Does Institutional Quality Drive Infrastructural Development? Evidence from Nigeria

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Abstract
Nigeria's persistent infrastructure deficit amid considerable resource wealth constitutes a compelling developmental paradox that demands institutional explanation. This study empirically investigates whether institutional quality drives infrastructural development in Nigeria over the period 1986–2024, anchored within the New Institutional Economics framework. Employing the Autoregressive Distributed Lag bounds testing approach alongside Granger causality analysis, and operationalizing institutional quality through the World Bank's six-dimensional Worldwide Governance Indicators framework, the study establishes three principal findings. First, institutional quality exerts a positive and statistically significant impact on infrastructural development in both the short run (4.51%) and long run (3.82%), confirming governance quality as a structural determinant of infrastructure outcomes. Second, while government capital expenditure independently promotes infrastructure development, its productive complementarity with institutional quality remains constrained by deep-seated governance inefficiencies. Third, no statistically significant short-run causal relationship exists between the two variables, suggesting their nexus is structurally cointegrated rather than directionally causal. These findings position institutional reform, not financing expansion, as the foundational precondition for sustainable infrastructural development in Nigeria.

Keywords: *Institutional Quality; Infrastructural Development; Infrastructure–Governance Nexus; Public Investment Efficiency; Governance Effectiveness; Resource Curse Hypothesis*

Introduction

The structural transformation of economies, across both developed and developing worlds, remains inextricably tied to the quality and adequacy of infrastructure. Beyond its role as a physical asset, infrastructure functions as a catalyst, compressing transaction costs, expanding market access, and amplifying total factor productivity across sectors. Calderón and Servén (2008) provide compelling cross-country evidence that infrastructure development simultaneously accelerates economic growth and narrows income inequality, a rare dual dividend in development economics. At the aggregate level, Égert et al. (2009) estimate that a 10% rise in infrastructure

stocks yields approximately 1.5% long-run GDP gains among OECD economies. Globally, the World Bank (2022) projects that bridging infrastructure deficits could lift developing-country annual growth by up to 1.5 percentage points. These convergent findings position infrastructure not merely as a policy priority, but as an irreplaceable structural precondition for sustainable and inclusive economic advancement worldwide.

Nowhere is the infrastructure imperative more acutely felt than across Sub-Saharan Africa, where chronic deficits in energy, transport, and digital infrastructure continue to suppress productive capacity and retard structural transformation. The African Development Bank (2018) estimates that the continent faces an annual infrastructure financing gap of between $68 billion and $108 billion, a chasm that systematically constrains growth, deepens poverty, and widens intraregional inequality. Within this landscape, Nigeria presents a particularly compelling and paradoxical case. As Africa's largest economy and most populous nation, Nigeria commands vast natural resource endowments and demographic potential, yet its infrastructure stock remains critically underdeveloped. The World Bank (2023) ranks Nigeria among the lowest quartile of African nations on key infrastructure access indicators, with electricity access stagnating at approximately 57% of the population and road density among the continent's most deficient. Fay et al. (2019) further demonstrate that infrastructure deficits in resource-rich African economies like Nigeria impose output losses estimated at 2% of GDP annually, a structural drag that compounds across decades of underinvestment and institutional inertia.

The persistence of Nigeria's infrastructure deficit amid considerable resource wealth constitutes one of the most confounding paradoxes in African development discourse. Since returning to civilian governance in 1999, Nigeria has earned over $600 billion in oil revenues, yet infrastructure access has improved only marginally, and the country remains among the world's most infrastructure-deprived nations relative to its economic size (Ogbuabor & Nwosu, 2017; Ogunleye 2022; Muskan, 2024; Anowor, Ukpere & Onodugo, 2025). This contradiction directly challenges capital-scarcity explanations, redirecting analytical attention toward deeper institutional determinants. Acemoglu, Johnson, and Robinson (2001); North (1990) identify weak institutions, manifesting through corruption, poor regulatory governance, and fragile rule of law, as the principal mechanism through which resource wealth fails to translate into productive infrastructure outcomes. Corroborating this, Transparency International (2023) ranks Nigeria 145th of 180 nations on its Corruption Perceptions Index, while the World Bank (2023) places Nigeria in the bottom 20th percentile on Government Effectiveness, institutional conditions profoundly hostile to sustainable infrastructure delivery.

Against this backdrop, the nexus between institutional quality and infrastructural development in Nigeria demands rigorous scholarly interrogation. While Nigeria's infrastructure deficit is well-documented, the institutional mechanisms through which governance failures translate into poor infrastructure outcomes remain insufficiently theorized and empirically underexplored in the existing literature. Institutional quality, encompassing regulatory effectiveness, accountability frameworks, rule of law, and corruption control, directly conditions the planning, financing, and execution of infrastructure investments, yet most Nigerian-focused studies treat institutions as peripheral rather than structural determinants (Acemoglu & Robinson, 2013; North, 1990; Abubakar, 2020; Eze et al, 2025; Anowor et al, 2025). Weak institutions breed procurement inefficiencies, elite capture of public resources, and chronic project abandonment, pathologies that are endemic to Nigeria's infrastructure delivery architecture. This study therefore investigates how variations in institutional quality systematically drive infrastructural development outcomes in

Nigeria, offering empirically grounded insights to guide institutional reforms and ultimately strengthen the foundations for sustainable national development.

Notwithstanding a growing body of literature examining infrastructure determinants in developing economies, significant analytical gaps persist. The preponderance of existing studies privileges financial variables such as public investment levels, foreign aid flows (Adegboye et al, 2020), and fiscal capacity, as the primary explanations for infrastructure outcomes, largely treating institutional quality as a background condition rather than an independent structural driver (Calderón & Servén, 2008; Onodugo et al, 2013; Fay et al., 2019; Sabir, Rafique, & Abbas, 2019; Anowor, Ichoku & Onodugo, 2020). Even within the Nigerian context, empirical inquiries have predominantly concentrated on macroeconomic correlates of infrastructure investment, including oil revenue allocation, external debt, and budgetary expenditure patterns, while the governance architecture mediating these flows into tangible infrastructure outcomes remains conspicuously underexamined (Ogbuabor & Nwosu, 2017). Furthermore, studies that do engage institutional dimensions often rely on single-indicator proxies (typically corruption indices alone) thereby failing to capture the multidimensional character of institutional quality (Onodugo et al, 2014; Asongu & Nwachukwu, 2016; Anowor, Onodugo & Ukpere, 2025). This study directly addresses these lacunae by isolating institutional quality as the central explanatory variable, employing the World Bank's six-dimensional Worldwide Governance Indicators framework to empirically establish its independent and composite effect on infrastructural development in Nigeria over a comprehensive time horizon.

Against the identified gaps, this study pursues three interconnected objectives: first, to examine the long-run effect of institutional quality on infrastructural development in Nigeria; second, to assess the individual contributions of specific governance dimensions, including control of corruption, rule of law, and government effectiveness, to infrastructure outcomes; and third, to determine the direction of causality between institutional quality and infrastructural development. Correspondingly, three research questions guide the inquiry: Does institutional quality exert a significant long-run effect on infrastructural development in Nigeria? Which governance dimensions most powerfully predict infrastructure outcomes? Does causality run from institutional quality to infrastructure, or bidirectionally? From these questions, three null hypotheses are derived: institutional quality has no significant long-run effect on infrastructural development in Nigeria; individual governance dimensions exert no significant independent effects on infrastructure outcomes; and no causal relationship exists between institutional quality and infrastructural development in Nigeria.

The justification for this study is simultaneously theoretical, empirical, and policy-driven. Theoretically, existing frameworks within New Institutional Economics, particularly North's (1990) seminal proposition that institutions constitute the rules of the game governing economic exchange, have rarely been subjected to rigorous empirical testing within Nigeria's infrastructure development context, leaving a consequential void in the literature. Empirically, Nigeria's ongoing institutional reforms under successive governance frameworks, including the Economic Recovery and Growth Plan and the Nigeria Agenda 2050, generate a uniquely fertile and timely dataset for examining whether measurable improvements in governance translate into tangible infrastructure gains. The urgency is further amplified by Nigeria's ambitious $3 trillion infrastructure investment target articulated in its National Integrated Infrastructure Master Plan (NIIMP), whose realization is structurally contingent upon institutional integrity (Davies, Nwankwo, Olofinnade and Michaels, 2019). For policy, this study equips legislators, infrastructure regulators, and anti-corruption agencies with empirically grounded evidence to prioritize institutional strengthening as

a precondition, not a complement, to infrastructure financing, thereby advancing more effective, accountable, and sustainable development outcomes across Nigeria.

Literature Review

Two foundational concepts anchor this study: institutional quality and infrastructural development. Institutional quality, drawing from North's (1990) seminal framework, refers to the effectiveness of the formal and informal rules (encompassing laws, regulatory frameworks, enforcement mechanisms, and governance norms) that structure economic and political exchange within a society. Operationally, this study adopts the World Bank's Worldwide Governance Indicators (WGI) framework, which measures institutional quality across six dimensions: voice and accountability, political stability, government effectiveness, regulatory quality, rule of law, and control of corruption (Kaufmann et al., 2011). Infrastructural development, conversely, encompasses two analytically distinct categories. Economic infrastructure, including transport networks, energy systems, and telecommunications, directly facilitates productive activity and market integration, while social infrastructure, comprising healthcare facilities, educational institutions, and water supply systems, shapes human capital accumulation and welfare outcomes (Calderón & Servén, 2008; Onodugo, Kalu & Anowor, 2013; Kessides, 1993). Together, both dimensions constitute the physical and institutional scaffolding upon which sustainable development is constructed.

This study is anchored within four complementary theoretical traditions that collectively illuminate the institutional pathways through which governance quality shapes infrastructure outcomes. First, New Institutional Economics (NIE), most rigorously articulated by North (1990), posits that institutions (as the formal and informal rules governing economic exchange) determine the incentive structures within which public investment decisions are made, enforced, and sustained. Where institutional frameworks are weak, transaction costs escalate, investment horizons shorten, and infrastructure commitments remain chronically unfulfilled. Second, Property Rights Theory, advanced by Alchian and Demsetz (1973), argues that clearly defined, enforceable property rights are prerequisites for efficient resource allocation; absent such rights, private participation in infrastructure financing remains constrained, and public assets are vulnerable to appropriation and mismanagement. Third, Public Choice Theory, pioneered by Buchanan and Tullock (1962), demonstrates that self-interested behavior among political actors systematically distorts public expenditure toward rent-generating activities rather than productivity-enhancing infrastructure, particularly in institutionally fragile environments. Fourth, Endogenous Growth Theory, as developed by Romer (1990), treats public infrastructure as an engine of long-run productivity growth, implying that institutional failures constraining infrastructure accumulation impose permanent, not merely transitional, losses on economic output. Synthesized, these theoretical lenses converge on a singular proposition: institutional quality is not incidental but structurally constitutive of infrastructural development trajectories.

Empirical inquiry into the institutional determinants of infrastructure has expanded considerably across global and African contexts. At the global level, Tetteh et al. (2022) demonstrate across a broad panel of developing economies that governance effectiveness and corruption control significantly accelerate infrastructure accumulation, with institutional quality explaining cross-country infrastructure variation beyond conventional financial determinants. Méon and Sekkat (2005) further establish that weak rule of law and regulatory quality systematically depress productive public investment, diverting expenditure toward economically unproductive channels. Shifting to the African context, Asongu and Nwachukwu (2016) confirm that governance quality,

particularly accountability and political stability, significantly conditions infrastructure access across Sub-Saharan African economies. Complementarily, Kodongo and Ojah (2016) find that institutional deficiencies constitute a more binding constraint on African infrastructure development than financing gaps alone, fundamentally challenging the dominant capital-scarcity narrative prevalent in African development discourse.

Within Nigeria specifically, empirical evidence consistently implicates institutional weaknesses as a structural impediment to infrastructure delivery. Nwachukwu et al. (2020) establish that corruption and regulatory fragility have historically suppressed electricity and transport infrastructure investment, generating chronic project abandonment and cost overruns that erode the developmental returns of public expenditure. Ogbuabor and Nwosu (2017) further demonstrate that institutional reforms generate measurable infrastructure productivity gains, suggesting that governance improvement carries direct, quantifiable infrastructure dividends. More recently, Adedoyin et al. (2021) confirm that political instability and weak government effectiveness significantly undermine infrastructure financing mobilization in Nigeria, particularly within the energy sector. On the aggregate, Nigerian-focused evidence reveals a consistent pattern: institutional quality is not peripheral to infrastructure outcomes but constitutes their primary structural determinant, rendering governance reform an indispensable precondition for closing Nigeria's persistent and widening infrastructure gap.

Notwithstanding the empirical progress documented above, three consequential gaps persist in the extant literature. First, while global and African studies have established broad associations between institutional quality and infrastructure outcomes, few studies isolate institutional quality as the primary independent variable within a rigorously specified econometric framework, most treat governance as one among several control variables rather than the central analytical object (Tetteh et al., 2022; Méon & Sekkat, 2005; Agbarakwe et al, 2018). Second, Nigerian-focused studies remain methodologically constrained, predominantly relying on single-equation ordinary least squares estimations that neither adequately address endogeneity concerns nor establish long-run cointegrating relationships between institutional quality and infrastructure development (Ogbuabor & Nwosu, 2017; Ochinanwata et al, 2020). Third, existing studies overwhelmingly employ single-dimensional institutional proxies, typically corruption indices, thereby failing to capture the composite, multidimensional character of institutional quality and its differentiated effects across governance dimensions (Kaufmann et al., 2011). This study addresses these gaps simultaneously by positioning institutional quality as the central explanatory variable, deploying the World Bank's six-dimensional WGI framework, and applying robust time-series econometric techniques, including bounds testing, error correction modeling, and Granger causality analysis, to generate credible, policy-relevant evidence on the institutional drivers of infrastructural development in Nigeria.

Methodology

This study is primarily anchored on New Institutional Economics (NIE), as seminal articulated by North (1990), which posits that institutions, encompassing formal rules, regulatory frameworks, enforcement mechanisms, and governance norms, constitute the fundamental incentive architecture within which economic decisions are made, resources allocated, and infrastructure investments planned, financed, and executed. NIE predicts that where institutional quality is strong, transaction costs diminish, accountability is entrenched, and long-term infrastructure commitments become credibly sustainable; conversely, institutional deterioration breeds elite capture, bureaucratic predation, and chronic underinvestment. Three complementary frameworks

further enrich this foundation: Property Rights Theory establishes that secure property rights attract private infrastructure financing (Alchian & Demsetz, 1973); Public Choice Theory demonstrates that weak institutions systematically distort infrastructure expenditure toward rent-seeking (Buchanan & Tullock, 1962); and Endogenous Growth Theory treats infrastructure accumulation as an engine of permanent productivity gains (Romer, 1986; Romer, 1990).

This study adopts an ex-post facto research design, using secondary data to examine the relationship between institutional quality and infrastructural development in Nigeria. The choice of this type of design also allowed the researcher the privilege of observing variables over a long period of time (1986-2024). Data for the study were sourced from World Development Indicators, 2024 (WDI, 2024). The dependent variable for the study is the infrastructural development index (IDI) as a proxy for infrastructural development. The independent variables are institutional quality, gross domestic product per capita, government capital expenditure, population growth, and inflation rate. Data on infrastructure development, institutional quality, gross domestic product per capita, government capital expenditure, population growth, and inflation rate were sourced from World Development Indicators, 2024. Data for the study were subjected to preliminary tests to ascertain the behavior of the data set. The data was analyzed with econometric techniques involving Descriptive Statistics, Augmented Dickey Fuller Tests for Unit Root Roots, cointegration test, and Autoregressive Distributed Lag (ARDL) Approach.

The most famous test to do so is the Augmented Dickey-Fuller (ADF). The ADF test is the test of a particular series, say, Y_t, such that;

$$\Delta y_t = \delta y_{t-} \quad _1 + \sum_{i=1}^{P} \alpha i \Delta y_{t-i} + \mu_t \qquad 3.1$$

The method to be applied in this study is the Augmented Dickey-Fuller Unit Root Test.

The ADF equation is stated below:

$$\Delta y_t = \delta y_{t-} \quad _1 + \sum_{i=1}^{P} \alpha i \Delta y_{t-i} + \mu_t \qquad 3.2$$

The testing procedure follows an examination of the student-t ratio for δ. The critical values of the test are all negative and larger in absolute terms than standard critical t-values, so they are called DF and ADF statistics. If the null hypothesis cannot be rejected, then the series Y_t cannot be stationary.

Decision Rule:

Reject Ho if the absolute DF or ADF t-statistic > 5% critical values. If otherwise, accept Ho.

Model Specification

To investigate the empirical relationship between institutional quality and infrastructural development, this study followed the works of (Agénor, 2010; Diugwu et al, 2015; Badiru et al, 2023; Foster et al, 2025), as the foundation for the model. However, this study introduced population growth and inflation rate as control variable in the model.

IDI=f(IQI, GDP pc, GOVE, POPG, INF) ---------- (1)

Where;

IDI = Infrastructural Development Index used as a proxy for infrastructural development;

IQI= Institutional Quality Index;

GDP pc = Gross Domestic Product per capita;

GOVE = Government capital expenditure;

POPG = Population growth;

INF= Inflation rate;

Econometrically, equations (1) can be represented in a linear form as:

$IDI_t = \beta_0 + \beta_1 IQI_t + \beta_2 GDPpc_t + \beta_3 lnGOVEt + \beta_4 lnPOPG_t + \beta_5 INF_t + \mu_t$ ---------- (2)

To address the two questions on whether government capital expenditure moderates the impact of institutional quality on infrastructural development, Eq (2) is augmented to include the interaction term, and the moderation model is expressed as

$IDI_t = \alpha_t + \beta_1 IQIt + \beta_2 GDPpc_t + \beta_3 GOVE_t + \beta_4 IQI * ln\ GOVE_t + \beta_5 lnPOPG_t + \beta_6 SCR_t + \beta_7 INF_{t+} \mu_t$ --------- (3)

IQI × lnGOVE denotes the interaction term between institutional quality index and government capital expenditure, which is used to investigate how government capital expenditure moderates the effect of institutional quality on infrastructural development. Also, this study is particularly interested in the marginal effect of a change in institutional quality index on infrastructural development, and how this change is influenced by the level of government capital expenditure. Hence, the marginal effect is computed via the partial derivative of Equation (3) with respect to government capital expenditure. This partial derivative of the institutional quality variable with respect to government capital expenditure is given by:

$$\frac{\partial IDIt}{\partial lnGOVE} = [1(/1 - \phi t)](\beta_1 + \beta_3 IQI) \text{ ---------- (4)}$$

Thus, the focal point of this study is on the coefficients in the partial derivative equation. If $\beta_1 > 0$ and $\beta_3 < 0$, it implies that the institutional quality index is a blessing while the government capital expenditure is adversely influencing that blessing. The adverse influence of public expenditure diminishes as government capital expenditure improves, indicating that whether the institutional quality index is a blessing or curse depends on the level of government capital expenditure in an economy, which suggests the presence of a threshold effect. If $\beta_1 < 0$ and $\beta_3 > 0$, it signals that institutional quality is a curse while government capital expenditure moderates that curse in Nigeria. However, if the two parameters carry positive signs, it signals that an increase in institutional quality would be a blessing to Nigeria economies, and improved government capital expenditure would intensify that blessing. However, if the two parameters carry negative signs, it signals that an increase in the institutional quality index would lead to a decrease in infrastructural development, while ineffective government capital expenditure would heighten the decrease.

The ARDL approach to long co-integration relationship involves estimating the unrestricted Error correction model (ECM) model and has been identified following Pesaran et al (2001) below as:

$$\Delta IDI_t = \beta_0 + \sum_{i=1}^{P} \beta_1 \Delta\, IDI_{t-i+} \sum_{i=2}^{P} \beta_2 \Delta\, IQI_{t-i} + \sum_{i=3}^{P} \beta_3\, \Delta GPDpc_{t-i} + \sum_{i=4}^{P} \beta_4 GOVE + \sum_{i=5}^{P} \beta_5\, \Delta POPG_{t-i} + \sum_{i=6}^{P} \beta_6\, \Delta POPG_{t-i} + \sum_{i=7}^{P} \beta_7\, \Delta INF_{t-i} + \alpha_1 IDI_{t-i} + \alpha_2 IQI_{t-i} + \alpha_3 GDPpct\text{-}i + \alpha 4 GOVEt\text{-}i + \alpha 5 POPGt\text{-}i + \alpha 6 INFt\text{-}i + \mu_t$$ ---------- (5)

The optimal Lag length test has been conducted by means of the lag length criteria which is (AIC) to obtain the optimal number of lags for each variable. This was followed by the estimation of a single equation unrestricted error correction model with the number of selected lags as shown in Equation (5).

To obtain the short-run coefficients, the short-run model is specified as follows: -

$$\Delta IDI_t = \beta_0 + \sum_{i=1}^{P} \beta_1 \Delta\, IDI_{t-i+} \sum_{i=2}^{P} \beta_2 \Delta\, IQI_{t-i} + \sum_{i=3}^{P} \beta_3\, \Delta GPDpc_{t-i} + \sum_{i=4}^{P} \beta_4 GOVE + \sum_{i=5}^{P} \beta_5\, \Delta POPG_{t-i} + \sum_{i=6}^{P} \beta_6\, \Delta POPG_{t-i} + \sum_{i=7}^{P} \beta_7\, \Delta INF_{t-i} + \alpha_1 IDI_{t-i} + \alpha_2 IQI_{t-i} + \alpha_3 GDPpct\text{-}i + \alpha 4 GOVEt\text{-}i + \alpha 5 POPGt\text{-}i + \alpha 6 INFt\text{-}i + \lambda ECT_{t-i} + \mu_t$$ ---------- (6)

Where;

ECT_{t-1}, is error correction term lagged by one period,

Δ is the first difference operator; p is the optimal lag length and all other variables remain the same in the model; ECT is the error correction term; λ in equation (6) represents the speed of adjustment

while the other coefficients (α1, α2, α3 … α8) of the short-run equation are coefficients relating to the short-run dynamics of the model's convergence to equilibrium; β_1 – β8 are long-run coefficients; and μ_t is the white noise error term.
The *a priori* expectations are:
β_1> 0, β_2>0, β_3>0, β4>0,5>0, 6<0.

4. Presentation and Analysis of Data

This section of the study presents the empirical analysis, results, and discussion of findings. The section also includes descriptive analysis, unit root test analysis, cointegration test using the bounds cointegration test, estimation using ARDL, and post-estimation tests

Descriptive Statistics

Table1: Result of Descriptive Statistics

	IDI	IQI	GDPPC	GOVE	POPG	INF
Mean	0.232653	-0.061088	1.454217	795.1384	2.598373	19.56418
Median	-0.668566	-1.114388	1.437691	508.7488	2.657389	12.94178
Maximum	5.048558	3.275151	12.21039	4486.206	2.802785	72.83550
Minimum	-2.125872	-3.537405	-4.597233	6.372500	2.092817	5.388008
Std. Dev.	2.220349	2.079278	3.618476	962.2542	0.214460	17.11452
Skewness	0.692455	0.433600	0.544054	2.075462	-1.415788	1.757983
Kurtosis	2.249471	1.690761	3.676241	7.590096	3.749435	4.885890
Jarque-Bera	3.928678	3.904727	2.598692	60.64032	13.58417	25.20445
Probability	0.140249	0.141938	0.272710	0.000000	0.001123	0.000003
Sum	8.840804	-2.321339	55.26026	30215.26	98.73819	743.4389
Sum Sq. Dev.	182.4082	159.9657	484.4547	34259524	1.701740	10837.55
Observations	38	38	38	38	38	38

Source: *Author's computation, E-views version 12*

Table 1 presents the descriptive analysis of the time series properties of the variables included in the model. The average value of infrastructural development index, institutional quality index, gross domestic product per capita, government capital expenditure, population growth and inflation rate are 0.232653, -0.061088, 1.454217, 795.1384, 2.598373 and 19.56418 respectively. The standard deviation which shows the nature of dispersal in the worth of the variables is small, which reveals that there has not been much increase in the value of the variables over the years considered for this study except for government expenditures. The mean of the variables falls within the range defined by the minimum and maximum values of the variables. Infrastructural

development index, institutional quality index, and gross domestic product per capita, government capital expenditure and inflation rate have positive skewness indicating they have a long right tale, while population growth has negative skewness implying, it has a long-left tale. The kurtosis of the variables is above 3, except for infrastructural development index and institutional quality index which are below 3 implying that most of the variable's distribution is thin and would turn leptokurtic. While gross domestic product per capita and population growth are exactly 3 platykurtic. The Jarque-Bera statistics mean the series is not normally distributed, with probability values greater than 0.05, but the normality assumption is not usually required for multivariate functions

Unit Root Test

The unit root test carried out is based on the augmented Dickey-Fuller (ADF) test at a 5 per cent level of significance.

Table 2: Result of Augmented Dickey-Fuller Unit Root Test

Variables	**Augmented Dickey-Fuller (ADF)**				**Order of Integration**
	At Level	**5% Critical Value**	**At First Difference**	**5% Critical Value**	
IDI	0.169352	-2.941145	-6.326514	-2.943427	**I(1)**
IQI	-2.059807	-2.943427	-18.80498	-2.943427	**I(1)**
GDPpc	-4.276790	-2.941145	---	---	**I(0)**
***ln*GOVE**	-1.474704	-2.943427	-6.891725	-2.945842	**I(1)**
POPg	-3.113283	-2.954021	---	---	**I(0)**
INF	-3.584477	-2.943427	---	---	**I(0)**

Source: *Author's computation, E-views version 12*

Based on the above result of the Augmented Dickey-Fuller unit root test, the variables are mixture 1(1) and I (0) and are significant at a 5 per cent level. Under the ADF approach, infrastructural development index (IDI), institutional quality index (IQI), and government capital expenditure (*ln*GOVE) were all integrated at first difference, I(1), while gross domestic product per capita (GDPpc), population growth (POPG), and inflation rate (INF) are stationary at levels form, I(0). Therefore, since our variables are in mixed order of integration, the analysis considers this by employing the ARDL approach to the error correction mechanism.

ARDL (Bounds) Test for Cointegration for Model

Table 3 Result of the ARDL (Bounds) Test for Cointegration for the infrastructure development and economic growth Model.

Test Statistic	**Value**	**k**
F-statistics (IDI, IQI, GOVE, POPG, INF)	5.919051	**6**
Critical Value Bounds,		
Significance	**I0 Bound**	**I1 Bound**
10%	1.99	2.94
5%	2.27	3.28
2.5%	2.55	3.61
1%	2.88	3.99

Source: *Author's computation, E-views version 12*

Table 3 is the ARDL bound test result, which reveals that there is existence of longrun relationship between the dependent and independent variables in the model. The test result showed that the F-statistics which is 5.919051, is above the upper bound critical values I (1) at all the levels of significance, indicating the existence of longrun relationship in the model. Based on this result, the study conducted the short-run and long-run forms of the ARDL model.

Estimates of institutional quality and infrastructure development Using the ARDL Approach

The short-run dynamic relationship between infrastructure development and economic growth in Nigeria, estimated ARDL model is reported below in Table 4.5.

Table 4 Result of Short Run ARDL Vector Error Correction

Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
D(IDI(-1))	-0.015172	0.086020	-0.176382	0.8625
D(IDI(-2))	-0.345227	0.083505	-4.134178	0.0010
D(IQI)	4.516872	0.418548	10.79177	0.0000
D(IQI(-1))	-0.355998	0.289447	-1.229925	0.2390
D(IQI(-2))	1.234255	0.288347	4.280446	0.0008
D(IQI_LNGOVE)	-0.832736	0.077879	-10.69274	0.0000
D(IQI_LNGOVE(-1))	-0.016339	0.052812	-0.309382	0.7616
D(IQI_LNGOVE(-2))	-0.217958	0.048648	-4.480305	0.0005
D(GDPPC)	-0.050989	0.011865	-4.297340	0.0007

D(LNGOVE)	0.601048	0.143325	4.193592	0.0009
D(LNGOVE(-1))	-1.463536	0.265831	-5.505503	0.0001
D(LNGOVE(-2))	-0.640947	0.197326	-3.248172	0.0058
D(POPG)	-3.585717	0.970815	-3.693513	0.0024
CointEq(-1)*	-0.209023	0.143456	-8.427847	0.0000
R-squared	0.881784	Mean dependent var		0.190217
Adjusted R-squared	0.808603	S.D. dependent var		0.502675
S.E. of regression	0.219915	Akaike info criterion		0.098021
Sum squared resid	1.015613	Schwarz criterion		0.720161
Log likelihood	12.28463	Hannan-Quinn criter.		0.312784
Durbin-Watson stat	2.409535			

Source: *Author's computation, E-views version 12*

Table 4 presents the short-run dynamic estimates of the ARDL model, revealing nuanced temporal relationships between institutional quality and infrastructural development in Nigeria. The lagged one-period value of the infrastructural development index exerted a negative and statistically insignificant impact on its current value, while the lagged two-period value produced a negative but statistically significant effect, suggesting that past infrastructure trajectories impose measurable short-run drag on current development momentum.

Institutional quality index (IQI) exerted a positive and statistically significant impact on infrastructural development index in the current period, consistent with a-priori expectations. Specifically, a one percent increase in institutional quality index generates a 4.51 percent increase in infrastructural development index, a finding that underscores the primacy of governance quality as a structural driver of infrastructure outcomes. The lagged one-period IQI, however, exerted a negative and statistically insignificant effect, while the lagged two-period value returned a positive and significant impact, indicating that institutional quality improvements transmit to infrastructure outcomes with a discernible temporal lag. This finding aligns with Flachaire et al. (2014) and Kodongo and Ojah (2016), reinforcing the proposition that institutional quality channels require sustained strengthening to generate consistent infrastructure development gains across African economies.

The interactive effect of institutional quality index and government capital expenditure exerted a negative and statistically significant impact on infrastructural development index in the current period. This negative sign persisted across lagged one and two periods, though significance varied. Since the coefficients of IQI and the interaction term carry opposing signs, this pattern reveals that institutional quality operates as a relatively weak standalone driver, while government capital expenditure functions as a positive moderating force, strengthening institutional effectiveness when deployed judiciously. Consequently, a one percent increase in the interaction term inversely generates a 0.83 percent increase in infrastructural development index, implying that disciplined

public expenditure progressively reinforces institutional capacity, enabling governance frameworks to more effectively stimulate infrastructure delivery over time.

The coefficient of gross domestic product per capita exerted a negative and statistically significant impact on infrastructural development index, contrary to a-priori expectations. This result suggests that a one percent increase in GDP per capita produces a 0.051 percent decline in the infrastructural development index, a counterintuitive outcome potentially attributable to Nigeria's resource-dependent growth pattern, wherein aggregate income expansion does not systematically translate into productive infrastructure investment due to institutional misallocation. Government capital expenditure, conversely, exerted a positive and statistically significant contemporaneous impact on infrastructural development, though its lagged one and two-period coefficients turned negative and significant, reflecting implementation lags and expenditure inefficiencies characteristic of Nigeria's public investment architecture. Additionally, population growth exerted a negative and statistically significant effect on infrastructural development index, conforming to a-priori expectations, a one percent increase in population growth generates a 3.585 percent decline in infrastructural development, reflecting the persistent inability of Nigeria's infrastructure supply to keep pace with escalating demographic demand.

The error correction model (ECM) coefficient satisfies all three requisite conditions, negativity, magnitude below unity, and statistical significance, validating the model's dynamic specification. The ECM coefficient of −0.209023, significant at the 1% level (p = 0.0000), confirms that deviations from long-run equilibrium are corrected at a speed of approximately 21% per period, consistent with Narayan and Smyth's (2005) criteria for correctly signed and statistically significant adjustment dynamics. Finally, the R-squared value of 0.8818 indicates that the regressors collectively account for approximately 88% of the variation in infrastructural development in Nigeria, with the remaining 12% attributable to factors outside the model's specification, a result that affirms the robustness and explanatory adequacy of the estimated framework.

Long Run Estimates for Model

Table 5 Result of Long-run Coefficient estimates

Selected model: ARDL (3,3,3,1,3,1,0)				
Variables	**Coefficients**	**Std. Error**	**t-Statistic**	**Prob.**
IQI	3.823811	0.465710	8.210715	0.0000
IQI_LNGOVE	-0.613317	0.052513	-11.67926	0.0000
GDPPC	-0.078172	0.043663	-1.790325	0.0950
LNGOVE	1.779448	0.208130	8.549684	0.0000
POPG	-0.373498	0.720687	-0.518253	0.6124
INF	-0.009706	0.008235	-1.178649	0.2582
C	-9.646433	2.806641	-3.437003	0.0040

Source: *Author's computation, E-views version 12*

Table 5 presents the long-run ARDL estimation results, offering empirical clarity on the structural relationships between institutional quality and infrastructural development in Nigeria over the study horizon. Institutional quality index (IQI) exerted a positive and statistically significant impact on infrastructural development index, fully consistent with a-priori expectations and the

study's foundational NIE theoretical proposition. Specifically, a one percent increase in institutional quality index generates a 3.82 percent increase in infrastructural development index in the long run, a magnitude that compellingly affirms institutional quality as a potent and durable structural driver of infrastructure outcomes in Nigeria, reinforcing the study's central thesis that governance quality is constitutive, rather than merely complementary, to sustainable infrastructure accumulation.

The interactive term between institutional quality index and government capital expenditure, however, exerted a negative and statistically significant effect on infrastructural development index in the long run, consistent with the short-run dynamics reported in Table 4. This persistent negative interaction coefficient, which aligns with the findings of Nair et al. (2021), suggests that while both institutional quality and government capital expenditure independently promote infrastructure development, their joint operation remains constrained by deep-seated governance inefficiencies that prevent the full productive synergy between public expenditure and institutional frameworks from being realized over the long run. This finding carries important policy implications: enhancing the complementarity between fiscal commitment and institutional integrity is not automatic but requires deliberate, sustained institutional reform. Furthermore, gross domestic product per capita, population growth, and inflation rate each exerted negative and statistically insignificant impacts on infrastructural development index in the long run — findings that collectively suggest these macroeconomic variables, while theoretically relevant, do not constitute binding long-run determinants of infrastructure outcomes within Nigeria's specific structural context. Government capital expenditure, conversely, retained its positive and statistically significant long-run impact on infrastructural development index, corroborating the short-run evidence and underscoring that disciplined, productivity-oriented public investment remains an indispensable complement to institutional quality in driving sustainable infrastructure development in Nigeria.

Granger causality Test

In examining the nature of the relationship between infrastructure development and institutional quality, the result of the Pairwise Granger causality test is presented in Table below.

Table 6 Pairwise Granger causality test result

Null Hypothesis:	Obs	F-Statistic	Prob.
IQI does not Granger Cause IDI	38	1.20105	0.2806
IDI does not Granger Cause IQI		3.03501	0.0903
IQI_LNGOVE does not Granger Cause IDI	37	0.61924	0.4368
IDI does not Granger Cause IQI_LNGOVE		15.4320	0.0004
GDPPC does not Granger Cause IDI	38	0.01145	0.9154
IDI does not Granger Cause GDPPC		0.27716	0.6019
LNGOVE does not Granger Cause IDI	37	2.13935	0.1527
IDI does not Granger Cause LNGOVE		0.43978	0.5117
POPG does not Granger Cause IDI	38	0.12157	0.7294
IDI does not Granger Cause POPG		3.96286	0.0544
INF does not Granger Cause IDI	38	2.45578	0.1261
IDI does not Granger Cause INF		0.71645	0.4031

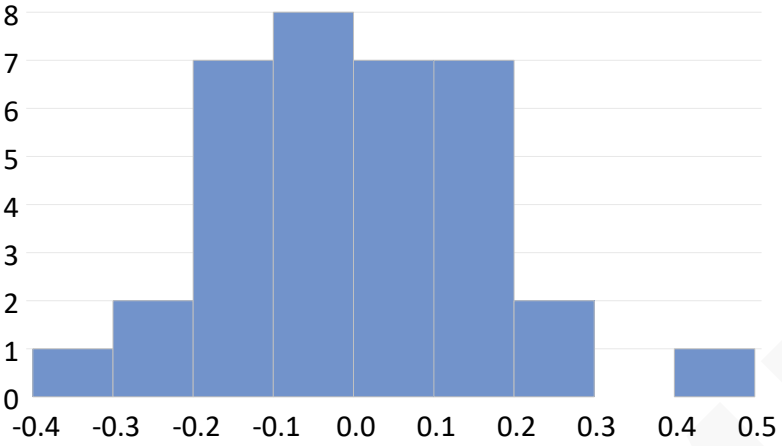
Source: *Author's Computation, E-views version 12*

Diagnostic Tests for the model

The estimated ARDL model is tested for heteroscedasticity, serial correlation, functional form misspecification, parameter stability, and normality. The results from these tests are shown below:

Normality Test

Figure 1: Test for Normality of the Residuals 9



Series: Residuals
Sample 1989 2023
Observations 35
Mean -6.54e-15
Median -0.035534
Maximum 0.481916
Minimum -0.368563
Std. Dev. 0.172832
Skewness 0.325941
Kurtosis 3.400232
Jarque-Bera 0.853322
Probability 0.652685

H_0: Null hypothesis: Residual is multivariate normal, H_1: Alternative hypothesis: Residual is not multivariate normal. Consideration of the Jacque-Bera statistic with value 2.460021 and Prob. value of 0.652685, which is greater than 0.05 levels. Hence, we accept the H0 that the residual is normally distributed. Therefore, the study concluded that the residual of the model is normally distributed.

Table 7. Other Diagnostic Tests of Selected ARDL Model

Test Statistics	P-value
Breusch-Godfrey Serial Correlation LM Test	0.2725
Heteroskedasticity Test	0.7791
Ramsey RESET Test	0.6982

Source: *Author's computation, E-views version 12*

The estimated ARDL model revealed that the model passed the serial correlation, normal test, heteroscedasticity and Ramsey RESET tests. The error terms were uncorrelated, normally distributed, had the same variance and the model were not mis-specified. Thus, they were satisfactory for the ARDL model.

Stability Tests

The graphs in Figures 3 and 4 show that our model is stable. Its stability is explained with the blue line within the upper and lower bound red lines. The above plot remaining within the critical bounds of the 5% significance level also reveals that our model is correctly specified.

Figure 6: Plot of CUSUM- Result of Stability Test

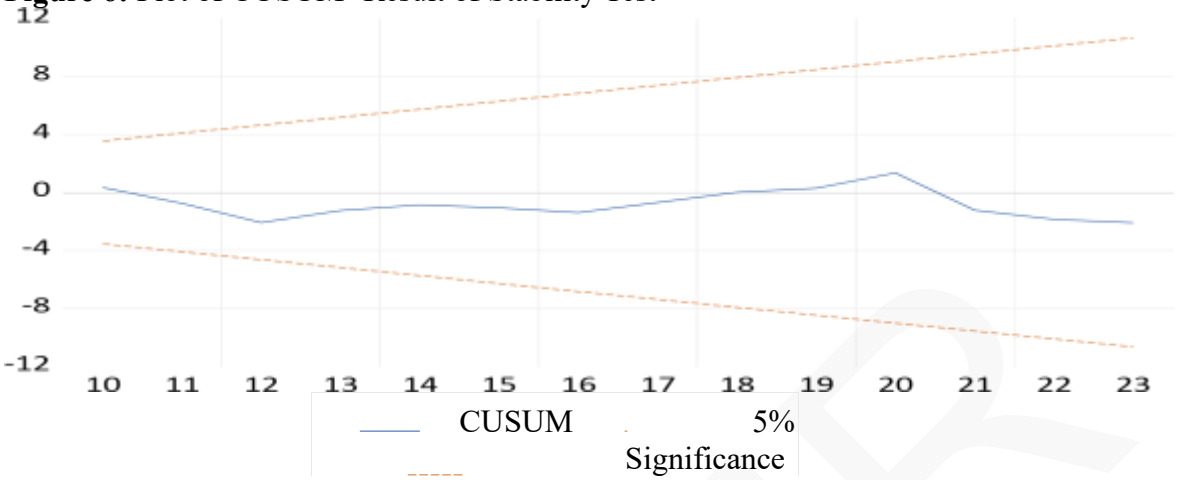
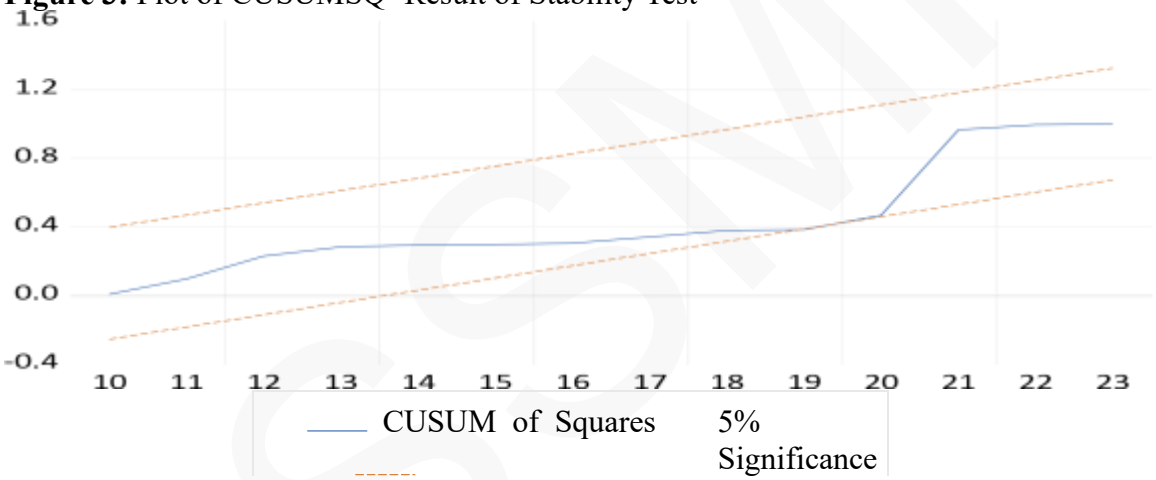


Figure 3: Plot of CUSUMSQ- Result of Stability Test



Both plots lie between the critical bounds at the 5% significance level. This indicates that the model is stable and can therefore be reliably deployed for policy purposes.

Evaluation of Research Hypotheses

The empirical results generated from the ARDL estimation framework are systematically evaluated against the study's three a-priori hypotheses, providing a structured basis for drawing theoretically grounded and policy-relevant conclusions.

The results presented in Tables 4 and 5 provide compelling grounds to reject this null hypothesis in both the short and long run. The probability values associated with the institutional quality index coefficient are statistically significant at the 1% level in both the short-run and long-run ARDL estimates ($p = 0.0000 < 0.05$), unambiguously confirming that institutional quality exerts a significant and positive impact on infrastructural development in Nigeria across both temporal horizons. This outcome is fully consistent with the study's NIE theoretical anchor and reinforces the central thesis that governance quality constitutes a structural, rather than peripheral, determinant of infrastructure outcomes in Nigeria.

The results presented in Tables 4 and 5 similarly warrant rejection of this null hypothesis. The probability values associated with the interactive term between institutional quality index and

government capital expenditure are statistically significant at the 1% level in both short-run and long-run specifications ($p = 0.0000 < 0.05$), confirming that the joint moderating effect of institutional quality and government capital expenditure exerts a significant impact on infrastructural development in Nigeria. Notably, the negative sign of the interaction coefficient across both temporal horizons indicates that while the moderating relationship is statistically significant, its direction reflects the constraining influence of institutional weaknesses on the productive deployment of public capital expenditure, an outcome with direct implications for fiscal governance reform.

Unlike the preceding hypotheses, the Granger causality results presented in Table 6 provide insufficient evidence to reject this null hypothesis. The probability values associated with the F-statistics for the institutional quality index and infrastructural development index pairing, IQI→IDI ($p = 0.2806$) and IDI→IQI ($p = 0.0903$), both exceed the 0.05 significance threshold, indicating the absence of a statistically significant causal relationship between institutional quality and infrastructural development in Nigeria within the study period. This finding suggests that while institutional quality and infrastructural development are significantly related in level and cointegrated in the long run, short-run directional causality between the two variables remains statistically indeterminate within the specific temporal scope of this study, a nuance that warrants careful interpretation and further longitudinal investigation.

Discussion of Findings

The findings present a coherent and theoretically grounded account of the institutional foundations of infrastructural development in Nigeria. Across specifications, institutional quality emerges as a robust structural determinant of infrastructure outcomes, reinforcing the central proposition of New Institutional Economics that credible rules, enforcement mechanisms, and governance integrity condition long-term investment performance.

Most notably, institutional quality exerts a positive and statistically significant effect in both the short and long run: a one percent improvement generates 4.51 percent and 3.82 percent increases in infrastructure development, respectively. This decisively rejects the null hypothesis and validates North's (1990) thesis that institutional strength reduces transaction costs and sustains credible public investment commitments. In the Nigerian context, characterized by procurement inefficiencies, corruption, and regulatory fragility, this magnitude underscores that governance failures, rather than capital scarcity, constitute the binding constraint. Institutional reforms appear to generate both immediate and lagged dividends, suggesting dynamic transmission channels rather than one-off effects.

The negative and significant interaction between institutional quality and government capital expenditure introduces important nuance. While both variables independently promote infrastructure development, their joint effect is constrained by governance weaknesses. This pattern aligns with Public Choice Theory: in weak institutional environments, increased expenditure is vulnerable to rent-seeking and misallocation. The implication is not that public spending is ineffective, but that its productivity is conditional on institutional depth. A threshold dynamic therefore emerges, fiscal expansion without governance consolidation yields diminishing infrastructure returns. This has direct implications for implementing Nigeria's National Integrated Infrastructure Master Plan.

The macroeconomic controls reinforce this institutional interpretation. The negative (and largely insignificant) impact of GDP per capita reflects Nigeria's resource-dependent growth structure, where oil-driven income expansion does not automatically translate into productive infrastructure

accumulation. This aligns with the institutional channel of the resource curse hypothesis: weak governance distorts revenue allocation toward rent-seeking rather than capital formation. Similarly, population growth exerts a significant negative effect, highlighting the structural inability of infrastructure supply to match demographic pressures. Demography thus amplifies institutional constraints rather than substituting for them.

Finally, the absence of short-run Granger causality between institutional quality and infrastructure development, despite long-run cointegration, suggests structural interdependence rather than directional immediacy. Institutions and infrastructure evolve as mutually reinforcing systems over time, but short-run impulses remain statistically indeterminate. This is consistent with Nigeria's episodic reform trajectory, where institutional adjustments have lacked sustained momentum sufficient to produce identifiable short-term causal shifts.

Taken together, the evidence converges on a clear conclusion: Nigeria's infrastructure deficit is fundamentally institutional. Financing matters, but governance quality determines whether financing translates into durable infrastructure outcomes. Sustainable infrastructural transformation therefore requires systematic, multidimensional institutional strengthening as the primary policy lever.

Conclusion and Policy Recommendations

This study empirically investigated whether institutional quality drives infrastructural development in Nigeria over the period 1986–2024, employing the ARDL bounds testing framework alongside Granger causality analysis. The findings establish three principal conclusions: institutional quality exerts a positive, significant, and durable impact on infrastructural development in both the short and long run; government capital expenditure positively moderates infrastructure outcomes but its productive synergy with institutional quality remains constrained by deep-seated governance inefficiencies; and no statistically significant short-run causal relationship exists between institutional quality and infrastructural development, suggesting their relationship is structurally cointegrated rather than directionally causal within the study horizon. Theoretically, this study advances New Institutional Economics by providing rigorous Nigeria-specific empirical validation of North's (1990) proposition that institutional frameworks constitute the foundational incentive architecture for productive infrastructure accumulation, a contribution that directly addresses the methodological gaps identified in existing literature through its deployment of the World Bank's multidimensional WGI framework rather than single-indicator institutional proxies.

These findings generate four specific, actionable policy imperatives. First, Nigeria's legislature should urgently strengthen the legal and budgetary frameworks governing infrastructure procurement, embedding mandatory institutional quality benchmarks, drawn from the WGI dimensions, as preconditions for project approval and disbursement. Second, the EFCC and ICPC must be granted enhanced operational independence, prosecutorial capacity, and asset recovery mandates specifically targeting infrastructure-related corruption, given the empirical evidence that corruption control constitutes a binding constraint on infrastructure delivery. Third, infrastructure regulators, particularly the Infrastructure Concession Regulatory Commission and the Nigerian Electricity Regulatory Commission, should institutionalize transparent, performance-based regulatory frameworks that enforce contractual accountability throughout the infrastructure project lifecycle, reducing the chronic project abandonment endemic to Nigeria's public investment architecture. Fourth, given that government capital expenditure's infrastructure impact is positively moderated by institutional quality, the Federal Ministry of Finance should tie capital expenditure

releases to verifiable institutional performance metrics, ensuring that fiscal expansion reinforces rather than dissipates governance integrity.

This study acknowledges several limitations. The analysis is constrained by data availability for certain WGI dimensions across the full study horizon, and the composite institutional quality index, while methodologically defensible, may obscure differentiated effects across individual governance dimensions. Additionally, the study's single-country time-series design, while generating Nigeria-specific depth, limits cross-country generalizability. Future research should address these limitations by: first, employing panel data frameworks across comparable resource-rich African economies to establish the generalizability of the institutional quality-infrastructure nexus; second, investigating threshold effects to identify the minimum institutional quality level at which government capital expenditure and institutional quality achieve full productive complementarity; and third, examining sector-specific infrastructure outcomes, disaggregating energy, transport, and digital infrastructure, to determine whether institutional quality dimensions exert differentiated effects across infrastructure typologies in Nigeria.

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