

Public Infrastructure Expenditure and Human Development in Nigeria: A Disaggregated Sectoral Analysis

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Abstract

This study examines the effect of disaggregated public infrastructure expenditure on human development in Nigeria, with particular emphasis on road and construction, education, health, communication, and security infrastructure expenditures. Using annual data sourced from the World Bank, United Nations Development Programme (UNDP), and Central Bank of Nigeria (CBN), the study employs the Autoregressive Distributed Lag (ARDL) approach to estimate both short- and long-run relationships between public infrastructure expenditures and the Human Development Index (HDI) – the proxy for human development. The results indicate that road and construction, education, health, and communication infrastructure have positive and statistically significant effects on HDI in both the short and long run. Road and construction infrastructure record the largest estimated effect, while security infrastructure exhibits a positive but statistically insignificant relationship with HDI. The findings underscore the importance of sustained investment in infrastructure that enhances access to education, healthcare, mobility, and communication services. The study contributes to the literature by demonstrating that the human-development effects of infrastructure differ across infrastructure components, providing evidence relevant to infrastructure prioritization and development policy in Nigeria.

Keywords: *Disaggregated Public Infrastructure Expenditures, Human Development, Security Infrastructure expenditure, ARDL, Nigeria.*

1. Introduction

Public infrastructure is fundamental to human development because it shapes access to essential services, economic opportunities, mobility, and information. Beyond its conventional role in promoting economic growth, infrastructure can directly enhance human capabilities by improving access to education, healthcare, employment, and markets. Empirical studies have established a strong relationship between infrastructure development and economic and social outcomes, although the magnitude of these effects varies across infrastructure types (Calderón & Servén, 2004, 2010; Nchofoung, 2022). This heterogeneity suggests that treating infrastructure as an aggregate construct may conceal important differences in its contribution to human development. Nigeria provides an important context for examining these relationships. Despite its considerable economic potential, the country continues to experience substantial human-development and infrastructure deficits. The United Nations Development Programme reports an HDI of 0.548, placing Nigeria in the low human-development category, while inequality reduces its HDI by approximately 32.7% (UNDP, 2024). Infrastructure gaps

remain pronounced: only about 61.2% of the population had access to electricity in 2023, while approximately 80% of the road network was reported to be in poor condition (World Bank, 2024). Although telecommunications and railway infrastructure have expanded, access and connectivity remain uneven. These deficiencies can constrain human development by limiting access to education, healthcare, employment, markets, and information.

The problem, therefore, extends beyond whether infrastructure matters to which forms of infrastructure matter most for human development. Existing research has frequently emphasized aggregate infrastructure or economic-growth outcomes, providing comparatively less evidence on the differentiated effects of individual infrastructure components on human development in Nigeria. Evidence from Nigeria nevertheless suggests that infrastructure can generate substantial and heterogeneous development effects; for example, Okoye, Pongou, and Yokossi (2019) find that railway expansion produced persistent effects on local economic development and human capital. Similarly, cross-country African evidence indicates that the effects of infrastructure differ across sectors and may be nonlinear (Nchofoung, 2022).

Against this background, this study examines the effects of road and construction, education, health, communication and security expenditures on Nigeria's Human Development Index (HDI). By disaggregating public infrastructure into its major components, the study provides a more nuanced assessment of the infrastructure–human development relationship and generates evidence that can inform the prioritization of public infrastructure investment in Nigeria.

2. Literature Review

Theoretical Review

Human Capital Theory

Human Capital Theory, principally developed by Theodore W. Schultz (1961) and Gary S. Becker (1964), views education, training, health, and other investments embodied in individuals as forms of capital that enhance productivity and future welfare. Becker's seminal Human Capital provided a systematic economic framework for understanding how investments in education and training generate returns through higher productivity, earnings, and employment opportunities (Becker, 1964). The theory assumes that individuals and societies make forward-looking investments in human capacities, that such investments involve current costs in expectation of future benefits, and that improvements in human capabilities raise productive efficiency. Consequently, investments that facilitate the acquisition and utilization of human capital are expected to improve socioeconomic outcomes.

The relevance of Human Capital Theory to the present study lies in the complementary relationship between public infrastructure and human-capital formation. Electricity can improve the conditions for education and facilitate the operation of schools and health facilities; roads and railways can reduce the physical costs of accessing educational and health services; air transport can improve the movement of people and specialized services; while telecommunications can facilitate access to information, knowledge, and educational resources. Thus, infrastructure can be regarded as an enabling input into the formation and utilization of human capital. In the context of this study, improvements in infrastructure are therefore expected to contribute to higher levels of human development through enhanced education, health, productivity, and living standards. This provides a theoretical basis for examining whether different infrastructure components exert differentiated effects on HDI.

Capability Approach

The Capability Approach, most prominently developed by Amartya Sen (1985, 1999) and subsequently advanced by scholars including Martha Nussbaum, conceptualizes development as the expansion of people's substantive freedoms and capabilities to achieve lives they have reason to value (Sen, 1999). Rather than defining development primarily in terms of income or

economic output, the approach focuses on what individuals are effectively able to be and do. The central assumptions are that human well-being is multidimensional, that resources do not automatically translate into well-being, and that individuals' ability to convert resources into valued outcomes depends on their social, economic, and institutional circumstances.

This theory provides the strongest conceptual foundation for the present study because the HDI is explicitly grounded in the human-development perspective associated with the capability approach. The HDI was introduced by the UNDP in 1990 to provide a broader measure of human achievement than income-based indicators, incorporating dimensions of health, education, and a decent standard of living. From this perspective, public infrastructure constitutes part of the enabling environment through which people exercise their capabilities. Reliable electricity may expand opportunities for learning and productive activity; transport infrastructure may enhance people's ability to reach schools, hospitals, workplaces, and markets; and telecommunications may expand access to knowledge and information. Consequently, infrastructure does not constitute human development in itself but can expand the opportunities and capabilities through which human development is realized. This makes the Capability Approach particularly appropriate for explaining the expected relationship between disaggregated infrastructure and HDI in Nigeria.

Public Goods Theory

The modern economic theory of public goods is principally associated with Paul A. Samuelson (1954), whose *The Pure Theory of Public Expenditure* formally distinguished private consumption goods from collective consumption goods. Samuelson characterized collective goods by the fact that consumption by one individual does not necessarily diminish the amount available to others, and assumed that individuals possess preferences over both private and collective goods (Samuelson, 1954). The theory assumes that markets may not provide socially optimal quantities of goods exhibiting public-good characteristics because of problems such as non-rivalry, non-excludability, and externalities. Public intervention can therefore be justified where private markets fail to provide infrastructure at socially desirable levels.

The theory is relevant to this study because major infrastructure systems generate benefits extending beyond their immediate users. Roads, railways, electricity networks, telecommunications infrastructure, and transport facilities can generate positive externalities by connecting communities, reducing transaction costs, facilitating economic activity, and improving access to social services. Their benefits may consequently exceed the private returns captured by individual users. Public investment and policy intervention are therefore important in ensuring adequate infrastructure provision, particularly where commercial incentives alone may leave underserved regions and populations without essential services. Within the Nigerian context, Public Goods Theory consequently provides the institutional and economic rationale for examining how government-supported infrastructure provision can influence broader human-development outcomes.

Empirical Review

Aninwagu, Onyema, and Amadi (2024) investigated the impact of infrastructural investment on Nigeria's economic growth from 1990 to 2022 using time-series data obtained from the CBN Statistical Bulletin and World Development Indicators. The study employed the Augmented Dickey-Fuller (ADF) unit root test, bounds cointegration test, ARDL estimation, and residual diagnostic tests. The findings established cointegration among the variables. The ARDL results showed that road and construction investment had a negative but statistically insignificant effect on economic growth, while electricity access and fixed telephone subscriptions had positive but insignificant effects. However, investment in transport and communication had a positive and statistically significant effect on economic growth.

Aninwagu, Onyema, and Amadi (2024) examined the effects of fiscal deficits in Nigeria using time-series data collected from the Central Bank of Nigeria's Statistical Bulletin and the World Development Indicators, covering a 38-year period from 1982 to 2020. The findings indicated that fiscal deficits had a positive but statistically insignificant effect on Nigeria's economic growth. External borrowing also had a positive but statistically insignificant effect on economic growth, whereas foreign exchange reserves had a positive and statistically significant effect. Domestic borrowing similarly had a positive and statistically significant effect on economic growth. Aninwagu et al. (2026) examined the determinants of Nigeria's economic growth from 1990 to 2023 using the ARDL bounds-testing approach. Real GDP per capita served as the dependent variable, while trade, foreign direct investment, gross fixed capital formation, and government education expenditure constituted the explanatory variables. The findings showed that trade and education expenditure had negative short-run effects, while FDI had a negative short-run but positive and significant long-run effect. Gross fixed capital formation had a positive and significant short-run effect but an insignificant long-run effect. The error correction term indicated approximately 62% annual adjustment toward long-run equilibrium. Siyan and Adewale (2017) examined the relationship between infrastructural development and economic development in Nigeria using data covering the period from 1981 to 2014. The data were subjected to stationarity and cointegration tests, after which a Vector Error Correction Model (VECM) was employed for the analysis. The results established a long-run relationship between infrastructure development and economic growth in Nigeria. The error correction term had the expected negative sign and fell within the acceptable range, although the speed of adjustment towards equilibrium was low. Specifically, road and communication infrastructure exhibited positive relationships with economic growth, whereas private investment, trade openness, and education showed negative relationships with economic growth during the study period. Iheanacho (2017) examined the short- and long-run relationships between public expenditure on infrastructure and economic development in Nigeria over the period from 1986 to 2014. The study employed the Johansen cointegration and error-correction approaches within a Cobb-Douglas production function framework. The explanatory variables included recurrent expenditure, capital expenditure, aggregate government expenditure, gross capital formation ratio, and non-oil prices as a control variable, while gross domestic product served as the dependent variable. The findings revealed that recurrent expenditure on infrastructure had a negative and significant long-run relationship with economic growth but a positive short-run relationship. Capital expenditure, however, had a negative and significant long-run effect on economic growth in Nigeria.

Aninwagu and Momodu (2025) investigated the impact of political instability, specifically Control of Corruption (COIN), Government Effectiveness (GOTE), and Political Stability and Absence of Violence/Terrorism (POLS), on human development, proxied by poverty (POVT), in Nigeria from 1995 to 2023. Using descriptive statistics, the Augmented Dickey-Fuller (ADF) unit root test, bounds cointegration analysis, and the Autoregressive Distributed Lag (ARDL) model, the study examined both the short- and long-run relationships between governance indicators and poverty reduction. The results revealed that control of corruption and government effectiveness significantly reduced poverty in the long run, supporting the institutional theory, which emphasized the role of effective governance in economic development. However, their short-run effects produced mixed outcomes, with initial increases in poverty attributed to transitional economic disruptions. Conversely, political stability was positively associated with poverty in both the short and long run, suggesting that stability alone was insufficient for poverty reduction without targeted economic recovery programmes. The error correction term was highly significant, confirming rapid adjustment towards long-run equilibrium. The model exhibited strong explanatory power ($R^2 = 0.975$), although potential overfitting warranted cautious interpretation.

Onwuemeka et al. (2023) examined the relationship between government spending on economic infrastructure and economic development in Nigeria from 1989 to 2018. Real gross domestic product (RGDP) was used as a proxy for economic growth and was specified as a function of government spending on transport and communication, government spending on power, and employment rate as a proxy for the classical theory of labour force. The Autoregressive Distributed Lag (ARDL) bounds testing approach to cointegration was employed to ascertain the impact of infrastructure spending and the existence of long-run relationships between the dependent and independent variables. The short- and long-run results showed that government spending on power exerted a positive but statistically insignificant effect on Nigeria's RGDP. However, government spending on transport and communication had a positive relationship with RGDP in the short run but a negative relationship in the long run.

3. Methodology

This study adopts an ex-post facto design. This is because it is deemed suitable, as the research depends on pre-existing macroeconomic and financial data that researchers cannot alter. The data for this study was sourced from the World Bank's World Development Indicators (WDI), the United Nations Development Report, and the Central Bank of Nigeria Statistical Bulletin from 1990 to 2024

The modelling of this study was theoretically anchored in the human capital theory.

The study specifies the following models:

$$HDI = f(RCI, EDI, HTI, CCI, SCI)$$

$$HDI = \beta_0 + \beta_1 \ln RCI + \beta_2 \ln EDI + \beta_3 \ln HTI + \beta_4 \ln CCI + \beta_5 \ln SCI + \mu_t$$

Where:

HDI = Human development index (proxy for human development)

RCI = road & construction infrastructure expenditure

EDI = education infrastructure expenditure

HTI = health infrastructure expenditure

CCI = communication infrastructure expenditure

SCI = security infrastructure expenditure

$\beta_1 - \beta_5$ = Parameters

e_t = Time subscript

NOTE: The logarithmic transformation of explanatory variables was intended to normalize the data, reduce heteroskedasticity, and interpret coefficients in elasticity terms.

4. Data Analysis

Table 4.1: Summary of descriptive statistics for the variables

	HDI	RCI	EDI	HTI	CCI	SCI
Mean	0.509143	120.4677	371.8654	227.8120	37.11543	125.6174
Median	0.506000	89.16000	214.1500	127.9200	32.13000	67.25000
Maximum	0.565000	402.3100	1260.550	814.0200	140.6100	679.4300
Minimum	0.465000	0.640000	0.450000	0.230000	0.370000	0.000000
Std. Dev.	0.032032	128.4622	391.0710	251.5545	34.67118	154.1037
Skewness	0.159118	0.748988	0.879804	0.921679	0.976891	1.587352
Kurtosis	1.639469	2.214071	2.496260	2.550243	3.615135	5.820139
Jarque-Bera	2.847133	4.173187	4.885382	5.250369	6.118666	26.29656
Probability	0.240853	0.124109	0.086927	0.072426	0.046919	0.000002
Sum	17.82000	4216.370	13015.29	7973.420	1299.040	4396.610
Sum Sq. Dev.	0.034886	561086.6	5199842.	2151508.	40871.08	807430.6

Observations	35	35	35	35	35	35
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Source: Researcher's computations using Eviews 12, (2026)

The summary statistics in Table 4.1 indicate that the mean values for the human development index (HDI) and road and construction infrastructure (RCI) recorded an average value of 48.5 and 120.47 during the study period, with PVR ranging from a minimum value of 42.7 to a maximum value of 54.4, while RCI ranged from a minimum value of 0.640 to a maximum value of 402.31.

Furthermore, the education infrastructure (EDI) and health infrastructure (HDI) recorded mean values of 371.87 and 227.81, with EDI ranging from 0.45 to 1260.55, while HDI moved from 0.23 to 814.02.

Additionally, the analysis shows that the communication infrastructure (CCI) and security infrastructure (SCI) recorded mean values of 37.12 and 125.62, respectively. While the CCI moved from a minimum value of 0.37 to a maximum of 140.61, the SCI ranged from a minimum value of 0.00 to a maximum value of 679.43.

The standard deviations indicate that the data for all variables are concentrated around their respective means except for RCI, EDI, HTI, and SCI. The outcomes of the Jarque-Bera test demonstrate that all variables exhibit normal distribution at the 5% significance threshold, as shown by JB and p-values exceeding 0.05 except for CCI and SCI.

Unit Root Test

Table 4.2: Augmented Dickey-Fuller (ADF) Test Results

Augmented Dickey-Fuller (ADF)						
Variables	Level	Critical Value 5%	1 st Difference @	Critical Value 5%	I(d)	Stationary @
LOG(HDI)	0.406697	-2.951125	-6.437183	-2.954021	I(1)	1 st Difference
LOG(RCI)	-1.307660	-2.960411	-5.951357	-2.960411	I(1)	1 st Difference
LOG(EDI)	-6.247955	-2.957110	-	-	I(0)	Level
LOG(HTI)	-4.689011	-2.976263	-	-	I(0)	Level
LOG(CCI)	-2.079476	-2.954021	-7.870732	-2.954021	I(1)	1 st Difference
LOG(SCI)	-1.075432	-2.951125	-6.840760	-2.954021	I(1)	1 st Difference

Source: Researcher's computation using Eviews 12 (2026).

Note: *, **, and *** denote significance at 10%, 5% and 1%, respectively.

Table 4.2 presents the summary results of the ADF unit root tests carried out on all the variables in our model. The unit root test results showed that education infrastructure (EDI) and health infrastructure (HTI) attained stability at levels. This is because their test statistic values are greater than the Mackinnon critical value at 5% level of significance at levels. This further indicates that education infrastructure (EDI) and health infrastructure (HTI) were stationary at order zero [i.e., I(0)]. On the other hand, other variables attained stability after first differencing. This is because their test statistic values are greater than the Mackinnon critical value at 5% level of significance at first difference. This further indicates that the variables were integrated at order one [i.e., I(1)].

Table 4.3: Bounds cointegration test results for the models

Significant Level	Critical Value Bound		Hypothesis	F-Statistics
	I(0) Bound	I(1) Bound		
10%	2.08	3	H0: There is no cointegration/long run relationship	5.452168***
5%	2.39	3.38		
2.5%	2.7	3.73		
1%	3.06	4.15		
F _{PVR} (RCI, EDI, HTI, CCI, SCI)			K = 5	

Source: Researcher's computation using Eviews 12, (2026).

Note: Null hypothesis: No level relationship; K = number of regressors; *, ** and *** denote significance at 10%, 5% and 1% level, respectively.

The results presented in Table 4.3 demonstrate that the F-statistics for the model, 5.452168, exceed the critical values at both the lower and upper bounds at a 5% significance level. This indicates a strong relationship between the dependent and the independent variables.

Model Result and Discussion

Table 4.4: Estimated Long-Run and Short-Run Coefficients of ARDL HDI Model

Dependent Variable = HDI				
Long-Run Results				
Variable	Coefficient	Std. Error	t-Statistic	Prob.*
LOG(RCI)	0.598551	0.073553	8.137678	0.0039
LOG(EDI)	0.194800	0.037003	5.264412	0.0134
LOG(HTI)	0.231258	0.035234	6.563557	0.0012
LOG(CCI)	0.259294	0.030350	8.543355	0.0004
LOG(SCI)	0.035486	0.031512	1.126118	0.2704
C	-0.750194	0.092533	-8.107284	0.0000
EC = LOG(HDI) - (0.5986*LOG(RCI) + 0.1948*LOG(EDI) + 0.2313*LOG(HTI) + 0.2593*LOG(CCI) + 0.0355*LOG(SCI) - 0.7502)				
Short-Run Results				
Variable	Coefficient	Std. Error	t-Statistic	Prob.*
DLOG(RCI)	0.287176	0.041062	6.993734	0.0009
DLOG(EDI)	0.303677	0.036878	8.234718	0.0004
DLOG(HTI)	0.056817	0.017673	3.214920	0.0236
DLOG(CCI)	0.016169	0.004461	3.624051	0.0152
DLOG(SCI)	0.000949	0.002222	0.427256	0.6727
CointEq(-1)*	-0.085090	0.015603	-5.453600	0.0000
R ² 0.714780				
Adjusted R ² 0.687117				
Durbin-Watson stat 2.315440				

Source: Researcher's Computation (EViews 12), 2026.

Road & Construction Infrastructure expenditure (RCI) and Human Development Index (HDI)

The long-run and short-run estimates of the ARDL model are shown in Table 4.4. The long-run estimates of the ARDL model results revealed road & construction infrastructure has a positive and significant effect on human development index in Nigeria. This is evident by the positive coefficient value (0.598551) of road & construction infrastructure and its p-value (0.0039) which is less than 0.05. This implies that an increase in the road & construction infrastructure by one percent will lead to 59.9% significant increase in human development index in the long run. Also, the short-run estimates of the ARDL model results revealed that road & construction infrastructure has a positive and significant relationship with the human development index in Nigeria. This is evident by the positive coefficient value (0.287176) of road & construction infrastructure and its p-value (0.0009) which is less than 0.05. This implies that an increase in the road & construction infrastructure by one percent will lead to 28.7% significant increase in human development index in the short run.

Education Infrastructure expenditure (EDI) and Human Development Index (HDI)

Furthermore, the results of the long-run estimates of the ARDL model revealed that education infrastructure has a significant positive long-run effect on human development index in Nigeria. This is evident by the positive coefficient value (0.194800) of education infrastructure and its p-value (0.0134) which is less than 0.05. This implies that an increase in education infrastructure by one percent will lead to 19.5% significant increase in human development index in the long run. Also, the results of the short-run estimates of the ARDL model revealed that education infrastructure has a significant positive long-run effect on human development index in Nigeria. This is evident by the positive coefficient value (0.303677) of education infrastructure and its p-value (0.0004) which is less than 0.05. This implies that an increase in the education infrastructure by one percent will lead to 30.4% insignificant increase in human development index in the short run.

Health Infrastructure expenditure (HTI) and Human Development Index (HDI)

Moreover, the results of the long-run estimates of the ARDL model revealed that health infrastructure has positive and significant effect on human development index in Nigeria in the long-run. This is evident by the positive coefficient value (0.231258) of health infrastructure and its p-value (0.0012) which is less than 0.05. This implies that one percent increase in health infrastructure will lead to 23.1% increase in human development index in the long run. Also, the results of the short-run estimates of the ARDL model revealed that health infrastructure has a significant positive short-run relationship with the human development index in Nigeria. This is evident by the positive coefficient value (0.056817) of health infrastructure and its p-value (0.0236) which is less than 0.05. This implies that one percent increase in health infrastructure will lead to 5.7% increase in human development index in the short run.

Communication Infrastructure expenditure (CCI) and Human Development Index (HDI)

Moreover, the results of the long-run estimates of the ARDL model revealed that communication infrastructure has significant positive long-run effect on human development index in Nigeria. This is evident by the positive coefficient value (0.259294) of communication infrastructure and its p-value (0.0004) which is less than 0.05. This implies that one percent increase in communication infrastructure will lead to 25.9% increase in human development index in the long run. Also, the results of the short-run estimates of the ARDL model revealed that communication infrastructure has a significant positive short-run effect on the human development index in Nigeria. This is evident by the positive coefficient value (0.016169) of communication infrastructure and its p-value (0.0152) which is less than 0.05. This implies that

an increase in the communication infrastructure by a unit will lead to 1.6% increase in human development index in the short run.

Security Infrastructure expenditure (SCI) and Human Development Index (HDI)

Moreover, the results of the long-run estimates of the ARDL model revealed that security infrastructure has non-significant positive long-run relationship with the human development index in Nigeria. This is evident by the negative coefficient value (0.035486) of security infrastructure and its p-value (0.2704) which is greater than 0.05. This implies that an increase in the security infrastructure by one percent will lead to 3.5% significant increase in human development index in the long run. Also, the results of the short-run estimates of the ARDL model revealed that security infrastructure has a non-significant positive long-run relationship with the human development index in Nigeria. This is evident by the positive coefficient value (0.000949) of security infrastructure and its p-value (0.6727) which is greater than 0.05. This implies that an increase in the security infrastructure by one percent will lead to 0.09% non-significant increase in human development index in the short run.

Interpretation of CointEq(-1) Result

The results of the short-run dynamic coefficients associated with the long-run relationships obtained from the error correction model are given in Table 4.8. The signs of the short-run dynamic interactions are consistent with that of the long-run relationship. The estimated error correction coefficient of -0.085090 (with p-value of 0.0000) is highly significant, has the correct sign, and imply a low speed of adjustment to equilibrium after a shock. This implies that approximately 8.5% of disequilibria from the previous year's shock converge back to the long run equilibrium in the current year.

Interpretation of Adjusted R-Squared (Adj. R²) Value

The Adjusted R-squared value of 0.687117 from the results of the short-run estimates of the ARDL model in Table 4.4 indicated that the estimated model is well fitted as the systematic changes in explanatory variables (road & construction infrastructure, education infrastructure, health infrastructure, communication infrastructure and security infrastructure) explained approximately 69 percent (R-squared) variation in human development index while the remaining 31 percent is explained by other variables of factors outside the model.

Interpretation of Durbin-Watson Statistic Value

Lastly, Durbin-Watson stat of 2.315440 which is greater than 2 indicates the absence of serial autocorrelation.

4.6.3 Post-Estimation Tests of Human Development Index Model

The results of the post-estimation tests are presented and discussed below:

Table 4.5: Post-Estimation Test Results

Test	Null Hypothesis	X ² Value	X ² Prob	Remark
Jarque-Bera	Normal distribution exists	1.031809	0.5969	Normal Residuals
Breusch-Godfrey LM	Serial correlation does not exist	1.410408	0.2636	Serial Independence

Breusch-Pagan-Godfrey Ramsey RESET	Homoscedasticity exists Model is stable	0.491230 0.301444	0.8322 0.7656	Constant Variance Correctly Specified Model
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Source: Researcher's Computation (EViews 12), 2026.

The Jarque Bera (Normality) test result in Table 4.5 shows that the probability value (0.5969) is greater than 0.05 level of significance which imply that the null hypothesis of Normal distribution cannot be rejected. Thus, this necessitates the acceptance of null hypothesis and therefore concludes that the model is normally distributed.

The Breusch-Godfrey Serial Correlation LM test result in Table 4.9 shows that the probability values (0.2636) is greater than 0.05 level of significance which imply that the null hypothesis of no serial correlation cannot be rejected. Thus, this necessitates the acceptance of null hypothesis and therefore concludes that the model has no serial correlation problem.

Also, the Breusch-Pagan-Godfrey heteroskedasticity test result in Table 4.9 shows that the probability values (0.8322) is greater than 0.05 level of significance which imply that the null hypothesis of homoscedasticity cannot be rejected. Thus, this necessitates the acceptance of null hypothesis and therefore concludes that the model has homoscedasticity. This implies that relevant variables were not omitted.

Lastly, the Ramsey RESET test result in Table 4.9 shows that the probability values (0.7656) is greater than 0.05 level of significance which imply that the null hypothesis of correctly specified cannot be rejected. Thus, this necessitates the acceptance of null hypothesis and therefore concludes that the model is correctly specified. This implies that the functional form of the model is correct.

5. Conclusion and Recommendations

Conclusion

The study concludes that road and construction, education, health, and communication infrastructure expenditures significantly contribute to human development in Nigeria, with positive effects observed in both the short and long run. Among these, road and construction infrastructure exhibit the strongest estimated relationship with HDI. The findings therefore underscore the importance of sustained and coordinated investment in these infrastructure sectors as a strategy for improving human development outcomes. However, security infrastructure expenditure does not demonstrate a statistically significant effect on HDI within the study period. Overall, the study highlights the need for Nigeria to prioritize infrastructure investments that directly enhance access to education, healthcare, mobility, and communication services.

Recommendations

Based on the findings and conclusion drawn from this study, the following recommendations are made:

- i. The government should prioritize the construction, rehabilitation, and maintenance of roads to improve access to economic and social services.
- ii. Government should expand and upgrade educational facilities, particularly in underserved areas, to strengthen access to quality education and improve human development.
- iii. Greater investment in healthcare facilities, equipment, and service capacity should be pursued, especially in areas with inadequate health infrastructure, to improve health outcomes and HDI.
- iv. Government should accelerate investment in telecommunications and digital

connectivity, particularly in rural and underserved communities, to enhance access to information, education, and economic opportunities.

v. Policymakers should coordinate investments across these sectors to maximize their combined contribution to human development.

References

- Aninwagu, V. O., & Momodu, A. A. (2026). Effect of political instability on human development in Nigeria. *International Journal of Research Publication and Reviews*, 6(6), 11416-11424
- Aninwagu, V. O., Momodu, A. A., & Momodu, M. (2026). Determinants of economic growth in Nigeria. *Journal of Economics and Allied Research*, 11(1), 588–601. <https://doi.org/10.5281/zenodo.19520052>
- Aninwagu, V. O., Onyema, J. I., Momodu, A. A., Amadi, C. R. (2024). Investment in Infrastructural and Economic Growth in Nigeria from 1990 - 2022. *International Journal of Applied Economics, Agriculture and Management Sciences (IJAAMS)*, 2(2), 149-163. <https://dx.doi.org/10.2139/ssrn.5358951>
- Becker, G. S. (1964). *Human capital: A theoretical and empirical analysis, with special reference to education*. University of Chicago Press.
- Calderón, C., & Servén, L. (2004). *The effects of infrastructure development on growth and income distribution*. World Bank Policy Research Working Paper No. 3400.
- Calderón, C., & Servén, L. (2010). Infrastructure and economic development in Sub-Saharan Africa. *Journal of African Economies*, 19(Suppl. 1), 13–87.
- Iheanacho, E. (2017). The contribution of government expenditure to economic growth in Nigeria: Disaggregated approach. *International Journal of Economics and Management Sciences*, 5(1), 369–375
- Nchofong, T. N. (2022). Linear and non-linear effects of infrastructures on inclusive human development in Africa. *African Development Review*.
- Nussbaum, M. C. (2000). *Women and human development: The capabilities approach*. Cambridge University Press.
- Okoye, D., Pongou, R., & Yokossi, T. (2019). New technology, better economy? The heterogeneous impact of colonial railroads in Nigeria. *Journal of Development Economics*, 140, 320–354.
- Onwuemeka, I. O., Nwogwugwu, U. C., & Onwuka, E. (2023). Impact of infrastructure investment on economic growth in Nigeria: An autoregressive distributed lag approach. *International Journal of Research and Innovation in Social Science*, 6(1), 288–298
- Samuelson, P. A. (1954). The pure theory of public expenditure. *The Review of Economics and Statistics*, 36(4), 387–389.
- Schultz, T. W. (1961). Investment in human capital. *The American Economic Review*, 51(1), 1–17.
- Sen, A. (1985). *Commodities and capabilities*. North-Holland.
- Sen, A. (1999). *Development as freedom*. Oxford University Press.
- Siyan, P., & Adewale, E. A. (2017). An assessment of nexus between infrastructural development and Nigerian economic growth. *African Journal of Business Management*, 11(18), 470–477
- UNDP. (2024). *Human Development Report 2023/2024*. United Nations Development Programme.
- United Nations Development Programme. (1990). *Human development report 1990: Concept and measurement of human development*. Oxford University Press.
- World Bank. (2024). *World Development Indicators*. World Bank.