Infrastructural Development and the Nigerian Industrial Sector Performance

Nsikan Umofia, Kingdom Eke Orji, Ibibia Lucky Worika

Abstract— The significance of infrastructure to the industrialization in any economy cannot be overflogged, thus making its enhancement relevant to the survival of the industrial sector. The purpose of this study is to analyse the effects of infrastructure on the industrial sector performance of Nigerian economy. In that vein, descriptive statistics to establish the trends, the unit root test (using Augmented Dickey-Fuller) to test fro stationarity, co-integration test (using Johansen co-integration) to check for long-run relationships between the variables in the model, and the dynamic ordinary least squares were adopted, using time series data spanning from 1980 to 2016. Industry value-added was used as an indicator of Nigeria's industrial sector performance, while electricity supply, gross capital formation, and federal government spending on transport and communication were used as indicators for infrastructural development. The results of showed that electricity supply exerted a positive but insignificant impact on industry value-added; gross capital formation and federal government spending had a positive but significant impact on industry value-added (on a 5% confidence level). The study recommended that measures to revamp and maintain the power sector of Nigeria must be taken seriously to ensure better supply of power. It was also recommended that corruption be curbed and funds disbursed to infrastructural development, and be monitored to ensure that the project it was allocated for is carried out and that adequate infrastructure will be built and properly maintained to encourage greater level of industrial experience and performance.

Index Terms— Development, Industrial performance, Industrial sector, Industrialization, Infrastructure.

1 Introduction

INFRASTRUCTURE can be appreciated as an economic factor which cuts across all segments of the economy because of its significance to the proper functioning of the economy as a whole. This is an indisputable fact as no economy can function efficiently without transport and telecommunication networks or systems, some form of power supply, and amenities such as drainage or disposal systems, markets, homes and offices, schools and the like. Jacobson and Tarr [6] defined infrastructure as structures and systems which frame and keep an economy thereby making provision for economic and social efficiency.

The developed and developing world alike, count industrialization as a significant dynamic for growth and development, and the relationship between infrastructure and industrialization in any economy can be appreciated from the perspective of distribution of resources which include production inputs and outputs to and from industries. Thus, infrastructure and industrialization go hand in hand on the quest for sustainable development in any economy.

However, it is obvious the deplorable condition of infrastructure in Nigeria with poor delivery and maintenance of the infrastructure. Inadequate infrastructure has been a thorn in the flesh of industrialization in Nigeria. It has led to low productivity and output, translating into low capacity utilization, higher production costs, and then inflation.

- *Nsikan Umofia is currently pursuing doctorate degree program in trade and development finance in University of Port Harcourt, Nigeria, PH-01123456789. E-mail: nsikaumofia@gmail.com*
- *Kingdom Eke Orji is currently a professor of history and diplomatic studies in Ignatius Ajuru University of Education, Nigeria, PH-01123456789. E-mail: orjiekingdom@yahoo.com*
- *Ibibia Lucky Worika is currently a professor of private law in University of Port Harcourt, Nigeria, PH-01123456789. E-mail: ibibia.worika@uniport.edu.ng*

The connection shared by infrastructure and industrial sector growth is undeniable. The multiplier effect expressed by industrial output thanks to infrastructure (for example, energy infrastructure) begs the need for infrastructural development in our great nation if there is any hope to enhance productivity [2].

2 Brief Literature Review

A negative correlation between electricity generated and communication system development and industrialization in Nigeria was perceived by Ijaya and Akanbi [5]. However, expenditure on water supply systems proved to have a positive bearing on industrialization in the nation in the period 1980-2014. Infrastructure also proved to impact negatively on industrialization in Bakere and Fawehimmi's [3] study of its bearing on the non-oil industrial performance in Nigeria from 1979 to 2009.

Using statistical tools like Granger Causality test and the Johansen's Cointegration test, Osabase and Bakere [11] found the fluctuating nature of power supply and its irregularity in Nigeria to be a major impediment to industrial development in Nigeria in the period 1975-2011. Ohajianya et al [10] concurred with Osabase and Bakere [11] and suggested that the causes of power supply issues in Nigeria revolved around government policy inconsistencies for power reforms, inefficient energy generation and supply systems, as well as the disorganisation in the energy companies regarding their workforce.

Jesuovie, Edafe and Onoriode [7] further found, in the period 1980-2012, that a positive influence was exerted by power on the output of the Nigerian economy, but negative on the industrial sector output in the economy. Although the two

results proved to be trivial statistically, it was still proffered by these researchers that corruption be checked in the economy's power segment in order to reduce negative yields in the industrial sector.

Regarding transport infrastructure, Ogwu and Agu [9] discovered a statistically trivial bearing of transport infrastructure on the growth of manufacturing output in Nigeria from 1999 to 2011. However, it was also discovered that the influence on sales was negative and this decreased profits over time. Akekere [1] studied industrialization growth in Nigeria from 2000 to 2016 and found infrastructure to have negative exertions on it. They attributed this to the poor quality of infrastructural development in the nation, even if the impact was found to be statistically inconsequential.

The study of human capital and infrastructural development on the Nigerian industrial segment proved to Udah and Bassey [12] that to develop the industrial segment of the nation power infrastructure stable government policies were key requirements to this end. Their study used time series data from, and including, 1970 to 2014.

3 METHODOLOGY

This paper espoused a variety of approaches in estimation of data. It first employed descriptive statistics to establish the trends, the unit root test (using Augmented Dickey-Fuller) to test fro stationarity, co-integration test (using Johansen co-integration) to check for long-run relationships between the variables in the model, and the dynamic ordinary least squares. The data used for the study were related to:

- Industry value-added: used as a proxy for industrial sector performance;
- Index of electricity supply by the industrial sector: used to represent power infrastructure performance;
- Gross capital formation: used as a proxy for other social infrastructure; and
- Federal government spending on transport and communication: also used as a measure for infrastructural development.

The equation used, in model expression, was:

IVA = f(GCF, FGN, ELECT)

Where, IVA = Industry Value Added (in constant 2016 USD)

GCF = Gross Capital Formation (in constant 2014 USD)

FGN = Federal government spending on transport and communication (in billion naira)

ELECT = Electricity Supply (in MW/hr)

The model was represented mathematically as;

$IVA_t = a_0 + a_1GCF_t + a_2FGN_t + a_3ELECT_t + U_t$ _____**(1)**

Where, a_0 = regression line intercept

a_1 and a_2 = coefficients of regression

U_t = Error term

t = time (1980-2016)

Equation (1) above was modified to a log-linear form, equation (2) below, to remove heteroscedasticity:

$LOG(IVA)_t = a_0 + a_1LOG(GCF)_t + a_2LOG(FGN)_t + a_3LOG(ELECT)_t + U_t$ _____ **(2)**

The apriori expectations are that, gross capital formation, Federal Government spending on transport and communication, and electricity supply will have a positive relationship with industrial output.

4 DATA PRESENTATION AND ANALYSIS

Table 1 below shows the values for Industry value-added, gross capital formation, Federal Government spending on transport and communication, and electricity supply for Nigeria from 1980-2016.

TABLE 1
DATA FOR INDUSTRY VALUE ADDED (IVA), GROSS CAPITAL FORMATION (GCF), FEDERAL GOVERNMENT SPENDING ON TRANSPORT AND COMMUNICATION (FGN), AND ELECTRICITY SUPPLY (ELECT) IN NIGERIA FROM 1980 TO 2016.

YEAR	IVA	GCF	FGN	ELECT
1980	22467804014	21011912633	0.4686	67.80365
1981	22467804014	20778736718	0.5	50.70674
1982	16662931034	15285268199	0.35	81.57746
1983	10028507645	7754941896	0.38	81.41297
1984	7484031901	3539991139	0.33	61.8158
1985	7961323125	3279340400	0.32	80.12961
1986	5195095436	3253792531	0.51	90.51529
1987	7997537137	3051147470	1.09	88.93497
1988	6955271354	2291915998	1.22	86.77632
1989	10025256682	2846362961	1.42	96.66263
1990	13231386279	4437547520	1.61	86.71021
1991	11889242487	3778425872	1.3	89.21814
1992	14890348152	3751158107	3.08	89.66875
1993	6444276821	2149349007	7.75	100.4507
1994	5655754782	2025018936	3.91	95.14616
1995	12643325611	2022047186	5.92	91.08615

1996	16390926500	2555421375	4.75	85.52179
1997	15241872319	2999098102	6.2	81.6319
1998	10328778409	2758753864	11.57	76.61259
1999	13095225698	2515105141	87.08	75.4092
2000	23521929452	3261427209	28.59	74.13121
2001	17362270945	3351751778	53.01	75.19744
2002	17495096535	4150200641	52.95	104.1345
2003	24136762100	6707073583	96.07	101.4018
2004	36143149994	6501716389	58.78	122.9846
2005	48296302630	6136633107	64.31	128.6357
2006	60486496719	12032452350	79.69	111.1444
2007	66749457865	15407429013	179.07	138.1424
2008	85019875323	17331412194	313.75	126.5322
2009	56956433808	20498099014	423.61	119.9494
2010	90514640115	63813637507	562.75	135.6377
2011	1.13299E+11	66751825543	310.44	149.3125
2012	1.21678E+11	68717568970	230.1	155.8544
2013	1.28983E+11	76749847087	291.23	141.873
2014	1.36178E+11	89826662945	266.4	141.873
2015	1.42175E+11	91825762945	275.36	142.3486
2016	1.48175E+11	1.01876E+11	296.42	150.794

Source: CBN Statistical Bulletin (2016) and World Development Indicators (2016).

TABLE 2
DESCRIPTIVE STATISTICS

	LOG (IVA)	LOG (GCF)	LOG (FGN)	LOG (ELECT)
Mean	23.90702	22.85395	2.625239	4.589037
Median	23.57757	22.21337	2.448416	4.511806
Maximum	25.72166	25.34702	6.332835	5.048922
Minimum	22.37098	21.42738	-1.139434	3.926059
Std. Dev.	1.057936	1.299228	2.565420	0.276684
Skewness	0.425247	0.746785	-0.090824	-0.047081
Kurtosis	1.850327	2.129162	1.506254	2.369351
Jarque-Bera	3.152841	4.608211	3.490753	0.626818
Probability	0.206714	0.099848	0.174579	0.730951
Sum	884.5596	845.5962	97.13384	169.7944
Sum Sq. Dev.	40.29221	60.76778	236.9297	2.755943
Observations	37	37	37	37

Table 2 above provides the rudimentary dynamics of the data considered in this study. The maximum and minimum values of the dynamics scrutinized reveal no variation of significance. The Skewness is an indicator of histogram symmetry and dispersion from mean value. The positive skewness of industry value added (IVA) and gross capital formation (GCF) indicate that the distributions possess long right tails, whereas, the negative skewness of Federal Government spending (FGN) and electricity supply indicate that the distributions possess long left tails. Skewness is also used to measure the normality or symmetry of a distribution, and the closer it is to zero, the more normal or symmetrical the distribution; this means that electricity supply and Federal Government spending will exhibit more normally distribution or symmetry than industry value added and gross capital formation (however, they all are). The Kurtosis is a measure of the peakedness or flatness of the distribution of a series, in which case, the distribution of all the series in consideration are flat (not peaked) because their Kurtosis values are less than 3. The Jarque-Bera test shows that all the residuals are normally distributed because all their probabilities exceed 5%.

TABLE 3
UNIT ROOT TEST RESULTS (AUGMENTED DICKEY FULLER, ADF)

Variables	Level	1st Difference	Decision
Log(IVA)	-0.146738	-4.686622	I(1)
Log(GCF)	0.275117	-4.126527	I(1)
Log(FGN)	-0.761710	-7.138844	I(1)
Log(ELECT)	-1.553881	-8.874307	I(1)

Critical values
1% = -3.639407
5% = -2.951125
10% = -2.614300

From Table 3 above, it could be seen that all the series are stationary at first difference; hence we proceeded to cointegration using Johansen cointegration.

TABLE 4
JOHANSEN COINTEGRATION TEST

Series: LOG(IVA) LOG(GCF) LOG(FGN) LOG(ELECT)
Lags interval (in first differences): 1 to 1

Unrestricted Cointegration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.556395	64.42579	47.85613	0.0007
At most 1 *	0.500367	35.97703	29.79707	0.0085
At most 2	0.177086	11.69115	15.49471	0.1723
At most 3 *	0.129884	4.869509	3.841466	0.0273

Trace test indicates 2 cointegrating eqn(s) at the 0.05 level
* denotes rejection of the hypothesis at the 0.05 level
**MacKinnon-Haug-Michelis (1999) p-values

From Table 4 above, it could be deduced that there is a long-

run relationship among the variables, hence, the next step was the dynamic ordinary least squares.

TABLE 5
REGRESSION ANALYSIS RESULTS

Dependent Variable: LOG(IVA)
Method: Dynamic Least Squares (DOLS)
Cointegrating equation deterministics: C
Fixed leads and lags specification (lead=1, lag=1)
Long-run variance estimate (Bartlett kernel, Newey-West fixed bandwidth = 4.0000)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LOG(GCF)	0.415756	0.101003	4.116259	0.0005
LOG(FGN)	0.203020	0.052784	3.846207	0.0009
LOG(ELECT)	0.242934	0.563094	0.431426	0.6706
C	12.83034	2.040480	6.287905	0.0000

R-squared	0.956107	Mean dependent var	23.85786
Adjusted R-squared	0.931025	S.D. dependent var	1.057539
S.E. of regression	0.277743	Sum squared resid	1.619961
Long-run variance	0.098801		

The regression result showed an R^2 of 96%, meaning that 96% of the changes in industry value-added are explained by the variables stated in the model (gross capital formation, federal government spending, and electricity supply), however, the remaining 4% is explained by the variables not included in the model, but accounted for by the error term U. The results also show that all the independent variables have a positive relationship with industry value-added; however, gross capital formation and federal government spending exhibit a statistically significant impact on industry value-added, while electricity supply has an insignificant influence on the dependent variable (all on a 5% level of confidence).

5 CONCLUSION

The insignificant bearing of electricity on the industrial sector may be attributed to the obvious inadequacy in the Nigerian power sector. The fluctuations of power, low voltage supply, and outright power outages suffice to drive individuals, and especially industries, to find alternative sources of energy to fuel production. This can diminish profit (because of the appreciating cost of various forms of fuel in the economy); however, production remains autonomous for as long as it is feasible. In some cases, companies rely solely on the alternative source of energy that they acquire, so much that they don't switch back to the nation's power supply grid so as not to be disappointed and incur losses in the process of coping with a power outage; for instance, the number of power outages in firms in a typical month increased from 25 in 2007 to 33 in 2014. This act is all important to some industries as a mere second of power loss may lead to billions in losses, which they cannot afford (especially since the costs of other necessary expenditures are rising). In other words, there could be some firms which can afford to make do with the power inadequacy, for instance, the low energy consuming firms; but the general effect of electric power supply will stay insignificant provided the state of the power sector and supply remains inadequate.

Gross capital formation and federal spending on transport and communication went with apriori expectations in having a positive and significant influence on industrial performance. This thus re-iterates government's responsibility in ensuring that the necessary measures are taken to develop and maintain infrastructure in the nation. With this act, a promise of greater industrial performance in the nation can be fulfilled. Funds disbursed to infrastructural development must be monitored to ensure that the project it was allocated to is carried; and this might require regular inspections to equally assure higher reliability value of the infrastructure. This will certainly boost the performance of the industrial sector of the nation.

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