Nigerian Journal of Accounting Research
Department of Accounting, Ahmadu Bello University, Zaria.
ISSN: 2636-5294 | Vol. 13, No. 1, 2026

MODERATING EFFECT OF DIGITALISATION ON THE RELATIONSHIP BETWEEN NON-TAX REVENUE AND BUDGET PERFORMANCE IN NIGERIA

Anzule Ewuga[1,*], Isah Shittu[2], Aliyu Baba Usman[1], Ejike Sunday Okoroigwe[1]
[1]Ibrahim Badamasi Babangida University Lapai
[2]Ahmadu Bello University
***Corresponding author**: anzuleewuga@gmail.com; +2348168348372; ORCID: 0009-0004-8352-624X
DOI: https://doi.org/10.xxxx/xxxx

Keywords:
Digitalisation, non-tax revenue, budget performance, ARDL Model.

Article History:
Received: 25 June 2026
Revised: 7 October 2026
Accepted: 7 October 2026
Published: 16 November 2026

Article Info:
Homepage: https://njar.org.ng
Volume: 13, No. 1, 2026
Pages: 115-138

ABSTRACT

Motivated by persistent fiscal imbalances, oil price volatility, and sustainability concerns, this study investigated the moderating effect of digitalisation on the relationship between non-tax revenue and budget performance in Nigeria using annual data from 1981 to 2024. A quantitative longitudinal design was adopted, and the Autoregressive Distributed Lag (ARDL) model was employed to examine short-run and long-run dynamics following stationarity confirmation through unit root tests. In the short run, aggregated non-tax revenue exerted a significant positive effect on budget performance ($\beta = 0.849$, $p = 0.017$), while independent revenue and gas-flaring penalties showed no significant direct effects. In the long run, independent revenue ($\beta = -1.676$, $p = 0.015$) and digitalisation ($\beta = -21.810$, $p = 0.015$) exerted significant negative effects on budget performance. However, the interaction between independent revenue and digitalisation exerted a significant positive moderating effect ($\beta = 6.364$, $p = 0.055$), indicating that digital systems improved revenue management and reduced leakages. Conversely, the interaction between gas-flaring penalties and digitalisation remained insignificant ($p = 0.589$). Furthermore, the 2003 digital transition produced a significant structural shift, reversing adverse revenue effects from $\beta = -29.000$ ($p = 0.001$) to $\beta = 5.185$ ($p = 0.096$). The study concluded that digitalisation significantly strengthened the non-tax revenue-budget performance nexus and recommended deeper digital integration across revenue-generating agencies to enhance fiscal stability.

1.0 Introduction.

Persistent oil revenue volatility historically caused fiscal imbalances in Nigeria, prompting greater focus on non-tax revenues—specifically federal independent revenues and gas flaring penalties—though manual administrative processes fostered leakages and corruption (Umar et al., 2023). Digitalisation emerged as a key structural intervention to optimize collections and curtail leakages (Moore, 2013). Despite initial technological readiness deficits (Mohammed et al., 2023; Premchand & Garamfalvi, 1992) and mixed empirical findings regarding digitalized fiscal systems (Berembo & Igonikon, 2020; Ikaye & Micah, 2018; Ofurum et al., 2018; Ogbada et al., 2023; Rossel et al., 2024), Nigeria's EGDI rose to 0.4331 in 2024. However, its African ranking fell from 14th in 2022 to 20th in 2024—lagging behind South Africa (0.8616)—exposing capacity gaps (United Nations, 2024). Consequently, this study examined digitalisation's moderating role between non-tax revenue components and budget performance to establish technology-driven fiscal equilibrium.

1.1 Objectives of the Study

The general objective is examining how digitalisation moderates non-tax revenue's impact on Nigerian budget performance Other specific objectives are to:

i. assess the effect of non-tax revenue on budget performance in Nigeria.
ii. investigate the moderating effect of digitalisation on the relationship between non-tax revenue and budget performance in Nigeria.

2.1 Conceptual Review.

2.1.1 Budget Performance

Budget performance measured by institutional achievement in revenue, expenditure, and debt sustainability, reflecting efficiency and fiscal discipline (Akano & Salawu, 2024; Osadola et al., 2023). Budget balance as a percentage of GDP was adopted over alternative proxies (Adeyemi et al., 2022; Ejeh et al., 2025; Ogiji & Ajayi, 2020; Okoye et al., 2021). Sensitivity analysis confirmed superior stability and explanatory power (0.961).

2.1.2 Non-tax Revenue

Non-tax revenue consisted of fiscal income from fees, state-owned enterprise surpluses, independent revenues, and gas-flaring penalties (Alade, 2025; CBN, 2017; OECD, 2023; Oladejo, 2024; Zhang & Huang, 2019). Weak enforcement caused revenue losses (NEITI, 2022; Okoro et al., 2021), but stricter penalties improved compliance, while digitalisation reduced leakages, automated collections, and enabled direct treasury remittances (Obidike & Onuora, 2025; Olaoye & Akinola, 2019).

2.1.3 Digitalisation

Digitalisation was defined as the application of ICT to enhance public financial management through improved governance, administrative automation, and real-time fiscal monitoring (Gherghin, 2025; Gradillas & Thomas, 2023; Ikwuanusi et al., 2024; Njoku et al., 2024; Temba, 2025; United Nations, 2024). In Nigeria, telecommunications deregulation and digital platforms reduced financial leakages (CBN, 2017; Eke et al., 2019). A spliced teledensity-EGDI measure captured digital maturity and demonstrated structural stability without parameter bias (Adefulu et al., 2024; Ishola et al., 2020; Ndam et al., 2023; Okere et al., 2024; Omotayo et al., 2025; United Nations, 2024; Usman & Mazadu, 2021).

2.2 Empirical Review

Alade (2025) found non-tax revenues significantly improved Nigerian budget implementation using GLS estimation, while Oladejo (2024) established that non-tax revenues explained 91.80% of GDP variation. Omodero and Alege (2023) and Solanke et al. (2021) demonstrated that independent revenues and penalties augmented infrastructure and total revenue. Widuri et al. (2019) and Sinnasamy and Bidin (2017) linked penalties to compliance, whereas Amaechi and Emejulu (2021) and Yunusa et al. (2016) highlighted gas flaring losses. Studies confirmed digitalisation enhanced governance, efficiency, and growth (Asomba et al., 2024; Gomba et al., 2024; Ndam et al., 2023; Njoku et al., 2024; Omotayo et al., 2025; Oti-Akenteng et al., 2025; Temba et al., 2025; Usman & Mazadu, 2021), with Mohammed and Gemu (2024) confirming technological moderation. Addressing static modeling limitations (Nwokoroeze et al., 2025), this study applied Autoregressive Distributed Lag (ARDL) modeling (1981–2024) to evaluate short- and long-run digital moderation on non-tax revenues and budget performance.

2.3 Theoretical Framework

2.3.1 Technology Acceptance Model (TAM)

The Technology Acceptance Model (TAM), developed by Davis in 1989, explained that system adoption depended on perceived usefulness and ease of use (Asomba et al., 2024; Emeh et al., 2023; Zhao et al., 2024). These factors enhanced adoption, transparency, and compliance, thereby reducing leakages and improving budget performance (Kaliky et al., 2024; Obideji & Sarumi, 2024; Okeke et al., 2023; Sepasgozar et al., 2020; Umar et al., 2023). TAM also underpinned the study's digitalisation-budget performance hypothesis.

2.3.2 Institutional Theory

Institutional Theory, developed by Meyer and Rowan (1977), explained how organizational structures aligned with governance to achieve legitimacy (Andriele et al., 2017; Lammers & Garcia, 2017; Meyer & Rowan, 1977). Weak institutions contributed to budget deficits, whereas digital platforms enhanced transparency, reduced rent-seeking, and improved revenue collection efficiency (Alesina & Perotti, 1996; Emelogu & Ozughalu, 2010; Emmanuel et al., 2024; Jameel et al., 2019; Kilishi, 2020; Rivero-del-Paso et al., 2023). The theory also underpinned the study's aggregated and disaggregated hypotheses.

2.3.3 Theory of Regulatory Compliance

The Theory of Regulatory Compliance (TRC), introduced by Richard Fiene in the 1970s, assessed how adherence to rules shaped outcomes through risk-based supervision (Fiene, 2016). Fiscal compliance reduced deficits (Emelogu & Ozughalu, 2010; Shleifer, 2005), whereas digital tools improved the transparency of enforcement, helping to stabilize budget performance (Akpukorji et al., 2024; Olaoye & Akinola, 2019). TRC underpinned the disaggregated gas flaring penalty hypothesis.

3.0 Research Methodology

The study used a quantitative longitudinal design to analyze Nigerian time-series data from 1981 to 2024, in line with prior work (Muhammad, 2025; Okoroigwe et al., 2023; Oladejo, 2024; Waleed, 2020). Secondary data covered a 44-year span, separating the pre-EGDI period (1981–2002) from the EGDI period (2003–2024). EViews 12 facilitated Principal Component Analysis, ARDL modelling, and moderated multiple regression to assess both short- and long-run relationships. Moreover, a robust partitioned regression approach was used to examine the pre-digitalisation and EGDI eras.

Table 1.1

Summary of Variables, Acronyms, Measurements, and Sources

Variable	Symbol	Description & Measurement	Source
Budget Performance	BP	Measure as overall budget balance (deficit) expressed as percentage of Gross Domestic Product (GDP) annually.	Ehizuelen & Bassy 2025
Non-tax Revenue	NTR	Measure as principal component index of annual value of non-tax revenue elements for the period in Nigeria.	Yurdadoğ et al., 2022
Independent Revenue	INR	Measure as natural logarithm of annual federal government independent revenue for the period in Nigeria.	Berembo & Igonikon, 2020
Penalty Revenue	PRG	Measure as natural logarithm of annual penalty revenue from gas flaring as over time in Nigeria.	Yunusa et al. 2016
Digitalisation	DIG	Measure as the E-Government Development index and World Development indicators Telecommunication Density period in Nigeria.	Kotenok et al., 2020 & Usman & Mazadu, 2021
Government Expenditure	GE	Measure as log of annual government expenditure as percentage of GDP in Nigeria for the period.	Gombe et al., 2024

Source: Author's Compilation, 2026

3.1 Model Specifications

The study adopted the ARDL moderated multiple regression models, drawing on Solanke et al. (2021) and Abba and Kakanda (2017), to examine government revenue, budget performance, and digitalisation. The dynamic models enabled estimation across combined I(0) and I(1) series while assessing time effects and control variables (Aboudi et al., 2023; Umaru et al., 2021).

Direct relationship equation is stated as follows:

$Y= f(X_1, , --------Xn)$ ..... (1)

Furthermore, the above functional form is presented in a statistics form as in the below. $Y= \beta_0 + \beta_1 Xi\varepsilon_i$..... (2)

Where Y is the dependent variable and Xi such that I = (1...n) is the explanatory variable.

Moderated multiple regression applied linear regression with interaction terms to test moderating effects (Prena & Putri, 2020):

$Y = \alpha + \beta_1X_1+ \beta_2X_2+ \beta_3X_1*X_2 + Ɛ$ ..... (3)

Where Y = the dependent variable; X_1 = independent variables; X_2 = moderating variable, $X1*X2$ =interaction between the independent variables and the moderating variable; α = Constant; β = Regression coefficient (increase or decrease value); and Ɛ = Error.

The generalized ARDL (p, q) model is specified as:

$\mathbf{Y}_t = g_{0i} + \sum_{i=1}^{p} d_i \mathbf{Y}_{t-i} + \sum_{i=1}^{q} b'_i\mathbf{X}_{t-i} + \mathbf{e}_t$ ..... (4)

Where Y'_t is a vector and the variable in (X'_t) are allowed to be purely I(0) or I(1) or cointegrated; d and b are the coefficients; γ is the constant; i =1..k; p, q are optimal lag orders; ε_t is a vector of the error terms – unobserved zero mean white noise vector process (serial uncorrelated or independent). More precisely, the researcher delineates models based on objectives of the study and formed as aggregated and disaggregated, all specify using ARDL as employed by Muhammad (2025).

Model 1: The effect of non-tax revenue on budget performance in Nigeria.

$$BP_t = \beta_0 + \beta_1 NTRI_t + \beta_2 lnGE_t + \varepsilon_t \quad (5)$$

Where:

BP	=	Budget performance proxied as Budget balances (% GDP)
β_0	=	The constant term.
NTRI	=	Non-tax revenue index.
lnGE	=	Natural log of government expenditure growth (%GDP).
$\beta_{1-3,}$	=	The coefficients of direct relationship.
ε_t	=	Error term.

The ARDL model is specified as follows:

$$\Delta BP_t = \beta_0 + \sum_{t=1}^{p} \phi i \, \Delta BP_{t-i} + \sum_{t=1}^{q} \alpha_1 \Delta NTRI_{t-i} + \sum_{t=1}^{q} \alpha_2 \Delta lnGE_{t-i} + \beta_1 BP_{t-1} + \beta_2 NTRI_{t-1} + \beta_3 lnGE_{t-1} + \varepsilon_t \quad (6)$$

Where:

p	=	lag is the lag length associated with the dependent variable
q	=	lags are the lags length associated with the exogenous variables
t=1	=	are the optimal lag orders.
t-1	=	are the lag values.
ϕ, α	=	short term dynamics.
β	=	long term dynamics.
ε_t	=	Error term.
Δ	=	is the difference operator.

The ARDL (Short run model) is specified due to lack of cointegration as:

$$\Delta BP_t = \beta_0 + \sum_{t=1}^{p} \phi i \, \Delta BP_{t-i} + \sum_{t=1}^{q} \alpha_1 \Delta NTRI_{t-i} + \sum_{t=1}^{q} \alpha_2 \Delta lnGE_{t-i} + \varepsilon_t \quad (7)$$

Where: All variables are as previously defined.

To examine specific components of non-tax revenue (NTR), NTR in model 5 is further decomposed and disaggregated to form model 8:

$$BP_t = \beta_0 + \beta_1 lnPRG_t + \beta_2 lnINR_t + \beta_3 lnGE_t + \varepsilon_t \quad (8)$$

Where: All variables are as previously defined except

lnPRG = Natural log of penalty revenue from gas flaring
lnINR = Natural log of Federal Government independent revenue.

The ARDL model is specified as follows:

$\Delta BP_t = \beta_0 + \sum_{t=1}^{p} \phi i\, \Delta BP_{t-i} + \sum_{t=1}^{q} \alpha_1 \Delta lnPRG_{t-i} + \sum_{t=1}^{q} \alpha_1 \Delta lnINR_{t-i} + \sum_{t=1}^{q} \alpha_2 \Delta lnGE_{t-i} + \beta_1 BP_{t-1} + \beta_2 lnPRG_{t-1} + \beta_3 lnINR_{t-1} + \beta_4 lnGE_{t-1} + \varepsilon_t$ ---------- (9) For No Cointegration, the ARDL (Short run model only) is stated as:

$\Delta BP_t = \beta_0 + \sum_{t=1}^{p} \phi i\, \Delta BP_{t-i} + \sum_{t=1}^{q} \alpha_1 \Delta lnPRG_{t-i} + \sum_{t=1}^{q} \alpha_1 \Delta lnINR_{t-i} + \sum_{t=1}^{q} \alpha_3 \Delta lnGE_{t-i} + \varepsilon_t$ -- (10)

Where: All variables are as previously defined.

Model 2: The moderating effect of digitalisation on the relationship between non-tax revenue and budget performance in Nigeria.

$BP_t = \beta_0 + \beta_1 NTRI_t + \beta_2 DIG_t + \beta_3 NTRI_t * DIG_t + \beta_4 lnGE_t + \varepsilon_t$ ---------- (11)

Where: All variables are as previously defined except

DIG = Digitalisation index

NTRI*DIG = Interaction between NTRI and DIG

The ARDL model is specified as follows:

$\Delta BP_t = \beta_0 + \sum_{t=1}^{p} \phi i\, \Delta BP_{t-i} + \sum_{t=1}^{q} \alpha_1 \Delta NTRI_{t-i} + \sum_{t=1}^{q} \alpha_2 \Delta DIG_{t-i} + \sum_{t=1}^{q} \alpha_3 \Delta NTRI_{t-i} * DIG_{t-I} + \sum_{t=1}^{q} \alpha_4 \Delta lnGE_{t-i} + \beta_1 BP_{t-1} + \beta_2 NTRI_{t-1} + \beta_3 DIG_{t-1} + \beta_4 NTRI_t * DIG_{t-i} + \beta_5 lnGE_{t-1} + \varepsilon_t$ -(12)

Where: All variables are as previously defined.

For No Cointegration, only the ARDL (Short run model) is specified as follows:

$\Delta BP_t = \beta_0 + \sum_{t=1}^{p} \phi i\, \Delta BP_{t-i} + \sum_{t=1}^{q} \alpha_1 \Delta NTRI_{t-i} + \sum_{t=1}^{q} \alpha_2 \Delta DIG_{t-i} + \sum_{t=1}^{q} \alpha_3 \Delta NTRI_{t-i} * DIG_{t-I} + \sum_{t=1}^{q} \alpha_4 \Delta lnGE_{t-i} + \varepsilon_t$ ---------- (13)

Where: All variables are as previously defined.

To further examine specific items of nontax revenue (NTR), NTR in model 11 is further decomposed and disaggregated to form model 14 as:

$BP_t = \beta_0 + \beta_1 lnPRG_t + \beta_2 lnINR_t + \beta_3 DIG_t + \beta_4 lnPRG_t * DIG_t + \beta_5 lnINR_t * DIG_t + \beta_6 lnGE_t + \varepsilon_t$ - ---------- (14)

Where: All variables are as previously defined except

lnPRG*DIG = Interaction between PRG and DIG

lnINR*DIG = Interaction between INR and DIG

The ARDL model is specified as follows:

$\Delta BP_t = \beta_0 + \sum_{t=1}^{p} \phi i\, \Delta BP_{t-i} + \sum_{t=1}^{q} \alpha_1 \Delta lnPRG_{t-i} + \sum_{t=1}^{q} \alpha_2 \Delta lnINR_{t-i} + \sum_{t=1}^{q} \alpha_3 \Delta DIG_{t-i} + \sum_{t=1}^{q} \alpha_4 \Delta lnPRG_{t-i} * DIG_{t-I} + \sum_{t=1}^{q} \alpha_5 \Delta lnINR_{t-i} * DIG_{t-I} + \sum_{t=1}^{q} \alpha_6 \Delta lnGE_{t-i} + \beta_1 BP_{t-1} +$

$\beta_2 \ln PRG_{t-1} + \beta_3 \ln INR_{t-1} + \beta_4 DIG_{t-1} + \beta_5 \ln PRG_t * DIG_{t-i} + \beta_6 \ln INR_t * DIG_{t-i} + \beta_7 \ln GE_{t-1} + \varepsilon_t$ ---------- (15)

Where: All variables are as previously defined.

The Error Correction Model (ECM) for BP_t was estimated because of the presence of cointegration as follows:

$\Delta BP_t = \beta_0 + \sum_{t=1}^{p} \phi i \, \Delta BP_{t-i} + \sum_{t=1}^{q} \alpha_1 \Delta \ln PRG_{t-i} + \sum_{t=1}^{q} \alpha_2 \Delta \ln INR_{t-i} + \sum_{t=1}^{q} \alpha_3 \Delta DIG_{t-i} + \sum_{t=1}^{q} \alpha_4 \Delta \ln PRG_{t-i} * DIG_{t-I} + \sum_{t=1}^{q} \alpha_5 \Delta \ln INR_{t-i} * DIG_{t-I} + \sum_{t=1}^{q} \alpha_6 \Delta \ln GE_{t-i} + \lambda ECT_{t-1} + \varepsilon_t$ ---------- (16)

Where: All variables are as previously defined except.

λ = $(1 - \sum_{i=1}^{p} d_i)$, speed of adjustment (speed limit of the recovery) parameter back to equilibrium, with a negative sign and statistically significant.

ECT_{t-1} = $(BP_{t-I} - \theta X_t)$, the error correction term which is the extracted residuals from the regressions of the long-run equation.

θ = $\frac{\sum_{i=0}^{q} b_i}{a}$, is the long-run parameters

4.0 Results and Discussions

4.1 Descriptive Statistics

Descriptive statistics (Table 1.2) indicated that budget performance remained at a stable mean (2.7098%) with low dispersion (SD = 1.8733); normality was supported (p = 0.0618), although the maximum value rose to 8.57% and surpassed the FRA threshold. By contrast, non-tax, independent, and gas flaring revenues displayed pronounced volatility, positive skewness, and leptokurtic distributions that failed to meet the normality assumption (p = 0.0000), suggesting pervasive fiscal instabilities and leakage effects (Hair et al., 2019; Olayemi & Olawole, 2024).

Table 1.2

Descriptive Statistics

Variable	Mean	Median	Max	Min	Std. Dev.	Skew ness	Kurtosis	Jarque - Bera	Probability	Obs.
BP	2.7098	2.6136	8.5696	0.0322	1.8733	0.7844	3.7576	5.5646	0.0618	44
NTR	279.58	67.100	2844.4	0.6407	572.68	3.0947	12.512	236.11	0.0000	44
PRG	19.941	3.4445	179.50	0.0014	40.695	2.5426	8.6218	105.35	0.0000	44
INR	259.63	49.300	2703.9	0.4076	536.56	3.1449	12.945	253.86	0.0000	44
DIG	0.2567	0.2580	0.8684	0.0979	0.1369	2.1158	10.133	126.11	0.0000	44
GE	8.3114	8.0117	17.286	5.0893	2.4816	1.5935	6.1894	37.273	0.0000	44

Source: *Researcher Computation Using Eviews12 Output, 2026.*

4.2 Principal Component Analysis for Non-tax Revenues.

Principal Component Analysis (PCA) generated a composite non-tax revenue index by combining gas-flaring penalties and federal independent revenue, thereby reducing multidimensionality and multicollinearity (Adedokun & Ukafor, 2024). Component 1 recorded an eigenvalue of 1.879717, explaining 93.99% of variance, while Component 2 recorded 0.120283 (6.01%). The index captured shared variance and provided a reliable revenue-performance measure (Adams et al., 2019; Berembo & Igonikon, 2020).

Table 1.3

Principal Component Analysis of Revenue Components

Component	Eigenvalues	Difference	Proportion	Cumulative Value	Cumulative Proportion
Non-tax Revenue					
PRG	1.879717	1.759434	0.9399	1.879717	0.9399
INR	0.120283	----------	0.0601	2.000000	1.0000

Source: Researcher Computation Using Eviews12 Output, 2026.

4.3 Correlation Analysis

The pairwise correlation matrix examined preliminary relationships and multicollinearity to ensure model validity (Kyriazos & Poga, 2023). Budget performance showed significant positive associations with NTRI ($r = 0.32$, $p < 0.05$) and expenditure growth ($r = 0.40$, $p < 0.05$). Strong correlations among NTRI, lnPRG, lnINR, and DIG ($r = 0.46$-0.83, $p < 0.05$) supported indexation, with no severe multicollinearity detected.

Table 1.4

Correlation Analysis of Government Revenue Components and Budget Performance in Nigeria

Variable	BP	NTRI	lnPRG	lnINR	DIG	lnGE
BP	1.00					
NTRI	0.32*	1.00				
lnPRG	-0.02	0.61*	1.00			
lnINR	-0.09	0.63*	0.83*	1.00		
DIG	-0.02	0.46*	0.67*	0.69*	1.00	
lnGE	0.40*	-0.27	-0.11	-0.41*	-0.22	1.00

Note: ∗ imply 5% level of significance. Source: Researcher Computation Using Eviews12 Output, 2026.

4.4 Pre-test Analysis of the Data

4.4.1 Stationarity Test

Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests assessed stationarity and reduced concerns about serial correlation and heteroscedasticity (Adedokun & Ukafor, 2024). ADF results revealed mixed I(0) and I(1) integration orders, while PP tests confirmed stationarity of non-tax revenue and other problematic variables.

Table 1.5

Stationarity test using Augmented Dickey-Fuller (ADF) and Philip Perron (PP)Unit Root Test: Without Structural Breaks

Augmented Dickey-Fuller (ADF)						
	Level			First Difference		
Variables	t-statistic	Critical Value	I(d)	t-statistic	Critical Value	I(d)
BP	-3.285[a]	-2.931**	I(0)	----------	----------	--------
NTRI	--------	----------	--------	----------	----------	--------
lnPRG	--------	----------	--------	-7.605[b]	-4.192***	I(1)
lnINR	--------	----------	--------	-6.600[b]	-4.198***	I(1)
DIG	-3.605[a]	-3.592***	I(0)	----------	----------	--------
lnGE	--------	----------	-------	-9.375[b]	-4.192***	I(1)
Philip Perron (PP)						
BP	-3.273[a]	-2.931**	I(0)	----------	----------	------
NTRI	--------	----------	-------	-9.459[b]	-4.192***	I(1)
lnPRG	--------	----------	-------	-7.809[b]	-4.192***	I(1)
lnINR	-5.103[a]	-4.186***	I(0)	---------	----------	------
DIG	-3.477[a]	-3.592**	I(0)	---------	----------	------
lnGE	--------	----------	-------	-9.367[b]	-4.192***	I(1)

Note: *The [a] indicates constant without deterministic trend; [b] is the model with constant and deterministic trend as exogenous lags are selected based on Schwarz info criteria. *, **, *** imply that the series is stationary at 10%, 5%, and 1% respectively. ADF and PP denote Augmented Dickey-Fuller and Phillip-Perron Unit Root tests. Source: Researcher Computation Using Eviews12 Output, 2026.*

Table 1.6

Stationarity Results using Vogelsang-Perron SB test Unit Roo Test: With Structural Breaks

		Level			**First Difference**		
Variable	Break Date	t-statistic	Critical Value	I(d)	t-statistic	Critical Value	I(d)
BP	1993	-4.620[a]	-4.443**	I(0)	---------	----------	------
NTRI	1992	--------	----------	------	-10.11[b]	-5.347***	I(1)
lnPRG	2019	--------	----------	------	-8.412[b]	-5.347***	I(1)
lnINR	1991	-5.816[a]	-5.347***	I(0)	---------	----------	------
DIG	2002	-9.393[a]	-4.949***	I(0)	--------	----------	------

		Level			First Difference		
Variable	Break Date	t-statistic	Critical Value	I(d)	t-statistic	Critical Value	I(d)
lnGE	1999	--------	----------	------	-10.99[b]	-5.347***	I(1)

Note: *The [a] indicates constant without deterministic trend; [b] is the model with constant and deterministic trend as exogenous lags are selected based on Schwarz info criteria. *, **, *** imply that the series is stationary at 10%, 5%, and 1% respectively. The ADF test with structural breaks is determined using the Vogelsang (1993) asymptotic one-sided p-values. Critical values from Vogelsang(1993), are at 1% levels of significance. Source: Researcher Computation Using Eviews12 Output, 2026.*

The Vogelsang-Perron unit root test identified mixed I(0) and I(1) integration orders, with structural breaks in 1992 (NTRI), 2019 (lnPRG), 1999 (GE), 1993 (BP), 1991 (lnINR), and 2002 (DIG). These findings supported the use of the ARDL bounds test while accounting for major policy shifts, including the 2003 e-government strategy.

4.4.2 Optimal Lag Length Selection

Optimal lag lengths were determined using information criteria within an unrestricted VAR framework to balance model fit and parsimony, thereby reducing over-parameterization and autocorrelation. The Akaike Information Criterion (AIC) selected an optimal lag of one for the aggregated and disaggregated versions of Models 1 and 2, ensuring unbiased, consistent, and statistically robust estimates.

Table 1.7

Optimal Lag Length Selection Criteria using Standard Vector Autoregression (VAR) estimates

Models	Model 1		Model 2	
	Agg	Disagg	Agg	Disagg
Inf. Criteria	AIC	AIC	AIC	AIC
Lag length	1	1	1	1

Source: *Researcher Computation Using Eviews 12 Output, 2026.*

4.4.3 ARDL Bounds Test

The ARDL bounds test assessed long-run cointegration among the variables (Pesaran et al., 2001). Model 2 (disaggregated) recorded an F-statistic above the 5% I(1) critical value, confirming cointegration, whereas Model 1 and Model 2 (aggregated) fell below I(0) thresholds, indicating no cointegration. Consequently, ARDL and ECM estimated both short- and long-run effects only for the disaggregated model.

Table 1.8

ARDL Bounds Cointegration Test Results

	Aggregated Model					Disaggregated Model				
Model	*F*-Stat	Lower Bound I(0) at 5%	Upper Bound I(1) at 5%	Coint-gration	Remark	*F*-Stat	Lower Bound I(0) at 5%	Upper Bound I(1) at 5%	Coint-gration	Remark
1	2.91	2.63*	3.35*	No.	ARDL	1.59	2.37*	3.2*	No	ARDL
2	1.48	2.2*	3.09*	No	ARDL	7.29	3.6***	4.9***	Yes	ECM

*Note: *, ** and *** imply cointegration at 10%, 5% and 1* level of significance, respectively. Source: Researcher Computation Using Eviews 12 Output, 2026.*

4.5 Data analysis

4.5.1 Effect of Non-tax Revenue on Budget Performance in Nigeria

The error-correction terms confirmed significant adjustment toward equilibrium, correcting 41.5% (-0.415, p = 0.005) and 35.7% (-0.333) of prior disequilibrium. Current non-tax revenue [D(NTRI)] and government expenditure [D(lnGE)] positively influenced budget performance, whereas lagged revenues were insignificant (Adebayo & Taiwo, 2025; Ebieri, 2022; Ogiji & Ajayi, 2020). Diagnostic tests and CUSUM/CUSUMSQ verified model validity, parameter stability, and the absence of serial correlation and heteroskedasticity.

Table 1.9

Regression analysis:

Estimated ARDL short run results for Model 3: BP=F(NTRI, lnGE) – (1,1,1,1) and BP=F(lnPRG, lnINR, lnGE)- (1,0,0,1)

	Aggregated Model 1					**Disaggregated Model 1**				
	ARDL Short Run Results					**ARDL Short Run Results**				
Variable	Coeff. (β)	Std. Error	t-Stat	P-v	VIF	Coeff. (β)	Std. Error	t-Stat	P-v	VIF
Constant	-1.687	1.876	-0.995	0.326	NA	-1.521	2.590	-0.587	0.560	NA
BP(-1)*	-0.415	0.139	-2.980	0.005	1.72	-0.357	0.127	-2.814	0.007	1.22
NTRI(-1)	0.039	0.211	0.185	0.854	5.90	--------	-------	--------	------	------
lnPRG**	--------	-------	--------	-------	------	-0.058	0.171	-0.343	0.733	4.43
lnINR**	--------	-------	--------	-------	------	0.076	0.188	0.407	0.685	5.34
lnGE(-1)	1.396	0.979	1.426	0.162	2.86	1.104	1.119	0.985	0.330	2.34
D(NTRI)	0.840	0.338	2.482	0.017	5.79	--------	-------	--------	------	------
D(lnGE)	4.628	1.050	4.406	0.000	2.08	4.363	1.213	3.594	0.000	2.38
Mean VIF					4.15					3.62

	Aggregated Model 1					Disaggregated Model 1				
	ARDL Short Run Results					ARDL Short Run Results				
Variable	Coeff. (β)	Std. Error	t-Stat	P-v	VIF	Coeff. (β)	Std. Error	t-Stat	P-v	VIF
R-squared		0.586				0.517				
Adjusted R-squared		0.530				0.452				
Durbin Watson Stat		2.180				2.250				
F-Statistic		10.47				7.950				
Prob(F-statistic)		0.000				0.000				
Diagnostics tests						**Diagnostics tests**				
Tests	F-Stat.	P-value	Decision (H_0)			F-Stat.	P-value	Decision (H_0)		
B-G LM test	2.051	0.160	Accept			2.962	0.064	Accept		
B.P.G Test	1.136	0.358	Accept			0.769	0.577	Accept		
ARCH test	1.977	0.167	Accept			0.026	0.871	Accept		
J-B test	0.056	0.972	Accept			1.176	0.555	Accept		
RESET test	0.497	0.485	Accept			0.025	0.874	Accept		
CUSUM	-------	-------	Stable			-------	-------	Unstable		
CUSUMSQ	-------	-------	Stable			-------	-------	Stable		

Note: The test includes only restricted constant and are at 5% level of significance. * *p-value incompatible with t-bounds distribution.* ** *variables interpret as Z = Z(-1) + D(Z) – this indicates a dynamic regressor with an optimal lag of zero, as such Eviews does not include lags and difference of such variables but estimates them contemporaneously. Source: Researcher Computation Using Eviews12 Output, 2026.*

4.5.2 Moderating Effect of Digitalisation on the Relationship between Non-tax Revenue (Disaggregated) and Budget Performance in Nigeria.

Over the long term, digitalisation (-21.81, p = 0.015) and independent revenue (-1.676, p = 0.015) reduced budget performance, whereas their interaction improved performance (6.364, p = 0.055), indicating moderation effects. In the short term, non-tax revenue (p = 0.046) enhanced performance, while independent revenue reduced it (-1.272, p = 0.014); its digital interaction remained positive (4.830, p = 0.053) (Adebisi & Salako, 2020; Omodero & Okafor, 2021). Diagnostic tests confirmed model reliability and significance

Table 1.10

Regression analysis: Estimated ARDL long run and short run results for Model 6: BP=F(NTRI, DIG, NTRI_DIG, lnGE) – (1,1,0,1,1,) and BP=F(lnPRG, lnINR, DIG, lnPRG_DIG, lnINR_DIG, lnGE)- (1,1,1,1,0,1,0)

Disaggregated Model 2

ARDL Long Run Results

Variable	Coeff. (β)	Std. Error	t-Stat	P-v
lnPRG	-0.572	0.543	-1.053	0.300
lnINR	-1.676	0.652	-2.568	0.015
DIG	-21.81	8.476	-2.574	0.015
lnPRG*DIG	-0.475	2.546	-0.186	0.853
lnINR*DIG	6.364	3.191	1.994	0.055
lnGE	7.869	1.649	4.769	0.000

	ARDL Short Run Results				***ARDL Short Run Results***			
	Aggregated Model 2				**Disaggregated Model 2**			
Variable	Coeff. (β)	Std. Error	t-Stat	P-v	Coeff. (β)	Std. Error	t-Stat	P-v
Constant	-0.636	2.088	-0.305	0.762	-10.65	3.014	-3.533	0.001
Trend	--------	-------	--------	-------	0.183	0.094	1.951	0.060
BP(-1)*	-0.356	0.154	-2.316	0.026	-0.758	0.124	-6.092	0.000
NTRI(-1)	0.963	1.978	0.485	0.629	--------	-------	--------	------
lnPRG**	--------	-------	--------	-------	-0.434	0.419	-1.036	0.308
lnINR**	--------	-------	--------	-------	-1.272	0.488	-2.606	0.014
DIG**	-1.468	3.022	-0.485	0.630	-16.55	6.657	-2.487	0.018
NTRI*DIG(-1)	-0.435	4.474	-0.097	0.923	--------	-------	--------	------
lnPRG*DIG	--------	-------	--------	-------	-0.360	1.923	-0.187	0.852
lnINR*DIG	--------	-------	--------	-------	4.830	2.407	2.006	0.053
lnGE**	--------	-------	--------	-------	5.972	1.145	5.212	0.000
lnGE(-1)	1.095	0.968	1.132	0.265	--------	-------	--------	------
D(NTRI)	3.102	1.500	2.067	0.046	--------	-------	--------	------
D(NTRI*DIG)	-9.633	5.762	-1.671	0.103	--------	-------	--------	------
D(lnPRG)	--------	-------	--------	-------	-0.094	0.415	-0.228	0.821
D(lnINR)	--------	-------	--------	-------	-0.276	0.577	-0.478	0.635

Disaggregated Model 2								
D(DIG)	--------	-------	--------	-------	4.165	8.724	0.477	0.636
D(lnINR*DIG)	--------	-------	--------	-------	-0.165	2.320	-0.071	0943
D(lnGE)	5.206	1.109	4.692	0.000	--------	-------	--------	------
CointEq(-1) *	--------	-------	--------	-------	-0.758949	0.096	-7.829	0.000
R-squared		0.642			0.697			
Adjusted R-squared		0.557			0.575			
Durbin Watson Stat		2.367			2.333			
F-Statistic		7.623			5.752			
Prob(F-statistic)		0.000			0.000			
Diagnostics tests				**Diagnostics tests**				
Tests	F-Stat.	P-value	Decision (H_0)	F-Stat.	P-value	Decision (H_0)		
B-G LM test	2.869	0.071	Accept	2.301	0.118	Accept		
B.P.G Test	0.803	0.604	Accept	0.649	0.783	Accept		
ARCH test	1.376	0.247	Accept	0.262	0.611	Accept		
J-B test	0.269	0.874	Accept	2.021	0.363	Accept		
RESET test	1.339	0.255	Accept	0.189	0.666	Accept		
CUSUM	-------	-------	Stable	-------	-------	Stable		
CUSUMSQ	-------	-------	Stable	-------	-------	Stable		

Note: The test includes restricted constant and constant and trend, and all are at 5% level of significance. * *p-value incompatible with t-bounds distribution.* ** *variables interpret as Z = Z(-1) + D(Z) – this indicates a dynamic regressor with an optimal lag of zero, as such Eviews does not include lags and difference of such variables but estimates them contemporaneously. Source: Researcher Computation Using Eviews12 Output, 2026.*

4.6 Discussion of Findings

Empirical results showed that non-tax revenue (NTRI) exerted a significant positive contemporaneous effect on Nigeria's budget performance, whereas lagged revenue streams remained insignificant (Alade, 2025; Sadiq & Durowaiye, 2020). Digitalisation positively moderated independent revenue collection despite implementation costs, improving efficiency (Abdulrahman et al., 2024; Obideji & Sarumi, 2024). However, negative gas-flaring interactions revealed enforcement weaknesses. Overall, integrated digital frameworks institutionalized fiscal accountability, consistent with the Theory of Regulatory Compliance.

4.7 Robustness Test

Partitioned ARDL estimations were conducted for the pre-digitalisation (1981-2002) and post-digitalisation (2003-2024) periods to isolate structural changes and reduce coefficient bias. The pre-digitalisation model used the ICT Development Index, proxied by telephone subscriptions (Usman & Mazadu, 2021), whereas

the post-digitalisation model applied the UN E-Government Development Index to capture fiscal transformation effects (Adekoya, 2020; Nwokoroeze et al., 2025).

4.7.1 Sub-sample Results: Moderating Effect of Digitalisation on the Relationship between Non-tax Revenue and Budget Performance in Nigeria.

Partitioned regression analysis revealed a structural shift in Nigeria's non-tax revenue administration. During the pre-digitalisation period (1981–2002), NTRI exhibited a negative effect (β = -29.26), whereas the digital era (2003–2024) produced a positive effect (β = 5.185), indicating reduced leakages (Etim et al., 2020). Digitalisation strengthened gas-flaring penalties (β = 3.543), stabilised independent revenue through interaction (β = 7.220), and generated a net positive elasticity of +0.75%. Except for pre-digital CUSUMSQ instability, parameters remained stable, supporting improved fiscal discipline and revenue management (Alade, 2025; Mohammed & Gemu, 2024).

Table 1.11

Partitioned ARDL Regression Analysis for Non-tax Revenue and Budget Performance (1981–2024): Model 2

	Aggregated Model 2				**Disaggregated Model 2**			
	Pre Dig: 1981-2002		**Dig Era: 2003-2024**		**Pre Dig: 1981-2002**		**Dig Era: 2003-2024**	
Variable	Coeff.	p-value	Coeff.	p-value	Coeff.	p-value	Coeff.	p-value
Estimated ARDL Long Run Results					***Estimated ARDL Long Run Results***			
NTRI	-29.26	0.001	5.185	0.096	-------	-------	-------	-------
lnPRG	-------	-------	-------	-------	-0.045	0.930	3.543	0.077
lnINR	-------	-------	-------	-------	3.068	0.040	-2.971	0.064
DIG	42.87	0.005	-9.423	0.378	79.54	0.023	-5.517	0.791
NTRI*DIG	131.1	0.006	-10.81	0.106	-------	-------	-------	------
lnPRG*DIG	-------	-------	-------	-------	2.002	0.589	-10.37	0.077
lnINR*DIG	-------	-------	-------	-------	-18.68	0.053	7.220	0.124
lnGE	9.881	0.000	3.898	0.147	9.935	0.000	1.682	0.506
Estimated ARDL Short Run Results					**Estimated ARDL Short Run Results**			
Constant	-24.87	0.000	-5.741	0.117	-31.16	0.000	-7.344	0.425
Trend	-------	------	0.152	0.022	-1.052	0.006	0.350	0.003
BP(-1)*	-0.786	0.000	-0.486	0.025	-1.370	0.000	-0.971	0.002
NTRI**	-23.01	0.000	2.520	0.005	------	------	-------	------
lnPRG**	------	------	-------	------	-0.062	0.930	-------	------
lnINR**	------	------	-------	------	4.205	0.049	------	------
lnPRG(-1)	------	------	-------	------	------	------	3.441	0.062
lnINR(-1)	------	------	-------	------	------	------	-2.885	0.094
DIG**	33.72	0.001	-4.580	0.344	109.0	0.031	-5.358	0.797
NTRI*DIG**	103.1	0.002	-------	------	------	------	-------	------
NTRI*DIG(-1)	------	------	-5.258	0.005	------	------	-------	------

	Aggregated Model 2				Disaggregated Model 2			
	Pre Dig: 1981-2002		Dig Era: 2003-2024		Pre Dig: 1981-2002		Dig Era: 2003-2024	
Variable	Coeff.	p-value	Coeff.	p-value	Coeff.	p-value	Coeff.	p-value
lnPRG*DIG(-1)	------	------	-------	------	2.744	0.576	-10.07	0.059
lnINR*DIG(-1)	------	------	-------	------	-25.60	0.055	7.011	0.162
lnGE**	7.771	0.000	1.895	0.150	------	------	-------	------
lnGE(-1)	------	------	-------	------	13.61	0.000	1.633	0.501
D(lnPRG)	------	------	-------	------	------	------	1.104	0.028
D(lnINR)	------	------	-------	------	------	------	-1.400	0.002
D(NTRI*DIG)	------	------	-8.256	0.012	------	------	-------	------
D(lnPRG*DIG)	------	------	-------	------	------	------	-4.664	0.007
D(lnINR*DIG)	------	------	-------	------	------	------	3.054	0.007
D(lnGE)	------	------	-------	------	7.907	0.000	-0.927	0.193
ECT(-1)	-0.786	0.000	-0.486	0.000	-1.370	0.000	-0.971	0.000
Diagnostics tests:								
Test	F-Stat.	p-value	F-Stat.	p-value	F-Stat.	p-value	F-Stat.	p-value
R-squared	0.776	--------	0.919	-------	0.883	-------	0.961	-------
Adj. R^2	0.702	--------	0.879	-------	0.788	-------	0.898	-------
F-statistic	10.43	0.000	22.94	0.000	9.278	0.000	15.37	0.000
Bounds F-stat.	11.99	3.09[a]	6.720	4.06[a]	6.260	3.59[a]	5.540	3.59[a]
B-G LM test	1.440	0.272	0.525	0.604	1.320	0.314	1.210	0.361
B.P.G test	1.658	0.205	1.450	0.261	1.049	0.461	0.427	0.916
J-Bera test	0.278	0.870	0.602	0.739	4.015	0.134	1.128	0.937
CUSUM	-------	Stable	-------	Stable	------	Stable	------	Stable
CUSUMSQ	--------	Stable	--------	Stable	------	Unstable	------	Stable

*Note: ECT = error correction term. a, b, c are Bounds test indication for cointegration at 10%, 5% and 1%. The test includes both constant and trend and all are at 5% level of significance. * p-value incompatible with t-bounds distribution () ** variables interpret as Z = Z(-1) + D(Z) – this indicates a dynamic regressor with an optimal lag of zero, as such Eviews does not include lags and difference of such variables but estimates them contemporaneously. Source: Researcher Computation Using Eviews12 Output, 2026.*

5.1 Conclusion

The study concluded that Nigeria's fiscal landscape underwent a structural transformation following the 2003 digital transition. Although digital systems reduced rent-seeking and stabilized independent revenue, implementation costs created short-run budgetary pressures, while enforcement gaps limited gas-flaring penalty effectiveness. Overall, digitalisation improved long-term fiscal discipline, but operational and regulatory constraints continued to hinder the full optimization of non-tax revenue streams.

5.2 Recommendations

The study recommended that the Federal Government of Nigeria strengthen integrated e-government systems to reduce administrative leakages. It also recommended the use of digital tracking to enhance gas-

flaring enforcement and institutional capacity building for automated supervision, thereby ensuring that independent revenues remained transparent, stable, and productive.

References

Abba, M., & Kakanda, M. M. (2017). Moderating effect of internal control system on the relationship between government revenue and expenditure. *Asian Economic and Financial Review, 7*(4), 381-392. https://doi.org/10.18488/JOURNAL.AEFR/2017.7.4/102.4.381.392

Abdulrahman, K., Mubaraq, S., & Ahmed, A. (2024). Effect of digitalized financial management practices on accountability of Ministries, Departments, And Agencies (MDAS) in Nigeria. *International Journal of Social and Educational Innovation*, 11(22), 95–114. https://doi.org/10.5281/zenodo.14414630

Aboudi, S. E., Allam, I., & Bakkouchi, M. E. (2023). ARDL modeling and analysis of the impact of the interaction between the exchange rate and inflation on economic growth in Morocco. *Revue Française d'Economie et de Gestion*, 4(6), 168–187.

Adams, S. O., Bamanga, M. A., & Mbusube, A. (2019). Principal component analysis of Nigerian economy from 2006 – 2017. *Asian Journal of Advanced Research and Reports*, 5(4), 1–9. https://doi.org/10.9734/AJARR/2019/V5I430139

Adebayo, I. A., & Taiwo, I. B. (2025). Convergence of fiscal policy and economic growth in Nigeria. *Journal of Social and Development Sciences*, 15(1), 1–13. https://doi.org/10.22610/jsds.v15i1(S).4368

Adebisi, D. G., & Salako, G. (2020). Fiscal policy sustainability in Nigeria: ARDL bounds testing technique. *Asian Journal of Empirical Research*, 10(3), 74–80. https://doi.org/10.18488/journal.1007/2020.10.3/1007.3.74.80

Adedokun, A., & Ukafor, U. O. (2024). The quality of institutions and tax effectiveness on Nigerian economy. *Journal of Finance and Economics*, 12(3), 46–52. https://doi.org/10.12691/jfe-12-3-1

Adefulu, A., Makinde, O. G., Akinyosoye, O., & Nwankwere, I. (2024). Tax digitalisation and revenue tax compliance: The empirical approach. *International Journal of Entrepreneurial Development, Education and Science Research*, 8(1), 110–133. https://doi.org/10.48028/iiprds/ijedesr.v8.i1.06

Adekoya, O. B. (2020). Portfolio balance approach to asymmetries, structural breaks and financial crisis: Testing a model for Nigeria. *CBN Journal of Applied Statistics*, 11(1), 87–110. https://doi.org/10.33429/Cjas.11120.4/5

Adeyemi, A., Asogba, O. I., & Ariyibi, E. M. (2022). Tax revenue and National budget performance in Nigeria. *Turk Finance and Economics Research*, 2(1), 74–94.

Akano, L. O., & Salawu, R. O. (2024). Budget performance and human capital development of relevant sectors in Nigeria. *Economic Insights – Trends and Challenges*, 13(4), 81–92. https://doi.org/10.51865/EITC.2024.04.07

Akpukorji, S. I., Nzeako, G., Akinsanya, O. M., Popoola, A. O., Chukwurah, G. E., & Okeke, D. C. (2024). Theoretical frameworks for regulatory compliance in Fintech innovation: A comparative analysis of Africa and the United States. *Finance & Accounting Research Journal*, 6(5), 721–730. https://doi.org/10.51594/farj.v6i5.1107

Alade, E. O. (2025). Assessing the influence of tax and non-tax revenue on budget implementation in Sub-Saharan African countries: A case study of Nigeria. *Asian Journal of Economics, Business and Accounting*, 25(4), 84–97. https://doi.org/10.9734/ajeba/2025/v25i41735

Alesina, A., & Perotti, R. (1996). Income distribution, political instability, and investment. *European Economic Review*, 40(6), 1203–1228. https://doi.org/10.1016/0014-2921(95)00030-5

Amaechi, C. F., & Emejulu, M. J. (2021). Cost–benefit analysis of associated gas flaring in the Niger – Delta area of Nigeria (A case study of 1958 – 2004). *Journal of Applied Sciences and Environmental Management*, 25(3), 363–369. https://doi.org/10.4314/jasem.v25i3.9

Andriele, D. P. C., Sieglinde, K. C., Luciano, F. L., & Danielle, D. C. (2017). The role and contributions of sociological institutional theory to the socio-technical approach to innovation theory. *Innovation & Management Review*, 14(4), 250–259. https://doi.org/10.1016/j.rai.2017.02.001

Asomba, I. I., Ejim, C. J., Onyia, O. D., & Orji, G. O. (2024). E-Governance and improved public revenue generation in Nigeria: Issues and prospects. *Social Science Research in Association*, 16(1), 38–54. https://doi.org/10.4314/jpds.v16i1.3

Berembo, P. A., & Igonikon, D. T. P. (2020). An empirical analysis of government revenue and economic growth in Nigeria: Implications for leadership. *International Journal of Institutional Leadership, Policy and Management*, 2(1), 36–53.

Central Bank of Nigeria. (2017). *Fiscal policy at a glance*. Abuja, Nigeria: Monetary Policy Department, Central Bank of Nigeria. 1-329.

Ebieri, J. (2022). ARDL approach to government revenue and economic performance of Nigeria: Post structural adjustment programme. *Journal of Accounting and Financial Management*, 8(6), 14–25. https://doi.org/10.56201/jafm.v8.no6.2022.pg14.25

Ehizuelen, O. D., & Bassey, E. E. (2025). Budget deficit, budget reform index and macroeconomic performance in Nigeria. *Asian Journal of Economics, Finance and Management*, 7(1), 24–35. https://doi.org/10.56557/ajefm/2025/v7i1251

Ejeh, G., Nkwagu, L. C., Aja, L., Ejeh, B. N., Muhammad, T., Elom, J., & Ogah, L. C. (2025). Tax revenue on government budget implementation in Nigeria: A historical evidence from the year 1999–2023. *Open Research Africa*, 8(27), 1–11. https://doi.org/10.12688/openresafrica.16271.1

Eke, C. I., Egwaikhide, C. I., Saheed, Z. S., Alexander, A. A., Farouk, B. U. K., & Adeleke, A. O. (2019). Impact of teledensity on economic growth in Nigeria. *International Journal of Innovative Finance and Economics Research*, 7(3), 67–78.

Emeh, I. E., Etea, E. A., & Elechi, F. A. (2023). Automation of internally generated revenue collection processes and improved internal revenue base of Nigerian local governments for efficient service delivery: A focus on Ohafia Local Government of Abia State. *International Journal of Information, Technology & Innovation in Africa*, 12(6), 1–24. https://doi.org/6732-0-183-066-35-1261

Emelogu, O. C., & Ozughalu, M. U. (2010). An examination of the relationship between government revenue and government expenditure in Nigeria: Cointegration and causality approach. *Central Bank of Nigeria Economic and Financial Review*, 48(2), 35–57.

Emmanuel, N., Usifoh, K. S., & Adu, M. J. (2024). Institutional quality, government expenditure and economic growth nexus in Nigeria. *NG-Journal of Social Development*, 13(1), 1–15. https://doi.org/10.4314/ngjsd.v13i1.1

Etim, S. R., Jeremiah, S. M., & Dan, B. S. P. (2020). Tax compliance and digitalization of Nigerian economy: The empirical review. *American International Journal of Social Science*, 9(2), 42–50. https://doi.org/10.30845/aijss.v9n2p5

Fiene, R. J. (2016). *Theory of regulatory compliance*. Penn State University Research Institute for Key Indicators. SSRN Electronic Journal. https://doi.org/10.2139/ssrn.3239691

Gherghin, C. A. (2025). Public policies for the digitalization of public services in the European Union: From foundations to contemporary challenges. *Technium Social Sciences Journal*, 67(1), 528–539. https://doi.org/10.47577/tssj.v67i1.12453

Gomba, N. P., Nmecha, A., & Uwaoma, I. (2024). Digital technologies and tax revenue in Nigeria. *GPH-International Journal of Business Management*, 7(6), 223–235. https://doi.org/10.5281/zenodo.13221206

Gombe, A. S., Umar, M., Kabara, M. Y., & Yusuf, G. (2024). Assessment of the impact of government expenditures on economic growth in Nigeria: The ARDL dynamic. *International Journal of Economics and Business Management*, 10(11), 30–40. https://doi.org/10.56201/ijebm.v10.no11.2024.pg30.40

Gradillas, M., & Thomas, D. W. L. (2023). Distinguishing digitization and digitalization: A systematic review and conceptual framework. *Journal of Product Innovation Management*, 42(1), 112–143. https://doi.org/10.1111/jpim.12690

Hair, J. F., Black, W. C., Babin, B. J., & Anderson, R. E. (2019). *Multivariate data analysis* (8th ed.). Boston, MA: Cengage Learning.

Ikaye, M. K., & Micah, C. L. (2018). Non–tax revenue and economic growth in Nigeria. *Scholars Journal of Economics, Business and Management*, 5(7), 645–657. https://doi.org/10.36347/sjebm.2018.v05i07.011

Ikwuanusi, U. F., Onunka, O., Owoade, S., & Uzoka, A. (2024). Digital transformation in public sector services: Enhancing productivity and accountability through scalable software solutions. *International Journal of Applied Research in Social Sciences*, 6(11), 2744–2774. https://doi.org/10.51594/ijarss.v6i11.1724

Ishola, A. A., Abdulkareem, A. K., & Omolabi, I. (2020). E-Government implementation in Nigeria: Building a new paradigm for public trust. *NILDS Journal of Democratic Studies*, 2, 158–183.

Jameel, A., Asif, M., Hussain, A., Hwang, J., Sahito, N., & Bukhari, H. M. (2019). Assessing the moderating effect of corruption on the e-government and trust relationship: An evidence of an emerging economy. *Sustainability*, 11(23), Article 6540. https://doi.org/10.3390/su11236540

Kaliky, S. F., Rahim, S., & Wahyuni, N. (2024). The influence of the Technology Acceptance Model (TAM), e-system and the role of the account representative on taxpayer compliance at West Makassar KPP. *Invoice*, 7(2), 248–260. https://doi.org/10.26618/inv.v6i2.14012

Kilishi, A. A. (2020). *Assessing the adequacy of budgetary institutions in Nigeria* (Working Paper No. 37). Ilorin, Nigeria: Department of Economics, University of Ilorin.

Kotenok, A., Kulaga, I., Klivak, V., & Tkachenko, O. (2020). The e-government's influence on the country's economy (at the example of Ukraine and Estonia). *Advances in Economics, Business and Management Research*, 129, 175–182.

Kyriazos, T., & Poga, M. (2023). Dealing with multicollinearity in factor analysis: The problem, detections, and solutions. *Open Journal of Statistics*, 13(3), 404–424. https://doi.org/10.4236/ojs.2023.133020

Lammers, C. J., & Garcia, A. M. (2017). Institutional theory approaches. In C. R. Scott & L. Lewis (Eds.), *The International Encyclopedia of Organizational Communication* (pp. 195–216). Hoboken, NJ: John Wiley & Sons. https://doi.org/10.1002/9781118955567.wbieoc113

Meyer, J. W., & Rowan, B. (1977). Institutionalized organizations: Formal structure as myth and ceremony. *American Journal of Sociology*, 83(2), 340–363.

Mohammed, L., & Gemu, A. A. (2024). Moderating role of technological innovations on the relationship between non-oil tax revenue and economic growth in Nigeria. *Journal of Business Development and Management Resources*, 5(7), 37–50.

Mohammed, S. D., Mas'ud, A., Karaye, Y. I., Sallau, M. M., Adam, A. D., & Sulaiman, B. A. (2023). An evaluation of tax digitalization efforts by Federal Inland Revenue Service and their impacts on tax collection. *Journal of Accounting and Taxation*, 3(2), 105–122.

Moore, M. (2013). *Obstacles to increasing tax revenues in low income countries* (ICTD Working Paper 15). Brighton, UK: International Centre for Tax and Development. https://doi.org/10.2139/ssrn.2436437

Muhammad, S. I. (2025). Role of revenue contributions to economic growth in Nigeria: 1994 – 2022. *Journal of Management Science and Career Development*, 7(27), 115–132. https://doi.org/10.70382/sjmscd.v7i7.018

Ndam, B. T., Madaki, A. I., Uwondo, I. E., & Naanzem, P. N. (2023). Contributions of teledensity on the Nigerian economic growth: Evidence from ARDL bound testing model. *IOSR Journal of Humanities and Social Science*, 28(1), 62–70. https://doi.org/10.9790/0837-2801086270

Nigeria Extractive Industries Transparency Initiative. (2022). *Solid minerals industry report 2020*. Abuja, Nigeria: National Stakeholder Working Group.

Njoku, C. O., Ozurumba, B. A., Ubah, C. P., Nwaimo, C. E., Ugwu, K. E., Akujor, J. C., Ejiogu, U. G. C., & Nwoko, N. M. (2024). Improving financial management of the Nigerian public sector using digital technologies. *Academy of Entrepreneurship Journal*, 30(4), 1–12.

Nwokoroeze, C. N., Onwuekwem, T. R., & Chukwu, U. H. (2025). Evaluating the impact of e-government and digital transformation on public service delivery in Nigeria. *Global Journal of Political Science and Administration*, 13(2), 31–41. https://doi.org/10.37745/gjpsa.2013/vol13n23141

Obideji, B., & Sarumi, F. R. (2024). Digitalization, internally generated revenue and financial performance of the Polytechnic Ibadan, Ibadan, Oyo State. *Lead City Journal of the Social Sciences*, 9(3), 61–68.

Obidike, J. C., & Onuora, J. K. J. (2025). Effect of digital transformation on public sector accountability and transparency in Nigeria. *Journal of Accounting and Financial Management*, 11(1), 40–51. https://doi.org/10.56201/jafm.v11.no1.2025.pg40.51

Ofurum, C. N., Amaefule, L. I., Okonya, B. E., & Amaefule, H. C. (2018). Impact of e–taxation on Nigeria's revenue and economic growth: A pre–post analysis. *International Journal of Finance and Accounting*, 7(2), 19–26. https://doi.org/10.5923/j.ijfa.20180702.01

Ogbada, E. I., Onyedika, V. A., & Modebelu, M. N. (2023). Digitalization and effective tax administration in Nigeria. *Journal of Accounting and Financial Management*, 9(4), 58–68. https://doi.org/10.56201/jafm.v9.no4.2023.pg58.68

Ogiji, P., & Ajayi, J. K. (2020). Estimating a fiscal reaction function for Nigeria. *CBN Journal of Applied Statistics*, 11(1), 125–150. https://doi.org/10.33429/Cjas.11120.2/5

Okeke, I. C., Agu, E. E., Ejike, O. G., Ewim, C. P.-M., & Komolafe, M. O. (2023). A digital taxation model for Nigeria: Standardizing collection through technology integration. *International Journal of Frontline Research and Reviews*, 1(4), 18–39. https://doi.org/10.56355/ijfrr.2023.1.4.0036

Okere, W., Nwobia, C. E., Okoye, N. J., & Olaleye, F. (2024). Impact of information communication technology penetration on tax revenue in Sub-Saharan Africa. *Nnadiebube Journal of Social Sciences*, 5(2), 93–118.

Okoro, E. E., Adeleye, N. B., Okoye, U. L., & Maxwell, O. (2021). Gas flaring, ineffective utilization of energy resource and associated economic impact in Nigeria: Evidence from ARDL and Bayer-Hanck cointegration techniques. *Energy Policy*, 156, Article 112260. https://doi.org/10.1016/j.enpol.2021.112260

Okoroigwe, S. E., Obilikwu, J., Sayedi, N. S., Yusuf, B. A., & Maichibi, J. H. (2023). Inflation rate and tax revenue performance: A time series assessment of Nigeria's four decades experience. *International Journal of Research and Innovation in Social Science*, 7(12), 265–276. https://doi.org/10.47772/IJRISS.2023.7012023

Okoye, J. N., Egbunike, F. C., & Ogbodo, O. C. (2021). Effect of oil revenue on Nigeria's budget performance. *Journal of Global Accounting*, 7(1), 32–41. https://doi.org/10.9790/5933-1502010108

Oladejo, O. J. (2024). Effect of federal government tax and non-tax revenue on economic growth in Nigeria. *African Journal of Accounting and Financial Research*, 7(3), 1–20. https://doi.org/10.52589/AJAFR-DJU0AHOI

Olaoye, F. O., & Akinola, A. A. (2019). Tax revenue and budget implementation in Nigeria. *American Journal of Industrial and Business Management*, 9(5), 1219–1233. https://doi.org/10.4236/ajibm.2019.95082

Olayemi, A. O., & Olawole, C. O. (2024). Revenue leakages and their implications on the Nigeria's economic development. *International Journal of Research and Scientific Innovation*, 11(4), 572–584. https://doi.org/10.51244/IJRSI.2024.1104042

Omodero, C. O., & Alege, P. O. (2023). Federal government tax independence, statutory quota and capital investment. *Heliyon*, 9(10), Article e20272. https://doi.org/10.1016/j.heliyon.2023.e20272

Omodero, C. O., & Okafor, C. M. (2021). Digital financing and taxation in the 4th industrial revolution: Evidence from Nigeria. *Universal Journal of Accounting and Finance*, 9(6), 1594–1601. https://doi.org/10.13189/ujaf.2021.090636

Omotayo, O. A., Kehinde, O., & Alaba, J. S. (2025). E-Governance and public service delivery: Evidence from Nigeria. *Global International Journal of Innovative Research*, 3(2), 74–88. https://doi.org/10.59613/global.v3i1.374

Organization for Economic Co-operation and Development. (2023). *Revenue statistics in Africa 2023*. Paris, France: OECD Publishing. https://doi.org/10.1787/15bc5bc6-en-fr

Osadola, O. S., Ojo, T. W., & Oludemi, S. A. (2023). Budget performance and economic growth in Nigeria: A historical review of the 4th Republic. *Rowter Journal*, 2(1), 12–19. https://doi.org/10.33258/rowter.v2i1.828

Oti-Akenteng, E., Ocansey, O. N. D. E., & Asamoah, O. F. (2025). Impact of digitalization on revenue generation and transparency within local government frameworks. *International Journal of Science and Research Archive*, 14(3), 1761–1777. https://doi.org/10.30574/ijsra.2025.14.3.0888

Pesaran, M. H., Shin, Y., & Smith, R. J. (2001). Bounds testing approaches to the analysis of level relationships. *Journal of Applied Econometrics*, 16(3), 289–326. https://doi.org/10.1002/jae.616

Premchand, A., & Garamfalvi, L. (1992). Government budgeting and accounting system. In A. Premchand (Ed.), *Public expenditure management* (pp. 268–290). Washington, DC: International Monetary Fund.

Prena, G. D., & Putri, P. D. (2020). Implementation of e-budgeting to government performance with internal control as a moderation variable. *E-Jurnal Akuntansi*, 30(5), 1318–1328.

Rivero-del-Paso, L., Pattanayak, S., Uña, G., & Tourpe, H. (2023). *Digital solutions guidelines for public financial management* (How-To Note No. 2023/007). Washington, DC: International Monetary Fund. https://doi.org/10.5089/9798400251566.005

Rossel, L., Santoro, F., & Hakizimana, N. (2024). *Technology evolution and tax compliance: Evidence from Rwanda* (ICTD Working Paper 182). Brighton, UK: Institute of Development Studies. https://doi.org/10.19088/ictd.2023.048

Sadiq, A. I., & Durowaiye, O. O. (2020). Impact of tax and non-tax revenue on Nigerian national development (1991–2020). *Journal of Public Finance and Economic Development*, 4(1), 1–13.

Sepasgozar, F. M. E., Ramzani, U., Ebrahimzadeh, S., Sargolzae, S., & Sepasgozar, S. (2020). Technology acceptance in e-governance: A case of a finance organization. *Journal of Risk and Financial Management*, 13(7), Article 142. https://doi.org/10.3390/jrfm13070142

Shleifer, A. (2005). Understanding regulation. *European Financial Management*, 11(4), 439–451. https://doi.org/10.1111/j.1354-7798.2005.00291.x

Sinnasamy, P., & Bidin, Z. (2017). The relationship between tax rate, penalty rate, tax fairness and excise duty noncompliance. *SHS Web of Conferences*, 34, Article 01001. https://doi.org/10.1051/shsconf/20173401001

Solanke, T. F., Olaleye, R. B., Efuntade, O. A., & William, Y. B. (2021). Impact of tax penalty on government revenue in Nigeria. *UMYU Journal of Accounting and Finance Research*, 1(2), 155–164. https://doi.org/10.61143/umyu-jafr.1(2)2021.010

Temba, S. R. (2025). Exploring the impact of e-governance on public sector efficiency and accountability in local governments: A case of Kinondoni and Ubungo Municipalities in Tanzania. *African Journal of Empirical Research*, 6(1), 158–170. https://doi.org/10.51867/ajernet.6.1.16

Umar, M., Bappi, U., & James, C. (2023). The effect of information communication technology (ICT) on revenue generation in Gombe State Internal Revenue Service. *AKSU Journal of Administration and Corporate Governance*, 3(3), 22–34. https://doi.org/10.61090/aksujacog.2023.017

Umaru, A. D., Aliero, H. M., & Abubakar, M. (2021). Budget deficit and economic growth in Nigeria. *Central Bank of Nigeria Economic and Financial Review*, 59(2), 23–41.

United Nations. (2024). *E-Government survey 2024: Accelerating digital transformation for sustainable development*. New York, NY: Department of Economic and Social Affairs, United Nations.

Usman, M. D., & Mazadu, U. S. (2021). Telecommunication infrastructure investment and economic growth nexus: Evidence from Nigeria. *Lapai Journal of Economics*, 5(2), 11–23. https://doi.org/10.5281/zenodo.6349118

Waleed, K. A. (2020). Direct and indirect taxes effects on public budget deficit in Jordan from 2008 to 2018. *International Journal of Management*, 11(8), 72–79. https://doi.org/10.34218/IJM.11.8.2020.007

Widuri, R., Devina, M. F., & Wati, Y. (2019). The influence of penalties, the trust on authorities, and the tax audit toward tax compliance. *Journal of Economics and Business*, 2(2), 218–229. https://doi.org/10.31014/aior.1992.02.02.81

Yunusa, N., Idris, T. I., Zango, G. A., & Kibiya, U. M. (2016). Gas flaring effects and revenue made from crude oil in Nigeria. *International Journal of Energy Economics and Policy*, 6(3), 617–620.

Yurdadoğ, V., Karadağ, N. C., Albayrak, M., & Bozatlı, O. (2022). Analysis of non-tax revenue: Evidence from the European Union. *Amfiteatru Economic*, 24(60), 485–506. https://doi.org/10.24818/EA/2022/60/485

Zhang, S. H., & Huang, Z. W. (2019). Research on perfecting government non-tax revenue management system. *Open Journal of Accounting*, 8(3), 35–46. https://doi.org/10.4236/ojacct.2019.83003

Zhao, X., Muhammad, B., Wu, J., Jan, M. S., Sadaf, A., & Muhammad, I. U. H. (2024). Unraveling the factors influencing digital transformation and technology adoption in high-tech firms: The moderating role of digital literacy. *SAGE Open*, 14(4), 1–16. https://doi.org/10.1177/21582440241300189