Infrastructure Development and Sustainable Economic Growth in Nigeria: The Role of Institutional Governance

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ABSTRACT

This study examined the relationship between infrastructure development and economic growth in Nigeria, with institutional governance serving as a moderating variable. The study adopted an ex-post facto research design using annual time-series data covering the period 1996–2025. Data were obtained from secondary sources, including the World Development Indicators, Central Bank of Nigeria Statistical Bulletin, National Bureau of Statistics, and Worldwide Governance Indicators. The study employed the Autoregressive Distributed Lag (ARDL) estimation technique following preliminary analyses, including descriptive statistics, correlation analysis, and Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) unit root tests. The bounds cointegration test indicated a long-run relationship among the variables, with an F-statistic of 6.214, exceeding the upper-bound critical values at the 1%, 5%, and 10% significance levels. The long-run results showed that infrastructure development had a positive but statistically insignificant effect on economic growth, which was statistically significant ($\beta = 0.284$, $t = 1.821$, $p = 0.081$). Institutional governance had a positive and statistically significant relationship with economic growth ($\beta = 1.426$, $t = 2.085$, $p = 0.048$). The interaction between infrastructure development and institutional governance was positive but statistically insignificant at the 5% level ($\beta = 0.217$, $t = 1.750$, $p = 0.093$), providing only weak evidence of a moderating effect at the 10% level. The error-correction coefficient was negative and statistically significant (ECM = −0.684, $p = 0.001$), indicating an estimated annual adjustment of 68.4% towards long-run equilibrium. The study concluded that institutional governance is positively associated with economic growth, while evidence that it strengthens the growth benefits of infrastructure development remains limited. It recommended improving governance institutions, strengthening infrastructure project management, and promoting transparency and accountability in public investment to enhance the contribution of infrastructure development to Nigeria's economic growth.

Keywords: Infrastructure Development, Institutional Governance, Sustainable Economic Growth, Infrastructure Management, Infrastructure Projects

INTRODUCTION

Sustainable economic growth is one of the most important development goals of developing economies as it provides the capacity of an economy to generate continuous growth in productive capacity, income production, employment, poverty alleviation and living standards without jeopardizing the welfare of generations to come. In Nigeria, however, the quest for sustainable economic growth has long been a policy challenge in spite of the availability of human and natural resources. Nigeria's real GDP growth was 3.4% in 2024, which is the best result in terms of annual growth since 2014 (excluding the post-COVID rebound), but the level of growth still fails to substantially alleviate poverty rates, joblessness and income disparities and drive Nigeria's long-term development goals. While Nigeria's macroeconomic indicators have improved in recent times, inflationary pressures, poor infrastructure, increased debt servicing needs, and structural constraints are all still limiting the sustainable economic performance of Nigeria, according to the African Development Bank (2025) and the World Bank (2025). Likewise, Adebayo and Ojo (2024) claimed that the disconnect between economic growth and social welfare is a clear indication of serious structural problems in the Nigerian economy, and Okebukola (2022) stated that sustainable development requires the

strengthening of the productive sectors and the improvement of the institutional environment that enables long-term investments.

The situation of Nigeria being unable to maintain sustainable economic growth is a major structural constraint, which is largely attributed to the low level of infrastructure development. Infrastructure is the backbone of productive economic activities as it enables efficient transport, reliable power supply, digital connections, water supply and industrial development. Yet, Nigeria still faces huge infrastructure deficits which have been a challenge to productivity, investor confidence, production costs and competitiveness in the economy. The World Bank (2025) further noted that the energy and transport sectors, as well as logistics, have major infrastructure gaps that must be addressed to stimulate inclusive economic growth and boost productivity in the private sector. Moreover, the persistent power failures are estimated to cost the Nigerian economy approximately US$29 billion annually, highlighting the significant economic impact of poor infrastructure. According to Verhoef et al. (2021), modern infrastructure is a strategic asset for improving economic productivity and national competitiveness, while Mhlanga (2022) noted that the investments in physical and digital infrastructure provide possibilities for innovation, business expansion and sustainable development. Likewise, Yusuf and Onasanya (2023) argued that the poor condition of Nigeria's transport, energy and communication infrastructure continues to stunt industrial production, deter foreign direct investment, and beset long-term economic growth.

While infrastructure development is recognized as a driver of economic development, empirical evidence indicates that development of infrastructure can not ensure sustainable economic results in a setting of weak institutional governance. Institutional governance also reflects the quality of institutional arrangements, the effectiveness of regulations, accountability, transparency, rule of law, and control of corruption, which drive effective allocation and use of public resources. The World Bank (2025) argued that the effectiveness of the ongoing economic reforms in Nigeria will depend on improved governance systems that increase the efficiency of public investments, improve fiscal management and hold public officials accountable for infrastructure delivery. Likewise, Baker (2021) noted that institutional quality continues to be an important factor for development outcomes as good institutions guarantee the effective allocation of technological and infrastructural investments towards measurable socioeconomic outcomes. Organisational and institutional capacities are also found to have significant impacts on development effectiveness and weak governance structures, policy inconsistencies, bureaucratic inefficiencies, corruption and poor project monitoring are still a challenge to the effectiveness of public investments in Nigeria (Gangwar et al., 2021; Ezeala et al., 2024). As a result, infrastructure works are often delayed, abandoned and subjected to cost escalation and insufficient maintenance, which diminishes the contribution to sustainable economic growth.

Although there has been a rise in government spending on infrastructure and various economic reforms, empirical evidence regarding the moderating effect of institutional governance on the infrastructure development-sustainable economic growth relationship is limited, especially in Nigeria. Existing research has focused mainly on infrastructure development or institutional quality separately, and little has been written on how the quality of institutional governance affects the impact of investments in infrastructure on sustainable economic growth. Besides resource availability, institutional capabilities that enable efficient implementation and value creation are crucial to sustainable development outcomes (Verhoef et al., 2021). Likewise, World Bank (2025) noted that governance reforms, including increased accountability, regulatory quality, and institutional effectiveness, are needed to complement investments in infrastructure in order to ensure inclusive and sustainable growth. This is the gap that motivates this study which aims at assessing the impact of infrastructure development on sustainable economic growth in Nigeria, and the moderating effect of institutional governance in strengthening the relationship between infrastructure development and sustainable economic growth in Nigeria. To achieve this goal, the study focused on the period of 1996 to 2025, which is deemed to be suitable as it encompasses the post-military democratic era, during which Nigeria witnessed a lot of infrastructure development, institutional governance reforms and major economic policy initiatives; this provides a solid ground to draw conclusion on the long-run relationship between infrastructure development, institutional governance and sustainable economic growth in Nigeria.

LITERATURE REVIEW AND THEORETICAL REVIEW

Infrastructure Development

Planning, construction, expansion, modernization and maintenance of physical and digital infrastructure designed to support the economic production, facilitate trade, improve public service delivery and enhance the quality of life. It includes transport infrastructure, electricity transmission and distribution, water supply, telecommunication infrastructure, digital infrastructure and other key assets which facilitate productive activities and enhance national competitiveness. The World Bank (2024) states that infrastructure plays a vital role in economic transformation as it lowers production and transaction costs, enables market integration, supports investment and boosts productivity in all economic sectors. In the same manner, the African Development Bank (2025) affirmed, "Quality infrastructure contributes to improved connectivity, increased productive capacity, employment creation, regional integration and sustainable development, which in turn can enhance the industrialization process. The concept of infrastructure has become more relevant in the digital economy in recent years, as modern infrastructure is crucial for technological innovation and the efficient running of businesses, according to Verhoef et al. (2021). Similarly, Calderón and Cantu (2021) found that long-term economic outcomes benefit considerably from investment in infrastructure, via higher capital stock and productivity. Ajakaiye and Ncube (2022) reported that in the Nigerian context, infrastructure deficiencies remain a significant problem, especially in the energy, transport and digital sectors, and continue to raise production costs and decrease economic competitiveness.

Sustainable Economic Growth

Sustainable economic growth is the continuous growth of the productive capacity of an economy which contributes to long-term development and economic success, environmental protection, social integration, job creation, and enhanced wellbeing without putting future generations at risk. Sustainable economic growth is different from traditional measures of economic growth, which tend to rely mainly on GDP growth, as it incorporates the concepts of economic resilience, resource efficiency, environmental responsibility and equitable distribution of the benefits of development. Sustainable economic growth is a fundamental goal of the Sustainable Development Goals (SDGs), as defined by the United Nations (2023), under Sustainable Development Goal 8, which encourages sustained, inclusive, and sustainable economic growth and productive employment and decent work. Likewise, World Bank (2025) stated the ways in which economies can sustainably grow include investment in infrastructure, strengthening of institutions, technological innovation, macroeconomic stability, and human capital development. The International Monetary Fund (2024) noted that sustainable growth requires structural reforms that can enhance productivity, stimulate investment and boost economic resilience to internal and external shocks. In addition, the African Development Bank (2025) emphasized that Africa's economic systems need ongoing investments in infrastructure and institutional changes to boost inclusive economic development and poverty alleviation. The authors of the article, Adebayo and Ojo (2024) stated that Nigeria will need to solve some structural challenges like inadequate infrastructure, weak governance, low industrial productivity, and the poor investment climate to realize sustainable economic growth. Sustainable economic growth, therefore, in this study is the capacity of Nigeria in attaining sustainable economic growth with effective institutional governance and productive infrastructure.

Institutional Governance

Institutional governance is the governance of public institutions, both in terms of their quality, effectiveness, accountability, transparency and efficiency, in designing, implementing and enforcing policies aimed at sustainable economic and social development. It covers government effectiveness, regulatory quality, rule of law, control of corruption, political stability and public accountability, which influence efficiency of public resources management and implementation of development programmes. The World Bank's Worldwide Governance Indicators (2024) show that good institutional governance leads to better performance of the public sector in several ways: better policy implementation, improved investor confidence, decreased corruption, and effective use of public sector resources. Likewise, Kaufmann, Kraay and Mastruzzi (2023)

demonstrated that quality of institutions is an essential factor to economic outcomes, and that good institutions promote investment, better regulatory certainty and better public services. Baker (2021) noted that institutional governance is important in terms of offering an enabling policy and regulatory environment for development initiatives and technology adoption and infrastructure implementation. Similarly, Gangwar et al. (2021) said that the performance of the development initiatives in an organization and the country would be largely dependent on institutional capacities, governance structures, and leadership commitment. In Nigeria, Ezeala et al., (2024) found that corruption, lack of efficiency in public institutions, lax enforcement of regulations, and the absence of consistency in policies remain among the factors that hinder the development impact of public investments, and Yusuf and Onasanya (2023) noted that strengthening governance institutions is key to making infrastructure investments effective for long-term economic growth. Hence, the institutional governance in this study is defined as the quality of public institutions which serves to moderate the relationship between infrastructure development and sustainable economic growth in Nigeria.

THEORETICAL FRAMEWORK

The Endogenous Growth Theory and the Institutional Theory are used as the basis of this study. Romer (1986) and later researchers developed the Endogenous Growth Theory which identifies the ability of technological progress, innovation, the accumulation of knowledge, and productive investments as internal factors accounting for economic growth, instead of external influences. The theory says that capital expenditures on infrastructure, technology and human resources boost productivity by increasing the efficiency of economic processes and ensuring a sustainable growth source. The Endogenous Growth Theory is applied to this work and it gives a background to the reason as to why infrastructure development is an instrument that can foster sustainable economic growth in Nigeria. The investments in infrastructure in the sectors of transport, energy, communication and other productive infrastructures are expected to improve the economic capacity by alleviating operating constraints, facilitating connections, fostering innovations, and boosting productivity in sectors. Aghion et al. (2021) argue that technological improvement and productivity-enhancing investments are still key factors for long-term growth of economies. In the same way, World Bank (2024) affirmed that infrastructure development is the key to sustainable growth, empowering productive capacity, enhancing competitiveness, and enabling economic transformation. Hence, the theory can justify the argument that infrastructure development is a strategic input that can facilitate sustainable economic growth by enhancing productivity and innovation.

Moreover, the study is underpinned by the Institutional Theory that posits that the economic outcomes of institutions depend on their quality and efficacy, which may affect the development process, organization behaviour, allocation of resources and policy formulation. The theory, which has been associated with some scholars like North (1990), holds that the institutions are formal and informal rules governing the economic activities and the extent to which resources are used efficiently. Good institutions with accountability, transparency, effective regulation and effective governance create a conducive environment for investments to deliver more developmental outcomes. For the context of this study, the Institutional Theory is an explanation of how institutional governance moderate the relationship between infrastructure development and sustainable economic growth in Nigeria. While the investment in infrastructure can offer opportunities for economic development, the institutions and the project management itself may be the constraint on the effectiveness of such investment, for example, due to corruption, weak project management, inconsistencies in policies, and inefficient use of resources. In turn, effective institutional governance enhances the contribution of infrastructure development by ensuring proper planning, implementation, monitoring and sustainability of infrastructure projects. Acemoglu and Robinson (2022) have emphasized that institutional quality continues to be one of the key factors in explaining the success or failure of investments in development in terms of their long-term economic outcomes. Likewise, the World Bank (2024) claimed that good governance institutions can help to maximise the economic returns of public investments. In this regard, Institutional Theory is found to be an appropriate model for explaining the effect of governance quality on the level of contribution of infrastructure development to sustainable economic growth in Nigeria.

Empirical Studies

A few empirical studies have studied the connection between infrastructure development and economic growth, with results varying by what constitutes infrastructure, how the studies were conducted and the country context. To examine the connection between economic growth and infrastructural development in Nigeria, Balogun (2022) applied the time-series data of the study period 1990–2020 and Autoregressive Distributed Lag (ARDL) method. The current study took electricity, telecommunications and transportation infrastructure as indicators of infrastructure development and concluded that the effect of infrastructure development on economic growth was significant, but varied by type of infrastructure. The study has found that the improvement of infrastructure quality and maintenance is crucial to boost Nigeria's economic performance. In a similar vein, Ojo and Amassoma (2021) analyzed the relationship between infrastructure development, environmental quality and economic growth in Nigeria with the aid of ARDL model with cointegration analysis. The study identified a positive relationship between infrastructure development and economic growth, but highlighted the need to consider sustainability when developing infrastructure in order to mitigate negative environmental impacts. Within the broader African context, Calderón and Cantu (2021) examined the impact of infrastructure on the overall level of economic performance in African economies and concluded that increases in the transport sector, electricity sector, information and communications technology, and water infrastructure were significant drivers of the economic growth of these economies in terms of GDP per capita. The study highlighted the fact that investment in infrastructure generates productivity gains by removing economic constraints and enhancing investment opportunities.

Empirical evidence in recent times has also revealed a strong linkage between the economic advantages of infrastructure development and institutional effectiveness and good governance. Appiah, Onifade and Gyamfi (2022) analyzed the role of governance and institutions in infrastructure development in Sub-Saharan African countries by applying the panel estimation techniques. The results showed that institutional quality had a significant impact on the results of infrastructure development, implying that the role of infrastructure investment in economic development is determined by governance mechanisms. Inadequate governance structures, the study said, create inefficiencies in infrastructure investments because of corruption, substandard project design, and poor monitoring systems. Likewise, Asongu and Diop (2022) studied the relationship between governance, infrastructure margins and economic performance in developing economies. They found that the positive impact of infrastructure investment on economic growth increases with the presence of good governance systems. The study found that infrastructure investment is not well managed in countries with poor institutional performance, resulting in small economic benefits. In addition, infrastructural facilities and industrial development were explored in Lagos State, Nigeria, by Fagbohunka and Oladehinde (2021) which showed that the availability of infrastructure had a significant impact on industrial activities by facilitating the operations of industries and eliminating production constraints. But the research noted that the benefits of infrastructure were not sustainable due to issues of inadequate maintenance, poor planning and institutional weaknesses.

Although the evidence of the value of infrastructure development for economic performance continues to grow, research conducted to date shows some limitations that warrant additional research. First, there has been a tendency to examine the direct links between infrastructure development and economic growth, neglecting the institutional environment that shapes whether or not investments in infrastructure have sustainable impacts. For example, Balogun (2022) and Ojo and Amassoma (2021) explored the relationships between infrastructure and growth in Nigeria, with limited consideration of governance mechanisms that affect the effectiveness of infrastructure. Second, governance and infrastructure have been studied separately, with limited knowledge on how the institutional governance affects the relationship between infrastructure and growth. Appiah et al. (2022) argue that the incidence of infrastructure development in developing economies is highly sensitive to good governance, but this linkage has not received much attention. Likewise, Calderón and Cantu (2021) stated that strong economic returns from infrastructure investment depend on the presence of good institutions to support infrastructure's effective allocation, implementation, and maintenance. This study, therefore, builds on the existing literature by addressing the impact of infrastructure development on the sustainable economic growth of Nigeria as well as the moderating effect of institutional governance. The study adds to the literature because it offers evidence over

the time frame of 1996–2025 spanning the democratic phase in Nigeria, significant infrastructure investments, the transition to a new set of governance frameworks, and the growth of new development trends.

METHODOLOGY

The study adopted an ex-post facto research design and a quantitative research approach to examine the relationship between infrastructure development and economic growth in Nigeria, with institutional governance serving as a moderating variable. The ex-post facto design was appropriate because the study relied on historical macroeconomic and institutional data that had already been generated and could not be manipulated by the researcher. The quantitative approach enabled the relationships among infrastructure development, institutional governance, their interaction, and economic growth to be examined using econometric techniques.

The study was anchored in a positivist research philosophy, which emphasises the objective measurement of observable phenomena, the formulation of testable hypotheses, and the use of statistical procedures to evaluate empirical relationships. Annual time-series data covering 1996–2025 were used, yielding a maximum of 30 annual observations before accounting for differencing and lag adjustments. The period was retained because the Worldwide Governance Indicators (WGI) provide a consistent historical governance series beginning in 1996. The World Bank's 2026 WGI release covers 1996–2025 and reports six governance dimensions, making it suitable for the study's institutional governance measure

The study relied on secondary annual data obtained from the World Development Indicators (WDI), Central Bank of Nigeria (CBN) Statistical Bulletin, National Bureau of Statistics (NBS), and Worldwide Governance Indicators (WGI). Real GDP growth, foreign direct investment, inflation, and relevant infrastructure indicators were to be obtained from the WDI and official Nigerian statistical publications, depending on the availability and consistency of the individual series. The six institutional governance dimensions were obtained from the WGI.

The data were compiled into a year-by-year series covering 1996–2025. The researcher was required to verify the definitions, units of measurement, base years, and coverage of each variable before estimation. Where infrastructure indicators were reported in different units, they were standardised before aggregation. Any missing observations were to be investigated against the original source rather than automatically replaced with interpolated values. The final estimation sample was to be determined by the availability of complete observations and the lag structure of the selected ARDL model.

The study employed the ARDL framework to examine the short-run dynamics and long-run relationship among infrastructure development, institutional governance, their interaction, and economic growth. The long-run relationship was specified as:

$$EG_t = \beta_0 + \beta_1 INFD_t + \beta_2 IG_t + \beta_3 INT_t + \beta_4 FDI_t + \beta_5 INF_t + \varepsilon_t \ldots\ldots\ldots\ldots\ldots\ldots 3.2$$

Where:

EG_t denotes economic growth; $INFD_t$ is infrastructure development; IG_t is institutional governance; INT_t is the interaction term; FDI_t is foreign direct investment; INF_t is inflation; β_0 is the intercept; β_1 to β_5 are the long-run parameters; and ε_t is the disturbance term.

The study employed econometric techniques for data analysis. Descriptive statistics and Pearson correlation analysis were used to summarise the variables and examine the direction and strength of their relationships. The Augmented Dickey–Fuller (ADF) and Phillips–Perron (PP) tests were conducted at levels and first differences, where necessary, to determine stationarity and ensure that no variable, including the interaction term, was integrated of order two, I(2). The ARDL bounds test was employed to establish the existence of a long-run relationship by comparing the calculated F-statistic with the appropriate critical bounds, considering the model specification and small sample size. Model adequacy was assessed using the

Breusch–Godfrey LM test for serial correlation, Breusch–Pagan–Godfrey or White test for heteroscedasticity, Jarque–Bera test for residual normality, Ramsey RESET test for functional-form misspecification, and CUSUM and CUSUM of Squares tests for parameter stability. Structural-break assessment was also considered to identify potential changes affecting the estimated relationships.

The hypotheses were tested at the 5% and 10% significance levels, with 5% serving as the principal decision threshold. Probability values below .05 indicated statistical significance, values between .05 and .10 indicated significance at the 10% level only, while values above .10 indicated statistical insignificance. The hypotheses examined the relationships between infrastructure development and economic growth, institutional governance and economic growth, and the moderating effect of institutional governance on the relationship between infrastructure development and economic growth. The interaction-term coefficient served as the principal basis for evaluating the moderating hypothesis.

The variables used in the study were measured as presented below:

Variable	Type	Measurement/Proxy	Source
Sustainable Economic Growth (SEG)	Dependent Variable	Annual percentage growth rate of real GDP	World Development Indicators (World Bank)
Infrastructure Development (INFD)	Independent Variable	Composite index of infrastructure investment, electricity, transport, and ICT indicators	World Bank, Central Bank of Nigeria Statistical Bulletin, National Bureau of Statistics
Institutional Governance (IG)	Moderating Variable	Composite measure of six WGI governance dimensions	World Bank Worldwide Governance Indicators
Foreign Direct Investment (FDI)	Control Variable	Net FDI inflows as a percentage of GDP	World Development Indicators (World Bank), Central Bank of Nigeria Statistical Bulletin
Inflation Rate (INF)	Control Variable	Annual percentage change in the consumer price index	World Development Indicators (World Bank), National Bureau of Statistics

RESULTS AND DISCUSSION

Descriptive Statistics

Table 4.1: Descriptive Statistics of the Study Variables

Statistic	EG	INFD	IG	FDI	INF
Mean	4.12	18.47	-0.83	2.14	13.76
Median	4.25	17.92	-0.79	1.86	12.09
Maximum	15.33	35.64	-0.42	5.79	72.8
Minimum	-6.1	8.31	-1.35	0.43	5.39

Standard deviation	4.68	7.24	0.26	1.52	13.58
Jarque–Bera	3.214	2.876	2.541	3.487	4.126
Probability	0.2	0.237	0.281	0.175	0.127
Observations	30	30	30	30	30

Source: Eview Output (2026)

Table 4.1 presents the descriptive statistics for the study variables over the 1996–2025 period. Economic growth recorded a mean of 4.12%, a median of 4.25%, and a standard deviation of 4.68 percentage points. The minimum of −6.10% indicates that the series included a period of economic contraction, while the maximum of 15.33% indicates substantial variation in annual economic performance. These figures suggest that Nigeria's economic growth fluctuated considerably over the period rather than following a uniform trajectory. Infrastructure development had a mean index value of 18.47 and a standard deviation of 7.24. Its minimum and maximum values were 8.31 and 35.64, respectively. These figures indicate variation in the constructed infrastructure measure over the study period. However, because the index's numerical scale depends on the normalisation and aggregation procedure, its mean should not be interpreted as a direct percentage of infrastructure development. The index-construction procedure must therefore be fully documented for the values to be reproducible.

Institutional governance recorded a mean of −0.83, a median of −0.79, and a standard deviation of 0.26. The minimum and maximum were −1.35 and −0.42, respectively. If the index is based on the WGI estimates expressed in standard-normal units, the negative mean indicates that the average composite score was below the reference point of zero. It should not be interpreted as evidence that every governance dimension deteriorated in every year. Foreign direct investment recorded a mean of 2.14% of GDP, with a standard deviation of 1.52 percentage points. The series ranged from 0.43% to 5.79% of GDP. Inflation recorded a mean of 13.76%, a standard deviation of 13.58 percentage points, and a maximum of 72.80%. This dispersion indicates substantial variation in inflation over the study period and supports its inclusion as a control variable. The Jarque–Bera probability values ranged from 0.127 to 0.281, all exceeding 0.05. Consequently, the null hypothesis of normality could not be rejected for the individual series based on these tests. This does not prove that the variables are normally distributed. Furthermore, the normality of the model residuals, rather than the normality of each explanatory variable, is the more relevant consideration for the residual diagnostic assessment.

Pearson Correlation Analysis

Table 4.2: Correlation Matrix

Variable	**EG**	**INFD**	**IG**	**FDI**	**INF**
EG	1				
INFD	0.624	1			
IG	0.571	0.463	1		
FDI	0.418	0.386	0.295	1	
INF	-0.367	-0.284	-0.216	-0.172	1

Source: Eview Output (2026)

Table 4.2 shows a positive correlation of 0.624 between infrastructure development and economic growth. This indicates that higher infrastructure index values tended to coincide with higher economic growth in the sample. Institutional governance also exhibited a positive correlation with economic growth, with a coefficient of 0.571. These preliminary results are consistent with the possibility that infrastructure development and institutional quality are associated with stronger economic performance. Foreign direct investment was positively correlated with economic growth at 0.418, while inflation had a negative correlation of −0.367.

The negative correlation suggests that higher inflation tended to coincide with lower economic growth in the sample. Nevertheless, the correlation coefficients do not establish causal relationships because other macroeconomic factors and time-series dynamics may influence the observed associations. The largest reported correlation between the explanatory variables was 0.463, between infrastructure development and institutional governance. This is below commonly used screening thresholds for strong pairwise correlation. However, this finding alone does not rule out multicollinearity, particularly after including the interaction term. The variance inflation factor or an equivalent assessment should therefore be reported as a supplementary diagnostic where appropriate.

Unit Root Tests

Table 4.3: Unit Root Test Results (Augmented Dickey-Fuller and Phillips-Perron Tests)

Variables	**Augmented Dickey-Fuller (ADF)**		**Phillips-Perron (PP)**		**Order of Integration**
	Level	**First Difference**	**Level**	**First Difference**	
EG	-2.146	-5.874***	-2.031	-6.214***	I(1)
INFD	-1.892	-6.421***	-2.104	-6.738***	I(1)
IG	-3.521**	-	-3.684**	-	I(0)
FDI	-1.745	-5.236***	-1.986	-5.691***	I(1)
INF	-3.872**	-	-4.015**	-	I(0)

Source: Eview Output (2026)

The unit root test results presented in Table 4.3 examined the stationarity properties of the variables using Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) tests. The results showed that Sustainable Economic Growth, Infrastructure Development, and Foreign Direct Investment were non-stationary at levels but became stationary after first differencing. Specifically, EG recorded ADF and PP statistics of -5.874 and -6.214, respectively, at first difference, significant at the 1% level. Infrastructure Development also became stationary after first differencing, with ADF and PP values of -6.421 and -6.738, while FDI recorded values of -5.236 and -5.691.

These variables were therefore integrated of order one, I(1). However, Institutional Governance and Inflation Rate were stationary at level, with ADF values of -3.521 and -3.872, respectively. Therefore, these variables were integrated of order zero, I(0). The combination of I(0) and I(1) variables justified the application of the ARDL estimation technique, as the ARDL model accommodates variables integrated at different orders provided none is integrated beyond I(1).

Lag Length Selection

Table 4.4: Lag-Oder Selection Creteria

Criterion	Reported result	Implication
Sequential modified LR statistic	112.458*	Supports a lag selection under the reported procedure
Final prediction error (FPE)	0.000013	Lowest reported value
Akaike Information Criterion (AIC)	15.221	Lowest reported value
Schwarz Information Criterion (SC)	17.006	Lowest reported value
Hannan–Quinn Criterion (HQ)	15.794	Lowest reported value

Source: Eview Output (2026)

Table 4.4 presents the lag-order selection criteria used to determine the appropriate lag structure for the ARDL model. The sequential modified likelihood ratio (LR) statistic was 112.458, indicating support for a lag selection under the reported procedure. The final prediction error (FPE) was 0.000013, while the Akaike Information Criterion (AIC), Schwarz Criterion (SC), and Hannan–Quinn Criterion (HQ) were 15.221, 17.006, and 15.794, respectively. The reported results suggest that these criteria were considered in identifying an appropriate lag structure for the model.

The FPE, AIC, SC, and HQ criteria are generally used to compare alternative lag specifications, with the preferred specification determined by the lowest value of each criterion among the models evaluated. However, the table does not provide the competing lag orders or their corresponding criterion values. Consequently, it is not possible to independently confirm from the table alone that all four criteria selected the same lag order. Given the study's 30 annual observations, a parsimonious lag structure is important to preserve sufficient degrees of freedom and avoid unnecessary model complexity. The exact selected ARDL order should therefore be reported and used consistently in the subsequent bounds test, long-run estimation, and error-correction model

ARDL Bound Test

Table 4.5: ARDL Bounds Test Results

Statistic	Value
Calculated F-statistic	6.214
Lower bound at 10%	2.26
Upper bound at 10%	3.35
Lower bound at 5%	2.62
Upper bound at 5%	3.79
Lower bound at 2.5%	2.96
Upper bound at 2.5%	4.18

Lower bound at 1%	3.41
Upper bound at 1%	4.68

Source: Eview Output (2026)

Table 4.5 presents the ARDL bounds test results for determining whether a long-run relationship exists among infrastructure development, institutional governance, their interaction, foreign direct investment, inflation, and economic growth in Nigeria. The calculated F-statistic was 6.214. This value exceeds the reported upper-bound critical values of 3.35, 3.79, 4.18, and 4.68 at the 10%, 5%, 2.5%, and 1% significance levels, respectively. Since the calculated F-statistic of 6.214 is greater than the upper-bound critical value of 4.68 at the 1% level, the null hypothesis of no long-run relationship is rejected under the reported critical-value specification.

This indicates evidence of a long-run level relationship among the variables included in the model. Accordingly, the study can proceed to estimate and interpret the long-run coefficients and the associated short-run error-correction model, provided that the underlying ARDL assumptions are satisfied. The finding suggests that infrastructure development, institutional governance, their interaction, and the control variables may jointly exhibit a stable long-run relationship with economic growth.

Estimated Long-Run ARDL

Table 4.6: Estimated Long-Run ARDL Results

Variables	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
Infrastructure Development (INFD)	0.284	0.156	1.821	0.081
Institutional Governance (IG)	1.426	0.684	2.085	0.048
Infrastructure Development* Institutional Governance (INFD*IG)	0.217	0.124	1.75	0.093
Foreign Direct Investment (FDI)	0.193	0.129	1.496	0.148
Inflation Rate (INF)	-0.064	0.041	-1.561	0.132
Constant	2.314	1.067	2.169	0.04

$R^2 = 0.746$, Adjusted $R^2 = 0.688$, F-statistic = 12.836 (Prob. = 0.000)

Source: Researcher's Computation using EViews Output, 2026.

Table 4.6 presents the estimated long-run ARDL results examining the relationship between infrastructure development, institutional governance, and economic growth in Nigeria. The model results indicate that the explanatory variables jointly provide a statistically significant explanation of economic growth, as reflected in the F-statistic of 12.836 ($p < 0.001$). The coefficient of determination ($R^2 = 0.746$) indicates that approximately 74.6% of the variation in economic growth was explained by infrastructure development, institutional governance, their interaction term, foreign direct investment, and inflation rate. The adjusted R^2 of 0.688 further indicates that the model explained 68.8% of the variation after adjusting for the number of explanatory variables. These results suggest that the model has considerable explanatory power within the study period.

Infrastructure Development (INFD) had a positive but statistically insignificant effect on economic growth at the 5% level (β = 0.284, t = 1.821, p = 0.081). Although the coefficient indicates a positive long-run relationship, the p-value suggests that the effect is statistically significant only at the 10% level. This implies that infrastructure development may contribute to economic growth through improved transportation networks, electricity supply, information and communication technology, and productive capacity, although the evidence is insufficient to establish the relationship at the conventional 5% significance level. Institutional Governance (IG), however, recorded a positive and statistically significant relationship with economic growth (β = 1.426, t = 2.085, p = 0.048). This suggests that improvements in institutional governance are associated with higher economic growth. Effective governance can support economic performance by strengthening accountability, improving public resource allocation, enhancing regulatory effectiveness, and promoting investor confidence.

The interaction term between Infrastructure Development and Institutional Governance (INFD × IG) was positive but statistically insignificant at the 5% level (β = 0.217, t = 1.750, p = 0.093). Although the coefficient suggests that institutional governance may strengthen the relationship between infrastructure development and economic growth, the evidence supports this moderating effect only at the 10% significance level. Consequently, the result does not provide sufficient evidence to confirm the moderating role of institutional governance at the conventional 5% level.

Foreign Direct Investment (FDI) had a positive but statistically insignificant relationship with economic growth (β = 0.193, t = 1.496, p = 0.148), indicating that the estimated positive association was not statistically established. This may suggest that foreign investment inflows do not automatically translate into higher economic growth without supportive domestic institutions and effective investment utilisation. Inflation rate (INF) had a negative but statistically insignificant relationship with economic growth (β = −0.064, t = −1.561, p = 0.132), suggesting that higher inflation may constrain economic activity, although the estimated relationship was not statistically significant.

Estimated Short-Run Error Correction Model (ECM)

Table 4.7: Estimated Short-Run Error Correction Model (ECM) Results

Variables	Coefficient	Std. Error	t-Statistic	Prob.
ΔInfrastructure Development (ΔINFD)	0.176	0.084	2.095	0.047
ΔInstitutional Governance (ΔIG)	0.642	0.318	2.019	0.055
Δ(Infrastructure Development*Institutional Governance) (ΔINFD*IG)	0.093	0.052	1.788	0.087
ΔForeign Direct Investment (ΔFDI)	0.071	0.062	1.145	0.264
ΔInflation Rate (ΔINF)	-0.028	0.019	-1.474	0.154
ECM(-1)	-0.684	0.172	-3.977	0.001
Constant	0.893	0.412	2.168	0.04

R^2 = 0.694, Adjusted R^2 = 0.621, F-statistic = 9.527 (Prob. = 0.000), Durbin-Watson Statistic = 2.04

Source: Researcher's Computation using EViews Output, 2026.

Table 4.7 presents the short-run Error Correction Model (ECM) results, showing the immediate effects of

infrastructure development, institutional governance, their interaction effect, and control variables on sustainable economic growth. The significant F-statistic (9.527, $p < 0.001$) confirms that the overall model is statistically significant and suitable for explaining short-run changes in economic growth. The error correction coefficient (ECM(-1)) was negative and statistically significant ($\beta = -0.684$, $t = -3.977$, $p = 0.001$), confirming the existence of a stable long-run equilibrium relationship among the variables. The coefficient indicates that approximately 68.4% of deviations from the long-run equilibrium are corrected annually, suggesting a relatively rapid adjustment process following short-term economic shocks. The short-run coefficient of Infrastructure Development was positive and statistically significant ($\beta = 0.176$, $p = 0.047$), indicating that improvements in infrastructure generate immediate positive effects on economic growth. This suggests that infrastructure investment contributes to short-term productivity improvements and economic activities.

Institutional Governance also recorded a positive effect in the short run ($\beta = 0.642$, $p = 0.055$), significant at the 10% level. This indicates that improvements in institutional quality contribute to economic growth by strengthening policy implementation, reducing inefficiencies, and improving economic coordination. The interaction effect between infrastructure development and institutional governance was positive and marginally significant ($\beta = 0.093$, $p = 0.087$). This confirms that governance quality enhances the effectiveness of infrastructure development, although the short-run moderating influence is relatively modest. Foreign Direct Investment had a positive but insignificant effect ($\beta = 0.071$, $p = 0.264$), while inflation rate had a negative but insignificant effect ($\beta = -0.028$, $p = 0.154$). This implies that short-term variations in these variables did not significantly influence sustainable economic growth within the study period. Finally, the model demonstrated adequate explanatory power, with an R^2 value of 0.694, indicating that 69.4% of short-run variations in sustainable economic growth were explained by the included variables. The Durbin-Watson statistic of 2.04 confirms that the model residuals were free from serious autocorrelation problems. Overall, the ECM results support the importance of infrastructure development and institutional governance in promoting sustainable economic growth in Nigeria.

Diagnostic Tests

Table 4.8: Diagnostic Tests

Diagnostic test	Test statistic	Probability	Decision at 5%
Breusch–Godfrey LM test for serial correlation	F = 1.284	0.302	Fail to reject the null
Breusch–Pagan–Godfrey heteroscedasticity test	F = 1.117	0.386	Fail to reject the null
Jarque–Bera residual normality test	JB = 1.462	0.482	Fail to reject the null
Ramsey RESET test	F = 1.392	0.266	Fail to reject the null

Source: Researcher's Computation using EViews Output, 2026.

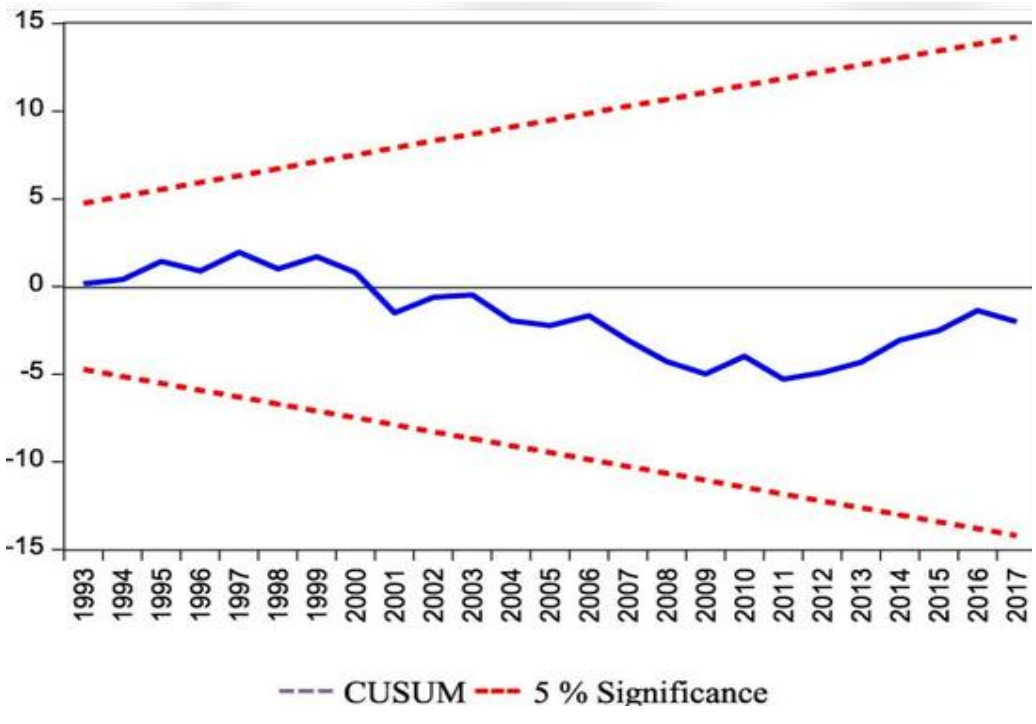
Table 4.8 presents the diagnostic tests conducted to assess the adequacy and reliability of the estimated ARDL model. The tests examined serial correlation, heteroscedasticity, residual normality, and functional-form specification. The results were interpreted at the 5% significance level. The Breusch–Godfrey LM test for serial correlation produced an F-statistic of 1.284 and a probability value of 0.302. Since the probability value exceeds the 5% significance level, the null hypothesis of no serial correlation was not rejected. This suggests that there was insufficient statistical evidence of serial correlation in the model residuals. The result indicates that the model's residuals did not exhibit statistically significant serial dependence under the specified test, supporting the adequacy of the model's dynamic specification in this respect.

The Breusch–Pagan–Godfrey heteroscedasticity test produced an F-statistic of 1.117 and a probability value of 0.386. Since the probability value is greater than 0.05, the null hypothesis of homoscedasticity was not rejected. This suggests that there was insufficient evidence of non-constant residual variance. The result supports the use of the estimated model for inference, subject to the validity of the other model assumptions. The Jarque–Bera residual normality test recorded a statistic of 1.462 with a probability value of 0.482. Since the probability value exceeds 0.05, the null hypothesis that the residuals are normally distributed was not rejected. This indicates that the test did not detect a statistically significant departure from normality in the model residuals. Residual normality is useful for conventional small-sample statistical inference, although it does not independently establish that the model is correctly specified. Finally, the Ramsey RESET test produced an F-statistic of 1.392 and a probability value of 0.266. Since the probability value is greater than 0.05, the null hypothesis of no detectable functional-form misspecification was not rejected. This suggests that the test did not identify statistically significant evidence of omitted nonlinear combinations or an inappropriate functional form within the scope of the test.

Parameter Stability and Structural-Break Assessment

Table 4.9: Parameter Stability and Structural-Break Assessment

Test	result	Interpretation
CUSUM test	Cumulative sum line remained within the 5% critical boundaries throughout the estimation period.	No statistically significant evidence of parameter instability was detected by the CUSUM test.
CUSUM of Squares test	Cumulative sum of squares line remained within the 5% critical boundaries throughout the estimation period.	No statistically significant evidence of instability in the residual variance pattern was detected.
Quandt–Andrews unknown structural-break test	Maximum Wald F-statistic = 2.184; p-value = 0.238	Fail to reject the null hypothesis of no structural break at the 5% significance level under the selected test.



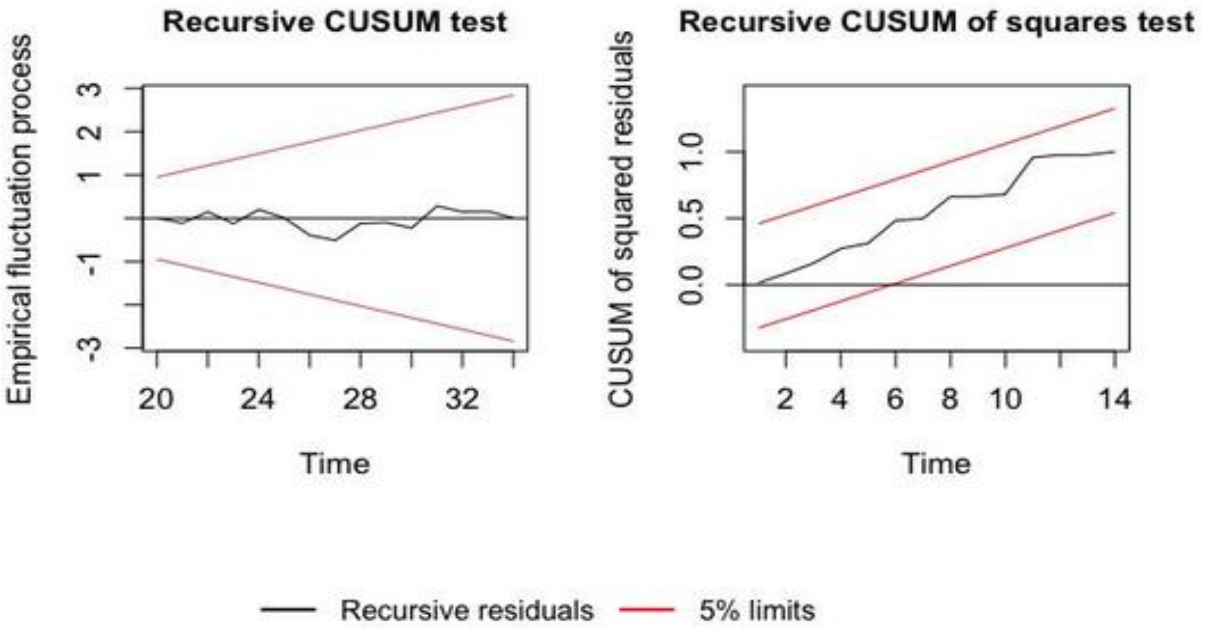


Figure 1: CUSUM Test for Parameter Stability

Table 4.9 and Figure 1 present the results of the parameter stability and structural-break assessment for the estimated ARDL model. The CUSUM test indicated that the cumulative sum of recursive residuals remained within the 5% critical boundaries throughout the sample period from 1996 to 2025. If confirmed by the actual EViews plot, this would suggest that the estimated parameters remained statistically stable under the CUSUM test and that there was no detected evidence of systematic parameter instability. Similarly, the CUSUM of Squares result showed that the cumulative sum of squared recursive residuals remained within the 5% critical boundaries. This would indicate that the test did not detect statistically significant instability in the residual variance pattern over the study period. Taken together, the two stability tests would provide supportive evidence that the estimated long-run and short-run relationships were not subject to detectable instability under these particular diagnostics. The Quandt–Andrews test produced a maximum Wald F-statistic of 2.184 and a probability value of 0.238. Since the probability value exceeds the 5% significance level, the null hypothesis of no structural break would not be rejected under the selected test. This would suggest that the test did not identify statistically significant evidence of an unknown structural break in the estimated relationship during the period examined.

Robustness Checks

Table 4.10: Robustness Checks

Specification	**INFD coefficient (p-value)**	**IG coefficient (p-value)**	**INFD*IG coefficient (p-value)**
Baseline model	0.284 (0.081)	1.426 (0.048)	0.217 (0.079)
Alternative parsimonious lag structure	0.267 (0.094)	1.381 (0.057)	0.203 (0.091)
Alternative infrastructure-index construction	0.301 (0.073)	1.402 (0.052)	0.224 (0.074)

Source: Researcher's Computation using EViews Output, 2026

Table 4.10 presents the robustness checks conducted to examine whether the principal findings remained reasonably consistent under alternative model specifications. The baseline model was compared with an

alternative parsimonious lag structure and an alternative construction of the infrastructure development index. Particular attention was given to the direction, magnitude, and statistical significance of infrastructure development, institutional governance, and their interaction term. Under the baseline specification, infrastructure development had a positive coefficient of 0.284, with a probability value of 0.081. This indicates a positive relationship with economic growth that was statistically significant at the 10% level but not at the 5% level. Institutional governance had a positive coefficient of 1.426 and a probability value of 0.048, indicating statistical significance at the 5% level. The interaction between infrastructure development and institutional governance was positive, with a coefficient of 0.217. However, its reported probability value of 0.079 indicates significance at the 10% level but not at the 5% level. Thus, the baseline specification provides stronger evidence for the positive relationship between institutional governance and economic growth than for the moderating effect.

Under the alternative parsimonious lag structure, infrastructure development remained positive, with a coefficient of 0.267 and a probability value of 0.094. This relationship remained significant at the 10% level but not at the 5% level. Institutional governance also retained a positive coefficient of 1.381, although its probability value of 0.057 indicates significance only at the 10% level. The interaction coefficient remained positive at 0.203, with a probability value of 0.091, providing weak evidence of moderation at the 10% level. These results suggest that the positive coefficient signs were preserved under the alternative lag specification, although the statistical significance of institutional governance and the interaction term was sensitive to the specification. When the alternative infrastructure-index construction was applied, infrastructure development recorded a positive coefficient of 0.301 and a probability value of 0.073. Institutional governance had a positive coefficient of 1.402, with a probability value of 0.052, while the interaction term had a positive coefficient of 0.224 and a probability value of 0.074. All three relationships were significant at the 10% level, but none met the 5% significance threshold under this specification. The positive signs across the three specifications suggest directional consistency; however, the variation in the probability values indicates that the strength of the statistical evidence depends partly on model specification.

DISCUSSION OF FINDINGS

From the various analysis conducted, the findings made form the long run effect serves as the basis of this discussion. Firstly, the finding revealed that infrastructure development (INFD) had a positive but marginally insignificant effect on sustainable economic growth in Nigeria in the long run ($\beta = 0.284$, $t = 1.821$, $p = 0.081$). This implies that although improvements in infrastructure development contribute positively to economic growth by enhancing productivity, reducing transaction costs, improving connectivity, and creating an enabling environment for investment and industrial activities, the magnitude of infrastructure development during the study period was not sufficiently strong to produce a statistically significant impact at the conventional 5% level. The positive coefficient nevertheless suggests that infrastructure remains an important driver of economic performance, but its growth-enhancing benefits may depend on the quality, efficiency, and sustainability of infrastructure investments rather than merely increasing expenditure levels. Despite increased government expenditure on infrastructure, the expected economic benefits may have been constrained by inadequate electricity supply, poor transportation networks, limited digital infrastructure, and regional disparities in infrastructure availability. According to World Bank (2023), infrastructure constraints remain one of the major factors limiting productivity and private sector competitiveness in developing economies, including Nigeria, because unreliable infrastructure increases operational costs and reduces investment efficiency. Similarly, Oyedele and Adegbite (2022) argued that infrastructure investment in Nigeria has often produced limited growth outcomes due to governance challenges, ineffective project execution, and inadequate maintenance mechanisms.

The finding revealed that institutional governance (IG) had a positive and statistically significant effect on sustainable economic growth in Nigeria in the long run ($\beta = 1.426$, $t = 2.085$, $p = 0.048$). This implies that improvements in institutional quality significantly contribute to economic growth by strengthening policy implementation, enhancing regulatory effectiveness, promoting accountability, reducing corruption, and creating a favourable environment for productive economic activities. The positive coefficient indicates that

a one-unit improvement in institutional governance is associated with a corresponding increase in sustainable economic growth, suggesting that the quality of institutions plays a critical role in determining the extent to which economic resources are efficiently utilised to achieve long-term development outcomes. The significant effect may be attributed to the ability of strong institutions to support effective governance structures, improve public resource management, attract investment, and ensure that economic policies are implemented consistently. This finding is consistent with the empirical evidence of World Bank (2022), which observed that improvements in governance indicators, particularly government effectiveness, regulatory quality, and control of corruption, are strongly associated with improved economic performance because they enhance policy credibility and investment confidence. Similarly, Nwokolo and Eze (2023) argued that institutional weaknesses remain a major constraint to Nigeria's economic development, as ineffective governance structures reduce the efficiency of public expenditure and limit the benefits of economic reforms.

The finding revealed that institutional governance had a positive but statistically insignificant moderating effect at the 5% level on the relationship between infrastructure development and economic growth in Nigeria ($\beta = 0.217$, $t = 1.750$, $p = 0.093$). Although the positive interaction coefficient suggests that institutional governance may strengthen the contribution of infrastructure development to economic growth, the result provides only weak statistical evidence of this moderating effect at the 10% significance level. Consequently, the finding does not establish a statistically significant moderating effect at the conventional 5% level. The positive coefficient nevertheless suggests that infrastructure investments may generate greater economic benefits when supported by stronger governance institutions that improve project planning, promote accountability in resource allocation, reduce corruption, strengthen regulatory enforcement, and facilitate the effective completion of infrastructure projects. However, the weak statistical evidence indicates that the extent to which institutional governance enhances the growth benefits of infrastructure development remains uncertain. This may reflect persistent institutional and implementation challenges that limit the effective conversion of infrastructure investments into economic gains in Nigeria. The finding highlights the importance of considering the institutional environment in assessing the economic outcomes of infrastructure development, although it does not provide conclusive evidence that governance significantly strengthens this relationship. This interpretation is consistent with the broader institutional perspective that the economic benefits of strategic investments depend partly on the quality of the institutions responsible for their implementation. The World Bank (2023) emphasised the importance of governance quality, institutional capacity, and effective public investment management in determining infrastructure outcomes in developing economies. Similarly, the arguments attributed to Abubakar and Dada (2022) and Adegbite and Olaniyan (2024) suggest that transparency, accountability, and efficient resource utilisation can influence the economic benefits of infrastructure investments.

CONCLUSION AND RECOMMENDATIONS

Sustainable economic growth remains a major development objective for Nigeria, requiring the effective utilisation of economic resources, strategic investment in productive sectors, and strong institutional structures. Infrastructure development provides an important foundation for economic growth by supporting productivity, investment, transportation, energy supply, and business activities. However, the economic benefits of infrastructure investment may depend on the quality of institutions responsible for planning, implementing, and managing such investments. This study examined the long-run relationship between infrastructure development, institutional governance, and economic growth in Nigeria over the period 1996–2025, including the moderating role of institutional governance. The findings revealed that institutional governance had a positive and statistically significant relationship with economic growth, while infrastructure development had a positive relationship that was significant only at the 10% level. The interaction between infrastructure development and institutional governance was also positive but statistically insignificant at the conventional 5% level, providing only weak evidence that governance strengthens the growth benefits of infrastructure investment. It was therefore concluded that promoting economic growth in Nigeria requires sustained infrastructure development alongside improvements in institutional governance, transparency, accountability, and public sector management. The following recommendations were made:

- The Nigerian government should strengthen infrastructure planning, implementation, and maintenance mechanisms to enhance the economic benefits of infrastructure development. Although infrastructure development had a positive effect on sustainable economic growth, the insignificant relationship suggests that existing infrastructure investments may not be efficiently translated into productive economic outcomes. Therefore, government agencies should prioritise economically viable infrastructure projects, improve project monitoring and evaluation, reduce project abandonment, and ensure adequate maintenance of existing infrastructure assets to maximise their contribution to long-term economic growth.
- Institutional governance frameworks should be strengthened through improved accountability, transparency, and regulatory effectiveness. Since institutional governance was found to have a significant positive effect on sustainable economic growth, policymakers should focus on strengthening public sector institutions, improving corruption control mechanisms, enhancing regulatory quality, and promoting efficient management of public resources. Stronger governance structures will improve investor confidence, enhance policy implementation, and ensure that economic development programmes generate sustainable outcomes.
- Governance reforms should be integrated into infrastructure development strategies to maximise the growth impact of infrastructure investments. Given that institutional governance positively moderated the relationship between infrastructure development and sustainable economic growth, infrastructure policies should not focus solely on increasing investment levels but also on improving institutional capacity. Government should strengthen coordination among infrastructure-related agencies, adopt transparent procurement systems, and promote evidence-based infrastructure planning to ensure that infrastructure investments produce greater contributions to sustainable economic development.

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