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**Digital Inclusion, Financial  
Inclusion and Inclusive  
Growth in Nigeria**



## **Digital Inclusion, Financial Inclusion and Inclusive Growth in Nigeria**

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**Abstract**

The paper examines the relationships among digital inclusion, financial inclusion and inclusive growth in Nigeria. In doing this, the ARDL bounds testing approach to analysis of short-run and long run relationships is employed to investigate the effect of digital inclusion on inclusive growth in Nigeria using annual time series data spanning the 1993-2023 period. The Toda-Yamamoto approach to Granger causality test is employed to investigate the causal relationship between financial inclusion and inclusive growth in the country using annual time series data spanning the 2007-2023 period. Empirical evidence from the bounds test indicates that digital inclusion significantly promotes inclusive growth in the country, while the evidence from the causality test indicates that financial inclusion causes inclusive growth uni-directionally (with no evidence of a feedback). The analysis also reveals that inflation and currency depreciation adversely affect inclusive growth in the country. Based on the evidence, the paper recommends efforts by the government to implement policies and programmes aimed at improving digital and financial inclusion, and reducing inflation and the nominal exchange rate to levels favourable to inclusive growth.

**Keyword:** Digital Inclusion, Financial Inclusion, Inclusive Growth, Broad-based Growth, Pro-poor Growth, Bounds Test, Toda-Yamamoto Causality Test.

**JEL Codes:** F43, O15, O16, O43

## 1. Introduction

The eighth Sustainable Development Goal (SDG) of the United Nations (UN) has to do with “promotion of sustained, *inclusive*, and sustainable economic growth, full and productive employment and decent work for all” (UN, 2023, p. 28). Member countries of the UN are to strive to achieve this goal (and other goals) by year 2030. Inclusive growth is key to achieving virtually all the seventeen SDGs, as it is potentially linked to them. It is the bedrock for achieving the SDGs. Without inclusive growth, achieving the SDGs may be elusive.

The Organisation for Economic Cooperation and Development sees inclusive economic growth as economic growth that is distributed fairly across society and creates opportunities for all (OECD, 2012). This implies that the dividends of growth are shared fairly among individuals and social groups (OECD, 2014). The World Bank (2009) sees inclusive growth as growth that is poverty-reducing. According to Duran (2015), the bases of inclusive growth are “the ‘equality of opportunity’ and ‘participation in growth by all with a special focus on the working poor and the unemployed’”. Thus inclusive growth is growth that is broad-based, growth that is pro-poor, or growth that improves the lot of the poor; growth characterized by job creation and suppression of income, wealth and consumption inequalities. Achieving this is therefore desirable considering the potential positive spillover effects it could have on various economic and social indicators (including security, health, life expectancy, labour productivity, output, etc.) in the economy.

Inclusive growth is affected by multiplicity of factors. These have been examined in numerous empirical research (Anand, *et al.*, 2023; Oluseye & Gabriel, 2017; Iyoha & Aigheyisi, 2021). The new global economic order stresses the importance of digital inclusion and financial inclusion, which respectively emphasise enhanced access to digital technology (particularly information and communications technology (ICT)) and financial services especially by the poor, underserved and unbanked populace, in countries’ drive to achieving inclusive economic growth (United Nations, 2025). Though these are contemporary issues in global economic discourse, yet quite a few studies have explored the effects of digital and financial inclusion on inclusive growth.

In spite of the some-what impressive growth of the nation’s economy reflected in the GDP figures reported in recent times by the Central Bank of Nigeria, the country’s economic growth has not been inclusive, as unemployment rate and poverty rates have been quite high, and the inequality in the distribution of income, wealth and consumption have been very wide (Oseni & Osen, 2021; Ozughalu & Ogwumike, 2015; Ajakaiye & Babatunde, 2016; Adefabi, 2018; Iyoha & Aigheyisi, 2021; Ajayi & Oburota, 2022). Though some progress had been made over the last decade at increasing financial inclusion in Nigeria due to the successful implementation of the National Financial Inclusion Strategy [introduced in 2012, and revised in 2019 (CBN, 2019)] which is now seen as a national development tool, yet some challenges still linger. The KPMG (2020) reported that 1 in 3 Nigerian adults were financially excluded: these had no access to useful, relevant and affordable financial services such as payments, savings, and credits. Recent reports from the CBN (2025) and the Enhancing Financial Innovation and Access (EFInA) Access to Finance (A2F) Report (2023) reveal that formal financial inclusion rose from 56% in 2020 to 64.1% in 2023. However, demographic gaps in financial inclusion persist. The Women’s World Banking (WWB, 2025) observed that financial inclusion remains a daunting challenge in Nigeria, with only 47% of women accessing formal financial services, compared to 58% of men. The EFInA A2F 2023 survey report

showed that all states in the North-Eastern part of Nigeria reported exclusion level above the national average.

The level of digital inclusion in Nigeria has been quite low, with less than 40% of the population having access to the internet (World Bank's WDI 2024). The Civil Society Alliances for Digital Empowerment (The CADE) reported that there has also been gender digital disparities in the country as only 32% of women own smartphones compared to 47% of men, and women are 15% less likely to have access to the internet than men (The CADE 2025).

Studies on the effects of digital and financial inclusion on inclusive economic growth are scanty, especially in the context of less developed countries (LDCs) including Nigeria. The dearth of empirical studies or research in this regard, and the need to examine the potentials of digital and financial inclusion to aid inclusive growth in an LDC such as Nigeria, provide a justification for, and creates the motivation for this study. The first and the seventh presidential priority areas of the Renewed Hope Agenda of Nigeria's Presidency are respectively, to "Reform the Economy for **Sustained Inclusive Growth**" and "Accelerate Diversification through Industrialization, **Digitization**, Creative Arts, Manufacturing **& Innovation**." (Central Results Delivery Coordination, 2025). The research question relates to whether digital inclusion and financial inclusion hold any relevance for achieving inclusive growth in Nigeria. The objectives of the study therefore are to investigate the relationships among digital inclusion, financial inclusion and inclusive growth in Nigeria.

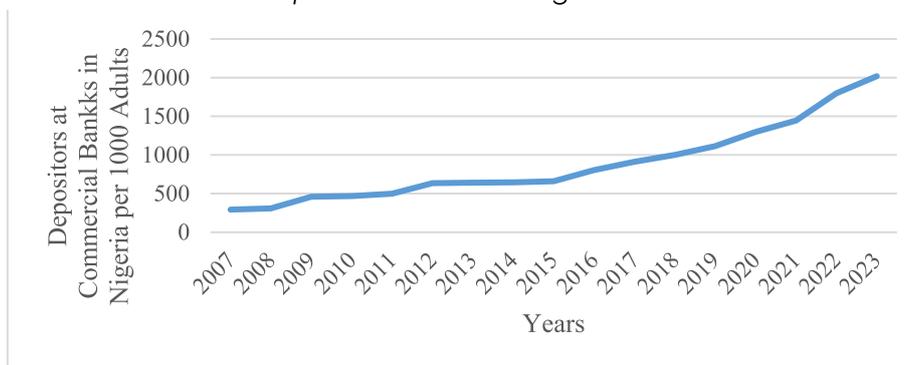
The remainder of this study is structured as follow: Section 2 presents detailed clarifications of the concept of digital inclusion, financial inclusion and digital financial inclusion. This is followed by brief theoretical literature, and thereafter the empirical literature is reviewed with a view to understanding the current state of the extant literature and identifying and highlighting the gaps therein. Section 3 presents the research methodology, wherein the conceptual/theoretical framework and the baseline model of the study are presented. The model estimation technique is also discussed. The results of empirical analysis are presented and discussed in Section 4. Section 5 concludes the paper with some recommendations for policy consideration and suggestions for further studies.

## 2. Trends in Financial and Digital Inclusion in Nigeria – Some Stylised Facts

Figure 1 to Figure 5 show the trends some indicators of financial inclusion in Nigeria. The trends show significant improvement in financial inclusion in the country in recent times. Number of depositors with commercial banks, registered number of mobile money accounts, number of mobile money transactions and value of mobile money transactions, all trended upwards during the period indicated. The improvement in the indicators can be attributed to the success of the National Financial Inclusion Strategy which aims to improve access to finance by the underserved portion of the population particularly those in the rural areas.

**Figure 1**

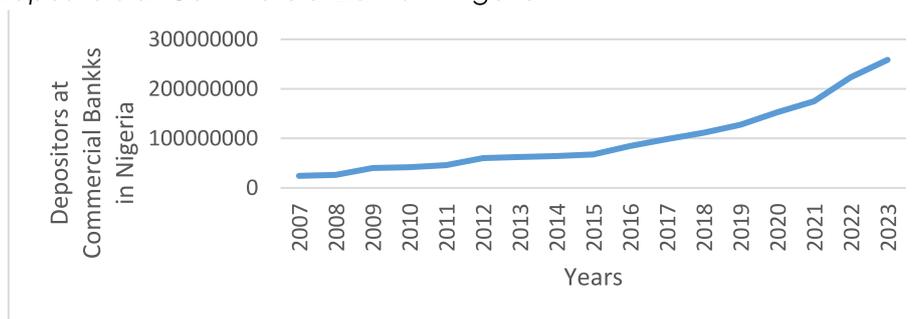
*Depositors with Commercial Banks per 1000 Adults in Nigeria*



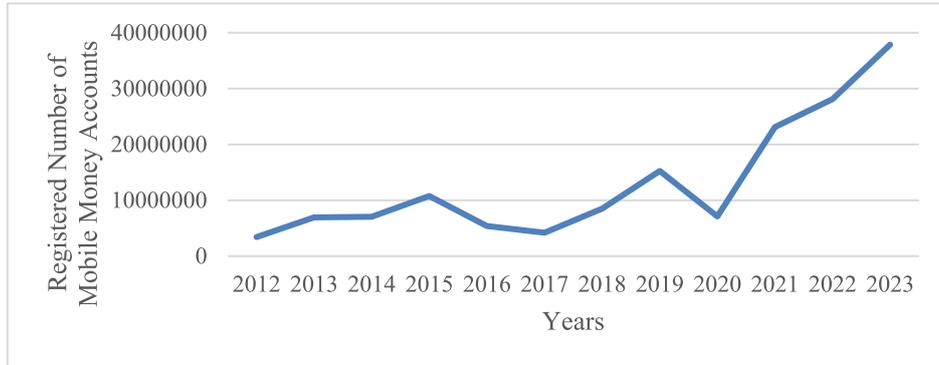
Source: International Monetary Fund via Federal Reserve Economic Data (FRED), 2025

**Figure 2**

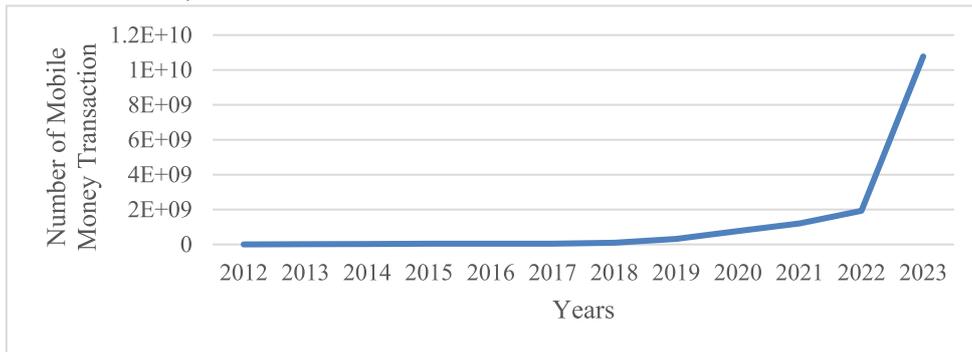
*Number of Depositors at Commercial Banks in Nigeria*



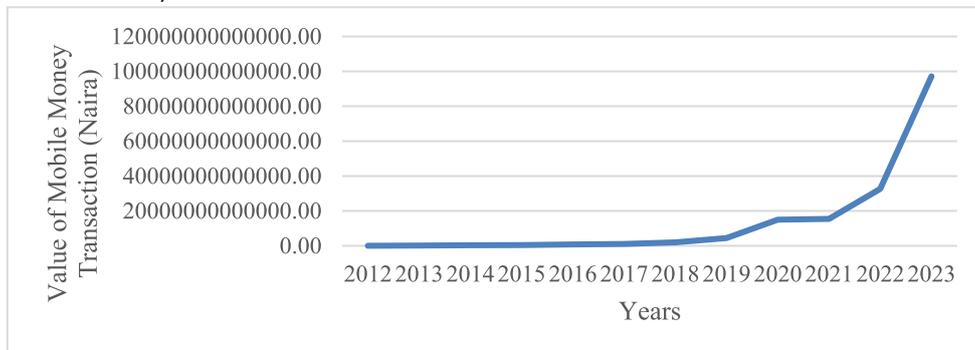
Source: International Monetary Fund via Federal Reserve Economic Data (FRED), 2025

**Figure 3***Mobile Banking: Registered Number of Mobile Money Accounts*

Source: International Monetary Fund via Federal Reserve Economic Data (FRED), 2025

**Figure 4***Number of Mobile Money Transaction*

Source: International Monetary Fund via Federal Reserve Economic Data (FRED), 2025

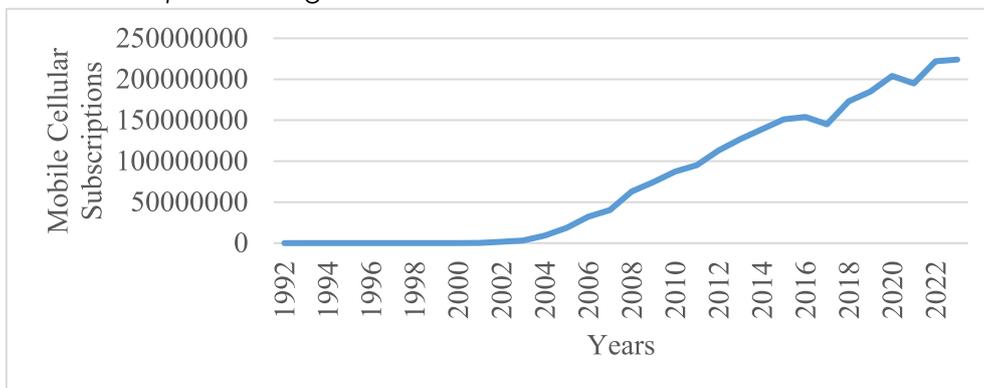
**Figure 5***Value of Mobile Money Transactions*

Source: International Monetary Fund via Federal Reserve Economic Data (FRED), 2025.

Figure 6 to Figure 8 show the trends in some indicators of digital inclusion in Nigeria. Figure 6 and 7 show that mobile cellular subscription rose from 9049 (representing 0.01 per 100 persons) in 1993 to 224,000,000 (representing 101.69 per 100 persons) in 2022. In same period, the percentage of the population using the internet rose from 0% to 37.7% as shown in Figure 8. This figure on internet usage reveals that digital inclusion by way of internet access or usage in the country is still quite low. The sharp rise in these indicators of digital inclusion may be attributed to the increased private investment in the telecommunications sector of the economy as well as the activities of the National Information Technology Development Agency (NITDA). A Comparison of the trends in the indicators of digital inclusion shown in Figures 7 and 8 reveals that most people subscribed to mobile cellular services are not subscribed to internet services.

**Figure 6**

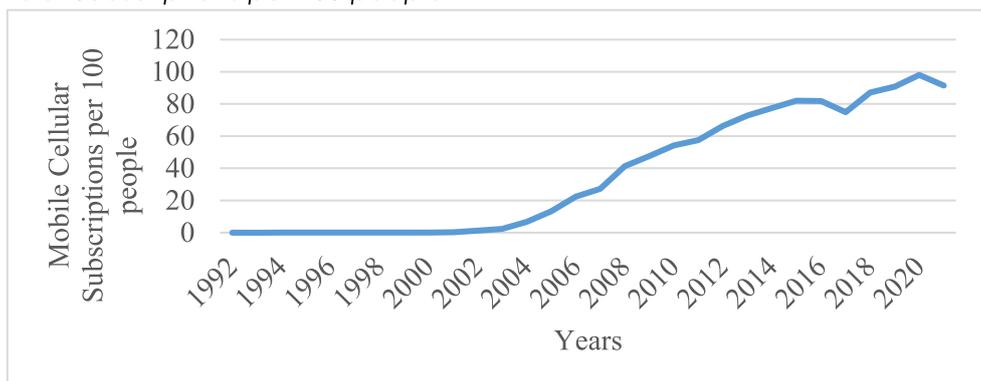
*Mobile Cellular Subscriptions in Nigeria*



Source: World Bank's World Development Indicators (2024)

**Figure 7**

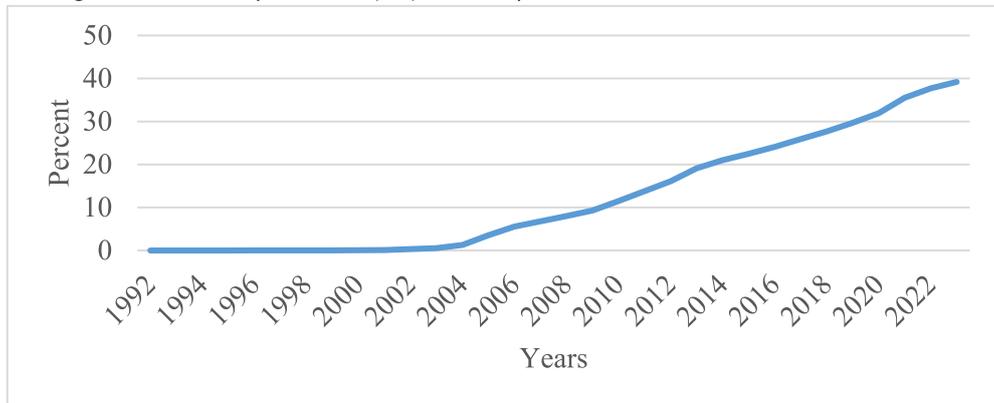
*Mobile Cellular Subscriptions per 100 people*



Source: World Bank's World Development Indicators (2024)

**Figure 8**

*Individuals using the internet (% of the population)*



Source: World Bank's World Development Indicators (2024)

This study aims to investigate whether financial inclusion and digital inclusion hold any relevance for inclusive growth in Nigeria.

### 3. Literature Review

#### 3.1. Conceptual Clarifications

##### 3.1.1. Digital Inclusion

The National Digital Inclusion Alliance (cited in The Centre for Digital Equity, 2025, para. 1) defines digital inclusion as “the activities necessary to ensure that all individuals and communities, including the most disadvantaged, have access to and use of Information and Communication Technologies (ICTs).” Digital inclusion is technology-driven, as it evolves with technological advancement. The Centre identifies five elements of digital inclusion. These include: (i) affordable and broadband internet; (ii) internet-enabled devices (such as computers, phones, tablets) that meet user’s need; (iii) (unhindered) access to digital literacy training; (iv) quality technical support; (iv) applications (apps) and online contents designed to enable and encourage self-sufficiency, participation and collaboration in the digital space.

Digital inclusion engenders digital equity which the National Digital Inclusion Alliance defines as “a condition in which all individuals and communities have the information technology (IT) capacity needed for full participation in our society, democracy and economy”. Digital equity is therefore essential for participation in civic, social and cultural activities, employment, lifelong learning and access to essential services.

The United Nations (n.d., p. 2) defined digital inclusion as “equitable, meaningful, and safe access to use, lead, and design of digital technologies, services, and associated opportunities for everyone, everywhere”. The UN also noted that digital inclusion needs to aim at equitable inclusion as the risk of digital inequality rises with greater ICT-enabled interconnectivity especially if those with already fewer opportunities are left behind digitally.

Gillan (2022) observed that digital inclusion supports inclusive growth through skill development especially in the youth. The UNDP (2024) noted that digital inclusion is the foundation for shared economic and social progress. This implies that digital inclusion is relevant to inclusive economic growth. The UNDP further noted that digital technologies are essential for the Sustainable Development Goals, directly benefiting 70% of the SDG targets. The UNDP highlighted four imperatives of digital inclusion. They include:

**Enabling full and flourishing lives:** Access to digital resources is essential for a fulfilling life, enabling people to fully participate meaningfully in civic life, education, and the workforce.

**Driving Economic Transformation:** Digital technologies have transformed industries, changing business models and creating new opportunities for innovation and growth. With the rise of e-commerce, digital marketing, and remote work, the digital economy offers people new ways to participate in and advance their careers. By promoting digital inclusion, countries can unleash the full potential of their workforce, boost productivity, and foster innovation that leads to economic growth and prosperity.

**Addressing Social Dimensions:** Digital inclusion is essential for tackling social inequalities and strengthening community bonds

**Fostering Inclusive, Effective and Accountable Governance Systems:** Digital inclusion helps create governance systems that are more inclusive, effective, and accountable. By making these systems more responsive to people’s needs – especially during crises – it empowers citizens and encourages them to participate in political life.

### 3.1.2. Financial Inclusion

According to the CBN (2020, p. 1):

Financial inclusion ... means bringing those who are currently not enjoying financial services such as savings, credit, payment, pensions, insurance, remittances amongst others into the financial system and by so doing, access and use such services for economic /other activities that better their lots.

Financial services may be obtained from formal providers – including banks, development finance institutions, and other regulated bodies – as well as from informal entities such as cooperatives, non-governmental organisations, and credit unions. Accordingly, financial inclusion can be understood in terms of two dimensions: formal and informal inclusion. The policy goal in many countries is to promote formal financial inclusion by incorporating those who are currently excluded into the formal financial system, since this sector is generally regarded as more reliable, less risky, and more efficient. Moreover, formal financial mechanisms are preferred because they enable the systematic recording of financial transactions, thereby facilitating the implementation of economic and monetary policy (CBN, 2020).

The CBN 2025 (para. 1) further defines financial inclusion as “an ideal state when adult Nigerians have easy access to a broad range of formal financial services that meet their needs”. According to the World Bank (2005, para 1), “Financial inclusion means that individuals and businesses have access to useful and affordable financial products and services that meet their needs – transactions, payments, savings, credit and insurance – delivered in a responsible and sustainable way”. The World Bank sees financial inclusion as a key enabler to reducing poverty, as it supports entrepreneurship and business growth, empowers women and build resilience for people and businesses vulnerable to climate change and natural disasters thereby promoting inclusive economic growth (World Bank, 2025).

FinDev Gateway (2025) sees financial inclusion as the state in which all individuals can appropriately, affordably and responsibly access and use financial services such as payments, savings, credit and insurance that improve their wellbeing. FinDev Gateway notes that financial inclusion, though not listed among the SDGs, is a key enabler of seven of them which explicitly has financial inclusion as a targets. The SDGs include SDG1 – eradicating poverty, SDG2 – ending hunger, SDG3 – good health and wellbeing, SDG5 – gender equality, SDG8 – decent work and economic growth, SDG9 – industry, innovation and infrastructure, and SDG10 reducing inequality. Improvement in access to financial services (financial inclusion) enhances access to important services such as healthcare, education and utilities such as water, energy (electricity) and sanitation, all of which are critical elements of human capital development.

### 3.1.3. Digital Financial Inclusion

Digital financial inclusion is financial services made available to the financially excluded and underserved or underbanked individuals and communities via digital means such as mobile phones, internet and other digital devices (United Nations, 2016). Digital financial services have made it much easier for low-income and rural communities to access formal bank accounts. This has also lowered the cost of sending money, helping families better manage their finances and become more financially resilient (Abdul Latif Jameel Poverty Action Lab (J-PAL), 2024).

Digital financial inclusion aims to responsibly extend a variety of formal financial services to those currently excluded or underserved financially by deploying cost-saving digital tools to make the services both affordable for customers and financially viable for the institutions providing them. It relies on three core elements (World Bank, 2014):

- Digital Platforms: Systems that let people send, receive, and store money electronically. Additional financial services, such as loans, savings, and insurance, are also provided through these digital platforms, often using data to manage risk and reach new customers.
- Customer Devices: Tools like phones or payment cards that connect to these digital platforms.
- Retail Agents: Individuals or businesses with digital devices (like a POS machine) that allow customers to convert physical cash to digital money ("cash-in") and vice-versa ("cash-out").

The World Bank highlights several key advantages digital financial inclusion offers to the financially excluded. First, it provides them with access to a range of formal financial services like payments, savings, and loans. Second, the lower costs of these digital services make it easier for people to handle small, frequent transactions, which helps them manage unpredictable income and expenses. Third, digital platforms also reduces the risks of cash-based transactions, such as theft and loss. Fourth, it promotes economic empowerment by helping people build assets and, in many cases, boosts women's economic participation.

Digital financial inclusion, while beneficial, also poses certain dangers to financially vulnerable individuals. The World Bank (2014) identifies some risks associated with delivery of financial services through digital means. One major concern is the novelty risk, which arises because these customers may lack experience with digital products and services, making them susceptible to abuse and scams. Additionally, since the new providers often operate outside the regulations that govern banks, customers are exposed to agent-related risks, as they may not have the same consumer protections. There are also inherent digital technology risks. These include the possibility of service interruptions, such as dropped messages, which can lead to data and transaction loss. Furthermore, the digital transmission and storage of personal information create a constant threat of privacy or security breaches.

The United Nations (2018) noted that digital financial inclusion has the potential to ignite faster progress towards the SDGs and create long-lasting social and economic impact for millions of people worldwide. The UN links achieving 13 out of the 17 SDGs to digital financial inclusion. The goals are: poverty eradication (SDG1), elimination of hunger (SDG2), better and improved health and wellbeing (SDG3), quality education (SDG4), gender quality (SDG5), clean water and sanitation (SDG6), affordable and clean energy (SDG7), decent work and economic growth (SDG8), industry, innovation and infrastructure – small industry expansion (SDG9), reduced inequalities (SDG10), creation of sustainable cities (SDG11), combating and adapting to climate change (SDG13), promoting peace, justice and strong institutions - promotion of just and inclusive societies (SDG16). This was corroborated by the IMF (2021) which noted that digital financial inclusion can accelerate economic growth.

### **3.2. Theoretical Literature**

This subsection delineates the theoretical foundations underpinning the nexus between digital inclusion, financial inclusion, and inclusive growth. It synthesizes established economic paradigms to elucidate the mechanisms through which access to digital technologies and financial services facilitates equitable and broad-based economic development.

Traditional growth theories lay emphasis on determinants of growth and strategies to achieve same without taking into consideration whether or not the desired or resultant economic growth translates into poverty reduction, employment generation and equitable distribution of income, consumption and wealth. Hitherto, while countries strived to achieve economic growth, many experienced growth (without development) characterized by rising poverty, widening income inequality and unemployment. The growth experienced by those countries was non-inclusive as it was not broad-based, non-participatory, and did not improve the well-being of the poor.

#### **3.2.1. Inclusive Growth Theory**

Inclusive growth extends beyond the simple increase of aggregate gross domestic product. It emphasises the fair distribution of income and access to opportunities (Asian Development Bank, 2014). Rooted in the principles of Welfare Economics and Pro-Poor Growth paradigms, this perspective contends that economic expansion can be regarded as genuinely inclusive only when it fosters productive employment and improves the living conditions of disadvantaged groups. It seeks to balance efficiency with equity, recognising that persistent structural disparities may undermine long-term economic stability and sustainability (African Development Bank, 2012).

Human Capital Theory (Becker, 1964) is likewise central to this discourse, asserting that investments in education, skills development, and health increase individuals' productivity and earning capacity. When growth strategies deliberately incorporate marginalised populations through digital and financial inclusion mechanisms, the accumulation of human capital becomes more widespread, thereby strengthening the inclusiveness of overall economic progress.

#### **3.2.2. Digital Inclusion Theory**

The theoretical basis for digital inclusion is rooted in Endogenous Growth Theory, which underscores the criticality of technological advancement, human capital, and innovation in sustaining long-term economic expansion. Within the Romer (1990) framework, investments in technology and knowledge generate significant positive externalities that bolster cross-sectoral productivity. Digital technologies mitigate information asymmetry, reduce transaction costs, and eliminate geographical constraints, thereby fostering broader economic participation.

Complementarily, the Diffusion of Innovations Theory developed by Rogers (1962) suggests that the systematic spread of new technologies across diverse societal segments enhances both aggregate productivity and social welfare. Inclusive diffusion ensures that marginalized populations can access information, markets, and public services, thereby expanding their economic agency. From a development economics standpoint, digital inclusion bolsters state

capacity and enhances service delivery transparency—both of which are fundamental pillars of inclusive growth.

### **3.2.3. Financial Inclusion Theory**

Financial inclusion focuses on the accessibility and utilization of regulated, affordable financial services, including credit, savings, insurance, and payment mechanisms. This concept is deeply embedded in Financial Intermediation Theory developed by Allen and Santomero (1992) and Ramakrishna and Thakor (1984), which posits that intermediaries optimize capital allocation, mobilize savings, and facilitate risk management. Inclusive financial systems empower households and Small and Medium-sized Enterprises (SMEs) to undertake productive investments, stabilize consumption, and mitigate idiosyncratic shocks.

The Life-Cycle Hypothesis developed by Modigliani and Brumberg (1954) and Ando and Modigliani (1963), and the Permanent Income hypothesis formulated by Friedman (1957) further clarify the welfare implications of financial access, as they suggest that financial tools allow individuals to smooth consumption and invest in human capital (health and education) despite income volatility. Moreover, Credit Market Theory (Caskey & Fazzari, 1986; Ma & Smith, 1996) emphasizes that households and firms make inter-temporal commitments in credit markets and these commitments significantly affect macroeconomic performance. Credit market friction engenders credit rationing which impacts on an economy's growth path (Ma & Smith, 1996). Relaxing credit constraints for previously excluded cohorts stimulates entrepreneurial activity and job creation, directly contributing to inclusive growth.

### **3.2.4. Inclusive Innovation Theory**

The theory of inclusive innovation posits that economic growth can be made more inclusive through innovations designed specifically for marginalized, low-income, and underserved communities. The innovations directly improve the well-being of these groups, often by adapting existing technologies, products, or services to better suit their needs (OECD, 2015). Such innovations especially in development and advancement of financial products and digital technologies lead to more than just cheaper, improved versions of existing products. They also aid in creating new business models, products, technologies, and services that empower the poor to become both producers and innovators. In essence, inclusive innovation highlights how technology and social advancements can close societal gaps and drive inclusive development. The concept is widely recognized as a key strategy for fostering inclusive growth. (George *et al.*, 2012; Hoffecker, 2023).

### **3.2.5. The Synergy between Digital and Financial Inclusion**

Theoretically, digital and financial inclusion are mutually reinforcing catalysts for growth. Digital inclusion optimizes information flow and market access, while financial inclusion provides the necessary capital for investment, collectively fostering sustainable development, reduced inequality and enhanced inclusive growth (Aker & Mbiti, 2010; World Bank, 2020).

### 3.3. Empirical Literature

In this subsection, relevant empirical studies are reviewed. The sub-section begins with a review of the relationship between digital inclusion, digital financial inclusion and inclusive (economic) growth. Thereafter, the literature on the relationship between financial inclusion and inclusive (economic) growth is reviewed.

#### 3.3.1. Digital Inclusion, Digital Financial Inclusion and Inclusive Growth

Xun *et al.* (2020) investigated the effect of digital financial inclusion on inclusive growth in China. The study found that digital finance promotes inclusive growth by raising the level of household income especially in rural areas and by enhancing rural households' access to entrepreneurship opportunities on the back of physical and social capital.

Aslam *et al.* (2021) examined the impacts of institutional quality, social inclusion and digital inclusion on inclusive growth across 83 different economies characterized by different income groups (high, middle and low) during the 2010-2017 period, using the two-step system GMM technique. The study found that for high-income group of countries, and not for the rest income group, direct link existed between institutional quality and inclusive growth. However, across all income groups, the contributions of social inclusion and digital inclusion to inclusive growth are positive and statistically significant.

Daud *et al.* (2022) examined the effect of financial inclusion and digital technology on economic growth in sample of 84 countries during the 2011-2017 period using dynamic panel data estimation technique. The study found that digital inclusion enhanced the effect of financial inclusion on economic growth through delivery of financial services using digital technologies.

Yang *et al.* (2023) investigated the effect of digital inclusion on inclusive growth in 30 provinces of China during the 2011-2021 period using series of mathematical and statistical models. The study found that digital financial inclusion promotes inclusive growth and that the effect of digital financial inclusion on inclusive growth were more significant in Central and Western regions. The channels of the effect were found to be innovation and human capital development.

Kristyanto and Jamil (2023) examine the effect of digital transformation on economic growth in Indonesia during the period from 1980-2021 using the two stage least squares (2SLS) estimation technique. The empirical evidence indicates that digital transformation significantly contributes to promotion of inclusive growth in the country.

Xi and Wang (2023) examined the effect of digital financial inclusion on the quality of economic growth in China during the 2011-2017, using panel fixed effect model, mediation effect model, panel threshold model, and spatial Durbin model. The study found that digital financial inclusion positively impacts the quality of economic growth, particularly in the eastern region and regions with high marketization by stimulating entrepreneurial vitality. The paper concluded that expansion in breadth of coverage and depth of usage of digital financial inclusion can significantly enhance the quality of economic growth.

Peng and Zeng (2024) explored the relationship between digital financial inclusion and inclusive green growth in 270 cities of China during the 2011-2021 period. The study employed a panel dataset, individual fixed-effects models, two-stage least squares (2SLS) and difference-in-

difference (DID) approaches and multiple mediation models for the analysis. The empirical evidence showed that digital financial inclusion effectively stimulated green growth in the country by enhancing green technology innovation, boosting entrepreneurship, and facilitating industrial structure upgrades, with green technology innovation being the key driver.

Ababio *et al.* (2024) examined the relationship between digital financial inclusion and inclusive development and the mediating role of institutions in the relationship, in 48 lower-middle income countries during the period from 2004-2022. The findings revealed positive and significant relationship between digital financial inclusion and inclusive growth in the countries. They further revealed that the relationship was stronger in countries with strong institutions than in countries with weak institutions.

The mediating role of governance and institution in the nexus between digital financial institution and economic growth in sub-Sahara Africa (SSA) during the 2014-2020 period was investigated in the study by Chinoda and Kapingura (2024). The study employed the generalized method of moment which controls for endogeneity. It was found that good governance and quality institutions enhanced the positive effect of digital financial inclusion on economic growth in the SSA.

Meniago (2025) investigated the relationship between digital financial inclusion and economic growth in SADC countries, while exploring the mediating role of institution in the relationship. The study employed the system GMM technique to analyse panel dataset spanning the period from 2011 to 2023. It was found that positive and significant relationship exists between digital financial inclusion and economic growth. It was further found that the mediation between digital financial inclusion and institutions enhanced the growth effect of digital financial inclusion on economic growth. The finding suggests that expansion of digital access, backed by establishment of robust institutions which guarantee improved governance, adherence to rule of law, strong regulatory frameworks, legal protections, and implementation of sound macroeconomic policies, would enhance the growth of the regional economic bloc.

Ho *et al.* (2025) examined the moderating role of governance in the impact of digitalization on income inequality in 45 developing countries during the period from 2002-2023 using the Method of Moment Quantile Regression (MMQR) technique. For robustness check, the system generalized method of moment (Sys-GMM) technique was employed. The study found statistically significant negative impact of digitalization on income inequality, signifying that digitalization engenders lowering or reduction of income inequality in developing countries. This effect was however dependent on the quality of governance and the type of digitalization (mobile phone usage, internet access, and fixed telephone subscriptions) adopted. The study found that a basic form of digital technology – fixed telephone subscriptions – was more effective at reducing income inequality than more advanced technologies like mobile phones and the internet. This challenges the common belief that only cutting-edge digital technology promotes economic inclusivity. The findings highlighted that affordability and accessibility are key to achieving digital equity.

### **3.3.2. Financial Inclusion and Inclusive (Economic) Growth**

The causal interactions among institutional quality, financial inclusion and inclusive growth were explored in the study by Olarenwaju *et al.* (2019) using the Toda-Yamamoto approach to Granger causality analysis within the framework of an augmented vector autoregressive (VAR) model. The evidence indicated that all the variables except financial inclusion index Granger-caused

inclusive growth with no evidence of feedback. This implies that there was no evidence of causality between financial inclusion index and inclusive growth.

Afolabi (2020) employed the ARDL technique to examine the effect of financial inclusion in the form of rural loan, number of bank branches and level of liquidity on inclusive growth measured as GDP per capita in Nigeria using time series data spanning the period from 1981-2017. The study found that financial inclusion positively and significantly impacted inclusive growth in the country. The relationship between financial inclusion, renewable energy consumption and inclusive growth in a sample of 40 countries during the period from 2010 to 2020, was examined in a study by Cui *et al.* (2022) using a spatial Durbin model. The results of the analysis showed that financial inclusion and renewable energy consumption positively and significantly impacted inclusive growth.

Sarpong and Nketiah-Amponsah (2022) employed various panel econometric techniques such as fixed effect modeling, random effect modeling and the system GMM technique to examine the effect of financial inclusion on inclusive growth in sub-Saharan Africa using a panel dataset covering the period from 2004-2028 on 46 countries. The study found that financial inclusion measured by usage of financial services, contributed more significantly to promotion of inclusive growth than knowledge and availability of financial services. The study specifically found that a unit rise in usage of financial services engendered 0.03 unit rise in the index of inclusive growth.

The nexus between financial inclusion and inclusive growth in five East African Countries was examined in a study by Ndungu (2023). The Driscoll and Kraal's augmented fixed effects estimation technique was employed to analyze data spanning the period from 2011 to 2021. The results showed that financial inclusion impacted positively and significantly on inclusive growth in the region.

Iddrisu *et al.* (2023) explored the relationship between financial stability, financial inclusion and inclusive growth in 40 African countries during the period from 2004-2020 using the two-step system GMM technique. The study revealed that financial inclusion promoted inclusive growth, financial stability on its own does not significantly promote inclusive growth, the mediation between financial inclusion and financial stability further enhances inclusive growth.

The relationship between financial inclusion and economic growth was examined in a study by Siddiki and Bala-Keffi (2024) using global datasets analysed panel threshold regression. The analysis revealed that financial inclusion impacted positively and significantly on economic growth across all panels, though the impact was greater in advanced countries. The impact was also found to be greater for non-fragile compared to fragile economies. Further evidence from the study are that financial development enhanced the impact of financial inclusion on economic growth.

Cheikh and Rault (2025) examined the effects of financial inclusion, institutional quality and ICT on inclusive growth in a sample of 67 countries using quantile regression techniques. Empirical evidence from the study are that financial inclusion and ICT were detrimental to inclusive growth, while institutional quality promoted inclusive growth. However, using non-linear models, a positive effect of financial inclusion on inclusive growth was found at higher levels of financial affordability.

### **3.4. Contribution to Knowledge**

Most of the related previous Nigeria-focus studies measured inclusive growth either as GDP per capita or as GDP per person employed, without taking cognizance of the distribution of income in the economy. The current study contributes to knowledge by investigating the effect of digital and financial inclusion on inclusive growth in Nigeria using an integrated measure (index) of inclusive growth which augments the growth rate of per capita income with changes in the distribution of income.

## 4. Methodology

### 4.1. Theoretical Framework and Model

The theory of inclusive innovation provides the theoretical framework for this study. The position of the theory is that innovations designed specifically for marginalized, low-income, and underserved communities can engender inclusive economic growth. Such innovations include digital and financial inclusion (Gillan, 2022; UNDP, 2024). In this study, it is hypothesized that inclusive growth in Nigeria is explained by digital and financial inclusion.

Due to data limitations, we specified and estimated two models: one representing the relationship between digital inclusion and inclusive growth, and the other capturing the relationship between financial inclusion and inclusive growth.

#### 4.1.1. Digital Inclusion and Inclusive Growth

The functional relationship between digital inclusion and inclusive growth is specified as:

$$INCGR = f(ISUB, MCSUB, INF, EXRT, TOPEN, FDI) \dots \dots \dots (1)$$

Where INCGR represents inclusive growth. This was measured following Anand *et al.* (2013) and Iyoha and Aigheyisi, 2021) as:  $INCGR = PCYGR - GINIGR$  that is, real GDP per capita growth minus annual percentage change in Gini index of income inequality). According to Anand *et al.* (2013), this approach to an integrated measure of inclusive growth is in line with absolute definition of pro-poor growth. Under this formulation, inclusive growth strictly requires growth in per capita income and the equality of its distribution. Stated alternatively, inclusive growth requires growth in per capita income and decline in income inequality (Iyoha & Aigheyisi, 2021). ISUB represents internet subscription per 100 persons, MCSUB represents mobile cellular subscribers as a percentage of the population. ISUB and MCSUB are the key explanatory variables of interest in the model. The other variables - INF (inflation, measured as annual percentage change in consumers' price index), EXRT (natural logarithm of the official ₦/\$ exchange rate), TOPEN (trade openness, measured as total trade (exports plus imports) as a percentage of the GDP), and FDI (net foreign direct investment as a percentage of the GDP) are incorporated in the model as control variables.

The static (long run) form of Equation (1) is specified stochastically as:

$$INCGR_t = \beta_0 + \beta_1 ISUB_t + \beta_2 MCSUB_t + \beta_3 INF_t + \beta_4 EXRT_t + \beta_5 TOPEN_t + \beta_6 FDI_t + \epsilon_{1t} \quad (2)$$

The variables are as defined previously. The  $\beta$ s are the parameters of the static model to be estimated, and  $\epsilon_1$  is the error term.

The *a priori* expectations are  $\beta_1 > 0$ ,  $\beta_2 > 0$ ,  $\beta_3 < 0$ ,  $\beta_4 < /> 0$ ,  $\beta_5 > 0$ ,  $\beta_6 > 0$ .

Digital Inclusion represented by ISUB and MCSUB is expected to positively impact inclusive growth. Improvement in access to digital technologies by the marginalized is expected to engender improvement in inclusive growth. Inflation adversely affects production and employment. It also adversely affect consumption levels of the poor through its effect on purchasing power. Thus it is expected to negatively impact inclusive growth. The effect of exchange rate on inclusive growth depends on country-specific conditions. For a country that is highly dependent on imports as a

result of low level of domestic product, currency depreciation (increase in the nominal exchange rate) can adversely affect domestic production that is dependent on foreign inputs. It can also worsen domestic inflation, thereby adversely affecting inclusive growth. However, for countries with high level of production, with elastic demand for imports, and whose exports has inelastic demand in foreign markets, currency depreciation may curb imports (resulting in decrease in payment for imports), and boost exports (resulting in increase in export earnings) as the export items becomes cheaper in foreign markets. In this scenario currency depreciation may be favourable to inclusive growth. Trade openness and FDI which are key elements of globalization are expected to enhance inclusive growth.

### Estimation Procedure: ARDL (Bounds Test)

Stationarity of the variables was evaluated through the Kwiatkowski-Phillips-Schmidt-Shin (KPSS) test, which is designed to determine whether a time series is stationary. In order to examine both short-run and long-run relationships, the Autoregressive Distributed Lag (ARDL) modelling framework developed by Pesaran *et al.* (2001) was adopted. This technique was chosen because of its flexibility as it can accommodate variables integrated of order zero or one [I(0) or I(1)] or a mix of both so long as none are integrated of order two [I(2)]. Moreover, the ARDL approach performs well even with relatively small samples, and produces efficient and reliable estimates of long-run parameters, including when regressors exhibit endogeneity, which often characterises cointegrated series (Harris & Sollis, 2003). This method entails using ordinary least squares (OLS) to estimate an unrestricted error correction model (UECM) form of the ARDL model, expressed as follows:

$$\begin{aligned} \Delta \text{INCGR}_t = & \beta_0 + \sum_{j=1}^p (\delta_{1j} \Delta \text{INCGR}_{t-j}) + \sum_{j=0}^p (\delta_{2j} \Delta \text{ISUB}_{t-j}) + \sum_{j=0}^p (\delta_{3j} \Delta \text{MCSUB}_{t-j}) + \\ & \sum_{j=0}^p (\delta_{4j} \Delta \text{INF}_{t-j}) + \sum_{j=0}^p (\delta_{5j} \Delta \text{EXRT}_{t-j}) + \sum_{j=0}^p (\delta_{6j} \Delta \text{TOPEN}_{t-j}) + \sum_{j=0}^p (\delta_{7j} \Delta \text{FDI}_{t-j}) + \psi_1 \text{ISUB}_{t-1} + \\ & \psi_2 \text{MCSUB}_{t-1} + \psi_3 \text{INF}_{t-1} + \psi_4 \text{EXRT}_{t-1} + \psi_5 \text{TOPEN}_{t-1} + \psi_6 \text{FDI}_{t-1} + \varepsilon_{2t} \quad [3] \end{aligned}$$

Pesaran *et al.* (2001) provided two sets of asymptotic critical values for the F-statistic across various significance levels (from 1% to 10%). The first set, known as the lower bound, assumes all variables are level stationary [I(0)], while the second set, the upper bound, assumes they are stationary after first differencing [I(1)]. The decision rule is as follows: if the computed F-statistic is greater than the upper bound critical value at the chosen significance level (typically 1% to 5%), the null hypothesis of no long-run relationship is rejected, indicating that a long-run relationship exists and can be estimated. If the F-statistic is below the lower bound at the chosen level of statistical significance, the null hypothesis is not rejected, suggesting no long-run relationship, and only short-run dynamics can be analyzed using the basic ARDL model. However, if the F-statistic lies between the two bounds, the result is deemed inconclusive.

If existence of long run relationship among the variables is indicated by the bounds test, the short run (error correction) model for the effect of the chosen indicators of digital inclusion (ISUB and MCSUB) and the other (control) variables is derived from the unrestricted error correction version of the ARDL model as:

$$\begin{aligned} \Delta \text{INCGR}_t = & \gamma_0 + \sum_{j=1}^p (\gamma_{1j} \Delta \text{INCGR}_{t-j}) + \sum_{j=0}^p (\gamma_{2j} \Delta \text{ISUB}_{t-j}) + \sum_{j=0}^p (\gamma_{3j} \Delta \text{MCSUB}_{t-j}) + \\ & \sum_{j=0}^p (\gamma_{4j} \Delta \text{INF}_{t-j}) + \sum_{j=0}^p (\gamma_{5j} \Delta \text{EXRT}_{t-j}) + \sum_{j=0}^p (\gamma_{6j} \Delta \text{TOPEN}_{t-j}) + \sum_{j=0}^p (\gamma_{7j} \Delta \text{FDI}_{t-j}) + \alpha \text{ECT}_{t-1} + \varepsilon_{3t} \quad [4] \end{aligned}$$

The  $\gamma$  coefficients represent the estimated short-run impacts of the independent variables on the dependent variable. The ECT, or error correction term, captures the rate at which the system returns to equilibrium following a short-run disturbance from the long-run relationship. For the ECT to fulfill its role, its coefficient ( $\alpha$ ) should be negative and statistically significant. A negative and significant  $\alpha$  also supports the existence of cointegration among the variables. The symbol  $\varepsilon_i$  denotes the error terms.

#### 4.1.2. Financial Inclusion and Inclusive Growth

To assess the relationship between financial inclusion and inclusive growth, the Toda-Yamamoto (TY) approach to Granger (non) causality test developed by Toda and Yamamoto (1995) was adopted. The choice of this method of analysis was informed by the (small) size of the series on an indicator of financial inclusion (depositors with commercial banks per 1000 of the population) available for the analysis. It is imperative to note that the TY Granger causality test suffers from small sample bias. This may be considered a limitation of the study. However, the TY approach performs better than the traditional time domain Granger causality test when the sample size is small (Kurozumi & Yamamoto, 2000; Aluko & Adeyeye, 2020).

The TY approach to Granger causality involves estimation and determination of the optimal lag length ( $k$ ) of a VAR model; determination of the maximum order of integration ( $d_{\max}$ ) of the variables utilized in the test using unit root or/and stationarity test(s) and using it to augment the optimal lag length as  $(k+d_{\max})$ ; estimating a VAR model of order  $(k+d_{\max})$ , [VAR( $k+d_{\max}$ )] and assessing its suitability using appropriate tests; examining the significance of the first  $k$  lags of each variables using the Wald test. If the results are significance, the null hypotheses of no causality are rejected, implying that causality exists.

The TY model based on the VAR( $k+d_{\max}$ ) framework for INCGR and DCB depositors with commercial banks per 1000 adults) can be expressed as:

$$\begin{aligned} \text{INCGR}_t = & \omega + \sum_{i=1}^k (\gamma_{1i} \text{DCB}_{t-i}) + \sum_{i=1}^k (\beta_{1i} \text{INCGR}_{t-i}) + \sum_{i=k+1}^{d_{\max}} (\delta_{1i} \text{DCB}_{t-i}) + \sum_{i=k+1}^{d_{\max}} (\psi_{1i} \text{INCGR}_{t-i}) + \varepsilon_{4t} \\ \text{DCB}_t = & \omega + \sum_{i=1}^k (\gamma_{2i} \text{DCB}_{t-i}) + \sum_{i=1}^k (\beta_{2i} \text{INCGR}_{t-i}) + \sum_{i=k+1}^{d_{\max}} (\delta_{2i} \text{DCB}_{t-i}) + \sum_{i=k+1}^{d_{\max}} (\psi_{2i} \text{INCGR}_{t-i}) + \varepsilon_{5t} \end{aligned}$$

#### 4.2. Data and their Sources

Data utilized for the study are annual time series data. Data used for estimation of the ARDL spans the period from 1993 to 2023, while data used for the TY approach to Granger causality analysis spans the period from 2007 to 2023. The scopes of the data were dictated by data availability.

The data were obtained from various authoritative sources. Data on GDP per capita growth and income inequality used for the computation of inclusive growth index were obtained from the World Bank's WDI (2024) and WID (2024) respectively. Data on ISUB, MCSUB, INF, EXRT, TOPEN and FDI were obtained from the World Bank's WDI (2024), and data on DCB was obtained from was obtained from the International Monetary Fund (2025).

## 5. Results and Discussion

### 5.1. Descriptive Statistics

We begin the analysis by presenting the descriptive statistics of the series used for the study. These are presented in Table 1. The index of inclusive growth averaged 1.50 during the 1993-2023 period, and ranged between -4.50 and 12.27. The coefficient of skewness is near zero indicating that the distribution is not visibly skewed, while the coefficient of Kurtosis which is greater than 3 indicates that the distribution is leptokurtic. The p-value of the Jarque-Bera statistic is greater than 0.05 – an indication that the series is normally distributed. Internet subscription as a percentage of the population and mobile cellular subscription per 100 persons averaged 12.23% and 38.66% respectively during the period, and ranged between 0.00-39.20% and 0.00-101.69% respectively. The statistics reveal that mobile cellular subscription grew faster than internet subscription during the period and that most people subscribed to mobile cellular services are not subscribed to internet services. Both series are normally distributed as indicated by the p-values of their Jarque-Bera statistics which are greater than 0.05. During the 2007-2023 period, depositors with commercial banks per 1000 adults averaged 882.12, and ranged between 292 and 2018.84. The coefficient of skewness, kurtosis and the p-value of the Jarque-Bera statistic indicate that the series is also normally distributed.

**Table 1**  
*Descriptive Statistics of Key Variables of the Study*

	INCGR	ISUB	MCS	DCB
Mean	1.5012	12.2277	38.6593	882.1241
Maximum	12.2782	39.2000	101.6858	2018.847
Minimum	-4.5051	0.0000	0.0000	292.7696
Skewness	0.4466	0.6652	0.2815	0.9200
Kurtosis	3.9457	2.0206	1.4184	2.8710
Jarque-Bera	2.1855	3.6387	3.6406	2.4102
Probability	0.3353	0.1621	0.1620	0.2997

Source: Author's Computations using Eviews 9

### 5.2. Stationarity Tests

The results of the stationarity test are summarized and presented in Table 2. The results show that ISUB, MCSUB and DCB are stationary at first difference, while the other variables are stationary at level. Thus the variables are integrated of mixed orders.

**Table 2**  
KPSS Stationarity Test

KPSS Stationarity Test							
Variables	Levels			1 <sup>st</sup> Difference			I(d)
	test Stat	Critical Value (5%)	Inference	test Stat	Critical Value (5%)	Inference	
INCGR	0.1811	0.4630	S	-	-	-	0
ISUB	0.1962	0.1460	NS	0.1254	0.1460	S	1
MCSUB	0.1679	0.1460	NS	0.0992	0.1460	S	1
DCB	0.1707	0.1460	NS	0.1440	0.1460	S	1
INF	0.3572	0.4630	S	-	-	-	0
EXRT	0.1151	0.1460	S	-	-	-	0
TOPEN	0.0990	0.1460	S	-	-	-	0
FDI	0.1350	0.1460	S	-	-	-	0

d stands for order of integration

Source: Author's Estimation using Eviews 9

### 5.3. Cointegration Test

Considering that the variables are integrated of mixed orders (1 and 0), and none is integrated of order 2, long run relationships among the variables in Equation (1) specified in section 4 was tested using the Bounds test. The result of the test for long run relationship using the Bounds test is presented in Table 3. The result shows that the computed F-statistic is greater than the upper bounds critical value even at the 1% level. The null hypothesis that long run relationships exist is therefore rejected at the 1% level. Thus it is inferred that the variables are cointegrated.

**Table 3**  
ARDL Bounds Test

Null Hypothesis: No long-run relationships exist		
Test Statistic	Value	k
F-statistic	7.98	6
Critical Value Bounds		
Significance	Lower Bound	Upper Bound
10%	2.12	3.23
5%	2.45	3.61
2.5%	2.75	3.99
1%	3.15	4.43

Source: Author's Estimation using Eviews 9

### 5.4. Model Estimation Results

#### 5.4.1. Digital Inclusion and Inclusive Growth

The result of the model estimated to examine the effect of digital inclusion on inclusive growth is presented in Table 4. The upper panel of the result which presents the short run (error correction) relationship shows that digital inclusion positively and significantly affects inclusive growth in the short run. The short run effect of increase in the number of internet subscribers on inclusive growth

is positive and significant at the 5% level. A 1% rise in the number of internet subscribers is associated with 0.41 unit rise in inclusive growth rate. The short run effect of increase in the number of mobile cellular subscribers on inclusive growth is positive and also significant at the 5% significant level. A 1% rise in the number of mobile cellular subscribers is associated with 5.34 unit rise in the index of inclusive growth rate contemporaneously. The lagged effect is also positive, but statistically significant at the 1% level. Thus, bridging the digital divide by way of increasing the people's access to internet and mobile cellular subscription will engender improvement in inclusive growth.

The short run effect of inflation on inclusive growth is negative and significant at the 1%. The short run (contemporaneous) effects of exchange rate, trade openness and FDI on inclusive are not statistically significant. However, the short run lagged effect of FDI on inclusive growth is negative and significant at the 5% level. The error correction coefficient has the expected negative sign and it is statistically significant at the 1% level. This further confirms that the variables are cointegrated and tend to converge in the long run. The size of the absolute value of the coefficient which lies outside the -1 to 0 range indicates that the convergence to equilibrium in the event of short run deviations therefrom is oscillatory (Narayan & Smyth, 2005).

The lower panel of Table 4 shows the long run relationships. Digital inclusion retains its positive effect on inclusive growth. Though the number of internet subscribers is significant at the 10% level, and the number of mobile cellular subscribers loses its statistical significance at the conventional levels (1%, 2.5%, 5% and 10%), yet the findings suggest that increase in the number of people having access to the internet and mobile cellular devices would enhance inclusive growth in the country in the long run. This finding corroborates evidence from the study by Xi and Wang (2023), Ababio *et al.* (2024) and Ho *et al.* (2025).

Inflation and currency depreciation adversely affect inclusive growth at the 1% and 10% significance levels respectively. A 1% rise in inflation engenders 0.17% decrease in inclusive growth, while a 1% rise in the exchange rate is associated with 0.05% decrease in inclusive growth. These are not unexpected considering their adverse effects on production, income and employment. The long run effects of trade openness and FDI on inclusive growth are positive, but statistically not significant.

The underlying (base) model has a high goodness of fit indicated by the R-squared (coefficient of determination) value of 0.8447, which implies that the model explains over 84.47% of systematic variation in the dependent variable. The adjusted R-Squared value of 0.7005 indicates that the model retains its high goodness of fit if it is adjusted for loss of degree of freedom resulting from addition of explanatory variables. The F-statistic of 5.8594 which passes the statistical significance test at the 1% level ( $p = 0.001$ ) indicates that though some of the variables are individually not significant, all the variables are however jointly significant in explaining the dependent variable. The Durbin-Watson statistic of 2.0805 points to absence of problem of autocorrelation in the model.

**Table 4**Dependent Variable: *INCGR*

Selected Model: ARDL(1, 0, 2, 0, 2, 0, 2)			
Cointegrating Form			
Variable	Coefficien	t	t-Statistic
D(ISUB)	0.408704		2.259552
D(MCSUB)	5.340134		2.192421
D(MCSUB(-1))	5.246856		4.136274
D(INF)	-0.206140		-3.825247
D(EXRT)	-2.177168		-1.174206
D(EXRT(-1))	5.589916		1.645889
D(TOPEN)	0.159128		1.358596
D(FDI)	-0.405631		-0.377617
D(FDI(-1))	-1.941208		-2.495472
CointEq(-1)	-1.197080		-6.728778
Long Run Coefficients			
Variable	Coefficien	t	t-Statistic
ISUB	0.341418		2.022699
MCSUB	0.514412		0.766558
INF	-0.172203		-4.199403
EXRT	-5.369035		-1.864789
TOPEN	0.132930		1.437755
FDI	2.433798		1.707691
C	6.354234		0.846528
R-squared	0.844741		
Adjusted R-squared	0.700572		
F-statistic	5.859370		
Prob(F-statistic)	0.001154		
Durbin-Watson stat	2.080477		

Source: Author's Estimation using Eviews 9

#### 5.4.2. Diagnostic Tests

Several diagnostic tests were performed to determine the reliability of the underlying unrestricted error-correction model from which the long run and the short run models were derived. The tests include the Jarque-Bera (J-B) test for residual normality, the Breusch-Godfrey (B-G) test for serial correlation, the Breusch-Pagan-Godfrey (B-P-G) test for heteroskedasticity, and the Ramsey's Regression Equation Specification Error Test (RESET). The level of statistical significance adopted for the various test statistic was the 5% significance level. The results of the test are summarized in Table 5. The p-values of the test statistics for all the tests are greater than 0.05 as indicated. This implies that the residuals of the model are normally distributed; there is no problem of serial correlation; there is no problem of heteroskedasticity; and the specification of the regression equation is appropriate.

**Table 5**

Summary of Diagnostic Test's Results

Tests	Test Stat	p-value	Inference
Residual Normality (J-B test)	1.3340	0.5132 > 0.05	Residuals are normally distributed
Serial correlation (B-G LM)	1.4637	0.2699 > 0.05	No serial correlation
Heteroskedasticity (B-P-G)	0.5175	0.8781 > 0.05	Residuals are homoscedastic
Ramsey's RESET	1.5461	0.1461 > 0.05	Model is appropriately specified

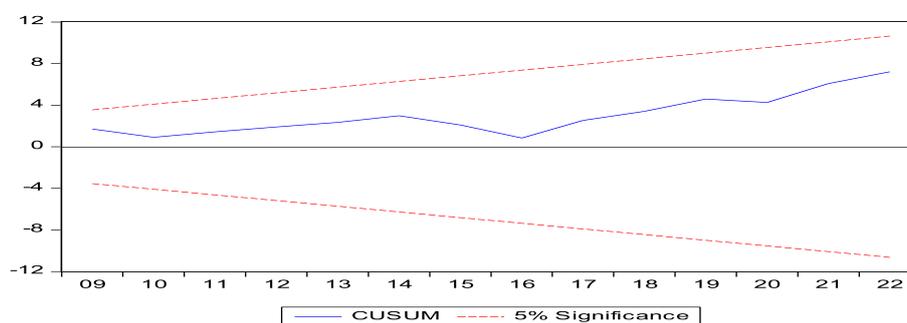
Source: Author's Estimations using EViews 9

### 5.4.3. Model Stability Test

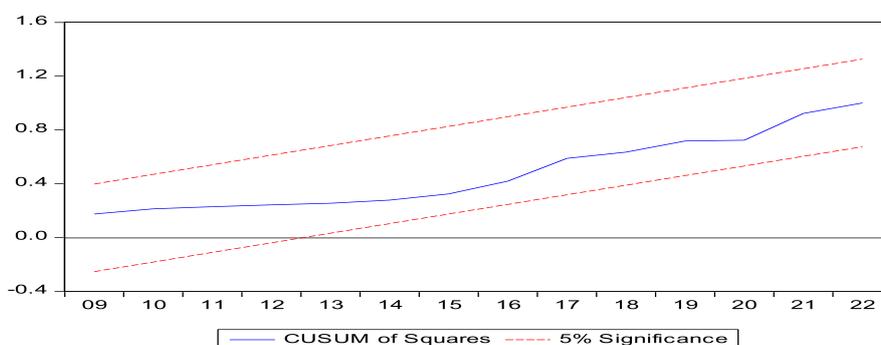
The stability of a model enhances its usefulness for policy pursuit. The long run stability of the model was tested using the plots of cumulative sum of recursive residuals (CUSUM) and cumulative sum of squared recursive residuals (CUSUMSQ) which are approaches developed by Brown *et al.* (1975) for testing the constancy of regression parameters over time. The results of the model stability test are presented in Figure 9a and Figure 9b respectively. The plots of CUSUM and CUSUMSQ lie between the 5% significance bands. This implies that the model is structurally stable and can be relied upon for policy formulation.

**Figure 9a**

CUSUM

**Figure 9b**

CUSUMSQ



## 5.5. Financial Inclusion and Inclusive Growth

The Toda-Yamamoto approach to Granger causality test was employed to test the causal relationship between financial inclusion and inclusive growth in Nigeria. The test involves Granger non-causality using an estimated VAR model of order  $(k+d_{max})$ , where  $k$  represents optimal lag length of a two-variable VAR model, and  $d_{max}$  represents the maximum lag length.

From stationarity test results presented in Table 2,  $d_{max} = 1$ . The result of the optimal lag order selection based on the estimated two-variable VAR model is presented in Table 6. All the selection criteria indicate that the optimal lag length of the VAR model is 1. The inverse root of the AR characteristic polynomial in Figure 10 shows that the underlying VAR model is stable.

**Table 6**

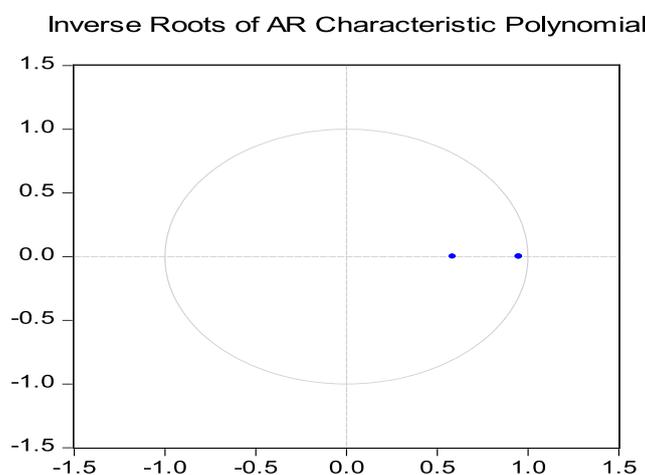
*VAR Lag Order Selection Criteria*

Endogenous variables: INCGR DCB						
Lag	LogL	LR	FPE	AIC	SC	HQ
0	-148.9227	NA	1881656.	20.12302	20.21743	20.12202
1	-117.5102	50.25994*	49178.02*	16.46803*	16.75125*	16.46501*
2	-113.9552	4.739947	54424.60	16.52736	16.99940	16.52234

Source: Authors' Estimation using Eviews 9

**Figure 10**

*VAR Stability Test*



The causality test result presented in Table 7 shows that null hypothesis of no causality from DCB to INCGR is rejected at the 5% significance level, while the null hypothesis of no causality from INCGR cannot be rejected at same level of statistical significance. Thus, unidirectional causality exists between financial inclusion (indicated by number of depositors with commercial banks) and inclusive growth, with causality running uni-directionally from the former to the latter. This suggests that financial inclusion promotes inclusive growth in the country. The finding is in sync with evidence from Iddrisu *et al.* (2023) which also found that inclusive growth is promoted by financial inclusion.

**Table 7**

VAR Granger Causality/Block Exogeneity Wald Tests (Toda Yamamoto Approach)

Dependent variable: INCGR			
Excluded	Chi-sq	df	Prob.
DCB	4.467322	1	0.0345
All	4.467322	1	0.0345
Dependent variable: DCB			
Excluded	Chi-sq	df	Prob.
INCGR	0.012815	1	0.9099
All	0.012815	1	0.9099

Source: Authors' Estimation using Eviews 9

### 5.6. Implications of the findings

The implications of the findings of the research are that digital and financial inclusion hold strong relevance for promotion of inclusive growth in Nigeria. Digitalisation by way of improvement in availability and affordable of digital technologies including internet and other information and communication devices which enhance communications, learning and skill acquisitions required for entrepreneurial development, as well as improvement in access to financial services (such as savings, loans, insurance, etc.) especially by the unbanked and underserved population mainly in the rural areas will expectedly aid in employment generation, promotion of entrepreneurship, poverty reduction, and reduction in inequalities in income, consumption and wealth, thereby promoting inclusive growth.

While digital and financial inclusion are key ingredients for achieving inclusive growth, it is imperative that the government, through relevant authorities, agencies and institutions take measures of control inflation and strengthen the domestic currency.

## 6. Recommendations and Conclusion

### 6.1. Recommendations

Based on the empirical evidence, the following are recommended for policy considerations:

- i. Considering that the indicators of digital inclusion were found to affect inclusive growth positively and significantly, there is need for the government to implement policies and programmes aimed at increasing the level and rate of digital inclusion in the country. The government may consider attracting more investments into the ICT sub-sector
- ii. The uni-directional causality which was observed to run from the indicator of financial inclusion to inclusive growth calls for measures by the government (in collaboration with players in the nation's financial system) to enhance the level of financial inclusion in the country by the creation of financial services suited to meet the financial needs of the financially marginalised and excluded, as this will likely promote inclusive growth therein.
- iii. The observed negative and significant effect of inflation on inclusive growth suggests the need to bring inflation under control using appropriate monetary and fiscal policy tools.
- iv. The observed adverse effect of currency depreciation on inclusive economic growth calls for measures by the government to strengthen the domestic currency. Such measures may include strategies to reduce demand for imports, particularly imports of finished and other consumer or final goods which can be easily sourced locally (and embrace import substitution strategies), boost domestic production by creating the conducive environment for businesses (or the private sector) to thrive, and encourage export by *inter alia*, developing more export processing zones.

### 6.2. Conclusion

The paper explored the relationships among digital inclusion, financial inclusion and inclusive growth in Nigeria using different econometric techniques including the ARDL approach to estimation of short-and long-run relationships, and the Toda-Yamamoto approach to Granger causality test. The results indicated that digital and financial inclusion contribute to promotion of inclusive growth, while inflation and currency depreciation impede achievement of inclusive in the country. Based on the results, it can be concluded that digital and financial inclusion hold strong relevance for achieving inclusive growth in the country. While pursuing these as strategies for achieving inclusive growth, the government should be mindful of inflation and currency depreciation as these would adversely affect the nation's chances of achieving inclusive growth.

### 6.3. Suggestions for Further Studies

The findings of this study are by no means exhaustive. Other indicators of digital and financial inclusion (apart from the ones utilized in this paper) may be utilized, employing appropriate analytical techniques, to investigate their effects on inclusive growth in Nigeria and other countries at same level of development. Additionally, future research may focus on identifying more factors that potentially affect inclusive growth in Nigeria with a view to recommending measures to promote inclusive growth in the country.

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