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# The Impact of Public Infrastructure on Industrialization

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## *Abstract*

*This study attempted to investigate the role of public infrastructure on the industrialization of Nigerian economy for the period 1981 to 2016. The extent to which the public and private sector can develop the infrastructural facilities, such as roads, rail lines, power, sewage, water, and telecommunication, etc., is the extent to which the industrial sector will have the required impetus to become more productive. The study investigated the impact of infrastructure in a VAR environment, after subjecting the data to pre-test for to check the stationarity and co-integration of the variables. The work embarked on variance decomposition to examine the impact of infrastructure on manufacturing sector. The findings revealed that expenditure on infrastructure does not significantly impact the manufacturing output in the short run, but becomes more significant in the long run. The study therefore went ahead to recommend that a deliberate and consistent attempts has to be made to develop the infrastructure of the economy so as to yield the desired manufacturing or industrial output expansion desired.*

***Keywords:*** *Impact, Public, Infrastructure, Industrialization, Industrial Output and Economy.*

## *Introduction*

The major objective of any economy is to increase the Gross Domestic Product and to raise the per capita income of its citizens. One major way to generate an increase in the GDP is to rapidly boost industrialization of such an economy. It has been observed from historical development that no country has ever become rich by exporting raw materials without also having an industrial sector, and in modern terms an advanced services sector. More so, the more a country specializes in the production of raw materials only, the poorer it becomes. In other words, industry multiplies National wealth (NIRP, 2014). A sustainable industrial development is the primary source of income generation, reduction in unemployment level, improvement in current account balance, and creating a stable price level in an economy. Industrialization could be seen as a deliberate and sustained application and combination of suitable technology, management techniques and other resources to move the economy from the traditional low level of production to a more automated and efficient system of mass production of goods and services (Ayodele and Falokun, 2003). It is well accepted that manufacturing activity is positively correlated with GDP and skilled employment, and has a multiplier effect on job creation, as every one job in manufacturing creates 2.2 jobs in other sectors (UNCTAD, 2006).

There is a general consensus that the key to the development and Industrialization of a nation and especially Nigeria is the extent to which the government and private sector can develop and maintain vital infrastructure such as power, roads, rail, ports and other facilities (Oseni & Pollitt 2013). The current infrastructure gap in Africa is estimated to be $93 billion annually (40 percent of which is power), or roughly one trillion dollars over the next decade, whilst in Nigeria according to the African Development Bank the infrastructure gap is believed to be $350 billion aggregated (NIRP, 2014). To achieve industrialization and inclusive growth therefore, industries must have access to reliable and affordable infrastructure.

Infrastructure is sine qua non for industrialization and that means that without adequate infrastructural facilities, industrialization will not happen, and without industrialization,

development will not happen. Basic infrastructure like roads, information and communication technologies, sanitation, electricity and water remains at unsatisfactory levels in many developing countries especially in Nigeria. Competitive economies require well-functioning infrastructure with access to modern energy services. Infrastructure provides the basic physical systems and structures essential to the operation of a society or enterprise. Industrialization drives economic growth, creates job opportunities and thereby reduces poverty. About 2.6 billion people in the developing world are facing difficulties in accessing adequate electricity supply. Not less than 2.5 billion people worldwide lack access to basic sanitation and almost 800 million people lack access to water, many hundreds of millions of them in Sub Saharan Africa and South Asia. About 1 to 1.5 billion people do not have access to reliable phone services. Quality infrastructure is positively related to the achievement of social, economic and political goals. Inadequate infrastructure leads to a lack of access to markets, jobs, information and training, creating a major barrier to doing business. Undeveloped infrastructure limits access to health care and education. Both the small, medium and large scale enterprises face the challenge of power supply and poor road infrastructure in Nigeria and this has to a large extent driven many of the entrepreneurs out of the country and sent many packing out of business due to the unbearable cost implications. In the least developed countries (LDCs), limited physical infrastructure, including electricity, water and sanitation, transport, institutional capacity and information and communications technology, is one of the major challenges to development (UNCTAD, 2006).

When infrastructure is inadequately available, it could create a poor performance of an economy (Azémar & Desbordes (2009); Dupasquier & Osakwe (2006); World Bank 2014). A study by Akinlo (2008) of 11 sub-Saharan African countries including Nigeria indicates that social infrastructure is an important factor of production that impacts greatly on economic growth.

**Literature review**

This section will present the review of all the relevant literatures beginning with the conceptual reviews, followed by the theoretical and then by the empirical reviews.

## Conceptual clarifications

### Public infrastructure

Public infrastructure refers to the relatively large physical capital facilities and organizational, knowledge and technological frameworks that are fundamental to the organization of communities and their economic development. It includes legal, educational and public health systems, water treatment and distribution systems, garbage and sewage collection, treatment and disposal, public safety systems, such as fire and police protection, communication systems, public utilities and transportation systems (Tatom, 1993).

Conceptually, infrastructure includes permanent sets of engineering construction, equipment, and machinery and the service they provide to production and household consumption. Infrastructure can be divided as economic and social ones, the former refers to the public utilities such as electricity, telecommunications, water supply, sanitary and drainage, public engineering construction such as dam and irrigation system, and the transport facilities such as railway road, harbor and airport; while the latter refers to education, medicare and health services (World Bank, 1999; Zhang and Gao, 2007

There are four channels through which infrastructure can have a positive impact on economic growth. First, energy and transport are used as inputs in firms' production function and hence influences their production cost, directly or indirectly, and ultimately their competitiveness from an international and national perspective (Pradhan and Bagchi, 2013). Second, investment in infrastructure may boost capital accumulation by providing opportunities for capital developments (Kirkpatrick, Parker and Zhang, 2004). Third, it can stimulate aggregate demand by increasing expenditure in construction and maintenance operations (Wang, 2002; Esfahani & Ramirez, 2003; Phang, 2003; Short & Kopp, 2005; Pradhan and Bagchi, 2013). Finally, it may induce other investments by providing signals to key sectors in the economy (Fedderke and Garlick, 2008).

Nigeria has been plagued with the numerous challenges of infrastructural development, and no doubt, one of the reason for poor diversification of productive capacities in the economy. The small, medium enterprises have been relegated to the background due to the infrastructural bottlenecks. A number of

potential entrepreneurs have been rendered ineffective; those who dared to stick out their necks have been forced to pack up due to the infrastructural constraints. It is impossible to talk of effective diversification of the economy when the bedrock of its survival is not properly addressed.

**Industrialization**

This is the process whereby nonindustrial sectors like the agriculture, education or health of an economy becomes gradually transformed into the similar manufacturing sector of the economy. When an economy is being industrialized, there is a gradual replacement of individual manual labor by mechanized mass production, and craftsmen are replaced by machines or assembly lines. This process creates a more efficient division of labor, and the use of technological innovation to solve problems. Consequently, this transformation generates economic growth. In other words, it can be conceptually presented as a set of economic and social processes related to the discovery of more efficient ways for the creation of value. These more efficient ways are lumped together under the label 'industry' or 'the secondary sector' The primary sector of economic activity referring to agriculture, hunting, fishing, and resource extraction, and the tertiary sector referring to services (Simandan, 2016). Thus, an industrialized development path consists of a process of reallocating factors of production from an agricultural sector characterized by low productivity and rudimentary technology to a modern industrial sector with higher productivity

(Szirmai, 2011). While Industrial activities can be classified into primary (extraction), secondary (manufacturing), tertiary (services), quarternary (knowledge) and quinary (culture and research), this work will proxy industrialization with manufacturing activities.

**Public infrastructure and industrialization**

Infrastructure has been seen as one of the most critical factors for economic development, considering its interaction with the economy through the production processes and whenever there are changes in the quality of infrastructure available for production, this will consequently and greatly impact the production and performance of an organisation's levels of output,

income, profits and employment creation in the economy. This is because of its direct link with the productivity (Adenikinju, 2005).

It is crystal clear that the cornerstone for productive and distributive efficiency in any economy is the development of infrastructural facilities. It is the bedrock for efficiency and competitiveness among different sectors of the economy. Infrastructural development, both economic and social, is one of the determinants of economic growth, particularly in developing economies. Development economics' literatures recognised that direct investment in infrastructure creates (i) production facilities and stimulates economic activities, (ii) reduces transaction costs and trade costs, thereby improving competitiveness, and (iii) provides employment opportunities for the poor (Sahoo, Dash and Natarai, 2010). Thus, the development of road networks, telecommunication, power, irrigation infrastructures, transportation modes, etc., all form the foundational requirements for any successful industrialization of any economy.

Rooted in development planning framework, the early development of Nigeria's infrastructure occurred within a four development plans in quick succession, between 1962 and 1985. The first national development plan (NDP), 1962-1968, was launched with a capital expenditure profile of about N2.2 billion representing about 15% of GDP. The plan which was expected to generate a 4% GDP growth rate recorded in the overall an average of 4.7% during the plan period despite the civil war distortions which stampeded and reversed the actual initial growth rate of 5.8%. The provision of infrastructure was characterised and constrained by lack of executive capacity, insufficient feasibility studies and heavily dependence on 'mistrust' foreign experts and foreign aids. The second NDP 1970-1974 was designed with a capital expenditure of N3.2 billion and growth rate projection of 6.6%. Largely influenced by the inflow of oil revenue, the provision of infrastructural facilities and institutional reforms led to an average growth rate of

8.4%; the growth rates in agriculture and manufacturing were very minimal at low rates of 2% and 1.2% respectively perhaps due to the gestation period as compared to commerce and services sectors. Apparently during the second NDP 1970-1974 period, the macroeconomic impacts were compromised by slow rate of disbursement of negotiated and committed project aids and the

dominances of recurrent expenditure which were driven by transfer and administration.

In support of the philosophy and long term objectives of the second NDP to establish

Nigeria firmly as a united, strong, self-reliant economy, the capital expenditure profile of the third

NDP (1975-1980) was estimated at N30 billion; which was ten times the N3.2 billion of the second NDP. The third NDP led to the development and establishment of several educational and health institutions, roads and recreational facilities. The input-output multiplier effects were less reported as the era spurred and led to high inflation in Nigeria. The capital expenditure profile of the fourth NDP of 1981-1985 was conceived in the midst of quantum leap in government revenue of 1980 but its euphoria was short-lived as it overlapped with a period of economic recession accompanied by severe austerity measures of the Shagari regime. With the decline in oil price from $40/bbl in 1980 to $10/bbl in 1985, the era marked perennial fiscal deficit with rising internal loans as financed by the banking system and nonbank public.

**Empirical Review**

A significant number of empirical works have attempted to investigate and evaluate the impact of infrastructure on industrialization and consequently on economic growth. The disparity in their findings were in terms of both the sign and magnitude of the impact**.** Some of the studies found a positive and significant contribution of infrastructure provision to economic growth, but quite a few studies have found a weak or negligible impact. Some studies even report some statistically significant negative effects.

A landmark research work on the impact of public spending on capital and economic growth was that of Aschauer (1989a, 1989b). His work revealed a strong positive relationship between public capital and GDP growth. More specifically, his work found that a 1% rise in the public capital stock would raise total factor productivity is between 0.38% and 0.56%. This result is in sharp contrast to some other findings like that of Ratner (1983), who found the output elasticity of infrastructure capital to be 0.06. Aschauer's study has however generated some criticisms (Gramlich 1994, Jorgenson 1991, Tatom 1991a,

Tatom 1991b, Tatom 1993). The bone of contention is that the elasticity found by Aschauer is too high to be plausible. Tatom (1991a), for example, points out that the econometric analysis of Aschauer is not appropriate since it neglects the data's time series properties. Specifically, Tatom shows that the times series used by Aschauer are nonstationary. Rerunning the regression from Aschauer (1989a) with variables in first differences and including an energy price variable to control for oil price shocks, it turns out that infrastructure capital no longer appears to be significant.

Singer (2017) revealed that the challenge of poor economic performance that has confronted most economies especially the United States has awakened the interest in some older theories such as secular stagnation and one way to address such stagnation is rooted in infrastructure stimulus. While support for traditional physical infrastructure could help increase employment if it is debt funded, we should not expect it to address the underlying structural problems of low investment and productivity stagnation that face the U.S. economy. Nor will it do much to revitalize the U.S. manufacturing sector, which suffered unprecedented output and job losses in the 2000s. In addition, innovation-based growth seems to have stalled except in software. Filling potholes and repairing sewers will do nothing to address these deeper problems. Restoring an innovation and investment-led economy depends in part on spurring growth through investments in America's "innovation infrastructure," including scientific and engineering research in the public, academic, and private sectors. The work revealed that making expansion of "innovation infrastructure", the new infrastructure around such areas as R&D investment, advanced-technology development, scientific infrastructure, and advanced manufacturing, needs to play a key role in any Trump administration policy attacking the structural problems of low productivity and investment, which in turn affect GDP growth and quality job creation.

Sharma and Véganzonès-Varoudakis (2016) examined the role of infrastructure and information and communication technology (ICT) in the context of total factor productivity (TFP) and technical efficiency (TE) of the Indian manufacturing sector for the period 1994– 2008. The study used advanced estimation techniques to overcome problems of non-stationary, omitted variables, endogeneity and reverse causality by applying fully modified

OLS, panel co-integration and system GMM. The findings revealed that the impact of infrastructure and ICT is rather strong. However, the results also revealed that sectors that are relatively exposed to foreign competition, like Transport Equipment, Textile, Chemicals, Metal and Metal Products are more sensitive to infrastructure deficiencies.

Obokoh and Goldman (2016) in their investigation into the relationship between infrastructure deficiency and SME's performance in Nigeria, adopted a longitudinal approach in their research, conducting a survey among 500 SMEs in Nigeria. In order to validate their results, an interview was conducted in 2007 and 2011. The findings of the study revealed that the deficiency in infrastructure has negative impacts the profitability and performance of SMEs, due to the high cost incurred by SMEs in the self-provision of infrastructure and distribution of finished goods. Furthermore, despite the successful privatization of electricity production in November 2013, there is still no significant improvement in the power supply in Nigeria. Considering the small and medium enterprises as the backbone of every industrialization of any economy, until this hitches on the pathway of their productivity is addressed, the pathway to industrialization will remain blocked.

Ogunlana, Yaqub and Alhassan (2016) analyzed the effect of private and public investment on infrastructure and its impact on economic growth in Nigeria during the period 1970 to 2014.

The study employed Engel-Granger (1987) cointegration and Error correction mechanism (ECM). The findings showed that infrastructure components exert positive contribution on economic growth in Nigeria. Domestic investment on infrastructure and total labour force correlated with economic growth negatively. Efobi and Osabuohien (2016) examined how much the manufacturing sectors in the ECOWAS countries has been affected by infrastructural development and the distilling role of institutions. The study presented stylized facts that poor infrastructures in ECOWAS countries has been caused by poor institutions.

Sahoo and Bhunia (2014) investigated the China's manufacturing success and came with the findings that much of China's performance on the exports front had to do with specific government policies geared towards broadening and modernizing China's manufacturing base. Infrastructure helps determine the

success of manufacturing and agricultural activities (World Bank 2010). Infrastructure development is also a vital component in enhancing a country's productivity, and its firms' competitiveness (Graefe and Alexeenko, 2008). The result also revealed that India in contrast seemed to have skipped the industrial phase as its manufacturing sector is lurking in the shadows with minimal investment, shoddy policy formation and implementation, bad infrastructure and a lack of FDI. Nedozi, Obasanmi and Ighata (2014) evaluated the infrastructural development and economic growth in Nigeria: using simultaneous equation. The study applied the reduced form of the equations to regress growth of the economy on infrastructure.

The study has shown that infrastructure is an intermediate goods and service for the real sector and a finished goods and service for consumers.

Onakoya, Salisu, and Oseni (2012) investigated the impact of infrastructure on economic growth in Nigeria using a multivariate model of simultaneous equations. The paper also utilized three-stage least squares technique to capture the transmission channels through which infrastructure promotes growth. The research covered 40 years (1970 to 2010). The finding showed that infrastructural investment has a significant impact on output of the economy directly through its industrial output and indirectly through the output of other sectors such as manufacturing, oil and other services. The results also show a bi-directional causal relationship between infrastructure and economic growth.

Adelegan (2011) studied the impact of infrastructural deficiency and investment in manufacturing firms in Nigeria using microeconomic evidence to show the effects of poor infrastructural services on private investment in Nigeria. Using data from 70 manufacturing firms, the study finds that infrastructure deficiencies, proxied by an unreliable and inadequate power supply, significantly curtails productive investment by firms. As a result of poor public infrastructure, many firms have invested in complementary capital rather than in productive capital.

Kim (2006) conducted a study that examined the impact of infrastructural development for the economic development of the developing countries, lessons from Korea and Japan. The idea is that the developing nations can benefit a great deal if they can learn from the nations that are ahead of them. The study revealed that the Korean government had massively invested in

infrastructural development and this yielded a great dividend. The study showed that investment in transportation and energy sector under the Japanese colonial rule had a strong positive impact on the industrialization and urbanization in the Korean peninsula. The Korean government has been investing a great share of expenditure for the infrastructure development in the postwar period. Construction of roads, power stations, and communication created jobs and stimulated the economy of the regions, and thereby increasing total regional production. And infrastructure investment was able to reduce the production costs indirectly and raise their productivity, and it raised the production in the regions.

Adenikinju (2005) embarked on the analysis of the cost of infrastructural failures in a developing country, considering the case of Nigeria electricity sector. His findings revealed that the poor state of electricity supply in Nigeria has imposed significant costs on the business sector.

The bulk of these costs relate to the firms' acquisition of very expensive backup capacity to cushion them against the even larger losses arising from frequent and long power fluctuations. Small-scale operators are more heavily affected by the infrastructure failures as they are unable to finance the cost of backup power necessary to mitigate the impact of frequent outages.

**Theoretical framework**

The effect of infrastructure on productivity can theoretically be analyzed using the product function, cost function or profit function. But this study will anchor its analysis of the productivity effects of public infrastructure on the production function approach. This framework is adopted because it treats inputs as given and output as endogenous, contrary to the cost function approach that treats output and factor prices as exogenous, whereas factor inputs and costs are treated as endogenous.

The choice of production function approach is anchored on two major assumptions. The first is that it enables road infrastructure to enter the production function of a firm as a public intermediate input, and secondly, that production in the manufacturing sector can be described by an aggregate production function. As mentioned in section 2.1.2, that manufacturing will be

used as proxy for industrialization, we shall henceforth refer to manufacturing as industrialization.

The manufacturing sector uses many goods and services in production. Besides private inputs such as labor and capital, a manufacturing firm also uses publicly provided inputs, such as highways, roads, water and sewage facilities. The highways and roads are needed to transport raw materials, intermediate and finished goods as well as for employees commute to work. An increase in the stock of highways and roads increases the quantity of transportation services available to firms, thus leading to lower transportation costs. In addition, efficiency in private factor inputs utilization increases as well as the firm's productivity (Deno, 1988).

The theoretical foundation for the inclusion of public inputs into the private production is rooted in the works of Kaizuka (1965) and Sandmo (1972). These papers showed, similar to the famous paper by Samuelson (1954) dealing with a pure public good for consumers, that resources are allocated efficiently when the sum of private producer's marginal rate of substitution between a public good and the labor service is equal to the marginal rate of substitution between two goods in the public production of the public good.

**Methodology and model specification**

This study adopts the works of Stephane, Vellutin, and Warlters (2007) and Sahoo, Dash, and Nataraj (2010) approach to explain the effect of public and private sector investment in infrastructure and its impact on economic growth. The study employed a generalized CobbDouglas production function extended it within the framework of neoclassical growth model to capture infrastructure variables. The choice of this technique was premised on the fact that positive effect of infrastructure on economic growth could be detected easily. The production function for the economy can be expressed as:

$$y = \mathbf{f}(pvc, pbc, infr, lab) \quad \ldots \quad (1)$$

where y = output growth, pvc = private capital, pbc = public capital, infr = infrastructure and lab = labour input.

Equation (1) is characterized by a constant returns to (Solow, 1956). Some endogenous growth advocates have admitted the possibility of constant or

increasing returns to capital when the production function is disaggregated into private and public capital (Romer, 1987).

But an increase in public expenditure on infrastructure investment improves living conditions in the form of better education facility, good health, improved human capacity, and improved manpower skills etc. which enhances productivity and in the long run promotes economic growth.

The variable rgdp can be conveniently replaced by manufacturing output.

Equation (1) turns out to be as follows:

$$man_t = \alpha + \beta_1 pvc_t + \beta_2 pbc_t + \beta_3 lab_t + \beta_4 infr_t + \mu \quad \ldots (2)$$

Due to inadequate data on infrastructural variables, labour, private capital expenditure, expenditure on education and health, we shall proxy expenditure on infrastructure by government capital expenditure, and we shall proxy private capital by gross fixed capital formation, and drop expenditure on education and health.

$$Logrgdp_t = \alpha + \beta_1 logpvc_t + \beta_2 logpbc_t + \mu \quad \ldots (3)$$

This study employs econometric technique to analyze the effect of infrastructure finance on manufacturing sector in Nigeria. The data employed in the study were subjected to unit root test using the Augmented Dickey-Fuller Statistics (ADF) to determine the order of integration of the variables and also to prevent spurious regression results.

**Analysis of the results**

The data are confirmed to be integrated of order one, I(1) as indicated in table one below. The cointegration test was carried out to confirm the existence of a long run relationship between the variables but there is none as indicate with the probability value in table two.

The diagnostic checks were carried out and they were all satisfied. No serial correlation in the residuals, no heteroscedasticity and they are normally distributed as indicated in table three from the probability values which are greater than 5% which also confirmed the Durbin Watson statistic. We shall therefore estimate the relationship using the unrestricted vector autoregressive model due to lack of cointegration between the variables. The variance

decomposition of the two models is also presented along with the impulse and response function.

**Table 1: Unit root test**

| **Unit root test for Man** | | | | | | |
|---|---|---|---|---|---|---|
| **ADF Statistic** | -1.5829 | P value | 0.4805 | -6.17179** | P- value | 0.0000 |
| **1% level** | -3.6329* | | | -3.63941** | | |
| **5% level** | -2.9484* | | | -2.95113** | | |
| **10% level** | -2.61287* | | | -2.6143** | | |
| | | | | | | |
| **Unit root test for tce** | | | | | | |
| **ADF stat** | 2.797653* | P value | 1.0000 | -4.53885** | P- value | 0.0011 |
| **1% level** | -3.66166* | | | -3.66166** | | |
| **5% level** | -2.96041* | | | -2.96041** | | |
| **10% level** | -2.61916* | | | -2.61916** | | |

*at level, ** first differenced

Computed by the authors using Eviews 8.0

**Table 2. Cointegration test**

| **Trace Test** | | | |
|---|---|---|---|
| **Null** | Trace Statistic | Critical Value at 5% | Prob. Value |
| **None** | 10.49827 | 15.49471 | 0.2443 |
| **At most 1** | 2.514849 | 3.841466 | 0.1128 |
| **Max Eigenvalue test** | | | |
| **Null** | Max- | Critical value at | |

| | Eigen Statistic | 5% Critical Value | Prob. Value |
|---|---|---|---|
| **None** | 7.983421 | 14.2646 | 0.3804 |
| **At most 1** | 2.514849 | 3.841466 | 0.1128 |

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**Table 3: VAR Model**

MAN = C(1)*MAN(-1) + C(2)*MAN(-2) + C(3)*TCE(-1) + C(4)*TCE(-2) + C(5)

| | **Coefficient** | **t-Statistic** | **Prob.** |
|---|---|---|---|
| **C(1)** | 0.754361 | 4.087508 | 0.0003 |
| **C(2)** | 0.105336 | 0.575811 | 0.5692 |
| **C(3)** | 3.35E-13 | 0.52262 | 0.6052 |
| **C(4)** | 2.73E-13 | 0.388578 | 0.7004 |
| **C(5)** | 0.53224 | 0.945937 | 0.352 |
| **R-squared** | 0.797587 | | |
| **Adjusted Rsquared** | 0.769668 | | |
| **F-statistic** | 28.56782 | | |
| **Prob(F-statistic)** | 0.0000 | | |
| **Durbin-Watson stat** | | 2.030335 | |

Computed by the authors using Eviews 8.0

The overall fit of the model is very good from the R-square and the F-Statistic and its P-value. .

**Table 3. Residual Diagnostics**

| **Test type** | **P-Value** |
|---|---|
| **Breusch-Godfrey Serial Correlation LM Test** | 0.2487 |
| **Heteroskedasticity Test: Breusch-PaganGodfrey** | 0.941 |
| **Normal distribution: Jarque-Bera** | 0.173939 |

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In the short run within three years, public expenditure on capital does not impact the variations in the manufacturing sector. It only accounts for 3. 01 per cent.

But in the long run of about ten years, it accounts for about 21.16 per cent changes in the manufacturing sector. On the other hand, the variance decomposition of total capital expenditure, manufacturing output does not contribute to the variations in the total capital expenditure both in the short run and long run. It accounts for only 7.9 and 8.2 per cent respectively.

**Table 4. Variance decomposition**

| **Variance Decomposition of MAN:** | | | |
|---|---|---|---|
| **Period** | S.E. | MAN | TCE |
| **1** | 1.176893 | 100.0000 | 0.000000 |
| **2** | 1.492280 | 99.39133 | 0.608673 |
| **3** | 1.749125 | 96.98554 | 3.014461 |
| **4** | 1.962393 | 93.84015 | 6.159850 |
| **5** | 2.137922 | 90.55789 | 9.442114 |
| **6** | 2.280660 | 87.46461 | 12.53539 |
| **7** | 2.394587 | 84.71538 | 15.28462 |
| **8** | 2.483615 | 82.36502 | 17.63498 |
| **9** | 2.551629 | 80.41512 | 19.58488 |
| **10** | 2.602362 | 78.83971 | 21.16029 |

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| **Variance Decomposition of TCE:** | | | |
|---|---|---|---|
| **Period** | S.E. | MAN | TCE |
| **1** | 3.54E+11 | 3.535813 | 96.46419 |
| **2** | 4.74E+11 | 8.194887 | 91.80511 |
| **3** | 5.31E+11 | 7.930546 | 92.06945 |
| **4** | 5.62E+11 | 7.336302 | 92.66370 |
| **5** | 5.79E+11 | 6.908888 | 93.09111 |

| | | | |
|---|---|---|---|
| **6** | 5.89E+11 | 6.760049 | 93.23995 |
| **7** | 5.94E+11 | 6.883951 | 93.11605 |
| **8** | 5.97E+11 | 7.221543 | 92.77846 |
| **9** | 5.99E+11 | 7.694582 | 92.30542 |
| **10** | 6.01E+11 | 8.226962 | 91.77304 |

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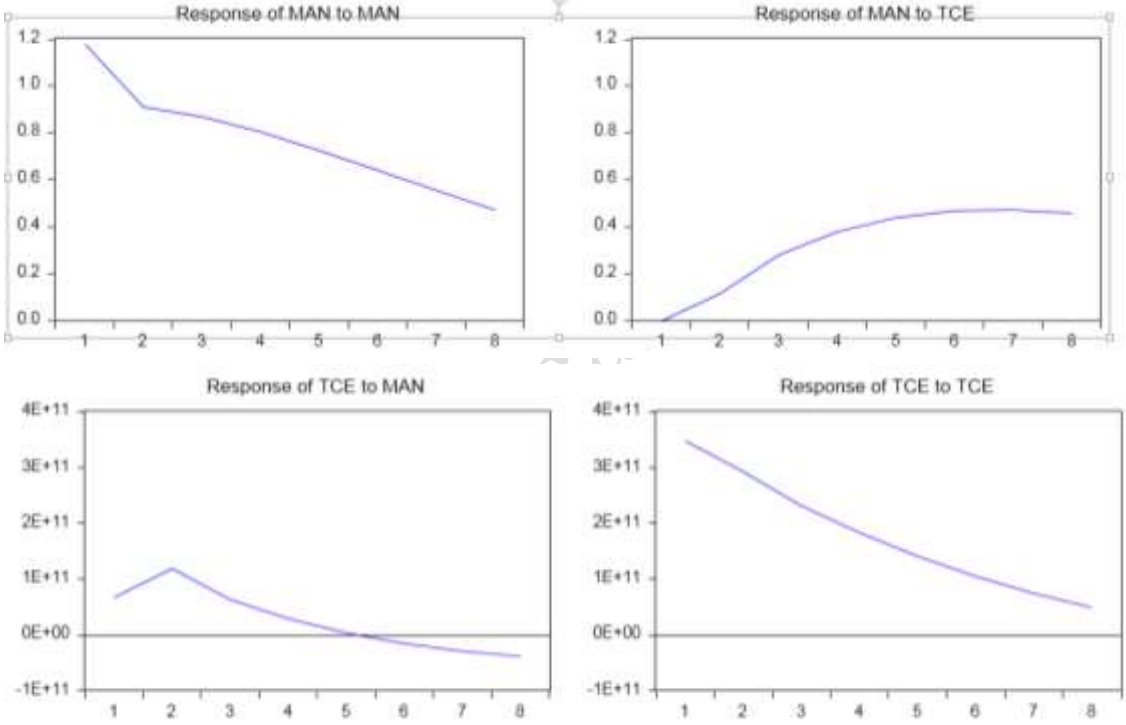
**Fig. 1: Impulse Response function of one standard deviation shocks.**

Response to Cholesky One S.D. Innovations




The results of the variance decomposition was confirmed by the impulse response function of manufacturing output to a shock in public expenditure. The response starts at a low level and gradually builds up in the long run.

## Conclusion and Recommendation

This study has demonstrated that the commitment of government to building the infrastructural base of the economy may not yield significant impact on the manufacturing output and consequently industrialization in the short run, due to the fixed nature of the infrastructural projects. But in the long run, it exerts a

heavier impact on the manufacturing sector. This result satisfies the a priori expectation of the relationship between public expenditure and industrialization.

In order to address the gross malfunctioning of the industrial sector resulting from despicable infrastructural deficiency in the country, it is expedient that the government begins to have a proper projection and execution of the expected expenditure in the infrastructural facilities that will eventually boost the manufacturing and industrial sector. Expenditure on power, roads, rail lines, and so on has be very deliberate and consistent to make the desired impact on the manufacturing output and consequently the industrialization of the economy.

## References


ADB (2011). Infrastructure and growth in Sierra Leone.

Adelegan, O. J. (2011). Infrastructure deficiencies and investment in manufacturing firms in Nigeria. *Journal of Economics and International Finance*. (3) 9, 542-552.

Adenikinju, A. (2005). Analysis of the cost of infrastructure failures in a developing economy: The case of the Electricity Sector in Nigeria, *AERC Research Paper 148*, African Economic Research Consortium, Nairobi.

Akinlo, A.E. (2008). Energy consumption and economic growth: Evidence from 11 Sub-Sahara African countries, *Energy Economics* 30, 2391–2400.

Andreas, S. (1997). The Impact of Road Infrastructure on Productivity and Growth: Some Preliminary Results for the German Manufacturing Sector. *WZB Discussion Paper*, No. FS IV 97-47

Ayodele, A. I. and Falokun, G. (2003) The Nigerian Economy*:* Structure and Pattern of Development**.** *JODAD Publishers*.

Azémar, C. & Desbordes, R., 2009, 'Public governance, health and foreign direct investment in Sub-Saharan Africa', *Journal of African Economies*, Vol 18(4), 667–709.

Deno, K. T. (1988). The Short-Run Relationship between Investment in Public Infrastructure and the Formation of Private Capital, *Southern Economic Journal*, 55, 400–411. Dupasquier, C. & Osakwe, P.N.(20060. Foreign direct investment in Africa: Performance, challenges and responsibilities. *Journal of Asian Economics* 17, 241–260.

Efobi, U. R. and Osabuohien, E. S. (2016). Manufacturing Export, Infrastructure and Institutions in Africa: Reflections from ECOWAS. *Researchgate. https://www.researchgate.net/publication/281237132.*

Esfahani, H. and Ramíres, M.T. (2003). Institutions, Infrastructure and Economic Growth. *Journal of Development Economics* 70, 443–477

Fedderke, J and Garlick, R. 2008. Infrastructure development and economic growth in South Africa: a review of the accumulated evidence. *Policy Paper No 12*. School of Economics, University of Cape Town and Economic Research Southern Africa.

Graefe, Laurel and Galina Alexeenko. 2008. 'Building a BetterWorld: Infrastructure's Role in Economic Growth.' *Econ South Magazine*. 10 (2).

Gramlich, E. M. (1994). Infrastructure Investment: A Review Essay. *Journal of Economic Literature*, 32, 1176–1196.

Jorgenson, D. W. (1991). Fragile Statistical Foundations: The Macroeconomics of Public Infrastructure Investment, in Paper presentated at the American Enterprise Institut Conference on Infrastructure Needs and Policy Options for the 1990s.

Kaizuka, K. (1965). Public Goods and Decentralization of Production. *Review of Economics and Statistics*, 47, 118–120.

Kirkpatrick, C., Parker, D, Zhang, Y. (2004). Foreign Direct Investment in Infrastructure in Developing Countries: Does Regulation Make A Difference? *Centre on Regulation and Competition, WP No. 85*, ISBN: 1-904056-84-9.

Kim, B. (2006). Infrastructure Development for the Economic Development in Developing Countries: Lessons from Korea and Japan. *Graduate School of International Cooperation Studies (GSICS Working paper series*, number 11.

Lin, J. Y. ( 2010). New Structural Economics A Framework for Rethinking Development. *Policy Research Working Paper* 5197

Mitra, A., Sharma, C. and Véganzonès-Varoudakis, M. (2016). Infrastructure, ICT and Firms' Productivity and Efficiency: An Application to the Indian Manufacturing. *India Studies in Business and Economics 17-41*

Nedozi, F. O., Obasanmi, J. O. and Ighata, J. A. (2014). Infrastructural Development and Economic Growth in Nigeria: Using Simultaneous Equation. *Journal of Economics*, 5(3): 325-332 Nigeria Industrial Revolution Plan (2014).

Obokoh, L.O. and Goldman, G. (2016). Infrastructure deficiency and the performance of small- and medium-sized enterprises in Nigeria's Liberalised Economy. *Independent Research Journal in the Management Sciences.* 1-10.

Ogunlana, O. F., Yaqub, J. O. and Alhassan, B. T. (2006). Infrastructure finance and development in Nigeria. *Arabian Journal of Business and Management Review (Nigerian Chapter).* (3) 12, 44-54.

Onakoya, A. B. , Salisu, A. A. and Oseni, I. O. (2014). Infrastructure and economic growth in Nigeria: A multivariate approach. *Research Journal of Business Management and Accounting.* (1) 3, 030 - 039

Oseni, M.O. & Pollitt, M.G., (2013). The economic costs of unsupplied electricity: Evidence from backup generation among African firms, *Energy Policy Research Group Working Paper 1326, Cambridge Working Papers in Economics* 1351, Cambridge University Press, Cambridge

Phang, S. (2003). Strategic development of airport and rail infrastructure: the case of Singapore. *Transport Policy*, 10, 27-33

Pradhan, R.P., Norman, N. R., Badir, Y., and Samadhan, B. (2013). Transport Infrastructure, Foreign Direct Investment and Economic Growth Interactions in India: The ARDL Bounds Testing Approach. *Social and Behavioural Sciences*, 2013.

Ratner, J. B. (1983). Government Capital and the Production Function for U.S. private Output, *Economic Letters*, 30, 213–217.

Romer, P.M.(1987). Crazy Explanations for Productivity Slowdown in S. Fischer ed., *NBER Macroeconomics Annual*, MIT Press, Cambridge, pp. 163-202.

Sahoo, P,. Dash, R. K. and Nataraj, G. (2010). Infrastructural development and Economic growth in China. *IDE Discussion Papers*. No 261.

Sahoo, P and Bhunia, A. (2014). China's Manufacturing Success: Lessons for India. *IEG Working Paper* No. 344.

Samuelson, P. A. (1954). The Pure Theory of Public Expenditure. *Review of Economics and Statistics*, 36, 387–389.

Sandmo, A. (1972). Optimality Rules for the Provision of Collective Factors of Production. *Journal of Public Economics*, 1, 149–157.

Short, J., & Kopp, A. 2005, Transport Infrastructure: investment and planning policy and research aspects. *Transport Policy*, 12, 360e367.

Simanda, D. (2009). Industrialization. *Researchgate.*: https://www.researchgate.net/publication/305725435

Singer, P. L. (2017). Investing in "Innovation Infrastructure" to Restore U.S. Growth. *Information Technology and Innovation Foundation*. 1-15.

Solow, R. (1956). A Contribution to the Theory of Economic Growth, *Quarterly Journal of Economics*, 70: 65-94.

Stephane, S. Vellutin, C and Warlters, M. (2007). Infrastructure and Economic Growth in East Asia, *The World Bank, Policy Research Working Paper, No.4589*.

Szirmai, A, (2009). Industrialisation and an engine of Growth in developing countries, 1990-2005. *Paper presented at the UNU – WIDER, UNU – MERIT UNIDO* Workshop on Pathways to Industrialization in the 21st Century: New Challenges and Emerging Paradigms; 22-23 October, 2009.

Tatom, J. A. (1991a). Public Capital and Private Sector Performance. *Federal Reserve Bank of St. Louis Review*, May/June, 3–15.

Tatom, J. A (1991b). Should Government Spending on Capital Goods Be Raised? *Federal Reserve Bank of St. Louis Review*, March/April, 3–15.

Tatom, J. A. (1993). Is an infrastructural crisis lowering the nation's productivity? *Federal Reserve Bank of St. Louis.* 1993.

UNCTAD (2006): The Least Developed Countries Report 2006. New York and Geneva. http://unctad.org/en/Docs/ldc2006_en.pdf

United Nations (2016). Sustainable Development Goals 9. https://sustainabledevelopment.un.org/?menu=1300.

UNIDO (2016). The Role of Technology and Innovation in Inclusive and Sustainable Industrial Development. *Industrial Development Report 2016.*

Wang, E. C. 2002, Public infrastructure and economic growth: a new approach applied to East Asian Economies. *Journal of Policy Modelling*, 24, 411e435.

World Bank (1999). Transport in China: An evaluation of World Bank Assistance Report No. 18865. Washington, D.C.: World Bank.

World Bank (2010). Foreign Direct Investment – the China story. World Bank Feature story.

World Bank (2014). Building integrated markets within the East African Community: EAC opportunities in public-private partnership approaches to the region's infrastructure needs, *International Bank for Reconstruction and Development/ World Bank*, Washington, DC.

Zhang, J. and Gao, Y. (2007). Why China possesses such good infrastructure? *China Economic Review* 3, 4-19.