Kashere Journal of Management Sciences, Volume 9, Issue 1, March, 2026
ISSN 2636-5421 pp 101-115

TAX POLICY AND THE GROWTH OF NIGERIA'S DIGITAL ECONOMY: A PANEL DATA ANALYSIS OF ICT AND REVENUE LINKAGES

RUTH ANYALEWA HARUNA, PhD
Department of Accountancy
Kogi State Polytechnic, Lokoja
ranyalewa@yahoo.com

YEMISI JOSEPH, PhD
Department of Accountancy
Kogi State Polytechnic, Lokoja
yemisijoseph@yahoo.com

EMMANUEL TEMITOPE ADEDOYIN, PhD
Department of Accountancy
Kogi State Polytechnic, Lokoja
doyintemi70@yahoo.com

PETERS ADE SANNI
Department of Accountancy
Kogi State Polytechnic, Lokoja
sannipeters@gmail.com

ABSTRACT
Tax revenue in Nigeria reflects the growing digital economy and the impact of recent ICT-focused tax reforms amid persistent administrative and legal challenges. This study examines the influence of Information and Communication Technology (ICT) indicators and recent digital tax reforms on tax revenue mobilization in Nigeria from 2010 to 2023. Using panel data from four purposively selected states, the analysis employs fixed-effects regression models to account for within-state variations and unobserved heterogeneity, with robust standard errors clustered at the state level. Results indicate that mobile subscriptions positively and significantly affect tax revenue, while internet penetration shows a small negative effect and broadband usage is not statistically significant. The interaction of ICT indicators with digital tax reforms, including digital service taxation and Significant Economic Presence (SEP) rules, reveals that internet and broadband usage enhance revenue, whereas mobile subscriptions show a negative effect. Joint significance tests confirm that both ICT indicators and reform interactions collectively influence tax revenue. The findings highlight the need for integrated ICT and digital taxation strategies to optimize revenue mobilization in Nigeria. The study concludes that integrating ICT development with digital tax reforms is key to enhancing tax revenue in Nigeria. It was recommended that the government combine ICT development with digital tax reforms to boost revenue from Nigeria's digital economy.

Keywords: Tax Policy, Digital Economy, ICT, Revenue Generation, Panel Data Analysis

INTRODUCTION

Nigeria's digital economy has seen exponential growth over recent years, underpinned by expanding internet access, mobile penetration, and fintech innovation. In 2023, the ICT sector directly accounted for 16.66% of Nigeria's real GDP in Q4, up from 16.22% the previous year. GSMA estimates that the broader mobile-sector contribution including indirect productivity effects reached 13.5% of GDP (₦33 trillion) and generated around ₦2.4 trillion in tax revenue in 2023.The Minister of Communications projected growth to 21% of GDP by 2028**,** highlighting the government's commitment to digital expansion.

Despite its growing economic footprint, Nigeria's tax base has struggled to keep pace with digital transformation. Studies by Oto and Wayas (2024) emphasize the potential of digital taxation to broaden Nigeria's revenue base but note that administrative and compliance challenges remain unresolved. Similarly, Mustapha et al. (2024) analyze the implementation of Significant Economic Presence (SEP) provisions introduced in the Finance Act 2020, advocating for a shift from profit-based to revenue-based nexus rules to tap digital transactions from non-resident firms. Meanwhile, Maccarthy and Nnah (2024) provide a systematic review arguing for stronger legal frameworks, public education, and engagement with global tax actors like the OECD to ensure effective digital taxation in Nigeria.

Policy reforms are underway: the Finance Act 2020 introduced a 6% VAT on intangible digital services and SEP rules, while comprehensive reforms under the Tax Reform 2025 package aim to streamline taxation by consolidating multiple levies into a unified 4% Development Levy, simplifying CIT allowances, and adjusting sector-specific levies for ICT firms. Nevertheless, key challenges persist. Nigeria's tax administration remains legacy-heavy, and physical presence assumptions limit its ability to tax digital actors effectively. Legal ambiguities, capacity gaps, and limited digital compliance infrastructure contribute to substantial revenue leakages as observed by Anushiem and Chukwuma (2024) in their critique of the Finance Act's impact on digital service taxation.

Given these dynamics, this study addresses the following research questions: To what extent does ICT/digital economy growth translate into increased government revenue? How well do recent tax policies like SEP and Development Levy capture value from digital economic activity? By combining empirical panel data analysis with policy context, the paper aims to provide robust evidence on ICT-revenue linkages and inform tax policy reform.

Despite the rapid expansion of Nigeria's digital economy, tax revenue has failed to keep pace due to structural and policy limitations. The continued reliance on physical presence-based tax rules makes it difficult to capture

value generated by digital and non-resident firms operating without a tangible presence in the country. Although reforms such as the Finance Acts and the Significant Economic Presence (SEP) framework have been introduced, their effectiveness is constrained by weak enforcement, administrative inefficiencies, limited technological capacity, and low compliance among digital businesses, many of which operate informally. Legal ambiguities, unclear definitions of taxable digital activities, and overlapping tax provisions further hinder effective implementation and enforcement. In addition, inadequate data systems, poor inter-agency coordination, and weak international collaboration limit the ability to track and tax cross-border digital transactions. These challenges, combined with Nigeria's low tax-to-GDP ratio, narrow tax base, and institutional weaknesses, have widened the gap between digital economic growth and revenue generation, highlighting the need for comprehensive reforms focused on administrative efficiency, legal clarity, and digital innovation.

This study aims to examine the impact of tax policy on the growth of Nigeria's digital economy and analyze the relationship between ICT development and government revenue generation across different states and sectors. Specifically, the study seeks:

i. To evaluate the extent to which ICT indicators (such as internet penetration, mobile subscriptions, and broadband usage) influence tax revenue generation in Nigeria from 2010 to 2023.
ii. To assess the effectiveness of recent tax reforms particularly digital service taxation and Significant Economic Presence (SEP) rules in enhancing revenue mobilization from the digital economy.

In line with the objectives of this study, and to empirically investigate the nature and strength of the relationship between ICT development and tax revenue in Nigeria, the following research hypotheses are proposed. These hypotheses will be tested using panel data analysis techniques across selected states and sectors from 2010 to 2023:

H_{01}: ICT indicators such as internet penetration, mobile subscriptions, and broadband usage have no significant effect on tax revenue generation in Nigeria.

H_{02}: Recent tax reforms targeting the digital economy, including digital service taxation and Significant Economic Presence (SEP) rules, have no significant impact on government revenue mobilization.

The hypotheses are essential for examining whether ICT growth and recent digital tax reforms significantly impact tax revenue in Nigeria. Their validation provides evidence to guide policy decisions aimed at improving tax efficiency in the digital economy.

LITERATURE REVIEW

Tax policy refers to the legislative and regulatory frameworks through which governments levy and administer taxes. In Nigeria, major reforms including the Finance Act 2020and2023 amendments introducing VAT on digital services and Significant Economic Presence (SEP) rules were instituted to address taxation of digital economic activities (Oto & Wayas, 2024). These changes aim to broaden the tax base by capturing revenue from non-resident digital service providers, though administrative and enforcement challenges limit their full impact.

The digital economy encompasses economic activities enabled by digital technology such as internet use, mobile communications, e-commerce, and fintech. In Nigeria, the ICT sector has contributed over 10% consistently to GDP (over 12% in 2022) and accounted for roughly 13.5% of GDP in 2023, generating around ₦33 trillion and contributing ₦2.4 trillion in tax revenue. These indicators internet penetration, mobile subscriptions, and broadband usage serve as proxies for the maturity and reach of digital infrastructure (Agbeyangi et al., 2024). Government revenue in Nigeria is largely derived from oil, company income tax, VAT, and customs duties. With rising volatility in oil income, digital taxation emerges as a critical lever for sustainable revenue. Studies show that digital technologies have a significant positive impact on revenue derived from corporate income tax (CIT) and capital gains tax (CGT) (Nwolu et al., 2023). Additionally, tax reforms combined with digitalization have been observed to boost federal revenue in both short and long terms, although they may adversely affect state revenue streams (Ajetunmobi, 2022).

The relationship between ICT growth and government revenue is mediated by the design and enforcement of tax policy. As digital infrastructure and usage expand, potential for tax income increases provided that tax frameworks are responsive to cross-border digital service models and capable of enforcement. Existing research emphasizes that digital taxation policies, when properly implemented, can significantly broaden Nigeria's tax base (Oto & Wayas, 2024; Maccarthy & Nnah, 2024). However, limitations remain due to administrative capacity, legal ambiguity, and fragmentation across tiers of government.

Theoretical Review

This study is underpinned by Ability-to-Pay Theory of Taxation, which was developed primarily by economists such as Adam Smith (1776) and later advanced by scholars like Pigou (1920) and Musgrave (1959**)**, posits that taxes should be levied according to an individual's or entity's capacity to bear the tax burden. In this framework, those who earn more or generate higher economic value should contribute proportionately more to public revenue. The

theory emphasizes equity and fairness in taxation and serves as a guiding principle for progressive tax systems.

The Ability-to-Pay Theory is particularly relevant to this study because the digital economy has introduced new forms of income, wealth, and value creation, much of which currently escapes traditional tax nets. Digital firms, particularly multinational platforms, generate significant revenue from users in Nigeria without a physical presence, thereby challenging the traditional basis for tax jurisdiction and fairness. This disconnect raises concerns about equitable taxation and tax justice, especially when domestic businesses remain fully taxed while foreign digital firms benefit from value extraction without proportional contributions to tax revenue (Mustapha et al., 2024; Oto & Wayas, 2024).

By applying the Ability-to-Pay Theory, the study underscores the need for tax reforms that align digital economic activities with their true taxable capacity. It provides a normative foundation for analyzing the effectiveness of Nigeria's tax policies such as the SEP rules and VAT on digital services in capturing revenue from those with the ability to pay in the digital space. In doing so, the study contributes to discussions on how to design fair, efficient, and modern tax systems in developing economies amid rapid digitalization.

ICT indicators operationalise the Ability-to-Pay Theory by serving as proxies for economic participation and taxable capacity in the digital economy. Higher mobile subscriptions, internet penetration, broadband access, and e-commerce activity reflect increased access to digital financial services, income opportunities, and consumption activities. In particular, higher mobile penetration suggests greater engagement in digital transactions and financial inclusion, which expands observable economic activity and tax potential. Overall, ICT indicators do not measure income directly but capture increased digital activity that reveals and broadens taxable capacity.

Empirical Review

Agbeyangi, Salami, and Tijani (2025) examined the impact of internet penetration, mobile phone subscriptions, and digital literacy on government tax revenue in 20 Nigerian states from 2010 to 2022. Using fixed effects and system GMM estimation techniques, the study found a statistically significant positive relationship between ICT indicators and total tax revenue. Specifically, a 1% increase in broadband usage was associated with a 0.42% increase in state-level tax collections. The study attributed this to improved e-tax systems, online business registrations, and digital financial inclusion. It recommended stronger ICT investments and harmonization of digital tax collection processes between federal and state tax authorities to maximize revenue benefits.

Ogunlana and Bello (2025) analyzed the effectiveness of digital service taxation under Nigeria's Finance Act 2020. Focusing on the Federal Inland

Revenue Service (FIRS) database covering the period 2015-2023, they applied a difference-in-differences (DiD) regression model to assess tax revenue trends before and after the introduction of the 6% VAT on digital services. Their findings showed a marked improvement in VAT collections from non-resident digital firms post-reform, although the compliance rate remained low due to enforcement challenges and limited cross-border tax treaties. They concluded that while the VAT policy was directionally effective, broader multilateral cooperation and clearer statutory definitions of digital presence were essential for sustainability.

Garba and Enemuo (2025) examined the fiscal outcomes of SEP rule implementation using synthetic control methods, comparing Nigeria's non-resident tax collection with a counterfactual model based on Kenya's and South Africa's approaches from 2010 to 2023. The study found that Nigeria's SEP rules had only marginal effects in terms of raising revenue, mainly due to enforcement delays and disputes over digital presence thresholds. In contrast, South Africa's simplified turnover-based thresholds showed greater success. They advised Nigeria to restructure its SEP framework around a digital turnover model and engage with the OECD's Inclusive Framework to reduce base erosion and profit shifting (BEPS) by large multinational platforms.

Maccarthy and Nnah (2024) examined digital taxation frameworks in Nigeria, Kenya, and South Africa between 2010 and 2023. Using qualitative content analysis and fiscal performance indicators, they found that Nigeria lagged behind its peers in implementing effective digital tax regimes, primarily due to the absence of a centralized digital tax policy and weak enforcement capacity. The study emphasized the importance of aligning Nigeria's digital tax rules with OECD guidelines and improving inter-agency coordination between the FIRS, NCC, and NITDA. They recommended the introduction of a unified digital tax compliance platform to reduce administrative bottlenecks and enhance data sharing.

Oto and Wayas (2024) evaluated the effectiveness of the Significant Economic Presence (SEP) rules introduced in the Finance Act 2020. Their study, which applied a pre-post intervention time-series analysis covering 2010 to 2023, revealed only a modest increase in tax revenue attributable to SEP rules. They attributed this to definitional ambiguity and enforcement loopholes that allowed major digital service providers to bypass SEP thresholds. Their policy recommendation was for Nigeria to revise the SEP framework by incorporating revenue-based nexus thresholds and to leverage international exchange of information agreements for enforcement.

Anushiem and Chukwuma (2024) conducted a diagnostic analysis of Nigeria's digital tax infrastructure from 2015 to 2023. Using qualitative surveys of FIRS officials and regression analysis on state-level tax performance indicators, they found that while e-tax systems and digital compliance platforms had been

introduced in select states, uptake remained inconsistent due to poor digital literacy among tax administrators and taxpayers alike. Their findings highlighted a gap between policy formulation and implementation. The study recommended sustained investments in digital tax capacity building, legal reforms to clarify digital tax obligations, and public awareness campaigns to drive voluntary compliance.

In a broader regional comparison, Okonkwo and Adeyemi (2024) conducted a panel study on the effectiveness of digital taxation frameworks across five West African countries including Nigeria, Ghana, and Côte d'Ivoire over the period 2010-2022. Utilizing panel generalized least squares (GLS) estimation, the researchers found that countries with more robust digital tax reporting systems particularly those with mandatory digital identification and transaction monitoring achieved higher tax-to-GDP ratios in the digital services sector. Nigeria, despite its large digital economy, showed relatively lower performance due to inconsistent enforcement of SEP rules and VAT registration challenges. Their recommendation was for Nigeria to adopt a centralized digital ID system linked to tax records and expand audit capacity for the digital sector.

Adewale and Mordi (2023) took a different approach by conducting a survey-based empirical study on digital tax compliance in Nigeria. The study sampled 500 digital entrepreneurs, e-commerce vendors, and IT professionals across six geopolitical zones to assess awareness and response to digital tax regulations. Logistic regression analysis revealed that while over 70% of respondents were aware of VAT on digital services, less than 40% had registered or complied with tax filing requirements. The main reasons cited were lack of clarity in tax rules, poor internet infrastructure in some areas, and distrust in government platforms. Adewale and Mordi recommended that the Federal Inland Revenue Service (FIRS) simplify digital tax registration processes and launch targeted public education campaigns to improve voluntary compliance.

Nwolu, Ezema, and Ajetunmobi (2023) which used panel data from 2011 to 2021 to examine how mobile banking and fintech penetration influence corporate income tax (CIT) and capital gains tax (CGT) revenues in Nigeria's financial sector. Employing panel ARDL and pooled mean group estimations, they observed that mobile transaction volumes and fintech user adoption were strongly correlated with long-run increases in CIT revenue, though short-run volatility was significant due to regulatory uncertainties. Their recommendation focused on enhancing tax registration processes for digital startups and providing tax incentives for fintechs that adopt transparent reporting mechanisms.

The empirical literature shows four main themes. First, studies such as Agbeyangi, Salami, and Tijani (2025) and Nwolu, Ezema, and Ajetunmobi

(2023) find that ICT development (internet penetration, mobile banking, and fintech) positively influences tax revenue by improving digital transactions and tax administration efficiency. Secondly, research on Nigeria's digital tax reforms, including Ogunlana and Bello (2025)**,** Oto and Wayas (2024), and Garba and Enemuo (2025), shows only modest revenue gains from VAT on digital services and SEP rules due to weak enforcement and design limitations. Also, studies such as Anushiem and Chukwuma (2024) and Adewale and Mordi (2023) highlight institutional challenges, including poor digital infrastructure, low compliance, weak administrative capacity, and implementation gaps. Finally, comparative evidence from Maccarthy and Nnah (2024) and Okonkwo and Adeyemi (2024) shows that Nigeria lags behind countries like Kenya and South Africa due to weaker digital tax systems, poor coordination, and less effective digital identification and monitoring frameworks. Overall, the literature consistently indicates that while ICT has strong potential to enhance tax revenue, its impact in Nigeria is constrained by policy inefficiencies, enforcement challenges, and institutional weaknesses.

Despite the rapid expansion of Nigeria's digital economy and the introduction of recent tax policy reforms such as the Finance Acts and Significant Economic Presence (SEP) rules, there remains a significant gap in empirical evidence linking ICT development to government revenue generation across states and sectors. Most existing studies have focused either on theoretical discussions or on national-level analyses without disaggregating data to assess sectoral and sub-national variations. Moreover, while some studies have evaluated individual tax instruments like VAT or SEP, few have employed panel data methodologies that capture the dynamic interactions between multiple ICT indicators (e.g., internet usage, mobile penetration, and broadband access) and various revenue streams over time. This study addresses this gap by using panel data analysis from 2010 to 2023 to provide a more comprehensive and state-level understanding of how digital infrastructure impacts revenue performance and the effectiveness of Nigeria's digital tax reforms.

METHODOLOGY

This study employs a quantitative panel data approach to examine the relationship between ICT development and tax revenue generation in Nigeria over the period 2010-2023. A purposive sample of Nigerian states was selected based on data availability and the extent of digital economic activity. Data were sourced from the National Bureau of Statistics (NBS), Federal Inland Revenue Service (FIRS), Nigerian Communications Commission (NCC), World Bank, GSMA, and Central Bank of Nigeria (CBN) publications.

The dependent variable is total tax revenue (TAXREV), most especially VAT and CIT because ICT development mainly drives VAT and CIT, moderately affects PIT, and has minimal impact on CED. The main independent variables include internet penetration (INTPEN) after the 2020 Finance Act and digital tax reforms, mobile subscriptions (MOBSUB), broadband access (BROAD), and e-commerce activity (ECOMM). The ICT indicators were chosen because they directly reflect digital access and economic activity relevant to tax revenue, and are reliable and measurable compared to other variables. Control variables consist of GDP per capita (GDPPC), ICT infrastructure investment (INFRA), and a policy dummy capturing digital tax reforms (DIGTAX).

Given the panel structure of the data and the potential for unobserved state-specific heterogeneity, the study primarily applies Fixed Effects (FE) regression models, which control for time-invariant characteristics of each state that could bias estimates. Random Effects (RE) models were also considered, and the Hausman Test was employed to confirm the appropriateness of the FE specification. To ensure robust inference, diagnostic checks for heteroskedasticity, autocorrelation, and multicollinearity were performed, and cluster-robust standard errors were applied at the state level.

Model Specification

The baseline fixed-effects panel regression model is specified as:

$$TAXREV_{it} = \alpha + \beta_1 INTPEN_{it} + \beta_2 MOBSUB_{it} + \beta_3 BROAD_{it} + \beta_4 ECOMM_{it} + \gamma X_{it} + \delta_t + \mu_i + \varepsilon_{it}$$

Where:

i = state

t = year

$TAXREV_{it}$ = tax revenue in state i at time t;

INTPEN, MOBSUB, BROAD, ECOMM = ICT indicators

X_{it} = vector of control variables (GDPPC, INFRA, DIGTAX)

δ_t = time fixed effects capturing year-specific shocks, including policy reforms

μ_i = state-specific fixed effect

ε_{it}= idiosyncratic error term

Interaction Terms for Digital Tax Reforms

To capture the effect of recent digital tax reforms on the relationship between ICT indicators and tax revenue, interaction terms were included:

$$INTPEN_{post_{it}} = INTPEN_{it} \times DIGTAX_{it}$$
$$MOBSUB_{post_{it}} = MOBSUB_{it} \times DIGTAX_{it}$$
$$BROAD\_post_{it} = BROAD_{it} \times DIGTAX_{it}$$

These interaction terms allow the study to assess whether the implementation of digital service taxation and Significant Economic Presence (SEP) rules modifies the effect of ICT infrastructure on tax revenue, thereby providing insight into the conditional effectiveness of digital tax reforms.

The updated FE regression model incorporating interaction terms is expressed as:

$$TAXREV_{it} = \alpha + \beta 1INTPEN_{it} + \beta 2MOBSUB_{it} + \beta_3 BROAD_{it} + \beta_4 ECOMM_{it} + \beta_5 INTPEN\_post_{it} + \beta_6 MOBSUB\_post_{it} + \beta_7 BROAD\_post_{it} + \gamma X_{it} + \delta_t + \mu_i + \varepsilon_{it}$$

This specification enables the study to isolate both the direct effects of ICT indicators and their conditional effects under digital tax reforms, providing a comprehensive understanding of the factors driving tax revenue mobilization in Nigeria's evolving digital economy.

RESULTS AND DISCUSSION

Data Summary

Table 1 presents descriptive statistics of key tax and ICT indicators across four Nigerian states (Abia, Kano, Lagos, and Rivers) for the period under study. The variables include the natural logarithm of tax revenue (Ln-TAXREV), internet penetration (Ln-INTPEN), mobile subscriptions (Ln-MOBSUB), broadband usage (Ln-BROAD), e-commerce activity (Ln-ECOMM), GDP per capita (Ln-GDPPC), and the digital tax indicator (DIGTAX). The table summarizes the mean, standard deviation, minimum, and maximum values for each variable, providing an overview of the distribution and variability of tax and ICT-related factors across the states.

Table 1: Descriptive Statistics of Key Tax and ICT Indicators by State

State	Ln-TAXREV *M (SD)*	Ln-INTPEN *M (SD)*	Ln-MOBSUB *M (SD)*	Ln-BROAD *M (SD)*	Ln-ECOMM *M (SD)*	Ln-GDPPC *M (SD)*	DIGTAX *M (SD)*
Abia	4.27 (.30)	3.36 (.29)	4.12 (.21)	2.37 (.49)	4.48 (.19)	7.36 (.16)	.36 (.50)
Kano	4.33 (.28)	3.33 (.31)	4.08 (.21)	2.12 (.65)	4.44 (.20)	7.38 (.16)	.36 (.50)
Lagos	4.35 (.27)	3.40 (.28)	4.12 (.21)	2.12 (.65)	4.48 (.19)	7.36 (.16)	.36 (.50)
Rivers	4.29 (.29)	3.40 (.28)	4.10 (.21)	2.12 (.65)	4.47 (.19)	7.39 (.16)	.36 (.50)

Note: N = number of observations; M = mean; SD = standard deviation; DIGTAX = digital tax indicator (0 = no, 1 = yes).

Table 1 presents the descriptive statistics of key tax and ICT indicators across four Nigerian states (Abia, Kano, Lagos, and Rivers). The sample comprised 14 observations per state (N = 56). As shown in Table 1, the natural log of tax revenue (ln-TAXREV) ranged from 4.27 (SD = 0.30) in Abia to 4.35 (SD = 0.27) in Lagos, indicating relatively higher average tax revenue in Lagos. Institutional reforms (ln-INTPEN) averaged between 3.33 (SD = 0.31) in Kano and 3.40 (SD = 0.28) in Lagos and Rivers, suggesting comparable levels of institutional reform across states.

Moreover, Mobile subscriptions (ln-MOBSUB) were highest in Abia and Lagos (M ≈ 4.12, SD ≈ 0.21) and slightly lower in Kano (M = 4.08, SD = 0.21) and Rivers (M = 4.10, SD = 0.21), reflecting moderately high mobile penetration across all states. Broadband access (ln-BROAD) showed greater variability in Kano, Lagos, and Rivers (M = 2.12, SD = 0.65) compared to Abia (M = 2.37, SD = 0.49), indicating uneven broadband infrastructure.

Finally, from Table 1, E-commerce activity (ln-ECOMM) was relatively similar across states (M ≈ 4.44-4.48), while GDP per capita (ln-GDPPC) ranged from 7.36 (SD = 0.16) in Abia and Lagos to 7.39 (SD = 0.16) in Rivers. The binary digital tax indicator (DIGTAX) averaged 0.36 (SD = 0.50) across all states, reflecting partial adoption of digital taxation policies.

Influence of ICT Indicators on Tax Revenue Generation in Nigeria

To evaluate the extent to which ICT indicators, including internet penetration (INTPEN), mobile subscriptions (MOBSUB), and broadband usage (BROAD)affect tax revenue generation in Nigeria, a fixed-effects (FE) panel regression model was employed. The fixed-effects approach is appropriate in this context because it accounts for unobserved, time-invariant heterogeneity across states, isolating the within-state variation over time (Josselin, & Le Maux, 2017). This method helps control for omitted variable bias stemming from state-specific characteristics that do not change over the study period, ensuring more reliable estimates of the ICT indicators' effects on tax revenue.

Table 2: Regression Results of ICT Indicators on Tax Revenue

Predictor	B	SE	*t*	*p*	95% CI
INTPEN	-0.022	0.007	-3.27	0.047	[-0.043, -0.001]
Ln-MOBSUB	2.456	0.428	5.75	0.010	[1.096, 3.817]
Ln-BROAD	-0.075	0.051	-1.45	0.242	[-0.239, 0.089]
Constant	-4.941	1.441	-3.43	0.042	[-9.528, -0.354]

Note: N = 56; No. of groups = 4; $F(3, 3) = 3110.90$, $p < 0.001$; $\sigma_u = 0.0441$, $\sigma_e = 0.0108$, $\rho = 0.9435$. Robust standard errors adjusted for clustering at the state level.

The fixed-effects regression results presented in Table 2 indicate that ICT indicators have differential impacts on tax revenue generation in Nigeria between 2010 and 2023. Specifically, internet penetration (INTPEN) was found to have a small but statistically significant negative effect on tax revenue (B = -0.022, SE = 0.007, p = 0.047, 95% CI [-0.043, -0.001]), suggesting that increases in internet access alone may not directly translate to higher tax collection, possibly due to the need for complementary digital infrastructure or enforcement mechanisms.

Conversely, mobile subscriptions (Ln-MOBSUB) exhibited a strong positive and significant association with tax revenue (B = 2.456, SE = 0.428, p = 0.010, 95% CI [1.096, 3.817]), indicating that higher mobile connectivity facilitates revenue mobilization, potentially through enhanced electronic payment

systems and communication channels between tax authorities and taxpayers. Broadband usage (Ln-BROAD), however, did not show a statistically significant effect on tax revenue (B = -0.075, SE = 0.051, p = 0.242, 95% CI [-0.239, 0.089]), implying that broadband infrastructure alone may not directly influence tax performance without accompanying policies or user adoption.

Overall, the model explained a substantial portion of the within-state variation in tax revenue, as reflected by the high rho value (ρ = 0.944), underscoring the relevance of accounting for state-specific characteristics in evaluating the impact of ICT on tax generation.

Effectiveness of Tax Reforms on Digital Economy Revenue Mobilization

To evaluate the impact of recent tax reforms, including digital service taxation and Significant Economic Presence (SEP) rules, on tax revenue mobilization in Nigeria, a fixed-effects regression model was used. This approach accounts for within-state variations over time and controls for unobserved state-specific factors affecting revenue performance.

Table 3: Regression Results of Tax Reforms and Tax Revenue

Predictor	B	SE	*t*	*p*	95% CI
INTPEN-post	127.35	38.52	3.31	0.046	[4.75, 249.94]
MOBSUB-post	-126.63	26.49	-4.78	0.017	[-210.93, -42.32]
BROAD-post	41.85	10.84	3.86	0.031	[7.35, 76.36]
Constant	64.75	0.44	148.73	0.000	[63.36, 66.13]

Note. N = 56; No. of groups = 4; $F(3,3) = 4081.03$, $p < 0.001$; $\sigma_u = 3.3541$, $\sigma_e = 11.1219$, $\rho = 0.0834$. Robust standard errors adjusted for clustering at the state level.

The results presented in Table 3 indicate that recent tax reforms, including digital service taxation and the Significant Economic Presence (SEP) rules, had a significant impact on tax revenue mobilization in Nigeria between 2010 and 2023. The interaction of internet penetration with digital taxation (INTPEN-post) was positively associated with tax revenue (B = 127.35, p = 0.046, 95% CI [4.75, 249.94]), suggesting that higher digital engagement in conjunction with tax reforms enhances revenue collection.

Meanwhile, the interaction of mobile subscriptions with digital taxation (MOBSUB-post) showed a negative effect on revenue (B = -126.63, p = 0.017, 95% CI [-210.93, -42.32]), indicating that increasing mobile subscriptions alone may not uniformly translate into higher tax revenue under the current digital tax framework. Broadband usage interacted with digital taxation (BROAD-post) positively influenced revenue (B = 41.85, p = 0.031, 95% CI [7.35, 76.36]), highlighting the importance of connectivity infrastructure in supporting effective digital taxation. Overall, these findings suggest that tax reforms are effective in enhancing revenue mobilization from the digital economy, but their impact is contingent on specific ICT indicators,

emphasizing the need for complementary digital infrastructure and policy measures.

Hypothesis Testing

To empirically evaluate the study objectives, two hypotheses were formulated and tested. **H_{01}** posits that ICT indicators, including internet penetration, mobile subscriptions, and broadband usage, do not significantly influence tax revenue generation in Nigeria. **H_{02}** asserts that recent tax reforms targeting the digital economy, specifically digital service taxation and Significant Economic Presence (SEP) rules, have no significant effect on government revenue mobilization. The following analyses employ fixed-effects regression models to test these hypotheses while accounting for within-state variations over time.

Table 4: Joint Significance Tests of ICT Indicators and Tax Reform Interactions on Tax Revenue

Hypotheses	Variables Tested	$F(3, 3)$	p-value
H_{01}	INTPEN, ln-MOBSUB, ln-BROAD	3110.90	.001
H_{02}	INTPEN-post, MOBSUB-post, BROAD-post	4081.03	.001

Table 4 presents the results of joint significance tests for ICT indicators and tax reform interactions on tax revenue in Nigeria. The test for H_{01} indicates that the combined effect of internet penetration, mobile subscriptions, and broadband usage on tax revenue is statistically significant, $F(3, 3) = 3110.90$, $p < .001$, suggesting that ICT indicators collectively influence revenue generation. Similarly, the joint test for H_{02} shows that the interaction terms representing recent tax reforms (digital service taxation and Significant Economic Presence rules) are also statistically significant, $F(3, 3) = 4081.03$, $p < .001$, indicating that these reforms have a significant impact on tax revenue mobilization. These results provide strong evidence to reject both null hypotheses.

CONCLUSION

The findings indicate that ICT indicators and digital tax reforms significantly influence tax revenue mobilization in Nigeria. Mobile subscriptions positively affected revenue, highlighting the role of connectivity in facilitating electronic payments, while internet penetration showed a small negative effect, and broadband usage had no significant direct impact. Interactions with digital tax reform revealed that internet and broadband usage enhanced revenue, whereas mobile subscriptions showed a negative effect in this context. Overall, the results emphasize that effective revenue mobilization requires integrating ICT development with targeted digital taxation policies.

RECOMMENDATIONS

To enhance tax revenue generation from Nigeria's digital economy, the government should expand mobile payment channels and digital tax platforms while integrating internet access with digital tax tools. This approach, complemented by taxpayer education and compliance enforcement, will facilitate electronic transactions, improve engagement, and ensure that increased connectivity translates into higher revenue mobilization.

The effectiveness of digital service taxation and SEP rules depends on robust ICT infrastructure. Policymakers should support tax reforms with adequate broadband systems, digital literacy programs, and monitoring mechanisms, adopting a coordinated strategy that links ICT development with targeted taxation policies to sustainably capture value from the growing digital economy.

REFERENCES

Adewale, M. & Mordi, S. (2023). Digital tax compliance in Nigeria: Awareness, behavior, and challenges across entrepreneurs and IT professionals. *African Journal of Fiscal Studies*, *17*(2), 53-70.

Agbeyangi, T., Salami, O. & Tijani, L. (2025). ICT indicators and tax revenue in Nigerian states: A panel data analysis. *Journal of Fiscal Performance*, *14*(1), 23-45.

Agbeyangi, A. O., Salami, K. O., Tijani, B. A., & Lawal, M. A. (2024). Digital infrastructure development and fiscal performance in Nigeria. *Journal of Digital Economy and Public Policy, 6*(2), 101-119.

Ajetunmobi, O. (2022). Digital transformation and revenue dynamics: Evidence from Nigerian federal revenue trends. *Fiscal Policy Review*, *33*(3), 88-104.

Anushiem, E. O., & Chukwuma, A. I. (2024). Digital tax administration and revenue performance in Nigeria: A diagnostic assessment. *Nigerian Journal of Taxation and Fiscal Policy, 7*(1), 23-46.

Eze, C. & Oladipo, J. (2024). Governance and digitalization in Nigeria: A mixed-method exploration of tax performance responses. *African Journal of Economic Development*, *19*(4), 87-105.

Garba, I. & Enemuo, R. (2025). Evaluating Nigeria's SEP rule fiscal outcomes: Synthetic control comparisons with Kenya and South Africa. *International Tax Review - Africa*, *7*(3), 43-63.

Ibrahim, A. & Chijioke, E. (2024). Fintech proliferation and corporate tax gains: A DiD study of fintech-intensive and low-adoption states. *Journal of Digital Economy and Taxation*, *5*(1), 55-72.

Josselin, J. M., & Le Maux, B. (2017). Econometric Analysis. In *Statistical Tools for Program Evaluation: Methods and Applications to*

Economic Policy, Public Health, and Education, 137-187. Cham:Springer International Publishing.

Maccarthy, N.& Nnah, C. (2024). Digital taxation frameworks in West Africa: Implementations, gap analyses, and policy lessons. *Regional Journal of Tax Policy and Governance*, 3(2), 76-98.

Musgrave, R. A. (1959). *The theory of public finance: A study in public economy*. McGraw-Hill.

Mustapha, A., Aliyu, I. H.& Olumide, K. (2024). From profit-based to revenue-based nexus rules: Revisiting SEP implementation under Nigeria's Finance Act 2020. *Nigerian Journal of Fiscal Studies*, *11*(1), 23-42.

Okonkwo, R. I., & Adeyemi, O. K. (2024). Digital taxation and tax-to-GDP performance in West Africa. *West African Journal of Economic Integration, 9*(1), 41-67.

Ogunlana, T. A., & Bello, M. S. (2025). Digital VAT reforms and non-resident tax compliance in Nigeria. *Journal of Tax Policy and Administration, 8*(2), 75-98.

Oto, B. O., & Wayas, P. B. (2024). Digital taxation and revenue mobilization in Nigeria: An evaluation of significant economic presence rules. *Journal of Accounting and Public Policy in Emerging Economies, 5*(1), 14-36.

Pigou, A. C. (1920). *The economics of welfare*. Macmillan.

Smith, A. (1776). *An inquiry into the nature and causes of the wealth of nations*. W. Strahan and T. Cadell.