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SOCIO-ECONOMIC INFRASTRUCTURE AND INDUSTRIAL SECTOR OUTPUT IN NIGERIA

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Abstract

This work examined the social infrastructure expenditures and manufacturing sector performance in Nigeria. It specifically examined the relationship between education infrastructure expenditure, health infrastructure expenditure, utility infrastructure expenditure, transportation infrastructure expenditure, and manufacturing sector performance. Relying on the characteristics of the series under investigation, the study adopted autoregressive distributed lag (ARDL) approach to econometric analysis with annual time series data sourced from the CBN Statistical Bulletin, National Bureau of Statistics (NBS), World Bank Development Indicators for the period of 24 years (1996-2019). The study revealed that utilities infrastructure and health infrastructure promote manufacturing sector, while transportation infrastructure reduces industrial output in Nigeria. The study recommended that social infrastructure expenditures should always be given adequate attention as it boosts the activities of the manufacturing sector towards positive and significant output.

Introduction

The concept of globalization, employed as a tool for implementing neoclassical macroeconomic policies within the new Washington Consensus, has significantly influenced the performance of manufacturing industries worldwide. The term "manufacturing industries" encompasses the sector of the economy engaged in the production of consumable and intermediate goods and services. This includes a spectrum of human activities ranging from handicrafts to high-tech processes, predominantly applied in large-scale industrial production where raw materials transform into finished goods (Adegoke, 2013).

The manufacturing sector bears dynamic benefits for individuals and the general public, including job creation, increased output, steady economic growth, and a favorable balance of payment position (Loto, 2013). According to a 2019 World Bank report, the global manufacturing outlook has witnessed significant improvement in the United States and China, surpassing other regions over three decades. Notably, East Asia countries, Thailand, Switzerland, Slovenia, Singapore, Puerto Rico, Oman, Myanmar, Liechtenstein, Korea, Japan, Ireland, Eswatini, and China contributed varying percentages to manufacturing value added (% of GDP) (WBG, 2019).

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Mesagan and Ezeji (2016) assert that infrastructure, particularly social infrastructure, plays a pivotal role in shaping the economy through channels linked to the manufacturing sector. Social infrastructure comprises assets and services that deliver social benefits, characterized by non-rivalry and non-excludability. These public goods encompass health, education, housing, transportation, communication, prisons, civic and utility services, correctional facilities, and the justice system (Mesagan and Ezeji, 2016). It is crucial to distinguish between economic infrastructure and social infrastructure. Economic infrastructure stimulates economic activities and attracts financial transactions, while social infrastructure involves public goods exclusively provided by entities with the financial and legal authority to do so.

Despite being the most populous country in Africa and a one-time largest economy, Nigeria grapples with infrastructural deficits, particularly in social infrastructure. These deficiencies trace back to the country's shift to an oil-oriented economy in the 1950s. The CIA World Factbook notes a decline in agricultural output share of GDP, contrasting with a rise in manufacturing output contributions from 4.4% in 1959 to 9.4% in 1970, only to decline to 7% in 1973 due to the oil boom. The oil boom era caused a substantial drop in manufacturing output and capacity utilization from 73% in 1984 to 53.3% in 2009 and 52.12% in 2010 (Edo, 2013). In 2014, the sector's average capacity utilization stood at 59.5% (CBN, 2015).

Oputu (2010) notes that in 1969 and 1979, the manufacturing sector contributed 8.2% and 9.6% to GDP, respectively. Oil productivity altered Nigeria's economic landscape, reducing the manufacturing sector's contribution from 5% to 4% of GDP (Okonji, 2013). The latest report from the National Bureau of Statistics indicates a decline in the Nigerian manufacturing sector's total output from N1.59tn in the first quarter of 2018 to N1.54tn in the second quarter. The Manufacturing Association of Nigeria (MAN, 2010) attributes the sector's decline to poor infrastructure, with about 834 manufacturing firms downsizing operations in 2009, resulting in a 4.7% drop in GDP and 4.5% in 2010.

Poor infrastructure, particularly the deplorable state of highways, has impeded the free movement of manufactured goods, causing traffic congestion, breakdowns, robberies, and loss of goods. The Nigerian economy slipped into recession in the second quarter of 2016, with a 2.06% contraction and an inflation rate of 17.1% (CBN, 2018). Addressing these challenges requires a comprehensive economic planning strategy, including increased investment in social infrastructure. However, concerns persist about the effective governance of government expenditures allocated to social infrastructure, with limited translation into meaningful growth and development.

In response, Mede (2017) advocates for increased funding in social infrastructure with effective control measures to stimulate the manufacturing sector. Despite these efforts, the manufacturing sector continues to face challenges, leading to the collapse of some manufacturing firms. Existing literature reflects diverse perspectives on the relationship between social infrastructure and manufacturing sector performance. Lucky et al. (2019), Olarunfemi (2008), and Oriji and Worika (2016) suggest a negative and insignificant effect, attributing misconceptions of the term infrastructure. In contrast, Ijaiyen and Akanbi (2009), Pohjola (2001), and Fernaldy (1999) posit a positive relationship between social infrastructure and industrial sector development. Addressing this disparity, the study investigates the impact of social infrastructure on industrial sector development in Nigeria using time series datasets spanning from 1996 to 2020.

Other sections of this work will be organized as follows. Section two deals with the review of relevant literature. Section three deals with the methodology, research design, model specification, source of data, method of data analysis. Section four presents' data analysis and interpretation of data, summary and conclusion, and recommendations.

LITERATURE REVIEW

Conceptual Clarifications

Social Infrastructure Oshikoya et al. (1999) defined social infrastructure as the subset of the infrastructure sector and typically includes assets that accommodate social services such as hospitals, transportation, power, prisons, community housing and so on. Social infrastructure are physical facilities and spaces where the community can access social services. These include health-related services, education and training, social housing programs, police, courts and other justice and public safety provisions, as well as arts, culture and recreational facilities (Loto, 2012). And they cover a range of services and facilities that meet local and strategic needs and contribute towards a good quality of life. It includes health provision, education, community, play, youth, recreation, sports, faith, and emergency facilities. Green infrastructure in all its forms is also a key component of social infrastructure. Social infrastructure in the context of this work is the provision of public goods and services to the society.

Several of the issues in the financing of education in Nigeria are embedded in the virtually endemic problems of expenditure governance like fiscal federalism in particular which gives rise to the so-called vertical and horizontal fiscal imbalances (Chandra, 2010). The first of these deals with the balance between the governance of the financial responsibilities and financial resources at each level of government: federal (or central), state and local. The second deals with governance of the equity across the subunits of each specific level of government such as state or local governments (Hinchliffe, 2002). Compared to the older political federations such as the United States, Australia and Canada, as well as younger ones such as Brazil and India, in Nigeria the lower tiers of government are funded more through revenue sharing arrangements than through locally collected taxes (Hinchliffe, 2002).

Theoretical Literature

The Peacock-Wiseman Hypothesis Peacock and Wiseman (1961) conducted a new study based on Wagner's law. They studied the public expenditure from 1891-1955 in the U.K. They found out that Wagner's law is still valid. According to Peacock and Wiseman's hypothesis, government spending tends to evolve in a step-like pattern, coinciding with social upheavals, notably wars. They adopt a clearly inductive approach to explaining the growth of government expenditure. When they observed that expenditure over time appeared to outline a series of plateaus separated by peaks, and that these peaks coincided with periods of war and preparation for war they were led to expound the "displacement effect" hypothesis. They further stated that the rise in public expenditure greatly depends on revenue collection (Ogba, 1999). The theory concluded that the emphasis is on the fact that public expenditure has a tendency to increase over time and thereby causing a positive economic development (Ogba, 1999). This theory is similar to the Keynesian expenditure approach, but it is not as comprehensive as the Keynesian expenditure approach. However, the writer tends to agree with this theory that public expenditure has a tendency to increase over time and thereby causing a positive effect on the industrial sector development.

Empirical Review

Lucky et al., (2019) examined the effects of infrastructure on the industrial sector of Nigeria. Using time series data spanning from 1990 to 2015, industry value-added (% of GDP) was used as an indicator of Nigeria's industrial sector performance. The results of the regression showed that the index of electricity consumption exerted a positive but insignificant impact on industry value-added. Gross capital formation and federal government spending had a negative but significant impact on industry value-added at a 5% confidence level.

Mesagan and Ezeji (2017) examined the role of economic and social infrastructure in manufacturing sector performance in Nigeria. The results showed that utilities had a positive impact on manufacturing performance in Nigeria. Additionally, growth of government capital expenditure and growth of government expenditure on education positively and significantly enhanced the manufacturing value-added, while growth of government expenditure on health, electricity generation, electricity consumption, inflation rate, and prime lending rate had insignificant negative effects on manufacturing value-added. The study emphasized the need to reduce wasteful spending in government.

Orji and Worika (2016) examined the Impact of Infrastructural Development on Nigeria's Industrial Sector. Using ordinary least square regression analysis with time series data from 1990 to 2015, the study found that the index of electricity consumption exerted a positive but insignificant impact on industry value-added. Gross capital formation and federal government spending had a negative but significant impact on industry value-added at a 5% confidence level. The study recommended measures to revamp and maintain the power sector of Nigeria, emphasizing the importance of curbing corruption and proper monitoring of projects.

Onakoye et al., (2012) examined the relationship between investment in telecommunication infrastructure and economic growth in Nigeria. Using a multivariate model of simultaneous equations and three stages of least squares method, the study found that telecommunication infrastructural investment has a significant impact on the output of the economy directly through its industrial output and indirectly through the output of other sectors.

Shobande et al., (2016) examined the impact of infrastructural investment on industrial growth in Nigeria. The study used annual time series data sourced from the Central Bank of Nigeria's statistical bulletin between 1960 and 2015. The study adopted the Autoregressive Distributed Lag (ARDL) bound testing approach. The long-run estimates indicated mutual co-integration, suggesting a long-run relationship. The short-run dynamics showed that changes in the previous one lag period of infrastructural growth, industrial growth, and labor growth triggered a 1% increase in the current industrial output growth. Therefore, infrastructural investment in the industrial sector is a necessary but not sufficient condition for economic recovery.

Olorunfemi (2008) investigated the relationship between infrastructural services and manufacturing output using the Vector Autoregressive model (VAR) and granger causality test. The study covered the period between 1981 and 2005 and revealed that transport and electricity services did not granger-cause growth in the manufacturing sector. However, there was a positive relationship between governmental capital expenditure and economic growth.

Nurudeen and Usman (2010) documented a negative relationship between transport infrastructure and economic growth. Holtz-Eakin (1994), in his study, classified public investment into education, road and highway system, drainage system, and public utilities. He found no significant evidence of a positive effect of the road and highway system on growth, whose share in total public spending was 34.5%, in the USA.

Evans and Karras (1994) used panel data from 1970 to 1986 to investigate the effect of public spending on economic growth. Their study revealed a negative effect of public spending on growth, partially due to the insignificant productivity effect of transport.

Ijaiya and Akanbi (2009) examined the effect of infrastructure on industrialization in Nigeria, employing Johanson cointegration approach and error correction mechanism. The study found a long-run relationship between infrastructure and industrialization, with transportation converging faster than any other facility, and communication facilities and electricity supply diverging from the long-run equilibrium position.

Fernald (1999) investigated the relationship between the construction of inter-state highways in 1950s and 1960s and growth in the 1970s. He revealed that investment in transport is productive, and the productivity effect of transport to growth is not permanent but once and for all, using panel data analysis of 12 OECD countries.

Pohjola (2001) investigated the relationship between telecommunication infrastructure and economic growth in 39 countries, using panel data from 1990 to 1995. His study revealed a 80% gross return on investment in IT for OECD countries, but the return for developing countries was not significant.

Aschauer (1989c) investigated the economic contribution of public investment to economic growth in the G7 countries, using panel data from 1966 to 1985. He documented an output elasticity of 0.34 to 0.73, using the Cobb-Douglas function, emphasizing the importance of public investment in productivity and growth.

RESEARCH METHODOLOGY

This section delves into the research design, method of data collection, description of variables in the model, model specification, and data analysis technique.

3.1 Research Design

Research design is a term used to describe a number of decisions that need to be taken regarding the collection of data before the data are collected. Baridam (1998) suggested that the choice of a design is influenced by the purpose of the study, the study setting, unit of analysis, and time horizon. The research design chosen for this work is a quasi-experimental design using time series econometric technique.

3.2 Sources of Data

Data for the study is derived mainly from secondary sources, including Central Bank of Nigeria (CBN) statistical bulletin, Nigeria Stock Exchange (NSE) annual report, National Bureau of Statistics (NBS), World Bank Group, Transparency International, textbooks, articles, journals, and the internet. This data is estimated using Econometric Views (E-Views) version 10.5.

Definition of Variables

INDEPENDENT VARIABLES

Utility Infrastructure Expenditure:

Government expenditure on utilities such as electricity, pipe-borne water, sanitation, etc. This expenditure aims to improve the power situation in the economy and the cost of running businesses, improving the life expectancy rate of the people as they consume clean water and live in a clean environment. It is expected in theory that an increase in utility infrastructure will increase industrial sector development in Nigeria. The a priori expectation is that utility infrastructure will have a positive effect on output (Utility Infrastructure Expenditure > 0).

Health Infrastructure Expenditure:

Insufficient infrastructure in the health sector represents a major cause of the loss of quality of life, healthy manpower, illness, and death. Jeffrey (2004) further submits that poor infrastructure impedes a nation's economic growth and international competitiveness. In the words of Onyenze (2017), the problem is not only that the funds are not enough, but the problem is worsened by the poor governance of the sector, which makes implementation of the inadequate budgetary allocation to the health sector a mirage. It is expected in theory that an increase in health infrastructure will increase human capital, which will stimulate industrial sector performance. The a priori expectation is that an increase in health infrastructure will have a positive effect on output (Health Infrastructure Expenditure > 0).

Expenditure on Transportation (TIE):

Expenditure on transportation includes all government expenditures on road construction, railway construction, purchase of free public buses that ferry people from one location to the other. An increase in expenditure on transportation is expected to stimulate the performance of the industrial sector or have a positive effect on output (Expenditure on Transportation > 0).

Expenditure on Education (EIE):

This captures the sum of government budgetary allocation to the education sector, such as expenditure on schools, universities, and other public institutions of learning in Nigeria. It is expected that an increase in expenditure on education will have a positive effect on output (Expenditure on Education > 0).

DEPENDENT VARIABLE

Industrial Sector Output:

Industrial sector performance in this context will be measured with the output from the industrial sector of the Nigeria economy. The industrial sector is a component of the manufacturing sector that deals with the production of goods and services in Nigeria.

3.6 Model Specification

To capture the effect of social infrastructure on industrial sector development in Nigeria, this work adopted the modified version of Pesaran, Shin, and Smith (2001) model. The adoption of Auto-Regressive Distributed Lag (ARDL) approach in this work is premised on the stationarity condition of the series under examination, and it will aid the robustness and accuracy of the model. This work adopted the modified version of the ARDL model below:

$\Delta yt = co + c1t + \pi yyyt - 1 + \pi yx.xxt - 1 + \sum_{i=1}^{p-1} \psi\, i\Delta zt - i + \omega \Delta xt + \mu t \ldots (1)$ $\Delta xt = p1\Delta xt - 1 + p2\Delta xt - 2 + \ldots\ldots ps\Delta xt - s + \varepsilon t \ldots..(2)$

Where:

- ******* is the K-dimensional I(1) variable that are not cointegrated among themselves and are serially uncorrelated disturbances with zero means and constant variance–covariances.
- ********xt* are K x K coefficient matrices such that the vector autoregressive process in is stable, Pesaran and Shin and Smith (2001).

Model 1: Social Infrastructure and Manufacturing Sector Performance

To investigate the effect of social infrastructure on industrial sector performance in Nigeria using time series datasets spanning from 1996 to 2019, ARDL of order P, var(P), was estimated. Thus, the models were specified to estimate the effect of social infrastructure on industrial sector performance.

$$\Delta MSO = \beta 0 + \beta 1MSOt - 1 + \beta 2HIEt - 1 + \beta 3EIEt - 1 + \beta 4HOIt - 1 + \beta 5TIEt - 1 + \beta 6CIEt + ut \ldots\ldots\ldots (3)$$

The estimation of an error correction model (ECM), which measures the speed of adjustment to restore equilibrium in the dynamic model, is presented as follows:

$$\Delta MSOt = \beta 0 + \sum_{i=1}^{p} \beta 1\Delta MSOt - i + \sum_{i=0}^{p} \beta 2\Delta HIEt - i + \sum_{i=0}^{p} \beta 3\Delta EIEt - i + \sum_{i=0}^{p} \beta 4\Delta HOIt - i + \sum_{i=0}^{p} \beta 5\Delta TIEt - i + \sum_{i=0}^{p} \beta 6\, \Delta CIEt - i + \varpi ECTt - 1 + \varepsilon t \ldots\ldots\ldots\ldots\ldots (4)$$

Where;

MSO is the industrial sector output.

HIE is health infrastructure for the education sector.

EIE is expenditure on education.

HOI is Housing infrastructure expenditure.

TIE is expenditure on transportation.

CIE is Communication Expenditure

= First-difference operator and εt = Error terms with standard deviation = Measures the intercept and coefficient of the variables,

Adopting the autoregressive distributed lag (ARDL) bounds testing approach to test for the existence of a cointegrating long-run relationship is based on the bounds test approach inherent in the ARDL framework. The upper bounds test critical value will be compared with the computed F-Statistics in line with the proposition of Pesaran et al. (2001). Given the small size of the study samples, the optimal lag length for estimating Eq. (3) is selected using the Schwarz Criterion (SC) given her consistency in selecting models. The decision criterion will be based on: If the computed F-statistic lies below the lower critical values, then the null hypothesis of no cointegration is not rejected. But if the computed F-statistic lies above the upper critical values, then the null hypothesis of no cointegration will not be accepted. The test is inconclusive if the computed F-statistic lies in between the lower and upper critical values. Once the bounds test establishes a long-run relationship between the variables, an estimate of the long-run equilibrium relationship between the variables is stated as: With equation (3) and (4), objective one of this study is confirmed.

Descriptive Statistics Table 4.2 Shows the summary statistics in the empirical examination of social infrastructure, governance, and the manufacturing sector performance in Nigeria.

	LMSO	LEIE	LHIE	LTIE	LUIE
Mean	4323.590	984.6813	340.8722	780.3198	327.2676
Median	2581.371	536.1014	248.1531	513.5163	156.9014
Maximum	13459.53	2934.527	881.6911	2958.368	1383.077
Minimum	477.9478	51.13194	24.12132	88.09558	14.76241
Std.Dev	4064.374	954.3947	278.3794	755.6058	374.7971
Skewness	0.914485	0.859513	0.657814	1.408922	1.343808
Kurtosis	2.518161	2.274626	2.052803	4.332106	3.995864
Jarque-Bera	3.577299	3.481220	2.628061	9.714751	0.215023
Probability	0.167186	0.175413	0.268735	0.457771	0.096449
Sum	103766.2	23632.35	8180.932	18727.68	7854.422

Table 4.2 illustrates the average of the distribution, which is the mean values for manufacturing sector output (LMSO), expenditure on education infrastructures (EIE), expenditure on health infrastructures (LHIE), expenditure on transportation infrastructures (LTIE), and expenditure on utilities infrastructures (LEIU) are 4323.590, 984.6813, 340.8722, and 327.2676. While the median values are 2581.371, 536.1014, 248.1531, 513.5163, and 156.9014. The maximum and minimum values for the distribution are 13459.53, 2934.527, 881.6911, 2958.368, 1383.077 and 477.9478, 51.13194, 24.12132, 88.09558, 14.76241 respectively. The skewness values for LMSO (0.914485), EIE (0.859513), and LHIE (0.657814) while others are not normally skewed. The Kurtosis which measures the peakedness of the distribution indicates that the residual of LMSO (2.518161), EIE (2.274626), and LHIE (2.052803) are mesokurtic in nature while LTIE (4.332106) and LEIU (3.995864). Jarque-Bera statistics and its associated probability values 0.167186, 0.175413, 0.268735, 0.457771, and 0.096449 indicate that the series are normally distributed.

Unit Root Testing (ADF)

Variables	Level	First difference	Order
LNMSO	-2.796722	-3.632896	-5.794220
LHIE	-8.189084	-3.658446	-
LEIE	-3.026960	-3.632896	-5.473235
LTIE	-2.636918	-3.632896	-5.965218
LUIE	-2.508154	-3.622033	-4.8180417

In line with the appropriate procedure in empirical examination involving time series analysis, it is necessary to ascertain the stationarity condition of the series in the model. The essence of which is to determine their order of integrations as to choose the appropriate approach which will be suitable for the study. The application of ARDL required the presence of data of different order of integration but that the dependent variable must be integrated of order one, 1(1). While the independent variable(s) may be integrated of the same order of integration 1(0) or 1(1) provided the series are not integrated of order 1(2). In testing for the order of integration of the series, this study adopted the Augmented Dickey Fuller (ADF) test. The ADF result shows that the log of health expenditure (LHIE) and is mean-reverting or stationary at level. Integrated of order zero 1(0). It was also inferred that; Manufacturing sector output (LMSO), educational infrastructure expenditure (EIE), transportation infrastructure expenditure (TIE), utility infrastructure expenditure (UIE), were all stationary after first differencing in line with Box and Jenkins (1987) proposition. A non-stationary series will be made stationary after first differencing. Given the presence of series of different order of integration. It became necessary to apply the Pesaran, Shin, and Smith (2001) approach, known as autoregressive distributed lag (ARDL) approach. ARDL is a dynamic regressive procedure in the sense that the lagged dependent variable is an explanatory variable in the same model and very suitable to solve the endogeneity problem.

Bounds Cointegration Test

Given the presence of series of different order of integration which warranted the adoption of ARDL approach, the bounds test for cointegration was estimated in line with the appropriate procedure. Bounds Cointegration

Test Statistic	Value	Signif.	I(0)	I(1)
Asymptotic: n=1000				
F-statistic	17.61873	10%	2.45	3.52
K	4	5%	2.86	4.01
		2.5%	3.25	4.49
		1%	3.74	5.06

The decision for the presence or absence of cointegration was premised on the F-Statistic and the upper bounds critical value. A close look at the bounds test results shows that the F-Statistic value 17.61873 is greater than the upper bounds critical value 4.01. This result implies that there exists a long-run cointegrating relationship among the series in question or that in the long run, there will be convergence, thus, the need to estimate the long-run coefficient of the series under examination.

ECM and Short-Run Result

The error correction term (ECM) appeared with the normal sign (-) and statistically significant at one percent. The result shows that the short-run disequilibrium will be adjusted at the speed of 76% annually. A 76% speed of adjustment is appropriate given the importance of the public goods on manufacturing industries.

Variable	Coefficient	Std.Error	t-Statistic	Prob.
C	287.8049	52.23167	4.169978	0.0007
D(LTIE)	1.267326	0.300599	3.550665	0.0027
CointEq(-1)*	-0.609757	0.073354	-10.49367	0.0000

R-squared	0.702022	Meand ependent var	564.4165
Adjusted R-squared	0.6203224	S.D. dependent var	625.3844
S.E. of regression	194.5501	Akaike info criterion	13.50036
Sum square dresid	756994.7	Schwarz criterion	13.64847
Loglikelihood	-152.2542	Hannan-Quinncriter.	13.53761
F-statistic	103.6643	Durbin-Watsons tat	1.756782
Prob(F-statistic)	0.000000		

*p-value in compatible with t-Bounds distribution.

The R-Square value 70% shows that the model has a good fit while the adjusted R2-Square value of 62% indicates that 62% of the variation in the dependent variable is caused by the combined action of the explanatory variables in the model while the remaining 38% is exogenously determined. The f-statistic 103.6643, which measures the overall goodness of the model and its associated probability value 0.000000, indicates that the model is good. The Durbin Watson statistic value 1.756782 shows the absence of first-order auto-correlation in the residual. Finally, Akaike information criterion (AIC) is the best for the empirical examination of the effect of social infrastructure on industrial sector performance in Nigeria due to the estimated lower value. Thus, the past disequilibrium occasioned by the relationship between social infrastructure and Manufacturing sector performance will be corrected at the speed of 60% annually. Given that the short-run elasticity is modeled as the estimated coefficient of the first-differenced variables. The short-run result revealed that the coefficient of transportation infrastructure expenditure (LTIE) exerts positive and significant pressure on the Manufacturing sector performance (LMSO), all things being equal. A percentage increase in transportation infrastructure expenditure (LTIE) will emit 1% increase in manufacturing sector performance (LMSO). This implies that transport infrastructure has temporal usefulness in Nigeria.

Long-Run Result

Variable	Coefficient	Std.Error	t-Statistic	Prob.
LEIE	-0.199986	0.843515	-0.237086	0.8156
LHIE	12.22546	3.196132	3.825081	0.0015
LUIE	10.75285	2.200390	4.886792	0.0002
LTIE	-5.239302	1.579963	-3.316092	0.0044

Having established the presence of a long-run relationship among the series, it became imperative to estimate the long-run coefficient of the variables as it concerns the examination of the effect of social infrastructure on industrial sector performance in Nigeria using a time series dataset from 1996 to 2019. The long-run results reveal that the coefficient of education infrastructure expenditure (EIE) is negatively related to Manufacturing sector performance (LMSO) but not statistically significant at the 5% level of significance. This outcome contradicts the a priori expectation, as an increase in investment in education is anticipated to improve the knowledge base, positively impacting the manufacturing sector. Although the parameter lacks statistical significance, the negative signal holds importance for policymaking.

In contrast, the coefficient of health infrastructure expenditure (LHIE) in the long run is positively related to Manufacturing sector performance (LMSO) and statistically significant at the 5% level. A percentage increase in health infrastructure expenditure (LHIE) translates to a 12.22% increase in Manufacturing sector performance, suggesting that an enhancement in the healthcare system stimulates productivity and contributes to increased industrialization in Nigeria. This aligns with previous studies by Omisakin (2008), Gbadebo and Okonkwo (2009), Yusuf and Yahya (2011), Pohjola (2001), and Aschauer (1989c).

Similarly, the coefficient of expenditure on utility is positively related to industrial output in the long run and is statistically significant at the 5% level. A percentage increase in (LUIE) corresponds to a 10.75% increase in Manufacturing sector (LMSO) in Nigeria. The positive sign conforms to theoretical expectations, indicating that an increase in social infrastructure provision, including sanitation, water, and electricity, stimulates Manufacturing sector output. This result supports the views of scholars like Ijaiya and Akanbi (2009), Bamidele and Englana (1998), and Akpan (1998), but contradicts opinions from Orji and Worika (2016), Mesagan and Ezeji (2017), Lucky, Nsikan, and Eke (2019), and Chiou-Wei et al. (2008), who posit that the growth of the manufacturing sector results from impulses generated by the provision of public goods.

In contrast, the coefficient of transportation infrastructure expenditure (LTIE) negatively influences industrial output (LIND) in the long run and is statistically significant. A percentage increase in (LTIE) results in a 5.23 percent decrease in industrial output. The coefficient of expenditure on transportation (ITIE) is negatively signed, contrary to the researcher's theoretical expectation. This implies that investments in the transportation sector of the national economy reduce manufacturing sector output. This aligns with the actual situation in Nigeria, where sub-standard materials and corrupt practices lead to frequent breakdowns in transportation facilities, making it challenging to move manufacturing sector outputs between locations. This outcome is consistent with the perspective of Olorunfemi (2008) and Nurudeen and Usman (2010).

Post-Estimation Testing,

In accordance with appropriate procedures, is deemed necessary to confirm adherence to the OLS specification.

S/N	TEST	T-STAT.	OBS.R.
1	Normality test (Jarque-Bera)	0.254856	(0.145785)
2.	Breusch-Godfrey serial correlation Lm test	2.547856	(0.0784)
3.	Heteroskedasticity test - breuschpagan-Godfrey	0.785785	(0.4578)
4.	Ramsey Reset Test	0.475869	(0.7892)
5.	CUSUM	Stable	Stable

The normality test (Jarque-Bera) result 0.254856 and its associated probability value 0.145785 more than 5% indicates that the series in question are normally distributed in line with Gaussian condition. The serial correlation test value 2.547856 (0.0784) and 4.578665 (0.4487) shows the absence of serial correlation in the residual. The heteroskedasticity test value 0.785785 (0.4578) and 4.458565 (0.4758) indicates the absence of heteroskedasticity in the residual. Ramsey reset test value 0.475869 (0.7892) shows that the model is correctly specified. Finally, the Cumulative Sum of recursive residuals (CUSUM) and CUSUM of squares (CUSUMSQ) test proposed by Brown et al. (1975) is applied to confirm that the models satisfied the stability test. Figure 4 below presents plots of both CUSUM and CUSUM square test statistics that fall inside the critical bounds of 5% significance. This implies that the estimated parameters are stable over the period 1996–2019.

Summary and Conclusion

In capturing the main objective of this research, an inquest into the stationarity condition of the series was initiated with Augmented Dickey Fuller Test (ADF). Learning on the presence of a long-run relationship observed from the bounds test, result through the instrumentality of the F-Statistic and the upper bounds critical value, the long-run coefficient of the long-run relations was estimated.

In the long run, the coefficient of expenditure on health (LHIE), utility infrastructure expenditures (LUIE), and transportation infrastructure expenditure (LTIE) enhanced industrial sector performance (IND) with varying degrees of impartation. The coefficient of education infrastructure, though insignificant to cause variation in industrial output, the sign of the parameter is important for policymaking. That implies that the educational system emits negative impulses to the manufacturing sector through the ineffective or inefficient curriculum adopted from the colonial masters. The educational system, by these results, discourages the industrial sector output. Also, the long-run coefficient of transportation infrastructure expenditure (TIE) exalting harms industrial sector output speaks volumes. Meaning that if the transportation facilities cannot stand the test of time, they get damaged months after their construction. These can be expressed in the short-run positive influence on manufacturing sector output. The presence of corruption and ethnic-centeredness makes contractors in Nigeria to perform below the world average.

Recommendation

i. Healthcare management and the provision of major utilities in the cities and urban areas of Nigeria should be given critical attention to ensure growth in the manufacturing sector.

ii. Health infrastructure expenditures should be improved upon. These expenditures will help to build the healthy human resources at the turn of 12.22546% that is required to drive the manufacturing sector in Nigeria.

iii. Utility infrastructure expenditures should always be given adequate attention as it boosts the activities of the manufacturing sector by 10.75285%.

iv. Transportation infrastructure in the form of road, railway, air, and waterways system should always be given adequate attention in terms of provision of qualitative facilities that will stand the test of time given that, as it reduced manufacturing sector by 5.239302%.

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