Public expenditure on infrastructural development and economic growth: Evidence from Nigeria

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Abstract
This research investigated the nexus between public spending on infrastructural development and economic growth: evidence from Nigeria. As a matter of urgency, there is a need for the Nigerian government to invest in infrastructure for sustainable economic growth since infrastructural development touches all human fields of endeavors in one way or another. Notably, despite the country’s pole position in the economic ranking in Africa, Nigeria’s infrastructural state still falls short, which has led to negative economic growth in recent years. Therefore, it is pertinent in this study to unravel the causes and the missing gaps between increasing fiscal spending on infrastructure and slow economic growth in Nigeria. Interestingly, Autoregressive Distributed Lags and cointegration techniques were adopted to investigate whether there are long interactions between economic advancement and public funding of social amenities in the case of Nigeria. Furthermore, post-estimation tests were carried out to ascertain the validity of the models adopted in the study. The investigations from the study showed that short and long-run nexus subsists between government investment in infrastructure and economic growth in Nigeria. Hence, to address the problems underpinning this research, the study recommended that a proactive policy framework be used to promote economic growth via a redesigned fiscal framework in Nigeria. Also, protective laws and acts to safeguard the existing infrastructures should be well-pronounced and adopted by policymakers to expand the productive life span of social goods.

Keywords: Economic growth, Infrastructure development, Public expenditure

JEL Classification: H41, H54, O47

INTRODUCTION
The need for infrastructural advancement cannot be over-emphasized in any small open economy, particularly when it comes to improving the living conditions of the populace through basic social needs such as education, transportation, and food security, among other important needs for livelihood. Infrastructural progress expands economic growth over time (Babatunde, 2018). Consequently, as a matter of urgency, the Nigerian government should invest in infrastructure for sustainable economic growth since infrastructural development touches all human endeavors in one way or another. However, with the current state of Nigerian infrastructural set-up, there is much to be worried about, as the state of public utilities remains a mirage. The dilapidated
state of infrastructural networks greatly threatened a smooth production flow across all economic sectors. Nworji (2012) argued that infrastructure facilities sustain business demands, household needs, industrial productivity, etc. This affirms one of the main conditions for economic growth in a developing country like Nigeria. In recent years, the Nigerian population has continued to rise with huge receipt from the cost of household consumption, as individual households pay for all the basic services rendered by social amenities firms as well as the business units that pay huge receipt for infrastructural services in the cause of production, which had brought about increasing social pressure on social amenities due to high demand by the populace.

Infrastructural development has remained the government's major role in emerging economies like Nigeria (Orji et al. 2017). However, the terrible state of the general infrastructural networks in Nigeria, characterized by poor maintenance culture, further deteriorates the values and the state of infrastructure in Nigeria. Orji et al. (2017) further argued that poor fiscal framework in public spending on the infrastructural network as the source of economic growth is a major cause for concern. It is worth noting that poor infrastructural funding in Nigeria has brought about slow productivity growth because business units are faced with challenges, including the higher cost of production such as the high cost of diesel, fuel plants, the rising cost of raw materials, kidnapping of the expatriates due to poor security link at the business zones and poor transportation networks that disrupt market flows with the inability to get goods to the end users.

Interestingly, infrastructure advancement has a double-edged sword; thus, it is the source of government revenue on the one hand and the source of government expenditure on the other. Also, social infrastructural development has multiplier effects on the prices of goods and services because the lower cost of productivity leads to lower market prices of the goods and services, thereby increasing aggregate output, which eventually enhances economic growth in the long run (Edun et al., 2013; Du et al., 2022). Nevertheless, poor delivery of infrastructure services in addressing the demands of the populace and other users remains one of the major obstacles hindering economic growth, particularly in Nigeria. This can be traced to the antecedent from the production costs and huge cost of refining crude oil outside the shore of Nigeria (Oyediran et al., 2016). In recent times, the Nigerian government's expenditure on productivity has continued to rise due to poor infrastructural set-up, evidently, with the huge receipts from production costs across the critical sectors of the economy, as well as the pressure to meet the increasing demand for public (utilities) goods like roads, communication, power, education, and health (Fedderke, 2006). The huge costs of these nature have different daunting effects in an attempt to drive economic growth in Nigeria. Also, Nigeria's historical socioeconomic network configuration had not allowed sustainable economic growth. Hence, this study intends to examine the inherent nature and the vital roles infrastructural development plays on economic growth, along with the systemic approach that the government must adopt to actualize a reliable flow of social services through coordinating and holistic fiscal planning.

Given the precarious state of infrastructure gaps in Nigeria, Afonso (2014) concluded that government spending on infrastructure in Nigeria has an insignificant effect on economic growth. Abu & Abdullahi (2010) argued from other fiscal perspectives and submitted that any increase in inflation and general spending results in slow economic growth. Conversely, Keji & Efuntade (2020) argued that a general increase in output level, specifically in a steady form over a specific period, brings about the desired economic growth in Nigeria. Since economic growth is classified as the level of increase in the nation’s per capita output, aided by a continuous rise in an
infrastructural set-up that predates the overall consumption, trade volume, labor force, and capital (Jhingan, 2003), it is surprising that, despite the yearly budgetary provision for government spending on infrastructural development in Nigeria, the infrastructure remains a deficit, making it difficult to achieve the required economic growth in Nigeria. Regarding infrastructural gaps, Nigeria is ranked among the world's poorest nations (World Bank Indicator, 2020).

Consequently, it is quite noticeable that the extent of government spending seems not to have been replicated with the expected level of economic growth in Nigeria, especially in terms of infrastructural developments (Chinedu, 2018; Chude & Chude, 2013). Given the narratives above, this study intends to investigate the disconnection between government spending on infrastructure and economic growth in Nigeria. Also, the researcher would seek to unravel the link between government expenditure on infrastructure and economic growth in Nigeria.

This is predicated on the current clamor for the stakeholders' expansion of infrastructural needs for economic growth stability after the 2016 economic recession in Nigeria. Hence, the relevance of this study at this crucial period cannot be overemphasized. In addition, the revelations from this study would greatly help the government, the policymakers, and the key players in the hems of affairs. Similarly, the study shall focus on government spending on infrastructure and its link with economic growth in Nigeria between 1985 and 2020.

Oshikoya et al. (1999) posited that social amenities were in two forms. The social amenities and physical infrastructure are termed soft-core and hard-core infrastructures. The authors posited that social structure comprises administration, healthcare, education, and property rights, enhancing economic transactions. At the same time, physical infrastructure covers transportation facilities, telecommunication devices, pipe-borne water, and energy supply, which are the pillars of economic transactions. Consequently, this study is motivated by the government expenditure towards improving infrastructural development for economic growth in Nigeria. Infrastructural development is a major priority in any small open economy, especially emerging economies like Nigeria, since this would pave the way for sustainable economic growth. Economic growth is a proxy of Gross Domestic Product, the total productivity level carried out within an economic unit, especially for a calendar year. Improvement in the general output level is a vital goal of every government because it is an important component of the macroeconomic objective, which precedes the living standard of the populace (Ogbaro & Omotosho, 2017; Babatunde & Shuaibu, 2011). In contrast, government expenditure is the sum of money the government expends in a fiscal year. In some cases, public spending tends to rise over time as the need for social infrastructure development comes up, which requires expanding and improving living conditions for economic growth to be achieved (Gukat & Ogboru, 2017).

In the works of Magazzino et al. (2015), Wagner’s law posited that in economic development, the share of the public sector in GDP has been on an increasing trend over time. Wagner articulated two purposes for the explanation of public spending on social infrastructure. The first of Wagner’s explanations identified the social transformation between a society-based primary activities (in agriculture and fisheries) and a society with the rising industrial sector. The second “law” of Wagner suggested that public goods were characterized by higher income elasticity (in the microeconomics context, luxury goods). Hence, findings on the related theory of fiscal illusion are an avenue to disclose the direction of cost and benefits analysis concerning government spending on infrastructure towards achieving the needed economic growth, as invented from the work of Puviani (1903) (cited in Mourao 2008). Keynesian Theory was a contrasting
viewpoint on this relation among the noted theories. The theory; argues that many economists link public expenditures with economic growth.

Keynes opines public expenditures are an exogenous factor and could be used as an instrument to spur growth (Keji & Efuntade, 2020). From the Keynesian point of view, public expenditure has a positive link with economic growth through the advancement of technology. Therefore, public spending enhances the aggregate demand and spurs a rise in output level subject to public expenditure multipliers.

The notable growth theories, such as classical and neo-classical, from the version Solow-Swan (1956) indicated the modern-day growth theory would be used as the bedrock in this study to achieve the set objective. The study agrees with the arguments of the Solow-Swan model, which focuses on exogenous factors as the major causes of economic growth, i.e., factor like technology is germane concerning infrastructure advancement as the cause of economic growth. The Solow & Swan (1956) theory states that long-term aggregate output can be achieved via technological improvement around social infrastructural development. Wells (2015) further argues that technological progression improves general economic growth because other factors (such as labor & capital) adjust according to technological advancement. Hence, government spending is necessary for economic growth in Nigeria (Keji & Efuntade, 2020).

Babatunde (2018) argues that government expenditure has diverse effects on the economic growth in Nigeria. The study investigated the impact of government spending on infrastructure and economic growth in Nigeria through statistical random sampling with descriptive statistics. The outcomes showed that government expenditure on education, health, transport, and communication networks significantly affects economic growth. Oyediran et al. (2016) studied the connection between government expenditure and economic growth, with evidence from Nigeria, between 1980 and 2013, through Ordinary Least Square (OLS). The findings show a significant relationship between government spending and economic growth in Nigeria. The study further suggests the need for fiscal discipline in governance through the necessary structural tools to check public outlays toward improved economic growth.

Meanwhile, Gukat & Ogboru (2017) posited that government expenditure has a negative and insignificant influence on economic growth in Nigeria. The authors adopted Ordinary Least Square (OLS) and Error Correction Mechanism (ECM) to deduce that administrative and social services show insignificant effects on growth. In contrast, economic services were positive but insignificant in growth. The study also concluded that government expenditure has not translated to the desired growth in Nigeria. As a result, the scholars suggested that the government needs to increase budgetary allocation to infrastructural projects with proper financial auditing. However, in a related study, Chude & Chude (2013) used education as the major source of social amenities to investigate the impact of public expenditure on economic growth in Nigeria between 1977 and 2012. The scholars used disaggregated and sectorial expenditures analysis. The results showed that total government expenditure on education has statistically significant and positive long-run effects on economic growth in Nigeria. This might be connected to prompt policy and budgetary operations in Nigeria for the period under review.

Using simultaneous analysis, Nedozi et al. (2014) evaluate the impact of infrastructural development on economic growth in Nigeria. The study adopts a reduced form of the equation to reveal that infrastructural development significantly impacts economic growth in Nigeria. Based on the previous, the study concludes that infrastructure is an intermediate good and service for the productive sector and a finished good and service for the aggregate demand. Meanwhile, Ogbaro & Omotosho
(2017) examine infrastructure development's function in attaining economic growth in Nigeria between 1980 and 2015. A Cobb-Douglas production function was embraced because infrastructure is a proxy as a stock value, and the model was logged for empirical analysis through the Ordinary Least Squares method. The study disclosed a positive and significant impact of infrastructure variables such as power (electricity), total air transport, communication amenities, and total rail line amenities on economic growth. Moreover, the author proposes the need for Nigerian politicians to implement policies geared toward infrastructural growth.

Chinedu et al. (2018) investigated the impact of sectorial spreads of government spending on Nigerian economic growth. The ex-post-facto research design was employed to estimate the link among the estimated variables through time-series secondary data between 1980 and 2017. Also, the Unit Root, Johansen Cointegration, and Error Correction tests were carried out. It was discovered that there was a positive impact of sectorial spreads of government outlay on economic growth in Nigeria. Hence, these conclusions established Wagner’s law, which states that increased economic growth can be achieved due to improvement in Government spending. At the same time, Onifade et al. (2020) examine the impacts of public expenditures on economic growth in the case of Nigeria. The researchers used Pesaran’s Auto Regressive Distributed Lag (ARDL) method to evaluate the impact of public spending on economic progress in Nigeria between 1981 and 2017. The authors submitted that government recurrent expenditures have a negative and significant impact on economic growth in Nigeria. In contrast, government spending on capital projects revealed a positive and insignificant impact on economic growth in Nigeria. Interestingly, the study recommends that the government should block loopholes in the share of recurrent expenditure as part of total expenditures and must be utilized to avoid leakages and wastages in the public financing of the country’s economy.

Nworji et al. (2012) investigated the impact of public spending on the economy in Nigeria between 1970 and 2009 through the OLS multiple regression model. The results showed that current and capital spending on economic performances has negative and insignificant effects for the period under review. Also, government spending on allocation has a positive and insignificant impact on economic growth. At the same time, recurrent spending on transfers and capital expenditure on social services significantly and positively affect economic growth. Given this, the authors advised that the government should channel its expenditure more to productive services to encourage a smooth flow of productivity across all the sectors of the economy.

Conclusively, previous researchers could not establish a consensus on the relationship between government spending on infrastructure and economic growth in Nigeria. Notably, most of these works directly focus on the link between aggregate government spending and economics without looking inwardly to assess the connection between infrastructural spending and economic growth in Nigeria between 1985 and 2020. Many of the available related studies in the case of Nigeria were carried out in the distance years back. Still, findings from this research would be of good help in updating the body of literature. Also, this study intends to carry out further post-estimation tests to check the empirical validity of the models employed in the study. On this note, this approach appears to form parts of the novelty of this research work.

METHODS

This section forms the third segment of the research, where the empirical methods will be explicitly explained. The necessary method adopted was a unit root test, where each of the variables was subjected to an Augmented Dickey-Fuller (ADF) unit root test.
to determine the level of its stationarity. The unit root analysis led us to the Auto-Regressive Distribution Lag model Cointegration and Error Correction Mechanism methods. Also, the study went further to check whether parameter estimation has theoretical meaning and statistical validity.

According to Solow & Swan (1956), as cited in the works of Wells (2015) and Keji & Efuntade (2020), long-run aggregate economic growth can be achieved through technological progress, which revolves around social infrastructural growth. The neo-classical posited that improvement in technology is capable of prompting productivity function upward, which brings about overall growth in an economy. The neo-classical growth model enumerated output as a linear function of labor (L), capital (K), and index of technology (T), and these factors are determinants of economic growth. The neoclassical model is expressed as follows:

\[ Y = F (K, L, T) \] ................................. (1)

Where Y is output, K is physical capital, L is labor force, and T is a technology or efficiency parameter index. The model was developed independently by Robert Solow and Trevor Swan in 1956 and superseded the study’s Keynesian, Harrod–Domar model.

The model in equation (i) above is therefore specified by introducing the explanatory variable of government expenditure on infrastructure and economic growth in Nigeria. Hence, the model in equation (i) above is hereby re-specified as;

\[ Y = f (GXT, ATE, GXE, GXM) \] ................................. (2)

Where GXT implies government spending on transportation, ATE identifies as access to electricity, GXE explains government expenditure on education, and GXM means government expenditure on military. The other determining estimate to be included in the model is Gross Capital Formation to account for the effects of technical progress due to government investment in infrastructure development in Nigeria. Hence the model (ii) becomes;

\[ Y = f (GXT, ATE, GXE, GXM, GCF) \] ................................................ (3)

The model (iii) is transformed into the model below for empirical analysis;

\[ RGDP = \beta_0 + \beta_1 GXT + \beta_2 ATE + \beta_3 GXE + \beta_4 GXE + \beta_5 GCF + U_t \] ...... (4)

Where RGDP = Real Gross Domestic Product
GXT = Government Expenditure on Transport/Communication
ATE= Access to Electricity
GXE= Government Expenditure on Education
GXM= Government Expenditure on Military
GCF= Gross Capital Formation
Where \( U_t \) is the stochastic error term.

After the test for the order of integration, the order of integration was a mixture of I(0) and I(1); the next step is to carry out the bounds cointegration test. This test checks whether there is a long-run relationship among the variables specified in the model. The generalized dynamic ARDL model is specified thus:

\[ Y_t = \gamma_0 + \sum_{i=1}^{n} \gamma_j Y_{t-i} + \sum_{i=0}^{R} \delta_j X_{t-i} + \mu_j t \] ........................................... (5)

Where \( Y_t \) is a vector and variables in \( (X_t) \) are allowed to be purely I(0) or I(1) or integrated; \( \alpha \) and \( \delta \) are coefficients; \( \gamma \) is the constant; \( j=1, 2, \ldots k; P, R \) are optimal lag
orders; \( \mu_t \) is a vector of error terms, i.e., unobserved zero mean white vector process (serially uncorrelated or independent).

Note: the lag length \( P, R \) may not be necessary the same: \( P \) Lag is used for the dependent variable, while \( R \) is used for exogenous variables.

Hypothesis:

\[
\begin{align*}
H_0 &= \beta_{1j} = \beta_{2j} = \beta_{3j} = \beta_{4j} = 0 \\
H_1 &= \beta_{1j} \neq \beta_{2j} \neq \beta_{3j} \neq \beta_{4j} \neq 0 \\
\end{align*}
\]

Where \( j = (1, 2, 3, 4) \)

\[
\Delta \text{Log GDP}_t = \beta_{01} + \beta_{11} \text{Log GDP}_i, i + \beta_{21} \text{LogGXT}_i, i + \beta_{31} \text{LogATE}_i, i \\
+ \beta_{41} \text{LogGXE}_i, i + \beta_{51} \text{LogGXM}_i, i + \beta_{61} \text{LogGCF}_i, i \\
+ \sum_{i=1}^{P} \beta_{1j} \Delta \text{Log GDP}_{t-i} + \sum_{i=1}^{R} \beta_{2j} \Delta \text{LogGXT}_{t-i} \\
+ \sum_{i=1}^{R^2} \beta_{3j} \Delta \text{ATE}_{t-i} + \sum_{i=1}^{R^3} \beta_{4j} \Delta \text{LogGXE}_{t-i} + \sum_{i=1}^{R^3} \beta_{5j} \Delta \text{GXM}_{t-i} \\
+ \sum_{i=1}^{R^5} \beta_{6j} \Delta \text{LogGCF}_{t-i} + \mu_t
\]

The Error Correction Model (ECM) shows the speed of adjustment from short-run to long-run equilibrium. The a priori expectation is that the ECM coefficient must be negative and significant for errors to be corrected in the long run. It indicates that the higher the ECM, the more the speed of adjustment. Secondary data are collected for this study; the data source includes annual time series data on the variables under study from 1985-2020. The data collected are mostly from the CBN statistical bulletin, World Bank Dataset, and National Bureau of Statistics NBS.

**Table 1.** A priori expectations

<table>
<thead>
<tr>
<th>Variables</th>
<th>A priori expectations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Real Gross Domestic Product (RGDP)</td>
<td>( \beta_1 &gt; 0 )</td>
</tr>
<tr>
<td>Government Expenditure on Transport (GXT)</td>
<td>( \beta_2 &gt; 0 )</td>
</tr>
<tr>
<td>Access to Electricity (ATE)</td>
<td>( \beta_3 &gt; 0 )</td>
</tr>
<tr>
<td>Government Expenditure on Education (GXE)</td>
<td>( \beta_4 &gt; 0 )</td>
</tr>
<tr>
<td>Government Expenditure on Military (GXM)</td>
<td>( \beta_5 &gt; 0 )</td>
</tr>
<tr>
<td>Gross Capital Formation (GCF)</td>
<td>( \beta_6 &gt; 0 )</td>
</tr>
</tbody>
</table>

The theoretical assumptions in Table 1 explain a priori expectation between dependent and independent variables. That is, Real Gross Domestic Product (RGDP) and all the independent variables such as Government Expenditure on Transport (GXT), Access to Electricity (ATE), Government Expenditure on Education (GXE), Government Expenditure on Military (GXM) and Gross Capital Formation (GCF), which are expected to be a positive relationship. All determinant estimates are expected to enhance economic growth in the long run.

**RESULTS AND DISCUSSION**

**Empirical data analysis**

This study adopted time series data to empirically assess the link between RGDP and infrastructural estimates for thirty-five years. Unit root and statistical attributes in Table 2 represent all the estimates in the model. It shows the mixture of variables at level and first difference for each unit-root test carried out in the model.
Table 2. Unit root tests results

<table>
<thead>
<tr>
<th>Unit Root Test</th>
<th>ADF t-statistics</th>
<th>Order of Integration</th>
<th>Prob. Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>RGDP</td>
<td>-10.4915</td>
<td>I(0)</td>
<td>0.0000</td>
</tr>
<tr>
<td>GXT</td>
<td>-8.3360</td>
<td>I(1)</td>
<td>0.0000</td>
</tr>
<tr>
<td>ATE</td>
<td>-4.0918</td>
<td>I(0)</td>
<td>0.0142</td>
</tr>
<tr>
<td>GXE</td>
<td>-6.7416</td>
<td>I(0)</td>
<td>0.0000</td>
</tr>
<tr>
<td>GXM</td>
<td>-7.8736</td>
<td>I(1)</td>
<td>0.0000</td>
</tr>
<tr>
<td>GCF</td>
<td>-6.2307</td>
<td>I(0)</td>
<td>0.0000</td>
</tr>
</tbody>
</table>

The null hypothesis states that each series has a unit root; some variables are stationary at level, while some are not. Therefore, the null hypothesis cannot be rejected because the ADF statistic is greater than the critical value at various significance levels. Augmented Dickey-Fuller reveals that RGDP, GXT, ATE, GXE GXM, and GCF are integrated into order one, i.e., I (1) and zero. Following the diverse outcomes in order of integration, the condition for Autoregressive Distributed Lags and Error Correction Mechanism techniques are met.

Bound test

The bound test is a cointegration test that checks for long-run equilibrium relationships among the series. Thus, given the unit root test result above, the most suitable cointegration test, like that of the Pesaran Bounds test, is pertinent to be conducted because it allows a combination of fractionally integrated variables, i.e., pool variables of diverse unit-root integration. The Bounds Cointegration test is presented thus:

Table 3. ARDL bounds test

<table>
<thead>
<tr>
<th>Test Statistic</th>
<th>Value</th>
<th>k</th>
</tr>
</thead>
<tbody>
<tr>
<td>F-statistic</td>
<td>4.430798</td>
<td>5</td>
</tr>
<tr>
<td>Critical Value Bounds</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Significance</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10%</td>
<td>I(0)Bound</td>
<td>I(1)Bound</td>
</tr>
<tr>
<td>5%</td>
<td>2.26</td>
<td>3.35</td>
</tr>
<tr>
<td>2.50%</td>
<td>2.96</td>
<td>4.18</td>
</tr>
<tr>
<td>1%</td>
<td>3.41</td>
<td>4.68</td>
</tr>
</tbody>
</table>

The ARDL Bounds test outcomes in Table 3 show the assumption of weak exogeneity on the real gross domestic product, government expenditure on transport, government expenditure on health, government expenditure on education, government expenditure on and gross capital formation. The null hypothesis of no long-run link among the variables can be rejected at 5% significant levels because the F-statistic in Table 3 is greater than 5% of both I (0) and I (1) bounds of 2.39 and 3.38, respectively. Consequently, the long-run relationship between real gross domestic product, government expenditure on transport, government expenditure on health, government expenditure on education, government expenditure on military, and gross capital formation.

Auto-regressive Distributed Lags (ARDL) analysis

This subsection presents the result obtained from the estimated Auto-regressive Distributed Lags (ARDL), unrestricted error correction model, and the ARDL long-run (static) model in equation form. With this outcome, the researcher tried to examine both the short-run and long-run relationships between real gross domestic product,
government expenditure on transport, government expenditure on health, education expenditure, military expenditure on the military, and gross capital formation.

**Table 4. ARDL results**

<table>
<thead>
<tr>
<th>Variables</th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>t-Statistic</th>
<th>Prob.*</th>
</tr>
</thead>
<tbody>
<tr>
<td>GDP(-1)</td>
<td>0.079976</td>
<td>0.225174</td>
<td>0.355173</td>
<td>0.7298</td>
</tr>
<tr>
<td>LOGGXE</td>
<td>9.440686</td>
<td>3.937731</td>
<td>2.397494</td>
<td>0.0375**</td>
</tr>
<tr>
<td>ATE</td>
<td>0.225256</td>
<td>0.182627</td>
<td>1.233425</td>
<td>0.2456</td>
</tr>
<tr>
<td>GXT</td>
<td>-0.120472</td>
<td>0.065290</td>
<td>-1.845190</td>
<td>0.0948*</td>
</tr>
<tr>
<td>GXM</td>
<td>-3.946361</td>
<td>3.966236</td>
<td>-0.994989</td>
<td>0.3432</td>
</tr>
<tr>
<td>GCF</td>
<td>0.116879</td>
<td>0.046230</td>
<td>2.528211</td>
<td>0.0300**</td>
</tr>
<tr>
<td>C</td>
<td>-78.81832</td>
<td>25.72571</td>
<td>-3.063795</td>
<td>0.0120</td>
</tr>
</tbody>
</table>

R-squared | 0.899586 | Mean dependent variance | 4.488235 |
Adjusted R-squared | 0.668635 | S.D. dependent variance | 3.861603 |
S.E. of regression | 2.222906 | Akaike info criterion | 4.623497 |
Sum squared residual | 49.41312 | Schwarz criterion | 5.700928 |
F-statistic | 3.895130 | Hannan-Quinn criter. | 4.990932 |
Durbin-Watson stat | 1.949203 |

The results obtained from Table 4 revealed a positive relationship between RGDP and GXE, GCF RGDP of the previous year. While GXT, GXM disclosed a negative relationship with RGDP. Also, only two variables, i.e., GCF and GXE, were significant at five levels within the model's short run. Hence, figures with (**) in parenthesis indicate a five percent significance level, while (***) explains a ten percent significance.

**Table 5. Long-run cointegrating coefficients**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>t-Statistic</th>
<th>Probability</th>
</tr>
</thead>
<tbody>
<tr>
<td>LOGGXE</td>
<td>3.900279</td>
<td>0.657915</td>
<td>5.928239</td>
<td>0.0001</td>
</tr>
<tr>
<td>ATE</td>
<td>-0.013239</td>
<td>0.118801</td>
<td>-0.111434</td>
<td>0.9135</td>
</tr>
<tr>
<td>GXT</td>
<td>-0.188558</td>
<td>0.037675</td>
<td>-5.004920</td>
<td>0.0005</td>
</tr>
<tr>
<td>GXM</td>
<td>-13.425242</td>
<td>4.051366</td>
<td>-3.313757</td>
<td>0.0078</td>
</tr>
<tr>
<td>GCF</td>
<td>0.035694</td>
<td>0.047805</td>
<td>0.746658</td>
<td>0.4725</td>
</tr>
<tr>
<td>C</td>
<td>-48.962977</td>
<td>9.249311</td>
<td>-5.293689</td>
<td>0.0004</td>
</tr>
</tbody>
</table>

Therefore, the cointegration equation is specified as:

\[
\text{LOG}\ (RGDP) = 48.9630 + 0.1886\ (TGXT) + 13.4252\ (GXM) \\
+ \text{LOG}\ 3.9003\ (TGXE) - 0.0357\ (GCF)
\]

The results show a long-run nexus between economic growth and spending on infrastructure. Government spending on education, military, transportation, and gross capital formation on infrastructure have a long-run significant effect on Nigerian economic growth. Student education development, easy mobility, improved security architecture, and investment in critical social amenities yield long-term benefits to Nigerian economic progress. However, the long-run effects of government spending on military and transportation are negative, and this is connected with poor policy implementation in those sectors of the Nigerian economy that this research intends to address. At the same time, data from access to electricity showed insignificant long-run effects on Nigeria’s growth paths. Notably, when long-run nexus, the Engle-Granger Theorem states the need for the encompassing power of the error correction mechanism over other forms of dynamic specifications. Hence, estimating the Error Correction Mechanism results in the next report is pertinent.
Table 6. Error Correction Model

<table>
<thead>
<tr>
<th>Variables</th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>t-Statistic</th>
<th>Prob.*</th>
</tr>
</thead>
<tbody>
<tr>
<td>D(RGDP(-2))</td>
<td>0.8899</td>
<td>0.2647</td>
<td>3.3619</td>
<td>0.0072</td>
</tr>
<tr>
<td>D(TGXE)</td>
<td>9.4407</td>
<td>3.9378</td>
<td>2.3975</td>
<td>0.0375</td>
</tr>
<tr>
<td>D(ATE)</td>
<td>0.2225</td>
<td>0.1826</td>
<td>1.2334</td>
<td>0.2456</td>
</tr>
<tr>
<td>D(TGXE (-1))</td>
<td>0.2005</td>
<td>0.0693</td>
<td>2.8941</td>
<td>0.0160</td>
</tr>
<tr>
<td>D(GXM)</td>
<td>-3.9463</td>
<td>3.9662</td>
<td>-0.9949</td>
<td>0.3432</td>
</tr>
<tr>
<td>D(GCF)</td>
<td>0.1169</td>
<td>0.0462</td>
<td>2.5282</td>
<td>0.0300</td>
</tr>
<tr>
<td>CointEq(-1)*</td>
<td>-1.6098</td>
<td>0.4253</td>
<td>-3.7854</td>
<td>0.0036</td>
</tr>
</tbody>
</table>

Data from the estimated series in Table 6 explained the rate of the speed of adjustment. The estimated models in the study can adjust from short to long run at a top speed of 160.098 high. This figure implies that the models can quickly re-adjust from an unexpected disequilibrium point at some point to an equilibrium point within the shortest possible time. Hence, with these results, it is worth noting that the estimated models in the study are valid and consistent economic intuitions.

![Figure 1. Residual test](image1)

![Figure 2. Normality test](image2)
The distribution figures in Table 7 state that the empirical models adopted in the study explain the impact of government spending on economic growth through public infrastructural development without any form of statistical bias or omission.

**Table 7. Empirical distribution test**

<table>
<thead>
<tr>
<th>Distribution Test</th>
<th>Sigma Value</th>
<th>Sigma Z-Statistics</th>
<th>Prob. Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>RGDGP</td>
<td>5.3964</td>
<td>8.8318</td>
<td>0.0000</td>
</tr>
<tr>
<td>GXT</td>
<td>29.2634</td>
<td>8.8318</td>
<td>0.0000</td>
</tr>
<tr>
<td>ATE</td>
<td>0.5627</td>
<td>8.8318</td>
<td>0.0000</td>
</tr>
<tr>
<td>GXE</td>
<td>1.8800</td>
<td>8.8318</td>
<td>0.0000</td>
</tr>
<tr>
<td>GXM</td>
<td>0.5612</td>
<td>8.8318</td>
<td>0.0000</td>
</tr>
<tr>
<td>GCF</td>
<td>1076.474</td>
<td>8.8318</td>
<td>0.0000</td>
</tr>
</tbody>
</table>

The Breusch-Godfrey Serial Correlation (LM) test suggests that the null hypothesis of autocorrelation can be rejected since the probability value is greater than the 5% critical value. Meaning that the research models are free from any form of autocorrelation.

**Table 8. Serial correlation test: Breusch-Godfrey test**

<table>
<thead>
<tr>
<th>F-statistic</th>
<th>Obs*R-squared</th>
<th>Prob. F(2,8)</th>
<th>Prob. Chi-Square(2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.3085</td>
<td>8.3807</td>
<td>0.3224</td>
<td>0.0151</td>
</tr>
</tbody>
</table>

**Discussion**

The results show that GXT and GXM have a negative significant relationship with RGDGP. This implies that as GXT and GXM reduce, the RGDGP increases. The result further shows that an average 1% increase in GXT and GXM leads to about 18.85% and -1342.52% increase in RGDGP, respectively. This might be caused by poor fiscal framework from those in charge of fiscal allocation for infrastructural development in Nigeria. Meanwhile, government spending on education and general gross investment in infrastructural sets positively and significantly impacts the economy in the long run. This implies that educational development and gross investments in infrastructural development can catalyst growth in Nigeria. In contrast, access to electricity has an insignificant link with economic growth variables. The emerging results are consistent with the conclusions of Bokana and Akinola (2017) and Du et al. (2022) posited that investment in infrastructure such as education, road networks, and sustainable projects catalyze economic growth.

Also, the coefficient of significance is the ECM coefficient. Table 6 defines the Error Correction Mechanism (ECM) term well. It is negative and statistically significant at a 5% level. The coefficient is -1.6098, which indicates approximately 160.98 percent quick adjustments from the previous year’s real gross domestic product disequilibrium are corrected by GXT, GXE, GXM, and GCF. This implies the speed at which the specified model touches equilibrium. The coefficient magnitude is quite high, implying that nearly 160.98 percent of any disruption in government spending on education, military, transportation, and other infrastructural investment is corrected quickly within one period at the shortest time. The implication is that the present value of real RGDGP will quickly adjust to GXT, GXM, GXE, and GCF changes. Consequently, the revelations from the study established that investment in public goods such as infrastructure improves the general well-being of the citizenry, which in turn improves economic growth. The findings of this nature are consistent with existing theoretical intuition, such as neoclassical and Keynesian theories.
Estimating the short and long-run analysis requires verifying whether the estimated model is efficient, valid, and consistent with the statistical rules. From Figures 1 and 2, the Jarque-Beta test suggests that the residuals for both models are normally distributed since the probability value is greater than a 5% significant level. Hence, the hypothesis of normal distribution for residuals cannot be rejected. The Breusch-Godfrey Serial Correlation (LM) test suggests that the null hypothesis of autocorrelation can be rejected since the probability value is greater than the 5% critical value. Findings from the study support the conclusions from Fedderke and Luiz (2005), Edun, Akinde, Jolaleye, and Idowu (2013), and Abdurraheem and Naim (2018) that stated that infrastructure investment influences economic growth across different small open economies.

CONCLUSIONS AND RECOMMENDATIONS

Conclusions
The study examined the nexus between government expenditure on infrastructure and economic growth in Nigeria, using annual time series data ranging from 1980 to 2020. To analyze the government expenditure patterns on education, military, transport, access to electricity, gross capital formation, and Nigerian economic growth.

Findings from the research broadly concluded that there are both short-run and long-run relationships between government spending on transport, military, education, and Nigerian economic growth.

It is also deduced from the results that government spending on transport and military has negative effects on Nigerian economic growth, though significant. In contrast, gross capital formation and educational development through government spending positively correlate with the Nigerian real gross domestic product. Moreover, it was concluded that the Bound test confirmed that the variables estimated were cointegrated.

Recommendations
Consequently, the study seeks the following recommendations: The focus is to assess the link between total government spending on transport, education, military, and Nigerian economic growth. Based on the results obtained from the previous sections, we recommend the appropriate policies necessary for the way forward out of those challenges revealed in this study. Hence, the findings recommend implementing the following policies for infrastructural development via government spending in Nigeria. Firstly, the government should redesign the fiscal framework to address leakages and budget padding. By so doing, the revenue base of the Nigerian government would rise to match up with budgeted items such as educational expenditure, spending on transportation, and expenditure on military wares.

Secondly, education is pertinent to any emerging economy like Nigeria (Bokana and Akinola, 2019); therefore, the government should improve educational spending for sustainable economic advancement over time. Intellectuals, especially professional intellectuals, are assets to the nation. They may be found in public service or private set-ups where they support economic productivity. Also, the government should ensure education is accessible and affordable across all levels. Education attainment conveys some skills and potential power that can spur economic growth. Finally, there is a need for improved and remodeled military spending. The government should strive to curb corruption in the military hierarchy by reducing out-of-pocket spending on household consumption by the officer’s on their necessary welfare. Hence, this would guarantee
job security and repose corrupt tendencies among military officers. This work's recommendations corroborate with Orji, Worika, and Umoafia (2017) and Babatunde (2018). However, the study is constrained by limited access to data, which affected the inclusion of some variables.

REFERENCES


Fedderke, J.W. & Bogetić, Ž. (2006) Infrastructure and Growth in South Africa: Direct and Indirect Productivity Impacts of 19 Infrastructure Measures. School of Economics, University of Cape Town, Private Bag, Rondebosch, 7701, Cape Town, South Africa, jfedderk@commerce.uct.ac.za


