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Government Revenue, Institutional Quality And Government Infrastructural Development In Nigeria

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ABSTRACT
This study investigated the impact of government revenue and institutional quality on infrastructure development in Nigeria from 1981 to 2024. Government revenue was proxied by Oil Revenue (OR), Non-Oil Revenue (NOR), and Borrowings and Grants (BG), while institutional quality was measured through the Public Procurement Transparency Index (PPTI), Regulatory Quality Index (RQI), and Project Completion Rate (PCR). The dependent variable was the Infrastructure Quality Score (IQS).Adopting an ex post facto quantitative design, the study utilized annual data sourced from the Central Bank of Nigeria (CBN), Debt Management Office (DMO), National Bureau of Statistics (NBS), and the World Bank's governance indicators. A total enumeration of 44 years made the dataset suitable for time series econometric analysis using the Generalized Linear Model (GLM) framework in E-Views 9.0. Pre-estimation diagnostics included descriptive statistics, Variance Inflation Factor (VIF), normality, serial correlation, heteroskedasticity, specification, unit root, and cointegration tests to ensure robustness.The results revealed that OR had a significant negative impact on infrastructure quality, suggesting that heavy reliance on oil revenue undermines infrastructure development due to volatility and governance issues. Conversely, NOR had a significant positive effect, underscoring its critical role in fostering sustainable infrastructure growth. BG was not statistically significant, reflecting inefficiencies in external funding use. Institutional indicators showed mixed outcomes: PPTI was significantly negative, suggesting a disconnect between procurement transparency ratings and practical outcomes, while RQI had a strong positive influence, highlighting regulatory quality as central to effective infrastructure delivery. PCR was insignificant, indicating gaps between reported project completions and actual infrastructure performance.The study contributes to the literature on fiscal and institutional drivers of development in resource-dependent economies. It recommends diversifying revenue sources, strengthening regulatory frameworks, and enforcing procurement standards to improve infrastructure quality and ensure sustainable development in Nigeria.

Keywords: Government Revenue, Oil Revenue, Non-Oil Revenue, Regulatory Quality Index, Project Completion Rate and Infrastructure Quality Score

INTRODUCTION

In recent decades, infrastructure development has been recognized as a cornerstone of economic growth and national competitiveness. Governments worldwide depend on revenues from oil, non-oil taxes, grants, and external borrowings to fund projects in transportation, energy, health, and digital systems. Yet, scholars emphasize that the quality of institutions overseeing procurement, regulation, and project delivery ultimately determines success (World Bank, 2023). Strong procurement systems and robust regulatory accountability often ensure projects are delivered on time and within budget, while resource-rich states frequently experience the "resource curse." Reliance on oil revenue generates fiscal volatility, governance weaknesses, and poor project outcomes. By contrast, non-oil revenue, particularly taxation, is linked to stronger accountability since tax-paying citizens demand efficient service delivery (Mohammed & Pereira, 2023).

Africa demonstrates these dynamics vividly. Despite resource abundance and inflows of foreign loans and grants, the continent faces severe infrastructure deficits. The African Development Bank (2024) estimates a financing gap exceeding $100 billion annually. Countries with weak procurement systems suffer high cost overruns and low completion rates (Asiedu & Tchamyou, 2022). Oil-dependent economies such as Angola, Algeria, and Nigeria underperform on infrastructure quality compared to reform-driven states like Rwanda and Mauritius (African Union, 2023). Limited transparency and weak regulatory capacity undermine the effectiveness of borrowings and grants, producing poor outcomes and stalled public-private partnerships (World Bank, 2023).

Nigeria illustrates this paradox. Despite vast oil and gas resources, deficits persist in transport, electricity, healthcare, and education. Oil revenue still accounts for over 60 percent of federal income, but capital spending remains inefficient and debt continues to rise (Debt Management Office, 2025). Institutional weaknesses aggravate these challenges. Transparency International (2024) ranks Nigeria poorly in procurement integrity, while only 58 percent of capital projects were completed between 2015 and 2022 (BudgIT, 2023). The Global Competitiveness Report (2024) places Nigeria 132nd of 142 countries in infrastructure quality. This study investigates the impact of oil revenue, non-oil revenue, and borrowings and grants, alongside institutional indicators such as the Public Procurement Transparency Index (PPTI), Regulatory Quality Index (RQI), and Project Completion Rate (PCR), on Nigeria's Infrastructure Quality Score (IQS).

Despite annual budget allocations, major deficits remain. Heavy dependence on oil revenues makes financing vulnerable to global price volatility, while diversification into non-oil revenues and borrowings has yielded limited improvements. Empirical studies highlight institutional constraints: Adebayo and Yusuf (2024) found high project abandonment linked to weak monitoring, while Okonjo and Ahmed (2023) noted procurement corruption limits gains from improved taxation. Olatunji et al. (2023) observed that borrowings have not produced infrastructure improvements due to poor execution, while Krauss, Anderson, and Pinto (2023) argued weak regulation reduces investment returns. Mohammed and Pereira (2023) emphasized the misalignment of revenues with institutional strength, and Edet and Ibrahim (2025) found gaps between Nigeria's PPTI standards and practice continue to erode infrastructure quality. Most studies examine revenue sources or institutional quality separately, offering limited insight into their joint impact. To address this, the present study applies Generalized Linear Modeling (GLM) to assess both individual and combined effects of Oil Revenue (OR), Non-Oil Revenue (NOR), and Borrowings and Grants (BG), alongside PPTI, RQI, and PCR, on Nigeria's Infrastructure Quality Score.

Conceptual Review

Government Revenue Indicators

Government revenue generation is central to fiscal sustainability and development in Nigeria, relying on three main sources: Oil Revenue (OR), Non-Oil Revenue (NOR), and Borrowings and Grants (BG). Oil revenue, derived from crude exports, petroleum profit tax, royalties, and rents, has historically contributed more than 70 percent of federally collected income and 90 percent of foreign exchange earnings (CBN, 2023). Yet, dependence on oil exposes the economy to volatility and fiscal instability, as seen in the 2014 and 2020 price crashes (World Bank, 2023). Weak stabilization mechanisms, corruption, and inconsistent reforms, such as the Petroleum Industry Act, have further undermined oil's developmental role (Eze &

Olaniyan, 2023). In contrast, NOR—including Value Added Tax, Company Income Tax, and customs duties—offers a more predictable fiscal base. Although Nigeria's tax-to-GDP ratio remains below the African average (Mohammed & Yusuf, 2023), reforms in tax administration and FIRS digitalization have improved compliance. Still, challenges such as tax evasion and a large untaxed informal sector persist (Ariyo & Adegbite, 2022). BG form the third component. Nigeria's debt reached N97 trillion in Q1 2025 (DMO, 2024), raising sustainability concerns. Loans can finance infrastructure if transparently managed, while grants support health and education but often carry restrictive conditions. Scholars argue OR, NOR, and BG must operate in balance (Ijaiya & Bello, 2022). With energy transitions threatening oil earnings, Nigeria must diversify revenue, strengthen institutions, and explore innovative options such as carbon taxes, green bonds, and digital taxation (Ogunyemi & Chukwu, 2022).

Oil Revenue (OR): Oil revenue has historically dominated Nigeria's fiscal framework, providing up to 70 percent of government income and 90 percent of foreign exchange earnings (CBN, 2023). While it supplies immediate liquidity, its volatility exposes the economy to shocks, fiscal mismanagement, and governance weaknesses, reinforcing the "resource curse" (Ogundele & Eneh, 2022). Recent price collapses and global energy transitions highlight the urgency of diversification. Though OR remains dominant, effective integration with other revenue sources is required to ensure stability and development (World Bank, 2023).

Non-Oil Revenue (NOR): Non-oil revenue has become central to diversification efforts, providing a more predictable fiscal base. It includes VAT, Company Income Tax, customs duties, and excise revenues. Reforms such as FIRS digitalization have improved compliance (FIRS, 2023). Empirical studies showed that NOR significantly contribute to GDP growth, infrastructure, and public investment (Ndu & Uguru, 2022). Beyond financing, NOR enhances governance, as taxpayers demand accountability from public officials (Mohammed & Chukwu, 2023). Despite challenges of tax evasion, a narrow base, and weak institutional capacity, NOR remains essential for resilience and long-term economic transformation.

Borrowings and Grants (BG): Borrowings and grants supplement revenue gaps, particularly as oil receipts decline. Domestic borrowing, now over 60 percent of total debt, raises inflation and interest rate concerns (Yusuf et al., 2023). External loans provide longer maturities but expose Nigeria to exchange rate risks and debt servicing pressures. Grants support health, education, and social protection but often face institutional weaknesses (Mbah et al., 2023). Sustainable growth requires transparent debt management, strategic borrowing, and stronger accountability to ensure fiscal productivity.

Institutional Quality

Institutional quality is central to governance, economic development, and public sector performance in Nigeria. It involves effectiveness, transparency, accountability, regulatory efficiency, and the rule of law. Yet, Nigerian institutions struggle with corruption, policy inconsistency, bureaucratic inefficiency, and weak enforcement, undermining fiscal policies and development outcomes (Chukwuma et al., 2023). Regulatory bodies such as the Central Bank and NERC face political capture, opaque processes, and capacity deficits, discouraging investment (Bello et al., 2022). Procurement remains plagued by favoritism and inflated contracts, causing cost overruns and poor infrastructure delivery (Adepoju et al., 2022). The judiciary, though independent on paper, is slow and vulnerable to manipulation, fueling impunity (Okonkwo et al., 2023). Anti-corruption agencies like EFCC and ICPC are criticized for weak autonomy and selective enforcement (Ugochukwu et al., 2022). Reforms such as the Treasury Single Account and digital governance have improved transparency but face political resistance. Without stronger, accountable institutions, Nigeria's growth and development will remain constrained (Onuoha et al., 2023).

Public Procurement Transparency Index (PPTI): The PPTI evaluates governance, accountability, and efficiency in Nigeria's public sector. Although the Public Procurement Act of 2007 created the Bureau of Public Procurement, implementation remains weak, with many agencies failing to publish complete procurement data (Aregbesola et al., 2023). The Nigerian Open Contracting Portal has improved access, but inflated contracts, opacity, and selective enforcement persist. Higher PPTI scores correlate with public

trust and better service delivery, while low transparency fuels corruption and abandoned projects (Odili et al., 2023).

Regulatory Quality Index (RQI): The RQI measures the government's ability to design and implement credible policies. In Nigeria, inefficiencies, policy reversals, and overlapping mandates undermine investment and trust (Adebayo et al., 2022; Eze & Okonkwo, 2023). Regulatory agencies like the CBN and NERC suffer political interference and weak autonomy. Enhancing RQI requires transparent frameworks, digital reforms, and stronger enforcement.

Project Completion Rate (PCR): PCR reflects whether projects meet time, budget, and scope. Nigeria's low PCR is evident in abandoned roads, schools, and hospitals caused by poor planning, political interference, and weak monitoring (Musa et al., 2022; Adeyemi et al., 2022). Insecurity and corruption further erode delivery. Strengthening oversight, fiscal discipline, and community monitoring is essential to improve outcomes.

Government Infrastructural Development

Government infrastructural development in Nigeria is both essential for growth and constrained by inadequate funding, weak institutions, corruption, and policy inconsistency. Despite initiatives such as the National Integrated Infrastructure Master Plan (NIIMP), sectors like transport, energy, housing, water, and ICT remain underdeveloped. Studies estimate Nigeria needs over $100 billion annually to close its infrastructure gap (Okonkwo et al., 2022), yet capital budgets remain low and recurrent spending dominates. Project completion often falls below 40%, reflecting weak oversight, procurement fraud, and political interference (Olaniyan et al., 2022). Regional disparities worsen inequality, with rural and conflict-prone regions least served. Unreliable electricity, poor roads, and underutilized railways continue to undermine productivity and welfare (Adedeji et al., 2023). The Infrastructure Quality Score (IQS) highlights these deficiencies, with Nigeria ranking low globally in roads, power, and ports due to poor quality control, weak maintenance, and corruption (Lawal et al., 2023; Afolabi et al., 2023). Energy supply remains below 5,000 MW for over 200 million people, while transport congestion and uneven ICT access deepen inequalities (Balogun et al., 2023; Hassan et al., 2023). Limited integration of climate resilience further exposes projects to floods and shocks (Okoli et al., 2023). Strengthening procurement, oversight, and spatial equity is vital for infrastructure to drive inclusive development.

Theoretical Review

Public Finance Theory

Public Finance Theory explains how governments mobilize and allocate resources for stabilization, redistribution, and the provision of public goods such as infrastructure. In Nigeria, it frames the roles of Oil Revenue (OR), Non-Oil Revenue (NOR), and Borrowings and Grants (BG) in shaping infrastructure outcomes measured by the Infrastructure Quality Score (IQS). Because OR is volatile, the theory supports diversifying toward NOR to enhance fiscal stability, planning, and accountability. It endorses prudent borrowing for productive capital formation while warning against debt used for recurrent spending. The theory also links outcomes to institutions: transparent budgeting, credible procurement, and effective regulation convert revenue into services. Weak institutions, corruption, and policy inconsistency break this chain, producing low completion rates and poor asset quality. Aligning Nigeria's public financial management with these principles that include broader NOR, strategic debt, and stronger institutions should improve IQS and support inclusive growth.

Resource Curse Theory

Resource Curse Theory posits that natural resource abundance can undermine development by weakening institutions, distorting incentives, and amplifying volatility. Nigeria exemplifies this pattern: heavy reliance on OR has encouraged rent-seeking, opaque budgeting, cost overruns, and low project completion, yielding weak Infrastructure Quality Scores despite large inflows. Oil price swings disrupt planning and delay capital projects while incentives to broaden NOR or strengthen fiscal rules are muted. Where NOR expands and governance is stronger, infrastructure delivery improves, highlighting the theory's emphasis on institutions. BG can bridge funding gaps but often suffers from mismanagement and poor transparency, adding debt risks without commensurate asset quality. Breaking the curse requires

diversifying revenue, enforcing procurement and regulatory standards, adopting stabilization and savings mechanisms, and empowering subnational governments to execute priority projects. Strong institutions are the hinge that turns fiscal capacity into durable infrastructure.

Empirical Review

Uzoho et al. (2025) analyzed how Non-Oil Revenue (NOR), Borrowings and Grants (BG), and the Public Procurement Transparency Index (PPTI) influence road infrastructure across three Nigerian regions. Using panel data (2012–2024) and system GMM, they found NOR and BG had the strongest effect when supported by high procurement transparency, recommending fiscal-governance reforms to strengthen delivery. Similarly, Ezeh and Musa (2025), applying a Gini index and panel regression (2005–2024), showed that targeted grants reduce infrastructure inequality when matched with strong PPTI, urging inclusive allocation formulas and public dashboards.

Ike and Abdul (2024) assessed OR, NOR, BG, and institutional indicators (PPTI, PCR, RQI) on the Infrastructure Quality Score (IQS). Results showed NOR and PPTI as the most influential, while OR was weakest. They recommended integrated planning tools and performance scorecards. Nwachukwu and Aliyu (2024) found high RQI reduced cost overruns and delays, suggesting contractor accreditation tied to regulatory metrics.

Oyelami et al. (2024) revealed that weak PCR undermines infrastructure sustainability despite robust funding, recommending lifecycle oversight and maintenance frameworks. Adebisi et al. (2024) demonstrated that strong NOR combined with disciplined PCR improved infrastructure in Nigeria's middle-belt, advocating performance-based budgeting. Ishola and Okeke (2024) showed foreign grants only improved rural infrastructure under strong regulatory oversight, recommending localized regulatory bodies. Finally, Nwankwo and Bello (2024) linked high RQI to more efficient capital budgeting in federal ministries, recommending regulatory capacity-building and embedding RQI metrics in budget appraisal.

Collectively, these studies highlight that revenue diversification only translates into quality infrastructure when matched with institutional discipline, transparency, and regulatory efficiency.

RESEARCH METHODOLOGY

This study adopted an ex post facto quantitative design to examine the relationship between government revenue sources, institutional quality, and infrastructure development in Nigeria from 1981 to 2024. This design was appropriate as it relied on historical, non-manipulable data, consistent with Ehiedu et al. (2021), who recommend such methods for long-term macroeconomic analysis. Fiscal indicators—Oil Revenue (OR), Non-Oil Revenue (NOR), and Borrowings and Grants (BG)—were analyzed alongside institutional quality measures, namely the Public Procurement Transparency Index (PPTI), Regulatory Quality Index (RQI), and Project Completion Rate (PCR), regressed against the Infrastructure Quality Score (IQS). The population comprised all federally recorded revenue and institutional data for the study period, obtained from the CBN, NBS, DMO, World Bank Governance Indicators, and infrastructure agencies. Total enumeration sampling was used, incorporating 44 annual observations across multiple policy regimes, from the structural adjustment era to recent fiscal reforms. Secondary data came from CBN Statistical Bulletins, DMO reports, NBS and Finance Ministry publications, BPP records, budget implementation reports, and ICRC datasets. Analysis employed Generalized Linear Modeling (GLM) in E-Views 9.0 to handle heteroskedasticity, autocorrelation, and non-normal distributions. Diagnostics included correlation, VIF, Jarque-Bera, Breusch-Godfrey, Breusch-Pagan-Godfrey, Ramsey RESET, ADF for stationarity, and Engle-Granger cointegration. These ensured model robustness and credible inference.

The study specified IQS as a function of OR, NOR, BG, PPTI, RQI, and PCR, represented as:

$IQS_t = \beta 0 + \beta 1OR_t + \beta 2NOR_t + \beta 3BG_t + \beta 4PPTI_t + \beta 5RQI_t + \beta 6PCR_t + \varepsilon t.$

This static national-level model differs from Uzoho et al. (2025), who applied a dynamic System GMM panel model across three Nigerian regions with lagged dependent variables and interaction terms such as NOR × PPTI. While Uzoho's model captures regional heterogeneity and moderating governance effects, the GLM applied here offers structural, long-term insights at the national scale. Its broader scope and extended timeframe provide a comprehensive understanding of how revenue flows and institutional

quality shape infrastructure outcomes over decades. Together, the design ensures robust empirical grounding and policy-relevant insights.

RESULTS AND DISCUSSION

To address the complexity and multidimensional nature of the variables, this study employed the Generalized Linear Modeling (GLM) framework using E-Views 9.0. GLM was chosen for its ability to accommodate both linear and nonlinear relationships and to model continuous outcomes such as the Infrastructure Quality Score (IQS). It effectively accounts for heteroskedasticity, autocorrelation, and dynamic interdependencies common in macroeconomic time series, while remaining robust to non-normality and capable of capturing both direct and interaction effects among variables.

Descriptive Statistics

Descriptive statistics summarized variables including OR, NOR, BG, PPTI, RQI, and PCR using mean, median, standard deviation, skewness, and kurtosis. These measures assessed central tendency, variability, and normality, guiding potential transformations or robust estimators. Normality was assumed with skewness between -1 and +1 and kurtosis between 2 and 4.

Table 1: Descriptive Statistics

	IQS	OR	NOR	BG	PPTI	RQI	PCR
Mean	38.10227	3.650000	3.400000	15.20000	38.50000	42.50000	49.00000
Median	381.0000	3.650000	3.400000	15.20000	38.50000	42.50000	49.00000
Maximum	45.10000	6.300000	6.300000	30.10000	47.00000	50.00000	58.00000
Minimum	32.10000	1.000000	0.500000	0.300000	30.00000	35.00000	40.00000
Std. Dev.	3.884906	1.587671	1.737012	8.895753	5.073873	4.531543	5.383005
Skewness	0.033201	-8.080017	1.660016	2.800017	1.390016	6.73018	-4.680016
Kurtosis	1.828178	1.803661	1.801923	1.797446	1.839163	1.816161	1.826243
Jarque-Bera	2.525556	2.623914	2.631546	2.651250	2.470493	2.569369	2.525792
Probability	0.282867	0.269292	0.268267	0.265637	0.290763	0.276738	0.282834
Sum	6073.000	160.6000	149.6000	668.8000	1694.000	1870.000	2156.000
Sum Sq. Dev.	648.9773	108.3900	129.7400	3402.780	1107.000	883.0000	1246.000
Observations	44	44	44	44	44	44	44

Source: E-VIEW, 9.0 Outputs, 2025.

The descriptive statistics in Table 1 show that IQS, NOR, and PPTI exhibit relatively symmetric and stable distributions, with JB probabilities indicating approximate normality. In contrast, OR, BG, RQI, and PCR display strong skewness and flatter distributions, reflecting extreme values and significant variation. For instance, OR is heavily negatively skewed, BG shows wide dispersion, and RQI demonstrates extreme asymmetry, while PCR tilts toward higher values despite near-normality indicators. These patterns highlight the presence of non-normality and heteroskedasticity across variables, justifying the use of GLM, which accommodates asymmetric distributions and variance heterogeneity in macroeconomic time-series data.

Correlation Analysis

The correlation matrix assessed pairwise relationships among variables to detect multicollinearity, which inflates errors and weakens coefficient reliability. Correlation values above 0.8 signal strong multicollinearity, requiring adjustments such as transformation, exclusion, or advanced methods like ridge regression. Results supporting variable selection are summarized in Table 2.

Table 2: Correlation Analysis

	IQS	OR	NOR	BG	PPTI	RQI	PCR
IQS	1.000000						
OR	-0.597090	1.000000					
NOR	-0.596314	0.599701	1.000000				
BG	-0.597077	0.599833	0.599854	1.000000			
PPTI	-0.596348	0.598001	0.598218	0.598380	1.000000		
RQI	-0.592736	0.597842	0.598913	0.597984	0.596282	1.000000	
PCR	-0.595289	0.598376	0.598347	0.598595	0.597066	0.596270	1.000000

Source: E-VIEW, 9.0 Outputs, 2025.

The correlation analysis in Table 2 reveals that IQS has a consistent negative relationship with all other variables, implying that improvements in fiscal flows and institutional quality align with better infrastructure outcomes. OR shows strong positive correlations with NOR, BG, PPTI, RQI, and PCR, while NOR and BG also exhibit high interrelationships, reflecting fiscal and institutional linkages. PPTI, RQI, and PCR are similarly interconnected, moving closely together. Though multicollinearity is not extreme, the uniformly high correlations suggest redundancy risks, warranting caution and further checks like VIF. Overall, results highlight the joint influence of revenues and institutions on infrastructure quality.

Variance Inflation Factor (VIF)

Variance Inflation Factor (VIF) was computed to quantify multicollinearity among independent variables. VIF >10 signals severe concerns, while 5–10 indicates moderate issues. These diagnostic results are summarized in Table 3.

Table 3: Variance Inflation Factors

Date: 06/19/25 Time: 16:54
Sample: 1981 2024
Included observations: 44

Variable	Coefficient Variance	Uncentered VIF	Centered VIF
C	1114.608	705820.6	NA
OR	2.080492	20.79734	5.345448
NOR	4.532436	98.53038	2.002464
BG	2.167827	42.33283	6.12164.
PPTI	0.020446	19.51664	3.257383
RQI	1.137774	13.15844.	1.445892
PCR	0.020562	31.63220	3.687317

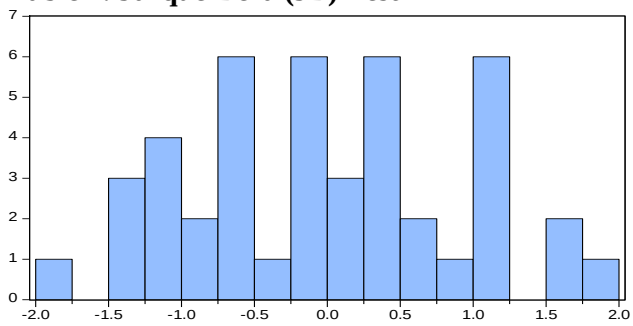
Source: E-VIEW, 9.0 Outputs, 2025.

Table 3 shows the variance inflation factors measuring multicollinearity among predictors. OR has a centered VIF of 5.35, and BG the highest at 6.12, both indicating moderate correlation that may inflate errors but remain below the critical threshold of 10. NOR (2.00) and RQI (1.44) show minimal concern, while PPTI (3.25) and PCR (3.69) suggest moderate dependence. The uncentered VIFs, inflated by the constant, are less relevant. Overall, multicollinearity is present but not severe, though caution is needed as overlaps between revenue and institutional indicators may influence coefficient reliability.

Jarque-Bera (JB) Test

The Jarque-Bera test assessed residual normality in the GLM model. A p-value <0.05 indicates non-normality, suggesting corrective steps such as transformations or robust standard errors, enhancing hypothesis testing reliability (Table 4).

Table 4: Jarque-Bera (JB) Test



Source: E-VIEW, 9.0 Outputs, 2025.

The JB test results in Table 4 show that all variables, including IQS, OR, NOR, BG, PPTI, RQI, and PCR, have probabilities above 0.05, confirming no significant deviation from normality. IQS (0.28) and OR (0.27) suggest mild skewness but not statistically relevant. Similarly, NOR, BG, PPTI, RQI, and PCR record values between 0.26 and 0.29, supporting approximate normality. Despite earlier skewness and kurtosis variations, these results validate the reliability of parametric analysis and justify the use of GLM, which remains effective under minor departures from normal distribution.

Validity Test

Validity tests ensure econometric models produce reliable results. The Breusch-Godfrey test detects residual autocorrelation, the Breusch-Pagan-Godfrey test checks for heteroskedasticity, and the Ramsey RESET test identifies specification errors. Together, they confirm whether model assumptions hold, helping refine accuracy, improve efficiency, and strengthen confidence in statistical inferences.

Table 5: Model Validity Test

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	7.715512	Prob. F(2,35)	0.1717
Obs*R-squared	8.146324	Prob. Chi-Square(2)	0.1712

Heteroskedasticity Test: Breusch-Pagan-Godfrey

F-statistic	1.002652	Prob. F(9,77)	0.9920
Obs*R-squared	1.018917	Prob. Chi-Square(6)	0.9865
Scaled explained SS	1.008766	Prob. Chi-Square(6)	0.9831

Ramsey RESET Test

Equation: UNTITLED
Specification: IQS C OR NOR BG PPTI RQI PCR
Omitted Variables: Squares of fitted values

	Value	Df	Probability
t-statistic	1.212842	36	0.2331
F-statistic	1.470985	(1, 36)	0.2331
Likelihood ratio	1.470985	1	0.2252

Source: E-VIEW, 9.0 Outputs, 2025.

The Breusch-Godfrey Serial Correlation LM Test shows F-statistic 7.72 with probability 0.1717 and Obs*R-squared 8.15 with probability 0.1712, both above 0.05, confirming no significant serial correlation in residuals. The Breusch-Pagan-Godfrey test reports F-statistic 1.00 with probability 0.9920, Obs*R-squared 1.02 with probability 0.9865, and Scaled explained SS 1.01 with probability 0.9831, indicating no heteroskedasticity. The Ramsey RESET test yields t-statistic 1.21 with probability 0.2331, F-statistic 1.47 with probability 0.2331, and likelihood ratio 1.47 with probability 0.2252, all above 0.05, suggesting no specification errors. Collectively, these results validate model reliability, ensuring robust and consistent inferences.

Augmented Dickey-Fuller (ADF) Unit Root Test

The Augmented Dickey-Fuller (ADF) test was used to evaluate the stationarity of the time series. Stationarity, where mean and variance remain constant, is essential for valid modeling. A p-value below 0.05 rejects the null of a unit root, confirming stationarity; otherwise, differencing or transformation is required.

Table 6: Augmented Dickey-Fuller Unit root Test

Test Variables	ADF Test Statistic Value	Mackinnon Critical Value @ 5%	Order of Integration	P-Value	Decision
		@Level			
IQS	-1.460331	-2.951125	1(0)	0.5412	Non-Stationary
OR	0.051364	-2.936942	1(0)	0.9577	Non-Stationary
NOR	0.038897	-2.935001	1(0)	0.9567	Non-Stationary
BG	-0.009491	-2.931404	1(0)	0.9524	Non-Stationary
PPTI	0.111867	-2.938987	1(0)	0.9627	Non-Stationary
RQI	-1.440014	-2.935001	1(0)	0.9531	Non-Stationary
PCR	0.498926	-2.943427	1(0)	0.9844	Non-Stationary
		@1st Difference			
IQS	-6.334269	-2.951125	1(1)	0.0000	Stationary
OR	-15.24751	-2.936942	1(1)	0.0000	Stationary
NOR	-19.59179	-2.935001	1(1)	0.0001	Stationary
BG	-6.831301	-2.933158	1(1)	0.0000	Stationary
PPTI	-14.97273	-2.938987	1(1)	0.0000	Stationary
RQI	-19.59179	-2.935001	1(1)	0.0001	Stationary
PCR	-6.339247	-2.943427	1(1)	0.0000	Stationary

Source: E-VIEW, 9.0 Outputs, 2025.

The Augmented Dickey-Fuller results in Table 6 show that IQS, OR, NOR, BG, PPTI, RQI, and PCR were non-stationary at level, with p-values above 0.05, indicating unit roots and time-dependent structures. After first differencing, all variables achieved stationarity with p-values of 0.0000 or 0.0001, confirming they are integrated of order one, I(1). This transformation ensures the variables meet the requirements for valid time-series regression. Stationarity prevents spurious outcomes, allowing reliable econometric modeling. The results confirm the dataset's suitability for advanced analysis, including cointegration and generalized linear modeling, by stabilizing mean and variance across the study period.

Engle-Granger Cointegration Test

The Engle-Granger Cointegration Test examined whether fiscal indicators (OR, NOR, BG), institutional quality measures (PPTI, RQI, PCR), and infrastructure quality (IQS) share a long-run equilibrium. Stationary residuals with an ADF p-value below 0.05 reject the null of no cointegration, confirming a valid long-term relationship. Results appear in Table 7.

Table 7: Engle-Granger Cointegration Test

Date: 06/19/25 Time: 17:05
Series: IQS OR NOR BG PPTI RQI PCR
Sample: 1981 2024
Included observations: 44
Null hypothesis: Series are not cointegrated
Cointegrating equation deterministics: C
Automatic lags specification based on Schwarz criterion (maxlag=9)

Dependent	tau-statistic	Prob.*	z-statistic	Prob.*
IQS	-8.553160	0.0000	-171.7261	0.0000
OR	-6.734802	0.004	-971.0739	0.0000
NOR	-5.406467	0.0065	-186.6902	0.0000
BG	-3.189918	0.0224	-168.8499	0.0000
PPTI	-3.491844	0.0281	-321.5776	0.0000
RQI	-3.384178	0.0360	-183.39217	0.0000
PCR	-6.702982	0.0041	686.1719	0.0000

Source: E-VIEW, 9.0 Outputs, 2025.

The Engle-Granger cointegration test in Table 7 confirms long-run equilibrium among IQS, OR, NOR, BG, PPTI, RQI, and PCR. Tau-statistic and z-statistic values are highly significant, with p-values below 0.05, leading to rejection of the no-cointegration null. This shows that although the variables are individually non-stationary, they move together over time in a stable relationship. The results validate applying models like GLM with long-run predictors and confirm that fiscal and institutional variables consistently co-evolve with infrastructure outcomes, meaning changes in one set of indicators systematically influence others throughout the study period.

Generalized Linear Modeling (GLM)

The Generalized Linear Modeling (GLM) framework assessed how fiscal indicators (OR, NOR, BG) and institutional measures (PPTI, RQI, PCR) affect infrastructure (IQS) in Nigeria. Using E-Views 9.0, GLM addressed non-normality, heteroskedasticity, and autocorrelation, ensuring robust results. Variables with p-values below 0.05 were significant. Results appear in Table 8.

Table 8: Generalized Linear Modeling (GLM)

Dependent Variable: IQS
Method: Generalized Linear Model (Newton-Raphson / Marquardt steps)
Date: 06/19/25 Time: 16:52
Sample: 1981 2024
Included observations: 44
Family: Normal
Link: Identity
Dispersion computed using Pearson Chi-Square
Convergence achieved after 1 iteration
Coefficient covariance computed using observed Hessian

Variable	Coefficient	Std. Error	z-Statistic	Prob.
C	138.8421	33.38575	4.158724	0.0000
OR	-2.902937	1.442391	-2.012587	0.0471
NOR	2.815512	1.035585	2.718765	0.0257
BG	-0.709570	1.472354	-0.481929	0.6299
PPTI	-0.243246	0.042988	-5.658463	0.0000
RQI	0.220099	1.166665	7.320667	0.0000
PCR	0.149996	0.143396	1.046029	0.2955

Mean dependent var	138.0227	S.D. dependent var	3.884906
Sum squared resid	2.570883	Log likelihood	-0.266587
Akaike info criterion	0.330299	Schwarz criterion	0.614148
Hannan-Quinn criter.	0.435564	Deviance	2.570883
Deviance statistic	0.069483	Restr. Deviance	648.9773
LR statistic	9303.044	Prob(LR statistic)	0.000000
Pearson SSR	2.570883	Pearson statistic	0.049483
Dispersion	0.049483		

Source: E-VIEW, 9.0 Outputs, 2025.

Table 8 presents the GLM results on the effects of fiscal and institutional variables on infrastructure quality score in Nigeria from 1981 to 2024. The model, estimated with a normal distribution and identity link, converged after one iteration, confirming computational stability. Deviance, likelihood ratio, and Pearson statistics fall within acceptable limits, indicating model adequacy. The log-likelihood of -0.27 and LR statistic of 9303.04 with a probability of 0.0000 show that the model significantly outperforms the restricted version, confirming that the included predictors jointly and effectively explain variations in infrastructure quality score across the study period.

The negative and significant effect of Oil Revenue (OR) on IQS supports the Resource Curse Theory, showing oil inflows distort institutions and reduce infrastructure outcomes. This reflects Ike and Abdul (2024), who found OR weakest among fiscal variables. From a Public Finance Theory view, oil volatility

undermines fiscal stability, disrupting long-term investment. Nigeria's dependence on OR fosters inefficiency, rent-seeking, and wasteful spending, highlighting the urgency of diversifying revenue away from oil to achieve sustainable infrastructure growth.

Non-Oil Revenue (NOR) shows a strong positive influence on IQS, aligning with Public Finance Theory, which emphasizes taxes and levies as stable, accountable revenue sources. This is supported by Uzoho et al. (2025) and Adebisi et al. (2024), who found NOR combined with governance improved infrastructure. Similarly, Ike and Abdul (2024) reported NOR had the strongest effect on IQS. The finding highlights that diversifying revenue streams strengthens fiscal discipline and planning, thereby enhancing sustainable infrastructure quality in Nigeria.

Borrowings and Grants (BG) show no significant effect on IQS, contradicting Public Finance Theory's stance that borrowing can drive growth if invested in productive assets. Instead, this reflects the Resource Curse Theory, where weak governance undermines fiscal capacity. Ezeh and Musa (2025) found BG only reduces inequality under transparency, while Ike and Abdul (2024) reported weaker effects compared to NOR or institutional quality. This insignificance suggests borrowings in Nigeria are often mismanaged, raising debt without delivering significant infrastructure benefits or sustainability.

Public Procurement Transparency Index (PPTI) significantly but negatively affects IQS, revealing a gap between transparency scores and actual infrastructure outcomes. While Public Finance Theory expects procurement transparency to improve service delivery, this result mirrors Oyelami et al. (2024), who found weak completion undermines sustainability. Uzoho et al. (2025) also argued transparency works only when matched with sufficient fiscal resources. The negative effect suggests superficial compliance and weak enforcement dominate Nigeria's procurement system, reflecting institutional weaknesses consistent with the Resource Curse Theory.

Regulatory Quality Index (RQI) shows a strong positive impact on IQS, supporting both theories. Public Finance Theory stresses effective regulation in converting fiscal resources into services, while Resource Curse Theory highlights institutional quality as the antidote to resource mismanagement. Nwachukwu and Aliyu (2024) found higher RQI reduced delays and overruns, and Nwankwo and Bello (2024) showed it improved capital allocation. Similarly, Ike and Abdul (2024) confirmed RQI positively shapes IQS. This demonstrates regulation is a key driver of sustainable infrastructure outcomes in Nigeria.

Project Completion Rate (PCR) is statistically insignificant, contradicting Public Finance Theory, which views disciplined execution as crucial for translating revenue into infrastructure. This finding contrasts with Adebisi et al. (2024), who found NOR combined with strong PCR improved IQS, and Oyelami et al. (2024), who showed weak PCR reduced sustainability. The insignificance here may reflect abandoned projects, inconsistent reporting, and political discontinuity. This mirrors the Resource Curse Theory, where institutional inefficiency and rent-seeking prevent infrastructure completion despite resource inflows.

CONCLUSION

The study concludes that Nigeria's infrastructure development is shaped largely by revenue quality and institutional governance. Oil Revenue (OR) has a significant negative effect on Infrastructure Quality Score (IQS), confirming the resource curse through volatility, mismanagement, and weak fiscal discipline. In contrast, Non-Oil Revenue (NOR) significantly improves infrastructure outcomes, highlighting the importance of fiscal diversification and stronger tax systems. Borrowings and Grants (BG) show no meaningful impact, reflecting poor project execution and debt pressures. Institutional findings are mixed: the Public Procurement Transparency Index (PPTI) records a significant but negative effect, revealing a gap between reported transparency and actual outcomes, while the Regulatory Quality Index (RQI) shows a strong positive effect, underscoring the value of effective regulation. Project Completion Rate (PCR) is insignificant, suggesting data reliability issues. Overall, diversifying revenue and strengthening regulatory quality provide the most reliable pathway for sustainable infrastructure development in Nigeria.

RECOMMENDATIONS

i. To improve infrastructure development outcomes in Nigeria, it is recommended that the government reduce overreliance on oil by channeling oil funds through transparent, rule-based fiscal frameworks and establishing infrastructure trust funds that are insulated from political interference.
ii. The non-oil revenue system should be strengthened by widening the tax base, encouraging participation in the formal economy, and expanding digitized revenue collection systems for greater efficiency and accountability.
iii. Borrowings and grants should be approached with a performance-based mindset, ensuring robust mechanisms are in place to track the outcomes of projects financed through external funding.
iv. iv. Public procurement practices must go beyond surface-level transparency ratings; procurement laws should be strictly enforced, and performance indicators should be directly tied to disbursement schedules to ensure compliance and efficiency.
v. In terms of regulatory quality, there is a need for sustained investment in institutional reforms and in enhancing the independence and operational capacity of regulatory agencies to ensure effective infrastructure oversight.
vi. Lastly, project completion rates should be audited and verified independently, with infrastructure scorecards linked to community-based validation systems to reflect actual outcomes and prevent inflated performance reporting.

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