Digital Economy and Innovation for Sustainable Growth in Nigeria

Nafisatu Isa Abdullahi

Department of Political Science, Plateau State University, Bokkos, Nigeria

DOI: https://dx.doi.org/10.47772/IJRISS.2026.101000818

Received: 31 October 2026; Accepted: 05 November 2026; Published: 19 November 2026

ABSTRACT

The transformation driven by the digital economy is reshaping global economic landscapes, offering unprecedented opportunities for innovation, diversification, and sustainable development. Nigeria, Africa's largest economy and most populous country, stands at a pivotal juncture where digital technologies could catalyze inclusive growth, reduce poverty, and foster sustainable development. This paper critically examines Nigeria's digital economy, highlighting the role of digital economy, innovation and sustainable growth. Employing the Autoregressive Distributed Lag (ARDL)/Bound cointegration method of analysis, the findings underscore a long run impact of the covariates of digital economy and innovation on sustainable growth in Nigeria, as the F-statistic value of 4.75 was found to be higher than the critical upper bound value of 3.67 at the 5% level of significance. Specifically, internet penetration and literacy aligns with the a priori expectation of the study based on the endogenous growth theory by reporting a positive impact on sustainable growth. Number of active GSM lines reported a negative impact on sustainable growth. The Error Correction Term (ECT) was correctly signed and statistically significant, indicating that 88% speed of adjustment from short-run to long-run equilibrium. A concerted effort involving the Federal Ministry of Communication and Digital Economy, NITDA and NCC, is essential for realizing Nigeria's digital promise, ensuring that growth is sustainable, equitable, and resilient.

Keywords: Digital Economy, Innovation, Sustainable Growth, Endogenous Growth.

INTRODUCTION

The digital economy offers Nigeria new opportunities to address the great challenges it faces, accelerate the pace toward improved productivity throughout the economy, and achieve more efficient and effective service delivery. Nigeria's economy, long reliant on oil, faces pressures from global energy transitions and domestic challenges like increased unemployment and inequality. The World Bank projected that by 2027, 83 million jobs will be eliminated globally as a result of the digital transition. The report identified administrative roles and traditional manufacturing as the most affected sectors, with significant job losses expected among clerical, secretarial, and data entry positions (Salmi *et al.,* 2025).

The digital economy is transforming global economies, offering opportunities for sustainable growth and innovation. The growth of the digital economy implies the development of a whole range of new professions and professional positions to be created. The Spanish Observatory of Employment in the Digital Era predicted that 4 out of 5 young people between 20 and 30 years old will work in positions, directly linked to the digital world (WEF, 2023). The creation of new jobs in the digital economy and the successful adoption of digital technologies and tools across all spheres in society can positively affect more people over a shorter period of time and with fewer resources than before. Among the professions likely to be most in demand are smart factory engineers, chief digital officers, digital innovation specialists, data scientists, expert in big data, smart city architect, director of digital content, expert in digital risks, director of digital marketing, and growth hackers (Salmi *et al.,* 2025).

With a growing digital population, Nigeria is well-positioned to leverage digital technologies to drive innovation and sustainable growth. The National Digital Economy Policy and Strategy (2020-2030) positions digital technologies as pillars for reorienting growth toward sustainability (NITDA, 2019). Innovation in areas such as e-commerce, mobile payments, and Artificial Intelligence (AI) readiness - evidenced by Nigeria's 31-

place jump in the 2025 Oxford AI Readiness Index - offers opportunities to boost productivity and environmental efficiency (Tech Africa News, 2026).

Digital innovation enhances inputs and outputs in Research and Development (R&D), promoting sustainability, particularly, energy efficiency and emission reductions, as seen in global models adaptable to Nigeria. Local efforts, such as NITDA's strategies, foster indigenous content and soft infrastructure for job creation which was put at about 18.4% GDP contribution by 2022 (Arinze, 2024). AI and digital payments spur economic diversification, with long-term potential for global tech exports if brain drain and policy gaps are addressed. The World Bank estimated that the creative industries in Nigeria, through innovations have the potential to produce 2.7 million new jobs by 2025. Close linkages between the ICT and creative industries can also materialize, for instance in the form of digital media in art production, or ICT-enhanced tourism (Salmi *et al.,* 2025).

Tijani, 2024, revealed that the Nigeria's Digital economy share surged from 13.85% of GDP in 2019 to 18% by 2023, peaking at 19.78% in Q2 2024 and adding ₦7.37 trillion ($4.4B) in Q2 2025 alone. Further, available statistics from the CBN revealed that revenues from the digital economy grew from $5B in 2019 to $9.97B in 2021, and projected to $18.3B by 2026 (Central Bank of Nigeria, 2024).

In terms of market penetration, Nigeria holds Africa's largest mobile market with over 157 Million subscribers, 142 Million internet users, with 49-55% smartphone penetration (Nigerian Communications Commission, 2023). In addition, digital tools boosted SME revenues by 25-30%; and jobs via 18.4% ICT GDP share between 2022 and 2023 (Unegbu *et al.,* 2025).

Despite the enormous potential in digital economy, Nigeria faces hurdles in leveraging innovation for sustainable growth ranging from limited infrastructure, skills gap and inadequate policy frameworks. The country's digital divide, cyber security threats and regulatory uncertainties hinder growth of digital businesses and investment. This study explores how digital economy and innovation can drive sustainable growth in Nigeria by exploring the multifaceted relationship between the digital economy, innovation, and sustainable development in Nigeria; it analyzes current landscape dynamics, and proposes strategic pathways to maximize digital potentials for inclusive and sustainable growth.

CONCEPTUAL CLARIFICATION AND LITERATURE REVIEW

Conceptual Review

Digital economy as a concept entails "a broad range of economic activities comprising all jobs in the digital sector as well as digital occupations in non-digital sectors" (WEF, 2023). The National Information Technology Development Agency (NITDA) viewed the digital economy to include any aspect of the economy that is based on or driven by the internet and digital technologies (NITDA, 2019). Access to the Internet has improved productivity and stimulated creativity and the emergence of emerging technologies have provided a platform for developing countries like Nigeria to use digital technology to drive the economy. The global digital economy is valued at $11.5 trillion dollars or approximately 16% of the Global Economy. The global digital economy is also projected to account for a quarter of the global economy in the next 10years. In the context of the Nigerian economy, ICT's contribution has been one of the fastest growing components of Nigeria's GDP and is emerging as its most important long-term growth prospect.

According to Schumpeter (1934), innovation involves the creation and utilization of new ideas, processes, and technologies to enhance productivity and competitiveness Digital innovation accelerates economic diversification and resilience. It is the creation of new ventures that drive the digital economy. Innovation is fundamental for transforming digital tools into economic and social value. Schumpeter (1934) emphasized that innovation - new products, processes, or organizational methods - drives economic development by creating competitive advantages and fostering productivity. Digital innovation accelerates this process, enabling countries to leapfrog older technologies and adopt more efficient, scalable solutions.

In Nigeria, digital innovation has led to the emergence of fintech startups, agritech solutions, and healthtech platforms, which address local challenges such as financial exclusion, agricultural productivity, and healthcare

access. The country's innovation ecosystem is supported by incubators, accelerators, and government programs like the National Information Technology Development Agency (NITDA)'s initiatives (NITDA, 2019).

Sustainable growth, as defined by the United Nations (2015), involves economic development that balances economic, social, and environmental considerations. Sustainable growth requires balancing economic expansion with social inclusion and ecological resilience, where digital tools can reduce energy intensity and emissions. Digital technologies can facilitate sustainable development by promoting inclusive access to services, reducing environmental footprints, and fostering resilient economies. In Nigeria, integrating digital innovation into sectors such as agriculture, energy, and healthcare can significantly improve resource efficiency, reduce emissions, and expand social equity.

From a theoretical standpoint, the **endogenous growth theory** posits innovation via knowledge spillovers drives sustained growth without diminishing returns **(Romer, 1990;** Aghion & Howitt, 1998). Romer contended that technological change is internally driven by investments in knowledge and innovation rather than being an external factor and highlighted the potential for technological progress and knowledge to yield increasing returns to scale; indicating that greater resource investment in these areas amplifies productivity and economic growth benefits. In this regards, digital infrastructure acts as non-rivalrous capital, amplifying R&D in Nigeria's fintech and AI sectors (Bankole, 2024).

Similarly, the **Schumpeterian creative destruction theory of innovation** views digital disruption as replacing obsolete processes, fostering entrepreneurship (Schumpeter, 1942). The theory posits that entrepreneurs drive growth by innovating—new products, processes, markets—destroying old equilibria. Digital platforms reallocate resources that enhance productivity, thus boosting sustainable growth. Hybrid with endogenous theory links fintech diffusion to inclusive growth, though regulation tempers disruption

Nigeria's Digital Economy Landscape: Current State and Key Drivers

Nigeria's digital economy has witnessed exponential growth over the past decade. The mobile penetration rate stands at over 85%, with more than 150 million internet users (Nigerian Communications Commission, 2023). The country's young population - over 60% under 25 -constitutes a critical driver of digital adoption, entrepreneurship, and innovation.

The fintech sector has experienced remarkable growth, with companies like Flutterwave, Paystack, and Paga revolutionizing mobile payments, remittances, and digital banking. E-commerce giants like Jumia and Konga have expanded access to goods and services beyond urban centers. Government policies such as the National Digital Economy Policy and Strategy (NDEPS) 2020-2030 aim to create a conducive environment for digital growth. The policy emphasizes infrastructure development, digital literacy, innovation hubs, and regulatory reforms to foster a thriving digital ecosystem.

Sustainable Growth through Digital Transformation in Nigeria

Digitalization contributes significantly to Nigeria's GDP. According to the Nigerian Bureau of Statistics (2023), the digital economy's contribution was approximately 14%, with potential to reach 20% by 2030. Digital platforms enable small and medium enterprises (SMEs) to expand markets, reduce operational costs, and increase revenues. The growth of digital services has also created millions of jobs in areas such as software development, digital marketing, and customer support, contributing to economic resilience.

In terms of social inclusion, digital platforms have expanded access to education, healthcare, and financial services. Initiatives like the Digital Literacy for All program aim to equip citizens with necessary skills. Mobile health applications improve healthcare delivery in underserved communities, reducing mortality and enhancing well-being.

In the sphere of environmental sustainability, digital technologies support environmental goals through smart agriculture, renewable energy management, and waste reduction. For instance, Internet of Things (IoT) devices monitor energy consumption, optimizing resource use, while drone technology aids in environmental monitoring.

Empirical Review

Empirical studies on Nigeria's digital economy and innovation reveal positive correlations with sustainable growth. By employing Ordinary Least Square (OLS) techniques, Arinze (2024) analyzed panel data from 2015-2023 on the Nigeria economy and found that digital innovation increased Nigeria's GDP growth by 2.1% annually through fintech and e-commerce, while financial inclusion rose 15%; although rural gaps persisted.

In an attempt to investigate the potential and ways of improving the implementation of digital economy for accelerated economic growth and sustainable GDP, Okopi and Sinnarong (2024) employed the descriptive survey design using 130 farmers selected through a convenience sampling approach in the four North Central States of Nasarawa, Benue, Plateau and Niger including the FCT Abuja. Data was gathered using close-ended questionnaires and measured using modified three-point Likert Scale. Findings showed that the farmers understood the potential of the digital economy in creating jobs and accelerating their economic status and contributing significantly to a sustainable GDP in Nigeria if properly utilized. This potential is however affected by the reduction in access to the internet, affordability and quality of service.

Anzor *et al.,* (2025) examined how effective governance, institutional efficiency and continuous innovation interact to drive digital transformation and sustainable economic growth in Nigeria. A mixed-method research approach was adopted while data were collected from policymakers, digital entrepreneurs and regulatory agencies to identify critical challenges and opportunities. Quantitative analysis using regression and structural equation modeling (SEM) was employed. Findings revealed that Nigeria's legal framework for digital economy indicate stakeholder confidence in existing policy, while government support for digital growth revealed weakness in policy execution.

Zain and Abbo (2025) interrogated the nexus between digitalization of bureaucracy and sustainable development in Nigeria and how investment in digital transformation via "e-government" initiatives has produced the intended outcomes in terms of significant sustainable development. The study utilized panel data from five selected states in the North-West geo-political zone of the country (Kano, Kaduna, Katsina, Jigawa and Sokoto states) to show the direct impact of digital public service delivery on sustainable development using panel regression modeling technique. The findings revealed that digital public services have an insignificant impact on sustainable development, hence, the need for environmental and infrastructural adjustments when implementing each digital economy index at any level.

Musa *et al.,* (2025) examined how digital infrastructure fosters innovation and sustainable growth in Nigeria using mixed-methods research design. Questionnaires were used as instrument for data collection while the OLS estimation technique was employed to investigate the relationship between internet access and sustainable development. Findings revealed that respondents possess a generally high level of education and digital literacy, reflecting a population that is both capable of and motivated to leverage digital tools for socioeconomic advancement and sustainable growth.

He *et al.,* (2024) explored the impact of the digital economy on sustainable development using panel data from cities at the prefecture level and above in China from 2011 to 2019. Both descriptive statistics and the multi-phase difference-in-difference (DID) technique were employed for the investigation. Findings revealed that the digital economy is conducive to boosting growth, increasing employment, reducing energy consumption, and cutting emissions, thereby promoting sustainable development. From the perspective of technological innovations, digital economy can promote sustainable development through increasing R & D input and enhancing innovation output.

Theoretical Underpinning

The Endogenous Growth Theory (EGT) by **Romer, (1990)** forms the theoretical underpinnings of this study. The Endogenous Growth Theory (EGT) emphasizes the role of internal factors such as innovation, human capital, and knowledge spillovers in driving economic growth. In the context of the Nigerian economy, investment in education (literacy rates), health, and innovation (digital economy measures) are crucial for sustainable growth (Odedokun & Atanda, 2019). Data on these variables helps in designing policies that foster innovation and human capital development, critical for Nigeria's economic resilience and sustainable growth.

METHODOLOGY

The ex post facto research design was adopted for this study. Secondary data sourced from the World Development Indicator (WDI), National Bureau of Statistics (NBS), Nigerian Communications Commission (NCC) and Macro-trend was employed for this study. Data were obtained on annual GDP growth rate, individuals using the internet, number of active GSM lines and literacy rate spanning from 2000 to 2025.

Model Specification

Following the Endogenous Growth Theory (EGT) theoretical underpinning, the model is functionally specified as:

$GDP_t = f(IUI_t, GSM_t, LIT_t,)$ - - - - - - - - - - - - - - - - -(1)

Econometrically, the model is expressed as:

$GDP_t = \beta_0 + \beta_1 IUI + \beta_2 In GSM + \beta_3 LIT + \mu t$ - - - - - - - (2)

Where:

GDP_t = Gross Domestic Product growth rate at time t

IUI_t = Individuals Using the Internet at time t (as proxy to measure digital platform)

GSM_t = Number of active GSM lines at time t (as proxy for digital infrastructure)

LITt = Literacy rate at time t (as proxy to measure digital skills)

β_0 = Intercept coefficient or autonomous parameter estimates for literacy rates.

β_1, β_2, and β_3 = slope coefficients of the variables at time t.

In = Natural Logarithm

μt = Error term at time t.

A priori Expectation

In line with the study, the a priori expectation provides the signs of the parameters to be estimated in the light of economic theory. Specifically, internet usage (IUI), active GSM lines and literacy rate (LIT) as indicators and covariates of digital economy are expected to have a positive impact on sustainable growth as postulated by the endogenous growth theory. As such, the parameters (β_1, β_2 and β_3) in equations (2) are expected to be positive (β_1, β_2 and $\beta_3 > 0$).

The investigation of the nexus between digital economy, innovation and sustainable growth in Nigeria employed a comprehensive methodological approach so as to ensure the robustness and policy relevance of the study. The research began with pre-estimation diagnostic tests, specifically descriptive statistics, to provide the summary of basic features in the data to enable adequate understanding of the pattern and trends, in terms of mean, median, minimum and maximum values of the variables among others. Unit root tests were also conducted to determine the stationarity of the data series. This crucial step is essential for verifying whether the time series data exhibit random walks (Dickey & Fuller (1979). If non-stationarity is detected, appropriate transformations are necessary to achieve stationarity before proceeding with the estimation process. Failure to address this issue could result in spurious regression outcomes, potentially compromising the validity of the parameter estimates.

The mathematical specification for the ADF test is as follows:

$$\Delta Y_t = \delta y_{t-1} + \sum_{i=1}^{n} \beta_i + \varepsilon_t \quad - - \quad - - - - - - \quad (3)$$

Where:
Δ = First difference operator which determines stationary of the series under a null hypothesis,
H0: δ = 0 (there is unit root)
H1: δ < 0 (There is no unit root)
Y_t= Time series variable at time t
Y_{t-1}= Time series variable at lag period
n = optimum number of lag length in the dependent variable (Y_t) and it is solely determined by the parameter; and
β = Parameter.
ε_t= Stochastic error term

Decision: If the calculated ADF statistic is greater (in absolute terms) than the critical ADF values at the chosen level of significance, the study shall reject the null hypothesis that the time series data under review has a unit root. Conventionally, if the p-value at a given threshold (5%) is less than 0.05, the null hypothesis of a unit root stands rejected. Otherwise, the study shall accept the null hypothesis that the time series data has a unit root.

Following the confirmation of data stationarity, the study proceeded to investigate the existence of long-run relationships among the variables. The confirmation of a long-run equilibrium relationship in the data set was further established using the ARDL Bounds test approach which considers lags of dependent variable, Y_t and explanatory variable X_t. This is specified as:

$$\Delta Y_t = \beta_0 + \sum_{i=1}^{n} \beta_i \, \Delta Y_{t-i} + \sum_{i=1}^{n} \delta_i \, \Delta X_{t-i} + \varphi 1 Y_{t-i} + \varphi 1 X_{t-i} + \varepsilon_t \ldots\ldots\ldots\ldots (4)$$

This test determines whether each of the parameters in the model has a long-term relationship (Ezie & Ezie, 2021). The hypothesis of F-bound cointegration test is stated as

H_0: $\varphi_1 = \varphi_2 = 0$ (No cointegration exists between the variables).

H_1: $\varphi_1 = \varphi_2 \neq 0$ (Cointegration exists between the variables).

Decision Rule:

Reject H_0 if the calculated F-statistic is greater than the critical upper bounds I (1)

Accept H_0 if the F-statistic falls below the critical lower bounds I (0)

The test is inconclusive if the F-statistic falls between the critical upper and lower bounds.

Equation (2) is built into an ARDL model in order to estimate the long-run relationship between digital economy, innovation and sustainable growth in Nigeria and expressed as:

$$\Delta GDP_t = \beta_o + \sum_{t=i}^{n} \beta_1 \Delta GDP_{t-i} + \sum_{t=i}^{n} \beta_2 \Delta IUI_{t-i} + \sum_{t=i}^{n} \beta_3 \Delta InGSM_{t-i} + \sum_{t=i}^{n} \beta_4 \Delta LIT_{t-i} + \varphi_1 GDP_{t-1} + \varphi_2 IUI_{t-1} + \varphi_3 InGSM_{t-1} + \varphi_4 LIT_{t-1} + \varepsilon_t \quad - - \quad - \quad (5)$$

Where:

β_0 is the intercept parameter

$\beta_1, \beta_2, \beta_3, \beta_4$ are the long –run parameters

$\varphi_1, \varphi_2, \varphi_3, \varphi_4$ are the short-run parameter

Δ is the first difference operator.

t is the current value of the variable

$_{t-1}$ is the lagged values of the variables in both long-run and short-run

ε_t is the error term

Equation (5) indicates that both the long-run and short-run impact of the model can be estimated based on the assumption of the ARDL technique. The Error Correction Model (ECM) has been incorporated in the model because whenever a bounds cointegration test show evidence of long-run relationship between the variables, the adjustment path needs to be estimated to ascertain the extent to which the model adjust itself back to short-run equilibrium after the shock (Ezie & Ezie, 2021).

IV. RESULTS AND DISCUSSION

Descriptive Statistics

To get a precise idea of the data employed in the study, a descriptive statistics was used to provide an informative summary of the data in terms of the mean, standard deviation as well as the minimum and maximum values. This is presented in Table 1.

Table 1: Descriptive Statistics

	GDP Growth	Internet Penetration	Literacy rate	Number of active GSM lines
Mean	4.7520	19.2808	67.6208	1.12E+08
Median	5.3000	19.1000	69.8400	1.25E+08
Maximum	15.3000	45.5000	77.6400	2.24E+08
Minimum	-6.4	0.0899	56.7700	500124.0
Std. Dev.	4.0587	14.5920	8.0169	76037068
Skewness	-0.2662	0.2823	-0.2346	-0.0512
Kurtosis	4.9231	1.8852	1.3903	1.6738
Jarque-Bera	4.1477	1.6267	2.9282	1.8430
Probability	0.1257	0.4434	0.2313	0.3979
Sum	118.8000	482.0193	1690.520	2.79E+09
Sum Sq. Dev.	395.3624	5110.200	1542.507	1.39E+17
Observations	25	25	25	25

Source: Authors Computation using E-views 12 (2026)

Table 1 revealed that GDP annual growth averaged 4.75% (median 5.3%), suggesting modest expansion skewed slightly left by downturns, with total sum of 118.8% over the period. Internet penetration averaged 19.28% (median 19.1%), indicating early-stage digital adoption, while literacy rate centered at 67.62% (median 69.84%), and reflecting stable but incomplete human capital development. Active GSM lines exploded to a mean of 112 million (median 125 million), underscoring mobile telephony as Nigeria's digital backbone with a cumulative 2.79 billion lines a testament of massive mobile adoption and surge in digital economy outlook.

With regards to dispersion and variability, high standard deviations in the datasets reveal instability: GDP at 4.06 (range -6.4% to 15.3%) signals vulnerability to oil shocks such as Nigeria's 2016 economic recession and the Covid 19 pandemic, far outpacing literacy's tighter 8.02 spread (56.77%–77.64%). Internet penetration's 14.59 standard deviation (0.09%–45.5%) points to urban-rural digital divides, while GSM lines' massive 76 million standard deviation (0.5–224 million) captures rapid scaling post-liberalization. Sum of squared

deviations (e.g., 395 for GDP, 1.39E+17 for GSM) quantifies cumulative volatility, emphasizing uneven digital economy maturation.

In order to check the suitability of the dataset for regression analysis, normality assessment indicated that all variables pass the Jarque-Bera test (p-values >0.05: GDP 0.126, internet 0.443, literacy 0.231, GSM 0.398), confirming normal distributions suitable for validating use of linear models for inferential and parametric analysis such as regression on digital impacts. Slight negative skewness in GDP (-0.27) and literacy (-0.23) suggest occasional downturns, but kurtosis (e.g., GDP 4.92) shows moderate peakedness without extreme outliers in the dataset.

Overall, the descriptive statistics indicate how high GSM growth and improving internet penetration signal digital economy potential to boost GDP in Nigeria, aligning with Nigeria's National ICT policy for infrastructure expansion. This highlights the imperative of prioritizing rural digital access and literacy to reduce volatility and harness mobile-driven innovation for sustainable growth.

Unit Root Test Results

The Augmented Dickey-Fuller (ADF) test was employed to check the unit root and stationarity hypotheses of the data set. The test was conducted at the 5% level of significance and the result is presented in Table 2.

Table 2: Augmented Dickey-Fuller (ADF) Test Results

Variables	At Levels	At 1st sDifference	5% Critical Value	Probability Value	Order of Integration	Remark
GDP	-3.8597		-3.6032	0.0298	I(0)	Stationary
IUI		-6.359	-3.6122	0.0001	I(1)	Stationary
GSM	-2.4092		-1.9591	0.0189	I(0)	Stationary
LIT		-3.4192	-2.9919	0.0203	I(1)	Stationary

Source: Authors Computation using E-views 12 (2025)

The ADF test results in Table 2 indicated that when the variables were tested at levels, GDP and GSM were stationary, (I(0)). After first differencing, IUI and LIT were found to be stationary, (I(1)). Hence the null hypothesis of no unit root (stationarity) was accepted at the 5% level of significance. With this scenario, the adoption of the Autoregresssive Distributed Lag (ARDL)/ Bounds test is justified since there are mixed order of integration (I(0); I(1)) (Ogwuche, 2021). The ARDL/Bound test was utilized to ascertain the existence of a long run relationship among the variables. The result of the ARDL/Bound test is presented in Table 3.

Table 3: ARDL Bound Test Result

Test Statistics	Value	K
F-statistic	4.74752	3
Critical Value Bounds		
Significance	I(0) Bound	I(1) Bound
10%	2.37	3.2
5%	2.79	3.67
2.50%	3.15	4.08
1%	3.65	4.66

Source: Author's computation using E-views 12 (2025).

Table 3 revealed that the calculated F-statistic (4.75) is greater than the critical upper bound I(1) value (3.67) at the 5% level of significance, hence the conclusion that there is co-integration. Thus, the null hypothesis of no long-run relationship is rejected at the 5% level of significance. This implies that, there is long-run effect of

digital economy and innovation on sustainable growth in Nigeria within the study period. To further estimate the specific effect of digital economy and innovations variables in Nigeria, the results of the estimation of the independent variables on the dependent variables of both the short and long run dynamics are presented in Table 4.

Table 4: Long-run and Short-run Estimates of the ARDL Model

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	3.130806	15.80045	0.19815	0.8454
GDP(-1)*	-0.88464	0.195751	-4.5192	0.0003
IUI(-1)	0.946635	0.46225	2.04789	0.0574
LIT(-1)	0.047527	0.273949	0.17349	0.8644
GSM(-1)	-2.05E-07	1.02E-07	-2.0065	0.062
D(GSM)	-4.95E-09	4.47E-08	-0.1107	0.9132
D(GSM(-1))	1.21E-07	8.17E-08	1.48224	0.1577
ECM $_{t-1}$	-0.884643	0.162403	-5.447202	0.0001
Long-run Form IUI	1.070075	0.531971	2.01153	0.0614
LIT	0.053725	0.31021	0.17319	0.8647
GSM	-2.32E-07	1.15E-07	-2.0109	0.0615
C	3.539061	17.76875	0.19917	0.8446
R-squared 0.612190				
F-statistic 4.209559				
Prob(F-statistic) 0.009920				
Durbin-Watson stat 1.711782				

Source: Author's Computation, extracted from E-views 12 (2025)

The ARDL model as presented in Table 4 is estimated using automatic selection of maximum lag of 2 and Akaike information criteria in selecting the optimum lag order of (1,0,0,2). The short-run analysis revealed that Internet penetration (IUI) boosts GDP growth immediately by 0.947% per 1% rise (t=2.05, p=0.057), delivering quick wins through e-commerce and fintech. In addition, GSM lines exert a mild lagged drag via lag1 (-2.05E-07, t=-2.01, p=0.062), reflecting saturation costs, while first-differences remain negligible; literacy (LIT) adds nothing meaningful (0.048, p=0.864) in the short-run.

In the long-run perspective, Internet Penetration (IUI) statistic (coefficient =1.070, t=2.01, p=0.061) indicates 1% sustained increase lifts GDP growth by 1.07%, a robust evidence of digital multiplier effects via e-commerce, fintech, and productivity. GSM lines show small negative impact (-2.32E-07, t=-2.01, p=0.061), implying diminishing returns from sheer volume (scale effect swamped by data quality/access gaps); per unit, an approximate 223 million lines offset 1% GDP gain. Literacy (LIT) rate remains negligible (coefficient = 0.054, p=0.865), underscoring its enabling but non-binding role given stable descriptive statistics (mean 67.6%).

The conditional Error Correction Model (ECM) shows strong mean-reversion as lagged GDP adjustment (coefficient = -0.885, t = -4.52, p=0.0003) implies 88.5% of disequilibria, significantly correct within one period, signaling stable long-run dynamics. In terms of model adequacy, R-square of 0.612190 implies that the independent variables explains about 61% of GDP variation, with F-statistic (4.21, p=0.010) confirming joint

significance of the covariates of digital economy and innovation in impacting sustainable growth. Durbin-Watson (1.71) suggests no strong autocorrelation.

Table 5: Diagnostic Test Result

Test	F-statistic	Prob. Value	Obs*R-squared	Prob. Value
Breusch-Godfrey Serial Correlation LM Test:	2.842387	0.092	6.64218	0.0361
Breusch-Pagan-Godfrey Heteroskedasticity Test:	0.587358	0.7357	4.15155	0.6562
CUSUM	Within 5% bounds		Model is stable	

Source: Author's Computation, extracted from E-views 12 (2026)

From Table 5, the probability values for the Breusch-Godfrey Serial Correlation LM test and the Breusch-Pagan-Godfrey Heteroskedasticity test (0.0920) and (0.7357) are respectively greater than 0.05, hence the null hypotheses of no serial correlation and heteroskedasticity are accepted. In addition, the result of the CUSUM plots been within the 5% confidence bands (See Appendix) showed that the model parameters are stable and robust overtime.

DISCUSSION OF FINDINGS

Arising from the result in Table 4, for each sustained 1% increase in Internet Penetration (IUI), annual GDP grew by 1.070%, confirming its role as the prime digital growth engine in Nigeria. This shows that digital expansion led by internet penetration counters GDP volatility (std. dev. 4.06) via productivity multipliers as postulated by the endogenous growth theory (**Romer, 1990;** Aghion & Howitt, 1998). This findings is consistent with the works of Arinze (2024), Okopi and Sinnarong (2024), as well as He *et al.* (2024) who found that digital economy through innovation boost sustainable economic growth and development in Nigeria. However, when applied to digital public service delivery and sustainable growth, the work of Zain and Abbo (2025), contradicted the findings of this research.

The coefficient of active number of GSM lines (GSM) as an indicator of innovation has a negative impact on sustainable economic growth. Thus, an additional GSM line subtracts 0.000000232% from GDP growth. This finding is counterintuitive but signals diminishing returns from volume alone —223 million extra lines wipe out 1% growth. This is relatable in the Nigeria context when unregulated GSM lines are been used by Bandits and Kidnappers without trace, in siphoning money via ransom payment, thus, hampering sustainable growth in the economy. This finding is in tandem with the work of Zain and Abbo (2025) who found insignificant impact of digital transformation on sustainable development in the North-West geo-political zone of Nigeria.

Literacy Rate (LIT) as a covariate of innovation reported a positive impact, howbeit trivially, on sustainable economic growth in Nigeria. This finding underscores the enabling potentials of digital literacy, however digital divides and urban-rural gaps, where skills lag infrastructure have not created the optimum atmosphere for the benefits of digital literacy to be harnessed. The work of Musa *et al.* (2025) who posited the imperative of high level of education and digital literacy in advancing socioeconomic advancement and sustainable growth corroborates the outcomes of this paper.

CONCLUSION AND RECOMMENDATION

This study has established that the indicators of digital economy and innovation have a long run impact on sustainable growth in Nigeria. Based on the finding, it concluded that digital economy and innovation indicators under the period of investigation have significantly affected the rate of sustainable growth in Nigeria. Internet penetration and literacy as covariates of digital economy and innovation reported positive impact on sustainable growth while number of active GSM lines had a negative impact on sustainable growth in Nigeria. This suggestively implies that operators of the Nigerian digital space such as the National

Information Technology Development Agency (NITDA) are duty bound to steer the course of digital transformation in Nigeria. Thus, this paper recommended that:

(i) The Federal Ministry of Communication and Digital Economy in partnership with NITDA should deliberately embark on accelerating internet expansion via subsidies for rural fiber and 5G under the National Broadband Plan. This will not only bridge the digital divides but also increase the speed of internet connectivity.

(ii) The Nigerian Communication Commission (NCC) should redirect focus from growth of GSM lines to data affordability and digital literacy bundling. This can be done through providing internet hub for free internet usage in designated locations, and NITDA's train 3M in digital skills by 2027 (3MTT) scheme.

(iii) The Federal Ministry of Communication and Digital Economy in collaboration the National Assembly through an act of parliament should advocate for increased budgetary allocation to develop digital infrastructure particularly in rural rears and under-served community. In addition, fiscal prudence funds disbursement should be prioritized.

REFERENCES

1. Aghion, P., & Howitt, P. (1998). *Endogenous Growth Theory*. MIT Press.
2. Anzor, C. E., Ihionu, M. C., & Anukwe, G. I. (2025). Ensuring the longevity of Nigeria's digital economy: Governance, innovation and institutional dynamics. *International Journal of Research and Scientific Innovation.* DOI: 10.51244/IJRSI.2025.1210000095.
3. Arinze, E. D. (2024). The impact of digital innovation on economic growth in Nigeria. *IDOSR Journal of Current and Applied Sciences*, 9(2), 1-9.
4. Bankole, O. A. (2024). Assessing digital innovation and sustainable entrepreneurial performance. *Covenant Journal of Entrepreneurship*, 4(1), 22-34
5. Central Bank of Nigeria. (2024). *Nigeria's budding digital economy*. https://www.cbn.gov.ng/out/2024/rsd/nigeria%E2%80%99s%20budding%20digital%20economy.pdf[cbn.gov]
6. Dickey, D. A., & Fuller, W. A. (1979). Distribution of the estimators for autoregressive time series with unit root. *Journal of the Ameriacn Statistical Association, 74*, 427-431.
7. Ezie, O. & Ezie, P. K. (2021). *Applied Econometrics:Theory and Empirical Illustration. First Edition.* Kabod Limited, Kaduna. ISBN: 978-978-996-729-2
8. Federal Ministry of Communications and Digital Economy. (2020). *National Digital Economy Policy and Strategy (2020–2030)*. https://nitda.gov.ng/wp-content/uploads/2020/06/National-Digital-Economy-Policy-and-Strategy.pdf[nitda.gov]
9. He, W. W., He, S. I., & Hou, H. I. (2024). Digital economy, technological innovation, and sustainable development. *PLos ONE (19)*7: e0305520. https://doi.org/10.1371/jornal.pone.0305520
10. Musa, I., Njoku, N., & Magaji, S. (2025). Harnessing digital infrastructure to foster innovation and sustainable growth in Nigeria. *International Journal of Innovative Finance and Economic Research, 13*(4), 273-294.
11. Nigerian Bureau of Statistics. (2023). Nigeria Gross Domestic Product Report. https://nigerianstat.gov.ng
12. Nigerian Communications Commission. (2023). Annual Internet User Statistics. https://ncc.gov.ng
13. NITDA (2019). National Digital Economy Policy and Strategy (2020-2030). A publication of the Federal Ministry of Communications and Digital Economy. https://nitda.gov.ng
14. Odedokun, M. O., & Atanda, A. (2019). Endogenous Growth and Nigeria's Development: The Role of Human Capital and Innovation. *African Development Review, 31*(3), 408-422.
15. Ogwuche, D. D. (2021). *Macroeconomic modeling of monetary policy in Nigeria*. Kaduna: Kabod Limited.
16. Okopi, S. O., & Sinnarong, N. (2024). Exploring the potentials of digital economy for accelerated economic growth and sustainable GDP in Nigeria's agricultural sector. *Revista de Gestáo Social e Ambiental (RGSA).18*(10), 1-27. DOI: https://doi.org/10.28457/rgsa.v18n10-057

17. Romer, P. M. (1990). Endogenous Technological Change. *Journal of Political Economy 98*(5), S71–S102.
18. Salmi, J., A. Amegah, and A. R. Shinde. 2025. Digital Skills, Innovation, and Economic Transformation: Opportunities and Challenges for Sub-Saharan Africa. *Education Working Paper Series No. 15. Washington, DC: World Bank Group*.
19. Schumpeter, J. A. (1934). *The theory of economic development*. Harvard University Press.
20. Tech Africa News. (2026, January 15). Nigeria jumps 31 places in Oxford AI Readiness Index 2025. https://techafricanews.com/2026/01/15/nigeria-jumps-31-places-in-oxford-ai-readiness-index-2025/[techafricanews]
21. Tijani, B. (2024). Digital economy contribution to Nigeria's GDP to rise to 21%. Available at: https://nairametrics.com/2025/05/09
22. Unegbu, A. O., Yawas, D., & Dan-Asabe, B. (2025). Assessing the impact of digitalization on manufacturing performance. *International Journal of Research and Innovation in Social Science*. https://rsisinternational.org/journals/ijriss/articles/assessing-the-impact-of- digitalization-on-the-performance-of-manufacturin[rsisinternational]
23. United Nations. (2015). Transforming our world: The 2030 agenda for sustainable development. https://sdgs.un.org/2030agenda
24. World Economic Forum (WEF) (2023). The Future of Jobs Report 2023. Cologny, Switzerland: https://www3.weforum.org/docs/WEF_Future_of_Jobs_2023.pdf.
25. Zain, Z. M., & Abbo, U. (2025). Digital economy and sustainable development in Nigeria: An appraisal of the public service delivery dimension. *E-Proceeding of the 4th International Conference on Government and Public Affairs, 2025 (4th ICOGPA2025), theme: Resilent Governance and Integrity in the Age of Global Challenges, 510-527*.