo & Akpan, 2026). Furthermore, inequality in access to digital technologies between urban and rural populations, as well as between low- and high-income earners, has raised concerns regarding whether digital financial inclusion genuinely reaches the poorest segments of society (Tay et al., 2022). Thus, understanding the extent to which digital financial inclusion influences poverty reduction in Nigeria has become increasingly important for policymakers seeking sustainable and inclusive economic development.



Furthermore, microfinance has undoubtedly played a pivotal role in poverty reduction in Nigeria. It aids in providing funds to households and small-scale businesses to improve their businesses and improve their livelihood. Microfinance is an important poverty reduction strategy aimed at extending financial services to economically excluded populations through the provision of microcredit, savings facilities, insurance services, and small business financing. The establishment and expansion of microfinance banks in Nigeria were therefore driven by the expectation that increased access to finance would stimulate entrepreneurship, enhance income generation, encourage self-employment, and improve household welfare. This developmental role of microfinance has gained increasing global attention as many developing economies continue to pursue inclusive growth and sustainable poverty reduction strategies (Martins, 2025).

Furthermore, the growing integration of technology into microfinance operations through mobile banking and digital financial services has expanded opportunities for financial inclusion among underserved populations (Osuma et al., 2025). Despite these expectations, poverty levels in Nigeria remain considerably high, suggesting that access to microfinance alone may not be sufficient to address the structural causes of poverty. Factors such as high interest rates, inadequate financial literacy, poor regulatory enforcement, weak institutional capacity, and limited outreach to remote rural areas continue to constrain the effectiveness of microfinance institutions in achieving meaningful poverty reduction (Ramanujam & Nigama, 2025). In addition, poor infrastructural development, unstable macroeconomic conditions, and loan repayment challenges have weakened the operational efficiency of many microfinance institutions across the country. Although microfinance has created opportunities for business expansion and income improvement among some low-income earners, concerns persist regarding its sustainability, accessibility, and long-term contribution to reducing poverty in Nigeria. Therefore, examining the role of microfinance in poverty reduction remains essential for understanding how financial inclusion policies can better support inclusive economic growth and improved living standards in Nigeria.

This study delved into assessing the influence of digital financial inclusion and microfinance on poverty reduction in Nigeria. The essence of studying these relationships lies in understanding how modern financial technologies translate into real welfare improvements for low-income households in Nigeria to ascertain whether access to digital financial services such as mobile banking, fintech platforms, and agent banking can effectively reduce poverty levels in Nigeria. Furthermore, to investigate the critical role of microfinance institutions in bridging the gap between digital finance and underserved populations. These are important because Nigeria still faces high poverty rates despite financial sector innovations and expanding digital infrastructure. Finally, the study would provide evidence to guide policies that strengthen financial inclusion, enhance microfinance efficiency, and promote sustainable poverty reduction. Based on this synopsis, this study employed indicators such as the number of automated teller machines per 10,000 adults, the number of mobile money agents per 1000 people, electronic banking (e-



banking), mobile banking, and financial literacy, as well as the mediating role of microfinance indicators such as the number of microfinance branches on poverty reduction in Nigeria. However, this necessitates the following questions: a) What is the role of the number of automated teller machines per 10,000 adults on poverty reduction in Nigeria? b). Does the number of mobile money agents per 1000 people significantly impact poverty reduction strategies in Nigeria? c). Is there a significant relationship between electronic banking (e-banking) and poverty reduction in Nigeria? d). How does mobile banking impact poverty reduction in Nigeria? e). Can the level of financial literacy determine poverty reduction in Nigeria? f). How does the outreach of microfinance services, such as the number of microfinance branches, determine the poverty reduction rate in Nigeria?

Building from the above discussions, we employed the autoregressive distributed lag (ARDL) as the baseline model to estimate the relationship between digital financial inclusion and poverty reduction, as well as the mediating role of microfinance in Nigeria. We also robustly checked the findings by employing the fully modified ordinary least squares (FMOLS) and dynamic ordinary least squares (DOLS). The incorporation of the Autoregressive Distributed Lag (ARDL) model in this study is essential because it allows for the estimation of both short-run and long-run relationships between digital financial inclusion and poverty reduction, even when variables are integrated of mixed order (Pesaran et al., 2001). This makes it particularly suitable for Nigeria's macroeconomic data, which often exhibits structural variability over time. In addition, the Fully Modified Ordinary Least Squares (FMOLS) technique is employed to correct for serial correlation and endogeneity, thereby providing unbiased and consistent long-run estimates (Phillips & Hansen, 1990). Similarly, the Dynamic Ordinary Least Squares (DOLS) model enhances robustness by incorporating leads and lags of regressors to eliminate endogeneity bias and improve estimation efficiency (Stock & Watson, 1993). Together, FMOLS and DOLS serve as confirmatory techniques that strengthen the reliability of the ARDL findings. This triangulation of econometric methods ensures that the estimated relationship is not model-specific but statistically stable and theoretically sound. Thus, the combined use of ARDL, FMOLS, and DOLS improves the credibility and policy relevance of the study's findings in explaining poverty reduction dynamics in Nigeria.

This study departs from existing knowledge by moving beyond the traditional and often fragmented examination of poverty reduction that focuses mainly on macroeconomic factors or conventional financial inclusion indicators in isolation. While earlier studies have extensively considered poverty in Nigeria from the perspectives of income growth, government intervention programmes, and general financial inclusion, they have given less attention to the evolving role of digital financial systems and how they interact with institutional financial structures such as microfinance institutions. More importantly, previous literature has largely treated digital financial inclusion and microfinance as separate explanatory factors, without adequately exploring how microfinance development can function as a transmission channel through which



digital financial services translate into improved welfare outcomes for poor households. This study therefore provides a more integrated framework by linking digital financial inclusion with microfinance development in explaining poverty reduction outcomes in Nigeria. It also shifts focus from general access to financial services to more functional dimensions such as usage intensity, outreach effectiveness, and financial literacy, which are critical in determining whether financial inclusion actually translates into poverty alleviation. Furthermore, unlike many existing studies that are heavily cross-country or region-specific with limited contextual depth, this study is firmly grounded in the Nigerian socio-economic environment, where poverty dynamics are shaped by structural inequalities, weak institutions, and financial exclusion. It also broadens the discourse by recognising that access to digital financial services alone is insufficient unless supported by effective microfinance structures that can channel credit, savings, and entrepreneurial support to underserved populations. In doing so, the study contributes to the literature by offering a more comprehensive and policy-relevant explanation of how financial innovation, institutional finance, and inclusion mechanisms jointly influence poverty reduction in Nigeria's developing economy context.

This study contributes to the existing literature on poverty reduction in Nigeria in several important ways, particularly through its methodological and empirical innovations. First, it advances previous research by employing an integrated econometric framework that combines the Autoregressive Distributed Lag (ARDL) model with Fully Modified Ordinary Least Squares (FMOLS) and Dynamic Ordinary Least Squares (DOLS), thereby ensuring both short-run dynamics and long-run equilibrium relationships are adequately captured and validated. This triangulation of techniques enhances the robustness and reliability of the estimated relationships between digital financial inclusion, microfinance development, and poverty reduction. Second, the study improves empirical understanding by providing evidence on both the direct and mediated effects of digital financial inclusion on poverty outcomes in Nigeria, an area that has received limited comprehensive empirical attention. Third, it contributes by using diverse indicators of financial inclusion and microfinance development, allowing for a more nuanced assessment of how financial access, usage, and institutional outreach influence poverty levels.

Fourth, by focusing on Nigeria, the study provides context-specific insights that reflect the country's structural constraints, financial exclusion patterns, and institutional realities. Finally, the study offers strong policy-relevant findings that can guide policymakers in strengthening digital financial systems, enhancing microfinance effectiveness, and improving financial inclusion strategies aimed at sustainable poverty reduction. The methodological rigour and integrated analytical approach distinguish this study from prior works and deepen the understanding of the financial inclusion–poverty linkages in developing economies. The remainder of the paper proceeds as follows. Section 2 reviews the theoretical framework and empirical literature on digital financial inclusion, microfinance innovation, and poverty reduction. Section 3 describes the data and econometric methodology. Section 4 presents and



discusses the empirical results. Section 5 concludes with targeted policy recommendations for Nigeria's financial inclusion agenda.

2. LITERATURE REVIEW

2.1 Theoretical Literature

2.1.1 Digital Financial Theory

Digital Finance Theory explains how digital technologies transform the delivery, accessibility, efficiency, and inclusiveness of financial services within an economy. The theory emerged from the broader evolution of financial intermediation and innovation theories, particularly in response to rapid technological advancement in banking, telecommunications, and financial systems. Digital finance encompasses mobile banking, internet banking, digital payments, fintech platforms, blockchain systems, mobile money, and electronic financial services that facilitate financial transactions without the limitations of traditional banking structures. The theory posits that digital financial systems reduce transaction costs, improve financial access, enhance financial efficiency, and stimulate economic activities by bridging the gap between financial institutions and underserved populations (Ozili, 2018). Through digital platforms, individuals and businesses can conduct savings, investments, credit acquisition, remittances, and payments more efficiently than through conventional financial systems. The theory further argues that digital finance enhances financial inclusion by integrating unbanked populations into formal financial systems, especially in developing economies where traditional banking infrastructure is weak (Demirgüç-Kunt et al., 2018). Scholars maintain that the diffusion of digital financial technologies contributes to poverty reduction, entrepreneurship development, and economic growth by improving access to financial resources and reducing financial exclusion (Sahay et al., 2020). Consequently, Digital Finance Theory provides a strong framework for understanding how technological innovations reshape financial markets, institutional efficiency, and developmental outcomes across emerging and advanced economies.

Furthermore, Digital Finance Theory emphasises that technological innovation in financial systems enhances transparency, accountability, risk management, and economic resilience within modern economies. The theory draws support from the innovation diffusion framework, which suggests that the adoption of digital financial technologies depends on perceived usefulness, accessibility, trust, and institutional support mechanisms (Rogers, 2003). In many developing countries, digital finance has become an important instrument for overcoming structural barriers associated with traditional banking systems, including geographical limitations, high operational costs, and inadequate financial infrastructure. The theory, therefore, suggests that digital financial services stimulate economic participation among households and small businesses by lowering entry barriers into formal financial markets (Lee & Shin, 2018). Additionally, proponents argue that digital finance enhances the effectiveness of monetary policy transmission and financial sector stability by increasing transaction traceability and improving data availability for regulatory institutions (Arner et al., 2020). However, the theory also recognises



challenges such as cybersecurity risks, digital illiteracy, weak regulatory frameworks, data privacy concerns, and unequal technological access, which may limit the effectiveness of digital financial systems in some economies (Philippon, 2016). Despite these limitations, Digital Finance Theory remains highly relevant in explaining the growing relationship between fintech innovation, financial inclusion, sustainable development, and economic transformation in both developed and developing nations.

2.1.2 Capability Approach Theory of Poverty Reduction

The Capability Approach Theory was propounded by Amartya Sen in the 1980s as a broader framework for understanding welfare, development, and poverty beyond the traditional income-based perspective. The theory argues that poverty should not merely be viewed as low income or inadequate consumption, but rather as the deprivation of basic capabilities that enable individuals to live meaningful and productive lives (Sen, 1985). According to the theory, capabilities represent the freedoms and opportunities people possess to achieve valuable “functionings,” such as being educated, healthy, socially included, and economically productive (Sen, 1999). The approach emerged as a criticism of conventional welfare economics, which concentrated excessively on income growth while neglecting human well-being and social opportunities. Sen maintained that two individuals with the same income level may experience different welfare outcomes because of disparities in education, health conditions, institutional access, and social discrimination (Robeyns, 2005). Consequently, poverty reduction should involve expanding access to healthcare, education, employment opportunities, financial inclusion, and social protection policies that improve human capabilities and freedoms. The theory further explains that sustainable poverty reduction depends on strengthening institutional structures and enhancing individuals’ capacity to participate effectively in economic and social activities. This perspective has significantly influenced global development policy frameworks, including the Human Development Index (HDI) introduced by the United Nations Development Programme and various multidimensional poverty measurement frameworks adopted across developing economies (Alkire & Foster, 2011).

This theory remains highly relevant in contemporary poverty reduction studies because it provides a multidimensional explanation of deprivation, particularly within developing countries where poverty extends beyond income insufficiency. The theory emphasises that public policy should focus on enlarging individuals’ choices, freedoms, and access to productive resources necessary for sustainable livelihoods (Sen, 1999). In African economies, where structural unemployment, weak institutions, poor healthcare systems, and limited financial access persist, the capability framework offers a comprehensive basis for understanding welfare challenges and developmental inequalities (Nussbaum, 2000). The theory strongly supports investments in education, digital financial inclusion, healthcare services, infrastructural development, and institutional reforms as mechanisms for improving people’s capabilities and reducing vulnerability. Furthermore, the approach aligns closely with the Sustainable Development Goals



(SDGs), particularly SDG 1 on poverty eradication, SDG 3 on good health and well-being, and SDG 4 on quality education. Scholars have argued that the capability approach is more effective than purely income-based poverty measures because it captures social exclusion, inequality, and human empowerment dimensions often ignored in orthodox economic models (Alkire, 2005). Despite criticisms that the theory lacks universally accepted capability indicators and may be difficult to operationalise empirically, it remains one of the most influential development theories in welfare economics and poverty studies. Its emphasis on human freedom, social justice, and opportunity expansion continues to shape poverty reduction policies in both developed and developing economies across the world.

2.2 Empirical Literature

2.2.1 Digital Financial Inclusion and Poverty Reduction

Hussaini and Umar Dikko (2025) examined the effects of financial inclusion and digital financial inclusion on poverty reduction in Northwestern Nigeria using primary data obtained from 415 households and analysed through PLS-SEM techniques. The study found that financial inclusion significantly enhanced job creation, purchasing power, and household living standards, thereby contributing to poverty reduction, although the findings were limited by the regional scope of the study. Udo and Akpan (2026) examined the impact of digital financial inclusion on poverty reduction in rural South-South Nigeria using mixed-method evidence from 397 households and 30 interviews across six states. The study found that active usage of digital financial services significantly reduced poverty, while inadequate infrastructure, affordability challenges, and limited agent access remained major barriers to effective financial inclusion. In another study, Udom et al. (2025). Conducted a study to investigate the impact of mobile payment services on customer behaviours in Nigeria's South-South geopolitical zone, focusing on civil servants and pensioners. Utilising a descriptive survey design, data were collected from 800 households across the south-south zone of Nigeria using a structured questionnaire, with Structural Equation Modelling (SEM) and regression analysis as the analytical techniques. The findings reveal that civil servants exhibit a higher adoption rate than pensioners, driven by greater perceived usefulness, ease of use, and trust. Based on findings, the study therefore recommended the need for targeted digital literacy programs, improved network infrastructure, and enhanced security to boost financial inclusion in the region. Simon-Ilogho and Moloi (2026) investigated the effects of financial and digital inclusion on poverty alleviation in Sub-Saharan Africa using System GMM analysis covering the period from 2000 to 2023. The study found that mobile subscriptions significantly reduced poverty, whereas ATM availability, mobile money usage, and digital inclusion indicators showed no significant moderating effect on the relationship between financial inclusion and poverty reduction. Aluya (2025) examined the effect of financial inclusion and digital finance on poverty alleviation in Nigeria using secondary data from 2015 to 2024 and multiple regression analysis. The study found that web-based, POS, and ATM transactions exhibited positive but statistically insignificant relationships with real GDP while emphasising the importance of strengthening digital financial systems and regulatory



frameworks for poverty reduction. In China, Peng and Mao (2023) investigated the impact of digital financial inclusion on urban households' relative poverty levels. The probit model, the mediating effect model, and the instrumental variable approach were used to perform empirical research. According to the findings, digital financial inclusion lowers the likelihood that urban households will experience poverty. Moreover, the study discovered that digital financial inclusion increases urban families' engagement in the financial sector and encourages entrepreneurship. A study by Tay et al. (2022) yielded mixed results. Using a systematic literature review, the cited authors examined digital financial inclusion across countries. The study revealed that, to combat poverty, developing countries, mostly in Asia, embrace and expand digital financial inclusion. However, the findings also showed that, in terms of access to and use of digital financial services, disparities persist by gender, between the wealthy and the poor, and between urban and rural areas in developing countries.

Tweneboah and Nsiah (2023) investigated how financial stability mediates the relationship between financial inclusion and poverty reduction in Africa. Using the panel Autoregressive Distributive Lag model, covering a period of 2004–2020, the study found that financial inclusion is positively related to financial stability in both the short and long run, with education, Gross National Income per capita (GNI), and domestic credit to the private sector contributing to financial stability, and trade openness is negatively related to financial stability in the long run. The study further established that financial stability is positively related to household consumption expenditure, thereby leading to poverty reduction, with trade openness, government expenditure, GNI, domestic credit to the private sector, and institutional quality contributing significantly to poverty reduction. This confirms the mediating role financial stability plays in enhancing the impact of financial inclusion on poverty reduction in Africa and must therefore be given the necessary attention through proper regulatory mechanisms. Mashoene and Schaling (2026) examined the impact of digital financial inclusion on inclusive growth and poverty reduction across emerging and developing economies using panel data and System-GMM estimation. The study found that digital financial inclusion significantly promoted inclusive growth, while inclusive growth in turn exerted a significant negative effect on poverty, highlighting the importance of digital finance in achieving broad-based economic development. Kelikume (2021) investigated the nexus between poverty reduction, financial inclusion, mobile phones, the informal economy, and the internet. The system-GMM technique and a panel dataset spanning 1995 to 2017 from 42 countries were employed in the study. The findings revealed a positive and significant relationship among internet use, mobile penetration, and poverty alleviation. Moreover, the study found that increased financial inclusion reduces poverty. Using a two-step System-GMM, a Toda causality test, and simultaneous-equations models, Wale-Awe and Evans (2023) examined the causal relationship between the growth-poverty-inequality triangle and digital financial inclusion from 1995 to 2018 in 42 African countries. The cited study found that increased digital financial inclusion leads to poverty alleviation and reduced inequality. The findings also revealed a bi-causality between digital financial inclusion and



poverty. Therefore, Wale-Awe and Evans (2023) suggest that enhancing access to digital financial services throughout the African continent is crucial to improving income levels, reducing poverty, and fostering an equitable income distribution. Focusing on South Asia and Sub-Saharan Africa, Lyons et al. (2020) examined the association between financial and digital inclusion and poverty across seven developing countries. The cited study found that substantial reductions in poverty are associated with increases in several measures of financial and digital inclusion. The study underscores the significance of digital financial services in assisting and maintaining efforts to reduce poverty in developing countries.

2.2.2 Microfinance and Poverty Reduction

Musukwa and Phiri (2025) investigated the impact of microfinance services on household poverty in Chongwe District, Zambia, using a case study design and survey data from 286 respondents. The study found that microloans and savings accounts significantly reduced household poverty, while microinsurance had a limited effect, highlighting the need for improved financial literacy, better access, and tailored microfinance products. Martins (2025) examines microfinance as a key instrument for financial inclusion and poverty reduction, aligning it with Sustainable Development Goal 1 across developing countries. The study highlights its positive role in improving economic welfare and living standards, while emphasising the importance of strong governance, macroeconomic stability, and effective regulation for maximising its poverty-alleviating impact. Osuma et al. (2025) examined the role of microfinance and financial inclusion in poverty reduction and sustainable development across 10 Sub-Saharan African countries from 2000 to 2023. The study found that ATM and mobile banking penetration significantly reduce poverty and promote economic growth, with effectiveness depending on reaching critical access thresholds, and recommended investment in digital financial infrastructure and supportive macroeconomic policies. Ramanujam and Nigama (2025) examined microfinance as a key instrument for poverty alleviation and economic development, focusing on its role in financial inclusion, entrepreneurship, and income generation among underserved populations. The study found that while microfinance improves livelihoods and supports inclusive growth, challenges such as high interest rates, indebtedness, and sustainability concerns require stronger regulation, financial literacy, and technological integration.

Adejuwon and Adetoun (2025) examined the role of microfinance institutions in poverty alleviation in Nigeria, focusing on how regulation, socioeconomic conditions, and technology shape their effectiveness. The study found that strong regulatory frameworks, improved socioeconomic support (especially education, healthcare, and welfare), and technological innovation significantly enhance poverty reduction, while highlighting the need for policy strengthening and fintech adoption to improve MFIs' impact. Isibor et al. (2025) examined the role of microfinance in poverty alleviation, noting its origins in the work of Muhammad Yunus and its continued relevance in supporting low-income households. The study found that despite



operational challenges, microfinance significantly contributes to reducing poverty, particularly in rural areas, and recommended a stronger focus on the diverse needs of the poor. Muhammed and Aliyu (2025) assessed the impact of microfinance loans on poverty reduction in Daura LGA using a descriptive survey design, focusing on awareness, access, challenges, and outcomes of loan utilisation. The study found that despite high interest rates and communication gaps, microfinance loans—especially agricultural credit—positively contributed to income generation, small business growth, and improved household welfare, supporting poverty alleviation in the area.

2.3 Existing Gaps in the Literature

Despite the growing body of literature on digital financial inclusion and poverty reduction, several important gaps remain evident, particularly in the context of Nigeria and other developing economies. First, most existing studies on digital financial inclusion have largely been fragmented in scope, with many focusing on specific regions, states, or limited household surveys rather than providing a comprehensive national-level analysis that captures Nigeria's diverse socio-economic structure (Hussaini & Umar Dikko, 2025; Udo & Akpan, 2026). This creates a significant generalizability gap, as findings from one geopolitical zone may not adequately represent the realities of others due to differences in infrastructure, income levels, and financial access. In addition, a considerable proportion of the literature relies on primary survey-based data or simple regression techniques, which limits the ability to capture dynamic relationships and long-run effects between digital financial inclusion and poverty outcomes (Aluya, 2025). Furthermore, although studies such as Peng and Mao (2023) and Wale-Awe and Evans (2023) acknowledge the positive role of digital finance in poverty reduction, they often overlook the structural constraints in developing economies like Nigeria, where weak institutions, digital inequality, and low financial literacy distort the effectiveness of financial inclusion policies. Another critical gap is the insufficient consideration of heterogeneity in access and usage of digital financial services across income groups, rural-urban divides, and gender categories, which may lead to biased conclusions regarding the true poverty-reducing effects of digital financial systems (Tay et al., 2022). Moreover, many cross-country studies fail to capture country-specific institutional and macroeconomic realities, thereby limiting the policy relevance of their findings for Nigeria. These gaps collectively suggest the need for more comprehensive, methodologically robust, and context-specific studies that integrate multiple dimensions of digital financial inclusion in explaining poverty dynamics.

Similarly, the literature on microfinance and poverty reduction reveals important conceptual and empirical limitations that this study seeks to address. Although numerous studies confirm that microfinance contributes to poverty alleviation through credit access, savings mobilisation, and entrepreneurship support, most of the evidence is derived from localized or case-specific studies that do not adequately capture broader national dynamics (Musukwa & Phiri, 2025; Muhammed & Aliyu, 2025). This creates an empirical gap in understanding the macro-level effectiveness of



microfinance institutions in reducing poverty across different economic contexts. Furthermore, while studies such as Martins (2025) and Ramanujam and Nigama (2025) emphasise the importance of governance, regulation, and macroeconomic stability, they do not sufficiently explore how microfinance interacts with modern digital financial systems to enhance or limit poverty reduction outcomes. This reflects a major conceptual gap, as the evolving financial landscape increasingly integrates microfinance institutions with digital platforms, yet the literature has not fully examined this synergy. Additionally, several studies focus predominantly on the positive impacts of microfinance while giving limited attention to persistent challenges such as high interest rates, loan defaults, limited outreach, and institutional inefficiencies, which may weaken its poverty-reducing potential (Isibor et al., 2025; Adejuwon & Adetoun, 2025). There is also limited evidence on the mediating or transmission role of microfinance in linking financial innovation to actual poverty outcomes, particularly within Nigeria's complex economic environment. Therefore, there remains a need for more integrated empirical investigations that combine digital financial inclusion and microfinance development within a unified framework to better explain poverty reduction dynamics in Nigeria.

3. METHODOLOGY

3.1 Data and Variables

This study evaluates the impact of digital financial inclusion on poverty reduction in Nigeria and examines the role of microfinance in reducing poverty. Annual time series data from 1990 to 2024 were used. To measure digital financial inclusion, we employed the number of automated teller machines per 10,000 adults (ATM), the number of mobile money agents per 1000 people (MM), electronic banking (E-Banking), mobile banking (MB), and financial literacy (FIL), while microfinance was measured with the number of microfinance branches (NMBB), which measured the outreach of microfinance banks. Additionally, poverty reduction was measured with the multidimensional poverty index (MDPI), while we controlled for exchange rate (EXR), interest rate (INTR), and inflation rate (INFR). We sourced these variables from relevant data sources like the World Bank's World Development Indicators (WDI), the International Monetary Fund (IMF), and the Central Bank of Nigeria (CBN). However, in Table 1 below, we defined each of the model data to give the readers a better understanding.

Table 1: Definition of Data

Variable	Definition	Repository
MDPI	Multidimensional Poverty Index	https://hdr.undp.org/content/2025-global-multidimensional-poverty-index-mpi#/indicies/MPI
ATM	Automated Teller Machines	https://data.worldbank.org/indicator/FB.ATM.TOTL.P5
MM	Mobile Money	https://databank.worldbank.org/id/d1fc2d5d
E-Banking	Electronic banking	https://www.worldbank.org/en/publication/globalindex
MB	Mobile Banking	https://www.worldbank.org/en/publication/globalindex
FIL	Financial Literacy	https://www.worldbank.org/en/publication/globalindex
NMBB	Number of Microfinance Bank Branches	https://fred.stlouisfed.org/series/NGAFCIODMFNUM
EXR	Exchange Rate	https://data.worldbank.org/indicator/PA.NUS.FCRF
INTR	Interest Rate	https://data.worldbank.org/indicator/FR.INR.RINR
INFR	Inflation Rate	https://data.worldbank.org/indicator/FP.CPI.TOTL.ZG

3.2 Econometric Modelling

3.2.1 Baseline Autoregressive Distributed Lag (ARDL) Model

To estimate the relationship between multidimensional poverty, digital financial inclusion variables, and macroeconomic conditions in the selected economy, this study employed the Autoregressive Distributed Lag (ARDL) estimation technique developed by Pesaran, Shin, and Smith (1999, 2001). The ARDL approach is preferred in empirical macroeconomic and development studies due to its flexibility in handling variables that are integrated of different orders, $I(0)$ and $I(1)$, while excluding $I(2)$ variables. It also addresses limitations associated with traditional cointegration methods such as the Engle and Granger (1987) two-step procedure and the Johansen (1991, 1995) maximum likelihood approach. Furthermore, the ARDL framework is particularly suitable for small and moderate sample sizes and provides efficient and unbiased long-run estimates alongside short-run dynamic adjustments through an error correction mechanism (Banerjee et al., 1993; Ghatak & Siddiki, 2001). Given these advantages, the ARDL method is appropriate for examining how digital finance indicators, financial literacy, and macroeconomic instability influence multidimensional poverty over time. The empirical ARDL model for this study is specified as follows:

$$\begin{aligned}
 MDPI_t = & \sum_{j=1}^p \beta_j MDPI_{t-j} + \sum_{j=0}^q \phi_{1j} ATM_{t-j} + \sum_{j=0}^q \phi_{2j} MM_{t-j} + \sum_{j=0}^q \phi_{3j} EB_{t-j} + \sum_{j=0}^q \phi_{4j} MB_{t-j} \\
 & + \sum_{j=0}^q \phi_{5j} FIL_{t-j} + \sum_{j=0}^q \phi_{6j} NMBB_{t-j} + \sum_{j=0}^q \phi_{7j} EXR_{t-j} + \sum_{j=0}^q \phi_{8j} INTR_{t-j} + \sum_{j=0}^q \phi_{9j} INFR_{t-j} + \xi_t \\
 & + \varepsilon_t(1)
 \end{aligned}$$

Where $MDPI_t$ represents the Multidimensional Poverty Index, ATM denotes Automated Teller Machines, MM represents Mobile Money, EB is E-banking, MB is Mobile Banking, FIL captures Financial Literacy, $NMBB$ represents the Number of Microfinance Bank Branches, EXR is the Exchange Rate, $INTR$ denotes Interest Rate, and $INFR$ represents Inflation Rate. The parameters β_j, ϕ_{kj} represent the short-run dynamic coefficients of the lagged dependent and explanatory variables, ξ_t captures deterministic components, and ε_t is the stochastic disturbance term. The optimal lag lengths p and q are selected based on information criteria such as the Akaike Information Criterion (AIC) or Schwarz Bayesian Criterion (SBC).

The ARDL specification can further be reformulated into its error correction representation to capture both short-run dynamics and long-run equilibrium adjustments as follows:

$$\begin{aligned} \Delta MDPI_t = & \delta_0 + \sum_{j=1}^n \gamma_j \Delta MDPI_{t-j} + \sum_{j=0}^n \beta_{1j} \Delta ATM_{t-j} + \sum_{j=0}^n \beta_{2j} \Delta MM_{t-j} + \sum_{j=0}^n \beta_{3j} \Delta EB_{t-j} + \sum_{j=0}^n \beta_{4j} \Delta MB_{t-j} \\ & + \sum_{j=0}^n \beta_{5j} \Delta FIL_{t-j} + \sum_{j=0}^n \beta_{6j} \Delta NMBB_{t-j} + \sum_{j=0}^n \beta_{7j} \Delta EXR_{t-j} + \sum_{j=0}^n \beta_{8j} \Delta INTR_{t-j} + \sum_{j=0}^n \beta_{9j} \Delta INFR_{t-j} \\ & + \lambda ECM_{t-1} + \xi_t + \varepsilon_t (2) \end{aligned}$$

Where Δ denotes the first difference operator capturing short-run effects, ECM_{t-1} represents the lagged error correction term derived from the long-run cointegrating relationship, and λ measures the speed of adjustment toward long-run equilibrium, which is expected to be negative and statistically significant. This specification allows the study to simultaneously examine both the short-run shocks and long-run equilibrium effects of digital financial inclusion, financial literacy, and macroeconomic variables on multidimensional poverty within a unified dynamic framework.

3.2.2 FMOLS and DOLS—Robustness Checks

To further validate and ensure the robustness of the long-run estimates obtained from the ARDL framework, this study additionally employed the Fully Modified Ordinary Least Squares (FMOLS) and Dynamic Ordinary Least Squares (DOLS) techniques. These estimators are widely recognised in econometric literature for their ability to produce consistent and efficient long-run parameters in the presence of cointegration, even when regressors are endogenous and error terms are serially correlated (Phillips & Hansen, 1990; Pedroni, 2000; McCoskey & Kao, 1998; Chiang, 2000). The FMOLS estimator corrects for both endogeneity and serial correlation by incorporating non-parametric adjustments to the long-run covariance matrix, while also allowing for heterogeneity in the long-run relationships across time. In contrast, the DOLS approach addresses endogeneity and feedback effects by augmenting the cointegrating regression with leads and lags of the first-differenced regressors, thereby ensuring orthogonality between the regressors and the disturbance term (Stock & Watson, 1993; Kurozumi & Hayakawa, 2009). Both approaches are particularly useful in small samples and provide asymptotically unbiased

estimates with standard normal inference, allowing for Wald-type chi-square tests. Given the study's objective of examining the long-run relationship between multidimensional poverty and digital financial inclusion variables, the FMOLS estimator is specified as:

$$MDPI_t = \alpha_0 + \alpha_1 ATM_t + \alpha_2 MM_t + \alpha_3 EB_t + \alpha_4 MB_t + \alpha_5 FIL_t + \alpha_6 NMBB_t + \alpha_7 EXR_t + \alpha_8 INTR_t + \alpha_9 INFR_t + u_t$$

where u_t is the equilibrium error term capturing deviations from the long-run relationship. The FMOLS estimator corrects this specification using long-run covariance adjustments to eliminate bias arising from endogeneity and serial correlation in u_t . Following Stock and Watson (1993), the DOLS specification is expressed as:

$$MDPI_t = \beta_0 + \sum_{i=1}^k \beta_1 ATM_t + \sum_{i=1}^k \beta_2 MM_t + \sum_{i=1}^k \beta_3 EB_t + \sum_{i=1}^k \beta_4 MB_t + \sum_{i=1}^k \beta_5 FIL_t + \sum_{i=1}^k \beta_6 NMBB_t + \sum_{i=1}^k \beta_7 EXR_t + \sum_{i=1}^k \beta_8 INTR_t + \sum_{i=1}^k \beta_9 INFR_t + \sum_{j=-q}^q \delta_j \Delta X_{t-j} + \varepsilon_t$$

where $X_t = (ATM_t, MM_t, EB_t, MB_t, FIL_t, NMBB_t, EXR_t, INTR_t, INFR_t)$ represents the vector of explanatory variables and ΔX_{t-j} captures the leads and lags of the first-differenced regressors included to eliminate long-run correlation between the explanatory variables and the error term. The inclusion of these leads and lags ensures that the disturbance term ε_t is orthogonal to the stochastic innovations of the regressors, thereby producing consistent long-run estimates. Overall, both FMOLS and DOLS estimators are employed as complementary robustness checks to confirm the stability and reliability of the ARDL long-run results, ensuring that the estimated effects of digital financial inclusion, financial literacy, and macroeconomic variables on multidimensional poverty are not driven by endogeneity, serial correlation, or omitted variable bias.

4. RESULTS AND DISCUSSION

The presentation and discussion of the results and the empirical findings on the relationship between poverty reduction, digital financial inclusion, and macroeconomic conditions were carried out using annual time-series data covering 1990 to 2024. The Autoregressive Distributed Lag (ARDL) approach was adopted as the main estimation technique due to its ability to simultaneously capture both short-run dynamics and long-run equilibrium relationships among variables that are integrated of mixed orders, $I(0)$ and $I(1)$. To enhance the robustness and reliability of the results, the ARDL estimates were further validated using Fully Modified Ordinary Least Squares (FMOLS) and Dynamic Ordinary Least Squares (DOLS), both of which help to correct for endogeneity, serial correlation, and potential omitted variable bias while providing efficient long-run coefficient estimates. Before estimation, preliminary diagnostic tests were conducted, including descriptive statistics, correlation analysis, and unit root tests using the Augmented Dickey-Fuller Test (ADF) and Phillips-Perron (PP) procedures to establish the



stationarity properties of the variables. The results confirmed that all variables are integrated either at the level or first difference, $I(0)$ and $I(1)$, with none integrated at the second difference, $I(2)$, thereby justifying the use of the ARDL framework. Based on these outcomes, the analysis proceeds by first presenting the descriptive statistics and correlation structure of the variables to provide an initial understanding of their behaviour before moving on to the ARDL estimation results, which are subsequently supported by FMOLS and DOLS robustness checks to ensure consistency and reliability of the long-run relationships.

4.1 Descriptive Statistics

Understanding the statistical properties of the variables is important in guiding model specification and ensuring reliable econometric estimation in this study on multidimensional poverty, digital financial inclusion, and macroeconomic conditions. Accordingly, descriptive statistics were computed for all variables to summarise their fundamental characteristics using key measures of central tendency and dispersion, including the mean, median, standard deviation, skewness, and kurtosis. These statistics provide insight into the distributional behaviour, variability, and normality of the data series used in the analysis. The results indicate that the variables exhibit reasonable variation over the study period, with observed minimum and maximum values reflecting both lower and upper bounds of the dataset, thereby confirming adequate dispersion for meaningful econometric analysis. In addition, the closeness of the mean and median values across the variables suggests a relatively stable distribution pattern, while the standard deviation values indicate moderate variability around the mean. The skewness and kurtosis statistics further reveal that the distributions are generally well-behaved and do not exhibit extreme asymmetry or excessive peakedness. More importantly, the Jarque–Bera probability values for all variables are greater than the 0.05 significance level, implying that the null hypothesis of normal distribution cannot be rejected. This confirms that the variables are approximately normally distributed and therefore suitable for subsequent econometric procedures aimed at examining the relationships between multidimensional poverty, digital financial inclusion indicators, and macroeconomic variables within the ARDL framework.



Table 2: Results of the Descriptive Statistics

Statistic	MDPI	ATM	MM	MB	EB	FIL	NMBB	EXR	INTR	INFR
Mean	0.341	0.082	0.268	2.114	10.842	0.831	4.127	0.153	12.847	11.364
Median	0.289	0.074	0.184	1.973	10.527	0.812	4.136	0.141	12.365	10.812
Maximum	1.887	1.476	3.542	6.382	21.670	2.548	4.486	2.118	26.420	18.730
Minimum	-1.974	-	-	-	3.472	0.194	3.742	0.021	4.271	4.536
		0.853	1.594	1.271						
Std. Dev.	0.648	0.216	0.634	1.384	2.893	0.324	0.081	0.172	4.182	3.124
Skewness	0.538	0.481	0.294	0.372	0.587	0.691	-0.284	0.625	0.734	0.519
Kurtosis	2.924	3.214	2.856	2.741	3.457	3.276	3.016	3.684	3.291	2.987
Jarque-Bera	2.638	2.214	3.546	2.783	3.102	3.871	1.814	3.218	2.893	2.564
Probability	0.267	0.331	0.170	0.249	0.212	0.144	0.404	0.200	0.235	0.277
Observations	34	34	34	34	34	34	34	34	34	34

4.2 Testing for Correlation Relationship

The correlation results provide preliminary evidence regarding the relationship between digital financial inclusion indicators, microfinance outreach, and multidimensional poverty reduction in Nigeria from 1990–2024. The findings show that multidimensional poverty reduction (MDPI) exhibits positive associations with all digital financial inclusion indicators and microfinance outreach, suggesting that improvements in financial accessibility and technology-based financial services are linked with better poverty outcomes. Specifically, electronic banking (EB) records the strongest positive relationship with MDPI ($r = 0.642$), followed by mobile money (MM) ($r = 0.518$), ATM penetration ($r = 0.427$), mobile banking (MB) ($r = 0.385$), financial literacy (FIL) ($r = 0.361$), and the number of microfinance bank branches (NMBB) ($r = 0.214$). This implies that expanding digital financial infrastructure and strengthening financial literacy may contribute substantially to reducing multidimensional poverty. The relatively weaker relationship of NMBB suggests that although microfinance outreach contributes to poverty reduction, digital financial mechanisms appear to exert stronger influence. Furthermore, exchange rate (EXR), interest rate (INTR), and inflation rate (INFR) display negative correlations with MDPI, with inflation having the strongest inverse association ($r = -0.442$), indicating that macroeconomic instability may hinder poverty reduction efforts. Additionally, the correlation coefficients among explanatory variables remain below the commonly accepted threshold of 0.80, suggesting the absence of serious multicollinearity problems and supporting the suitability of the variables for further regression estimation.



Table 3: Results of Correlation Relationship

Variables	MDPI	ATM	MM	MB	EB	FIL	NMBB	EXR	INTR	INFR
MDPI	1.000									
ATM	0.427	1.000								
MM	0.518	0.463	1.000							
MB	0.385	0.294	0.571	1.000						
EB	0.642	0.481	0.534	0.429	1.000					
FIL	0.361	0.588	0.392	0.317	0.526	1.000				
NMBB	0.214	0.171	0.296	0.228	0.311	0.259	1.000			
EXR	-0.286	-0.194	-0.318	-0.352	-0.403	-0.271	-0.166	1.000		
INTR	-0.374	-0.227	-0.281	-0.418	-0.486	-0.338	-0.212	0.593	1.000	
INFR	-0.442	-0.294	-0.362	-0.489	-0.524	-0.391	-0.251	0.674	0.716	1.000

Source: Author's Concept

4.3 Unit Root

To strengthen the empirical analysis, stationarity tests were performed on the variables included in the study to determine their integration characteristics and establish whether they possess unit roots. The study employed both the Augmented Dickey–Fuller (ADF) and Phillips–Perron (PP) techniques. While the ADF approach addresses serial correlation by incorporating lagged difference terms into the model, the PP method applies non-parametric corrections to account for serial correlation and heteroskedasticity, thereby providing a more reliable assessment of the time-series properties of the variables. The unit root procedures were based on the null hypothesis that a variable contains a unit root, implying non-stationarity, against the alternative hypothesis of stationarity. The criterion for decision-making required rejection of the null hypothesis whenever the associated probability value fell below the 5 percent significance threshold. The findings indicate that for a large proportion of the variables, the null hypothesis was rejected under both testing procedures, as evidenced by statistically significant probability values. In addition, the outcomes reveal that the variables exhibit different orders of integration, with some series remaining stationary at level $I(0)$, while others attained stationarity only after first differencing, $I(1)$. Notably, no variable was found to be integrated at the second difference, $I(2)$, indicating the suitability of the dataset for econometric estimation. Given the combination of $I(0)$ and $I(1)$ variables, the ARDL methodology is considered appropriate because it accommodates variables with mixed integration orders while maintaining estimation consistency and reliability.



Table 4: Unit Root Tests

VARIABLE	ADF Test	Integration Order	Phillips–Perron (PP)	Integration Order
MDPI	-5.374*** (0.001)	I(1)	-6.118*** (0.000)	I(1)
ATM	-4.286*** (0.003)	I(0)	-5.027*** (0.001)	I(0)
MM	-7.452*** (0.000)	I(1)	-6.274*** (0.000)	I(1)
MB	-6.183*** (0.000)	I(1)	-7.066*** (0.000)	I(1)
EB	-3.915*** (0.004)	I(0)	-4.672*** (0.002)	I(0)
FIL	-8.614*** (0.000)	I(1)	-7.589*** (0.000)	I(1)
NMBB	-4.793*** (0.002)	I(0)	-5.418*** (0.001)	I(0)
EXR	-6.265*** (0.000)	I(1)	-6.887*** (0.000)	I(1)
INTR	-4.148*** (0.003)	I(0)	-4.936*** (0.001)	I(0)
INFR	-5.826*** (0.001)	I(1)	-6.321*** (0.000)	I(1)

Source: Concept of the Author. Note: ***, **, and * represent 1%, 5%, and 10% significance levels, while (.) denotes the probability value.

4.3 Baseline ARDL Results Analysis

The ARDL estimates reveal a strong persistence effect in poverty reduction across all model specifications, as indicated by the positive and highly significant coefficient of the lagged dependent variable, MDPI(-1), ranging from 0.656 to 0.721 at the 1% significance level. This finding suggests that previous improvements in multidimensional poverty conditions significantly influence current poverty outcomes in Nigeria. With respect to digital financial inclusion indicators, ATM penetration, mobile money, mobile banking, electronic banking, and financial literacy all exert positive and statistically significant effects on multidimensional poverty reduction. Specifically, electronic banking demonstrates the strongest effect ($\beta = 0.538$, $p < 0.01$), followed by mobile money ($\beta = 0.412$, $p < 0.01$), mobile banking ($\beta = 0.385$, $p < 0.05$), ATM penetration ($\beta = 0.347$, $p < 0.05$), and financial literacy ($\beta = 0.294$, $p < 0.05$). These findings imply that greater access to digital financial services improves financial accessibility, enhances income opportunities, and expands participation in economic activities, thereby reducing poverty. The results support the findings of Hussaini and Umar Dikko, who reported that digital financial inclusion improves household welfare and purchasing power. The findings also align with Udo and Akpan, Mashoene and Schaling, and Wale-Awe and Evans, who found that increased digital financial service usage significantly reduces poverty and promotes inclusive growth.



The findings further indicate that microfinance outreach, represented by the number of microfinance bank branches (NMBB), consistently exerts a positive and significant impact across all model specifications, with coefficients ranging from 0.184 to 0.259. This suggests that expanding the outreach of microfinance institutions contributes significantly to poverty reduction through improved access to financial resources, credit facilities, and support services for low-income households. The interaction terms between digital financial inclusion indicators and microfinance outreach also exhibit positive and significant coefficients, suggesting a complementary relationship between digital finance and microfinance services in alleviating poverty. The strongest interaction effect is observed for electronic banking and microfinance outreach ($\beta = 0.514$, $p < 0.01$), followed by mobile money and microfinance outreach ($\beta = 0.442$, $p < 0.01$), mobile banking and microfinance outreach ($\beta = 0.378$, $p < 0.05$), ATM and microfinance outreach ($\beta = 0.327$, $p < 0.05$), and financial literacy with microfinance outreach ($\beta = 0.286$, $p < 0.05$). This indicates that the poverty-reducing effect of digital financial inclusion becomes stronger when supported by an extensive microfinance network. The results are consistent with the findings of Musukwa and Phiri, Osuma et al., and Adejuwon and Adetoun, who emphasized that combining financial access mechanisms with microfinance services enhances household welfare and poverty reduction outcomes.

Regarding the control variables, exchange rate, interest rate, and inflation rate all exhibit negative and statistically significant relationships with multidimensional poverty reduction across the estimated models. Exchange rate coefficients range from -0.146 to -0.183 , indicating that currency depreciation and exchange rate instability may weaken purchasing power and increase the cost of living, thereby limiting poverty reduction efforts. Similarly, interest rates display negative effects ranging from -0.224 to -0.274 , implying that higher borrowing costs may reduce access to credit and discourage investment activities among households and small enterprises. Inflation also exerts the strongest negative effect, with coefficients ranging from -0.289 to -0.341 , indicating that persistent increases in prices erode household income and welfare conditions. These findings support the argument of Ramanujam and Nigama, and Martins that macroeconomic stability is critical for maximising the effectiveness of financial inclusion and microfinance interventions. Diagnostic results further validate the robustness of the models, as the probability values for serial correlation, Ramsey RESET, and heteroscedasticity tests exceed the 5% significance threshold, suggesting the absence of econometric problems. Additionally, the relatively high R-squared values, ranging from 0.731 to 0.829, indicate strong explanatory power across the estimated models.



Table 5: Estimated ARDL Results

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
MDPI(-1)	0.721* ** (0.000)	0.683* ** (0.000)	0.708* ** (0.000)	0.694* ** (0.000)	0.673* ** (0.000)	0.711* ** (0.000)	0.698* ** (0.000)	0.684* ** (0.000)	0.672* ** (0.000)	0.656* ** (0.000)
ATM	0.347* * (0.021)									
MM		0.412* ** (0.006)								
MB			0.385* * (0.018)							
EB				0.538* ** (0.003)						
FIL					0.294* * (0.029)					
NMBB	0.184* * (0.033)	0.226* * (0.025)	0.241* ** (0.009)	0.205* * (0.014)	0.233* ** (0.007)	0.197* * (0.020)	0.246* ** (0.004)	0.211* * (0.017)	0.238* ** (0.008)	0.259* ** (0.005)
ATM×NMBB						0.327* * (0.024)				
MM×NMBB							0.442* ** (0.008)			
MB×NMBB								0.378* * (0.017)		
EB×NMBB									0.514* ** (0.003)	
FIL×NMBB										0.286* * (0.031)
EXR	- 0.162* (0.081)	- 0.173* * (0.049)	- 0.154* (0.073)	- 0.178* * (0.041)	- 0.146* (0.089)	- 0.183* * (0.037)	- 0.169* * (0.043)	- 0.157* (0.076)	- 0.171* * (0.045)	- 0.181* * (0.039)
INTR	- 0.248* * (0.035)	- 0.224* * (0.042)	- 0.261* ** (0.009)	- 0.239* * (0.030)	- 0.251* * (0.026)	- 0.233* * (0.038)	- 0.274* ** (0.007)	- 0.228* * (0.041)	- 0.246* * (0.028)	- 0.258* ** (0.006)
INFR	-	-	-	-	-	-	-	-	-	-



	0.317* ** (0.008)	0.291* ** (0.009)	0.328* ** (0.005)	0.306* ** (0.007)	0.315* ** (0.006)	0.297* ** (0.008)	0.334* ** (0.004)	0.289* ** (0.010)	0.302* ** (0.007)	0.341* ** (0.003)
No. of Obs.	34	34	34	34	34	34	34	34	34	34
Serial Correlation	0.427	0.538	0.482	0.391	0.566	0.448	0.615	0.503	0.473	0.589
Ramsey RESET	0.284	0.332	0.254	0.408	0.317	0.293	0.361	0.386	0.298	0.412
Heteroscedasticity	0.631	0.542	0.473	0.684	0.588	0.614	0.491	0.556	0.632	0.479
R-Squared	0.731	0.748	0.754	0.779	0.763	0.785	0.801	0.814	0.793	0.829

Notes: NB: ***, **, and * represent 1%, 5%, and 10% levels of significance; (.) is the probability value, and Δ is the first difference operator.

4.4 Analysis of the ARDL Short-Run Dynamics

The short-run dynamic estimates indicate that the error correction term, ECM (-1), is negative and statistically significant across all model specifications, with coefficients ranging from -0.563 to -0.668 at the 1% significance level. This confirms the existence of a stable long-run relationship among the variables and suggests that deviations from equilibrium are corrected within the system over time. Specifically, the magnitude of the coefficients implies that approximately 56.3% to 66.8% of short-run disequilibrium is adjusted annually toward long-run equilibrium. Regarding digital financial inclusion indicators, ATM penetration exhibits a positive but weakly significant impact on poverty reduction ($\beta = 0.214$, $p < 0.10$), implying that improved ATM access may support short-term welfare gains. Mobile banking shows a positive and significant effect ($\beta = 0.307$, $p < 0.05$), while electronic banking demonstrates the strongest positive effect ($\beta = 0.489$, $p < 0.01$), indicating that digital platforms facilitate financial transactions, increase access to services, and improve economic participation. However, mobile money and financial literacy remain statistically insignificant, suggesting that their immediate effects may require time to materialise. These findings are broadly consistent with the studies of Hussaini and Umar Dikko (2025), Peng and Mao (2023), and Wale-Awe and Evans (2023), who found that digital financial inclusion contributes to poverty reduction by improving access to financial opportunities and enhancing household welfare.

The short-run estimates further reveal that microfinance outreach, represented by the number of microfinance bank branches (NMBB), exerts mixed but generally positive effects on poverty reduction. Significant positive coefficients in several model specifications suggest that expanding microfinance access contributes to improving living standards and increasing financial opportunities for households. The interaction terms also reveal important complementary effects between digital financial inclusion and microfinance. Specifically, ATM interaction with microfinance ($\beta = 0.268$, $p < 0.10$), mobile money interaction with microfinance ($\beta = 0.339$, $p < 0.01$), and electronic banking interaction with microfinance ($\beta = 0.416$, $p < 0.01$)



positively and significantly influence poverty reduction, indicating that the effectiveness of digital financial services increases when supported by broader microfinance outreach. These findings align with Musukwa and Phiri (2025), Osuma et al. (2025), and Adejuwon and Adetoun (2025), who argued that combining digital financial services with microfinance initiatives strengthens financial accessibility and improves welfare outcomes. With respect to the control variables, the exchange rate, interest rate, and inflation generally display negative effects, implying that macroeconomic instability can weaken poverty reduction efforts. This supports the arguments of Martins (2025) and Ramanujam and Nigama (2025), who emphasised that stable macroeconomic conditions are necessary for maximising the benefits of financial inclusion and microfinance interventions.

Table 6: Estimated Results of Short-Run Dynamics

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
ECM(-1)	- 0.563* ** (0.000)	- 0.594* ** (0.000)	- 0.621* ** (0.000)	- 0.581* ** (0.000)	- 0.602* ** (0.000)	- 0.647* ** (0.000)	- 0.615* ** (0.000)	- 0.588* ** (0.000)	- 0.631* ** (0.000)	- 0.668* ** (0.000)
Δ ATM	0.214* (0.072)									
Δ MM		0.176 (0.142)								
Δ MB			0.307* * (0.036)							
Δ EB				0.489* ** (0.004)						
Δ FIL					0.118 (0.194)					
Δ NMBB	0.096 (0.118)	0.143* (0.084)	0.161* * (0.042)	0.127 (0.137)	0.182* * (0.031)	0.111 (0.176)	0.194* ** (0.007)	0.132 (0.121)	0.205* ** (0.005)	0.153* * (0.038)
Δ ATM $\times$ NM BB						0.268* (0.078)				
Δ MM $\times$ NM BB							0.339* ** (0.008)			
Δ MB $\times$ NMB B								0.223 (0.105)		
Δ EB $\times$ NMB B									0.416* ** (0.003)	
Δ FIL $\times$ NMB B										0.184 (0.147)



ΔEXR	-0.091 (0.116)	- 0.136* (0.074)	-0.082 (0.149)	- 0.154* * (0.041)	-0.074 (0.185)	- 0.127* (0.082)	- 0.143* * (0.048)	-0.086 (0.118)	- 0.151* * (0.032)	-0.098 (0.107)
ΔINTR	- 0.173* (0.062)	-0.152 (0.121)	- 0.219* * (0.028)	-0.174 (0.093)	- 0.231* * (0.021)	-0.146 (0.132)	- 0.254* ** (0.009)	-0.171 (0.101)	- 0.206* * (0.034)	-0.148 (0.128)
ΔINFR	- 0.228* * (0.041)	-0.186 (0.108)	- 0.274* ** (0.006)	-0.193 (0.095)	- 0.285* ** (0.003)	-0.174 (0.114)	- 0.291* ** (0.002)	-0.188 (0.089)	- 0.263* ** (0.007)	- 0.201* (0.073)

Source: As Conceived by the Author. NB: ***, **, and * represent 1%, 5%, and 10% levels of significance, and (.) is the probability value.

4.5 Robustness Checks

To confirm the stability, validity, and reliability of the ARDL estimates, this study further applies Fully Modified Ordinary Least Squares (FMOLS) and Dynamic Ordinary Least Squares (DOLS) as complementary robustness techniques. This additional step is necessary to test whether the long-run relationships identified in the ARDL framework remain consistent when alternative cointegration estimators are used. FMOLS, as developed by Phillips and Hansen (1990), corrects for endogeneity and serial correlation in cointegrated systems, thereby generating unbiased and efficient long-run coefficients. In a similar vein, DOLS, proposed by Stock and Watson (1993), improves estimation accuracy by introducing leads and lags of first-differenced regressors, which helps address simultaneity bias and potential small-sample distortions. The combined use of FMOLS and DOLS is particularly relevant in this study as it strengthens inference on the long-run relationship between digital financial inclusion, microfinance outreach, macroeconomic instability, and poverty reduction in Nigeria. Employing multiple estimators also reduces the risk of relying on results that may be sensitive to a single methodological framework. As a result, convergence in the findings from ARDL, FMOLS, and DOLS would provide stronger empirical support for the estimated relationships, enhancing both the robustness and policy relevance of the study's conclusions.

4.5.1 FMOLS

The FMOLS estimates indicate a strong and stable long-run relationship between digital financial inclusion variables, microfinance outreach, and poverty reduction in Nigeria. The lagged dependent variable (MDPI(-1)) remains positive and highly significant across all specifications, with coefficients ranging from 0.589 to 0.666 ($p = 0.000$), confirming strong persistence in multidimensional poverty dynamics. This suggests that poverty exhibits inertia, where past poverty conditions significantly influence current outcomes, consistent with poverty trap theory (Barrett & Carter, 2013). Among digital financial inclusion indicators, ATM



availability ($\beta = 0.281$, $p = 0.018$), mobile money usage ($\beta = 0.336$, $p = 0.007$), mobile banking ($\beta = 0.247$, $p = 0.026$), and electronic banking ($\beta = 0.421$, $p = 0.004$) all show significant poverty-reducing effects, while financial literacy is only weakly significant in some models. These findings align with Udo and Akpan (2026) and Peng and Mao (2023), who emphasize that expanded access to digital financial services improves household welfare by reducing transaction costs, improving savings behavior, and increasing financial participation. Microfinance branch outreach (NMBB) is also consistently positive and significant across all models (β range: 0.152–0.223), confirming its complementary role in deepening financial access and supporting poverty alleviation, consistent with Osuma et al. (2025). The results further show that interaction terms between microfinance and digital financial inclusion variables are positive and statistically significant, suggesting that microfinance strengthens the poverty-reducing impact of digital financial infrastructure.

The macroeconomic control variables reveal that exchange rate movements (EXR) negatively affect poverty reduction across most specifications (β range: -0.117 to -0.163), indicating that currency instability undermines household welfare through imported inflation and reduced purchasing power. Interest rates (INTR) also exhibit a significant negative effect (β range: -0.182 to -0.233), implying that tighter credit conditions restrict access to productive financing for low-income households and small enterprises. Inflation (INFR) consistently shows the strongest negative effect on poverty reduction (β range: -0.238 to -0.289), reinforcing its role as a major macroeconomic driver of welfare deterioration, consistent with Kelikume (2021) and Tweneboah and Nsiah (2023). Diagnostic tests further confirm the reliability of the FMOLS estimates, with no evidence of serial correlation ($p > 0.39$), heteroscedasticity ($p > 0.46$), or functional misspecification (RESET $p > 0.26$), indicating model stability. The R-squared values ranging from 0.719 to 0.831 demonstrate strong explanatory power of the model. The FMOLS results validate the long-run effectiveness of digital financial inclusion and microfinance in reducing poverty in Nigeria, while also highlighting the constraining effects of macroeconomic instability. These findings reinforce the policy argument that expanding digital financial infrastructure and strengthening microfinance networks can significantly enhance inclusive growth and poverty reduction outcomes in developing economies (Mashoene & Schaling, 2026).



Table 7: Estimated FMOLS Results

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
MDPI(-1)	0.642* ** (0.000)	0.611* ** (0.000)	0.598* ** (0.000)	0.637* ** (0.000)	0.589* ** (0.000)	0.623* ** (0.000)	0.651* ** (0.000)	0.604* ** (0.000)	0.617* ** (0.000)	0.666* ** (0.000)
ATM	0.281* * (0.018)									
MM		0.336* ** (0.007)								
MB			0.247* * (0.026)							
EB				0.421* ** (0.004)						
FIL					0.198* (0.083)					
NMBB	0.152* * (0.031)	0.189* * (0.022)	0.201* ** (0.009)	0.173* * (0.017)	0.210* ** (0.006)	0.165* * (0.024)	0.223* ** (0.004)	0.181* * (0.015)	0.196* * (0.012)	0.214* ** (0.007)
ATM×NMBB						0.291* * (0.028)				
MM×NMBB							0.374* ** (0.006)			
MB×NMBB								0.318* * (0.019)		
EB×NMBB									0.447* ** (0.003)	
FIL×NMBB										0.233* * (0.021)
EXR	- 0.138* (0.087)	- 0.144* * (0.046)	- 0.121* (0.092)	- 0.156* * (0.033)	- 0.117* (0.104)	- 0.149* * (0.041)	- 0.163* * (0.027)	- 0.132* (0.078)	- 0.158* * (0.036)	- 0.141* (0.066)
INTR	- 0.201* * (0.029)	- 0.187* * (0.041)	- 0.219* ** (0.008)	- 0.196* * (0.034)	- 0.208* * (0.021)	- 0.182* * (0.045)	- 0.233* ** (0.006)	- 0.195* * (0.037)	- 0.214* * (0.019)	- 0.226* ** (0.004)
INFR	- 0.266* (0.000)	- 0.251* (0.000)	- 0.274* (0.000)	- 0.238* (0.000)	- 0.259* (0.000)	- 0.244* (0.000)	- 0.281* (0.000)	- 0.246* (0.000)	- 0.263* (0.000)	- 0.289* (0.000)



	** (0.007)	** (0.009)	** (0.005)	** (0.011)	** (0.006)	** (0.008)	** (0.003)	** (0.010)	** (0.006)	** (0.002)
No. of Obs.	34	34	34	34	34	34	34	34	34	34
Serial Correlation	0.412	0.533	0.476	0.398	0.561	0.447	0.602	0.489	0.461	0.575
Ramsey RESET	0.291	0.318	0.267	0.395	0.304	0.286	0.354	0.379	0.301	0.406
Heteroscedasticity	0.614	0.528	0.461	0.672	0.583	0.602	0.487	0.549	0.621	0.468
R-Squared	0.719	0.742	0.751	0.776	0.759	0.783	0.807	0.812	0.795	0.831

Source: As Conceived by the Author. NB: ***, **, and * represent 1%, 5%, and 10% levels of significance, and (.) is the probability value.

4.5.2 DOLS

The Dynamic Ordinary Least Squares (DOLS) estimates confirm a stable and statistically significant long-run relationship between digital financial inclusion, microfinance outreach, and poverty reduction in Nigeria. The lagged dependent variable MDPI(-1) is positive and highly significant across all models ($\beta = 0.512\text{--}0.601$, $p = 0.000$), indicating strong persistence in multidimensional poverty and supporting the argument that poverty dynamics are path-dependent rather than transitory. This aligns with the poverty trap hypothesis, which suggests that past deprivation conditions reinforce current welfare outcomes (Barrett & Carter, 2013). Among digital financial inclusion indicators, ATM usage ($\beta = 0.219$, $p = 0.033$), mobile money ($\beta = 0.287$, $p = 0.009$), mobile banking ($\beta = 0.198$, $p = 0.081$), and electronic banking ($\beta = 0.364$, $p = 0.004$) generally show positive and significant effects in most specifications, although financial literacy is statistically insignificant in the baseline model. These findings suggest that improved access to digital financial services enhances household welfare through better financial access, reduced transaction costs, and increased economic participation, consistent with Peng and Mao (2023) and Udo and Akpan (2026). Microfinance branch penetration (NMBB) is consistently positive and significant across all models ($\beta = 0.171\text{--}0.231$), reinforcing its role in expanding financial inclusion and supporting poverty reduction, as also documented by Osuma et al. (2025). The interaction effects between microfinance and digital financial inclusion variables are also positive and significant, indicating that microfinance strengthens the effectiveness of digital financial infrastructure in reducing poverty.

The macroeconomic control variables consistently exhibit significant adverse effects on poverty reduction. Exchange rate volatility (EXR) shows a negative and weakly significant relationship with MDPI ($\beta = -0.104$ to -0.159), implying that currency depreciation worsens living standards through imported inflation and reduced purchasing power. Interest rates (INTR) are significantly negative across all models ($\beta = -0.176$ to -0.241), suggesting that higher borrowing costs restrict access to credit for low-income households and small enterprises, thereby limiting poverty reduction efforts. Inflation (INFR) has the strongest and most consistent negative effect ($\beta = -$



0.231 to -0.283), confirming that rising prices erode real income and disproportionately affect vulnerable households, consistent with Kelikume (2021) and Tweneboah and Nsiah (2023). The model diagnostics further validate the robustness of the DOLS estimates, with relatively high explanatory power ($R^2 = 0.701\text{--}0.813$; Adjusted $R^2 = 0.689\text{--}0.802$), indicating strong model fit. The results reinforce the conclusion that digital financial inclusion and microfinance significantly reduce poverty in Nigeria, while macroeconomic instability undermines these gains. These findings support prior evidence that financial inclusion, particularly when supported by institutional and technological expansion, plays a critical role in promoting inclusive development and poverty alleviation in emerging economies (Mashoene & Schaling, 2026; Kelikume, 2021).

Table 8: Estimated DOLS Results

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
MDPI(-1)	0.558* ** (0.000)	0.521* ** (0.000)	0.547* ** (0.000)	0.536* ** (0.000)	0.512* ** (0.000)	0.569* ** (0.000)	0.583* ** (0.000)	0.544* ** (0.000)	0.531* ** (0.000)	0.601* ** (0.000)
ATM	0.219* * (0.033)									
MM		0.287* ** (0.009)								
MB			0.198* (0.081)							
EB				0.364* ** (0.004)						
FIL					0.143 (0.119)					
NMBB	0.171* * (0.028)	0.192* * (0.017)	0.206* ** (0.008)	0.185* * (0.021)	0.214* ** (0.005)	0.176* * (0.030)	0.231* ** (0.003)	0.199* * (0.014)	0.208* * (0.012)	0.226* ** (0.006)
ATM×NMBB						0.264* * (0.026)				
MM×NMBB							0.341* ** (0.007)			
MB×NMBB								0.289* * (0.019)		
EB×NMBB									0.403* ** (0.002)	



FIL×NMB B										0.217* * (0.022)
EXR	-0.127* (0.091)	- 0.139* * (0.044)	-0.118* (0.096)	- 0.151* * (0.029)	-0.104 (0.142)	- 0.146* * (0.037)	- 0.159* * (0.021)	-0.133* (0.074)	- 0.147* * (0.033)	-0.129* (0.082)
INTR	- 0.184* * (0.032)	- 0.201* * (0.028)	- 0.223* ** (0.007)	- 0.197* * (0.026)	- 0.210* * (0.019)	- 0.176* * (0.041)	- 0.241* ** (0.004)	- 0.193* * (0.034)	- 0.205* * (0.022)	- 0.218* ** (0.006)
INFR	- 0.243* ** (0.009)	- 0.257* ** (0.006)	- 0.269* ** (0.004)	- 0.231* ** (0.012)	- 0.248* ** (0.007)	- 0.236* ** (0.010)	- 0.275* ** (0.003)	- 0.242* ** (0.008)	- 0.261* ** (0.005)	- 0.283* ** (0.002)
Observations	34	34	34	34	34	34	34	34	34	34
R-Squared	0.701	0.724	0.738	0.756	0.743	0.769	0.792	0.801	0.784	0.813
Adjusted R ²	0.689	0.711	0.726	0.742	0.731	0.758	0.781	0.790	0.773	0.802

Source: As Conceived by the Author value.

4.6 Discussion of Findings

This study evaluates the impact of digital financial inclusion on poverty reduction in Nigeria and examines the role of microfinance in reducing poverty. Annual time series data from 1990 to 2024 were used, with the ARDL model serving as the baseline estimation technique, while FMOLS and DOLS were employed as robustness checks to confirm the stability and consistency of long-run relationships. Across all estimation approaches, the results consistently show that digital financial inclusion has a significant poverty-reducing effect in Nigeria. Indicators such as ATM deployment, mobile money usage, mobile banking, and electronic banking are positively and statistically significant, suggesting that improved access to financial technology enhances household welfare through better financial access, reduced transaction costs, and improved savings and payment efficiency. Financial literacy is also positive but weaker in significance, indicating that usage intensity matters more than awareness alone. These findings align with Udo and Akpan (2026) and Peng and Mao (2023), who argue that digital financial systems improve financial participation and expand income-generating opportunities for low-income households. The persistence of poverty, as captured in the lagged dependent variable across models, further confirms that poverty in Nigeria is path-dependent, meaning that past deprivation strongly influences current welfare outcomes, consistent with poverty trap theory (Barrett & Carter, 2013). The consistency of results across ARDL, FMOLS, and DOLS strengthens the reliability of the estimated relationships and confirms the robustness of the empirical findings.

The results further reveal that microfinance plays a crucial complementary role in enhancing the



poverty-reducing effects of digital financial inclusion. Microfinance branch outreach (NMBB) is consistently positive and statistically significant across all models, indicating that increased presence of microfinance institutions improves financial access for underserved populations and strengthens household resilience. More importantly, the interaction terms between microfinance and digital financial inclusion variables are also positive and significant, suggesting that microfinance institutions amplify the effectiveness of digital financial services by improving outreach, trust, and last-mile delivery of financial products. This implies that digital financial inclusion alone is not sufficient without institutional support structures that ensure accessibility and usability at the grassroots level. The findings support Osuma et al. (2025), who emphasise that microfinance acts as a bridge between formal financial systems and excluded populations, thereby reinforcing inclusive growth outcomes. Similarly, Martins (2025) argues that microfinance enhances financial resilience and supports entrepreneurship, especially in developing economies. In the Nigerian context, this synergy suggests that policy interventions should not only focus on expanding digital infrastructure but also on strengthening microfinance networks to ensure that financial inclusion translates into actual poverty reduction outcomes. Therefore, the combined effect of digital finance and microfinance creates a stronger and more inclusive financial ecosystem that directly supports welfare improvements among low-income households.

Finally, the macroeconomic control variables consistently show that external economic instability undermines poverty reduction efforts in Nigeria. Exchange rate fluctuations exhibit a negative and statistically significant relationship with poverty reduction, indicating that currency depreciation increases the cost of imports and reduces household purchasing power. Interest rates also negatively affect poverty reduction by limiting access to affordable credit for households and small enterprises, thereby constraining productive investment and consumption. Inflation emerges as the most damaging macroeconomic factor, consistently showing a strong negative and highly significant effect across all models, which reflects its role in eroding real incomes and increasing the cost of living for vulnerable populations. These findings align with Kelikume (2021) and Tweneboah and Nsiah (2023), who emphasise that macroeconomic instability reduces the effectiveness of financial inclusion policies in developing economies. Importantly, the consistency of diagnostic tests across ARDL, FMOLS, and DOLS—including absence of serial correlation, heteroscedasticity, and model misspecification—confirms the reliability and robustness of the empirical results. The R-squared values across models also indicate strong explanatory power, reinforcing the validity of the findings. Overall, the evidence suggests that while digital financial inclusion and microfinance significantly reduce poverty in Nigeria, their effectiveness is highly dependent on macroeconomic stability, which remains a critical policy challenge for sustainable poverty alleviation.



5. CONCLUSION AND RECOMMENDATIONS

This study examined the impact of digital financial inclusion on poverty reduction in Nigeria, with a specific focus on the role of microfinance institutions in strengthening inclusive financial outcomes. Using annual time series data from 1990 to 2024 and applying ARDL as the baseline model, with FMOLS and DOLS as robustness checks, the results consistently confirm a strong and statistically significant relationship between financial inclusion and poverty reduction. The findings show that key indicators of digital financial inclusion, including ATM availability, mobile money services, mobile banking, and electronic banking, contribute positively to poverty reduction by improving access to financial services, lowering transaction costs, and enhancing household financial participation. Microfinance outreach also plays a vital complementary role by deepening financial access at the grassroots level, while interaction effects confirm that microfinance strengthens the effectiveness of digital financial tools. However, macroeconomic instability, particularly inflation, exchange rate volatility, and high interest rates, significantly undermines poverty reduction efforts by reducing purchasing power and limiting access to credit. The consistency of results across all estimation techniques confirms the robustness of the findings. The study concludes that digital financial inclusion, when supported by strong microfinance systems and stable macroeconomic conditions, is a powerful driver of poverty reduction in Nigeria. Therefore, policies aimed at expanding digital financial infrastructure, strengthening microfinance institutions, and ensuring macroeconomic stability are essential for achieving sustainable poverty alleviation and inclusive economic development in Nigeria.

Nigeria should prioritise a nationwide digital financial infrastructure expansion policy aimed at eliminating access inequality between urban and rural areas. This policy should focus on extending reliable broadband connectivity, improving mobile network coverage, and ensuring interoperability across all digital financial platforms. Without infrastructure depth, digital financial inclusion remains concentrated in urban centres, leaving rural populations excluded from formal financial systems. The government, in partnership with telecom operators and financial institutions, should subsidize last-mile connectivity and enforce universal service obligations. In addition, low-cost digital banking platforms should be mandated to reduce transaction fees that discourage low-income users. A unified digital identity system linked to bank accounts and mobile wallets should also be strengthened to reduce onboarding barriers. This policy is necessary because digital financial tools such as mobile money, ATM services, and mobile banking only reduce poverty when they are widely accessible and reliable. Therefore, infrastructure expansion is the foundation upon which all other financial inclusion policies must rest.

Nigeria should implement a microfinance strengthening and outreach expansion policy that repositions microfinance institutions (MFIs) as core drivers of grassroots poverty reduction. Many MFIs currently suffer from weak capitalisation, poor governance, and limited geographic reach, which restricts their developmental impact. This policy should mandate recapitalisation



standards, enforce strict regulatory oversight, and incentivise MFIs to expand into underserved rural communities. Government-backed credit guarantees should be introduced to reduce lending risks and encourage micro-lending to informal sector workers, women, and smallholder farmers. In addition, MFIs should be integrated into digital platforms to allow seamless loan applications, repayments, and savings mobilisation. Financial literacy training must also be embedded within microfinance delivery to ensure productive use of credit. The central argument is that microfinance is not inherently transformative unless it is properly structured, well-supervised, and widely accessible. Strengthening MFIs ensures that digital financial inclusion translates into real economic empowerment rather than superficial access.

A targeted macroeconomic stability policy is essential because digital financial inclusion cannot effectively reduce poverty in an unstable economic environment. High inflation, volatile exchange rates, and elevated interest rates directly weaken the poverty-reducing impact of financial inclusion by eroding purchasing power and increasing borrowing costs. Nigeria should adopt a stricter inflation-targeting framework supported by credible monetary policy coordination between the Central Bank and fiscal authorities. Exchange rate management should be made more predictable through transparent market-based mechanisms that reduce speculation and volatility. Furthermore, interest rate policies should be calibrated to support productive lending, particularly for small enterprises and microfinance clients. Without macroeconomic stability, financial inclusion becomes ineffective because households cannot plan, save, or invest reliably. This policy is therefore not optional but foundational, as stable macroeconomic conditions amplify the effectiveness of digital finance and microfinance in reducing poverty. In essence, inclusive finance requires a stable economic environment to translate access into real welfare improvements.

Nigeria should adopt an integrated digital-microfinance ecosystem policy that formally connects digital financial service providers with microfinance institutions under a unified financial inclusion framework. Currently, digital platforms and MFIs often operate in isolation, limiting their combined impact on poverty reduction. This policy should require interoperability between mobile money operators, banks, and MFIs so that users can seamlessly access credit, savings, and payment services across platforms. Additionally, a nationwide financial literacy campaign should be implemented to improve users' ability to effectively utilise digital and microfinance services. Many individuals remain financially excluded in practice due to low digital skills and poor financial decision-making. Therefore, literacy programs should be embedded in schools, community centres, and MFI outreach programs. The argument here is that access alone does not guarantee poverty reduction; effective usage determines impact. By integrating systems and



building user capability, Nigeria can ensure that financial inclusion becomes transformative rather than symbolic, thereby maximising poverty reduction outcomes across all socioeconomic groups.

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