AN EMPIRICAL ANALYSIS OF INFRASTRUCTURE INVESTMENT AND MSMES’ PERFORMANCE IN NIGERIA

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Abstract
This paper analyses empirically the effects of infrastructure investment on four critical infrastructures (electricity; transport; water; and communications) on the performance of MSMEs in Nigeria. An extended Cobb-Douglas production function was utilized. Input in the production process represents infrastructure investment and the output is represented by the performance (proxied by annual turnover) of MSMEs. A total of seven hundred (700) randomly selected firms were surveyed using a structured questionnaire. Analysis of regression results found that adequacy of water infrastructure and adequacy of communication have negative co-efficient though significant in explaining changes in MSMEs performance. However, adequacy of transport (road) infrastructure and adequacy of electricity infrastructure showed not only negative co-efficient but also insignificant in explaining changes in MSMEs’ performance. The Small and Medium Enterprise Development Agency of Nigeria (SMEDAN) is charged to play its role in infrastructure investment deployment, and also revisit the objectives of the set-up of industrial parks to nurture MSMEs within an environment with the critical infrastructure. Implementation of public-private partnership (PPP) for the provision of critical infrastructure in Nigeria is suggested, while Non-governmental organizations (NGOs), international agencies and philanthropists should be encouraged to complement government efforts in the provision and repair of existing infrastructure.

Keywords: Infrastructure Investment, Performance, Enterprises, SMEDAN, MSMEs.

Background: Introduction
Infrastructure refers to “assets” such as large-scale public systems; services and facilities of a country or region that are necessary for economic activity. Infrastructure can be classified into several sub-groups but two sub-groups that have been most prominent are economic (physical) and social infrastructure. Economic infrastructure is defined as the infrastructure that promotes economic activity, such as roads, highways, railroads, airports, sea ports, electricity, telecommunications, water supply and sanitation. Social infrastructure (such as schools, libraries, universities, clinics, hospitals, courts, museums, theatres, playgrounds, parks, fountains and statues) is defined as the infrastructure that promotes the health, education and cultural standards of the population – activities that have both direct and indirect impact on the welfare. Concepts such as institutional infrastructure, and critical infrastructure, hard and soft infrastructure have come up in the literature, but often, these are re-classifications of items that fall under physical and social infrastructure (Adenikiju, 2005).
In this paper, the critical infrastructure in focus includes the following: water, electricity, transport (roads), and communications. We argue that these are the key critical infrastructure for the expansion of the productive capacity at enterprise level. Infrastructure is the foundation for the operation of enterprise; the society and the economy for the achievement of optimal productivity.

Infrastructure investment is the channelling of financial resources into the provision of “assets” (i.e facilities and services) that are essential for a functioning economy. Infrastructure investment would cover spending on new assets and the improvement of existing ones. Infrastructure investment is capital-intensive and often involves long-term cash flows. Infrastructure investment in most developing countries has been the responsibility of the government. However the reality is that government in most of these developing countries, including Nigeria are faced with dwindling resources, and have found it increasingly difficult to keep pace with adequate provision and maintenance of infrastructure. MSMEs in Nigeria have had to resort to making infrastructure investments to be able to play their role in economic development. Infrastructure investments by MSMEs however has the likely effect of shifting of resources away from core productive investment; raise capital costs, result in underutilization of existing productive capacity, constrain short-run productive efficiency and output growth of firms. The main question which this paper addresses is to examine if there is any relationship between infrastructure investment and performance of MSMEs in Nigeria? The objective of the paper is therefore to determine the relationship between infrastructure investments and the performance of MSMEs in Nigeria. This paper is structured into five sections, including this introduction. Section two gives a review of the state of infrastructure in Nigeria, and some of the challenges often associated with infrastructure investment. The section also presents the theoretical framework of the study from which this paper is drawn. Section three highlights methodological issues, focusing on the research design, sampling procedure, questionnaire administration and returns. Section four presents the results and discussions, while section five provides some policy recommendations and conclusions.

The State of Infrastructure in Nigeria
In Nigeria, the state of the totality of the national infrastructure is generally adjudged to be in a deplorable and decaying state. The government, MSMEs and even households are all variously negatively affected by huge infrastructure deficits despite the investments made by various bodies at national and international levels of commitments. The Nigerian government currently invests about 7% of GDP on infrastructure, which is above the average for sub-Saharan Africa (Foster and Pushak, 2011). Research has shown the need to increase this figure to at least 12% of GDP. Overall, the country requires an annual investment of US$10 billion over the next ten years in order to reduce its infrastructural deficit; an amount the Nigerian government cannot solely provide. The non-availability of long-term funds, absence of risk sharing structures, lack of clarity around the governance of the PPP framework, and a dearth of expertise to assist banks and other firms engaged in infrastructure financing, are some of the challenges that are hampering infrastructure investments efforts. In general, infrastructure investment is a capital-intensive process involving large initial costs, low operating costs and long term finance given the gestation period of projects. Infrastructure projects are often characterized by non-recourse or limited recourse financing i.e. lenders can only be repaid from the revenues generated by the projects. This results in greater market and commercial risks for the lender, who has to be prepared for a longer

1 Whether economic (physical); social; critical; institutional, hard or soft infrastructure amongst other classifications.
horizon of debt repayment. The non-recourse nature, unique risks, and complexity of arrangements also call for special appraisal skills. In addition to general project risks, some infrastructure projects typically possess externalities, whereby the social returns are often greater than the private returns. This necessitates some form of subsidization, such as government guarantees or viability gap funding, in order to attract the private sector. Government has traditionally been the main financier of infrastructure projects, including responsibilities for implementation, operations and maintenance. However, declining financial resources and competing priorities have made it difficult to continuously utilize the fiscal budget. Experience has shown that funding for infrastructure through budgetary allocations can be volatile and inadequate.

In what follows we shall give an overview of the state of each of the infrastructure under consideration:

**Electricity**

Electricity is almost a necessary and essential requirement for all activities. Electricity generation continues to be a drag to overall development of the country in spite of enormous resources that have been invested in it to ensure efficiency and reliability (CBN, 2010). According to the chairman of the Nigerian Electricity Regulatory Commission (NERC), generation went down to as low as 2000MW, but later increased to 4700MW. Though the country’s installed capacity stands at 11,165.40MW, the network operational capability has remained 5,500MW, and this has been the peak generation ever attained. For majority of the populace, electricity generation is characterized by a high cost of service and low accessibility to what is supplied.

**Transport (ROAD)**

Transport infrastructure is in various stages of disrepair and disuse, and deplorable conditions. The railway system is in a state of near collapse while the airports and waterways parade obsolete equipment and poor patronage. Nigeria has the largest road network in West Africa and second largest in south of Sahara. About 95 percent of passenger and freight movements are by roads in Nigeria (Filani, 2013). Nigeria has a total road network of about 193200 km; rail network 3505 km; airport, 56km, which is deemed adequate relative to population size (Ahmed, 2010). Buhari, (2000) reported that there are 32,000km Federal Highways, 30,500km state roads and 130,000km local roads in Nigeria. However, 70 percent of these roads are in deplorable condition while 30 percent are in fairly good condition (Onolememen, 2013). The country is an emerging economy with exploding road infrastructure investments with a growing funding gap between public spending on road infrastructure and capital needed to build new road, upgrade and maintain the existing ones. Onolememen (2013) observed that about N500billion will be needed over ten years to fix, build and reconstruct ailing roads. Vision 20:2020 (2010) also estimated about N300 billion will be required over the next 10 years to put Nigerian roads in satisfactory usable condition.

**Water**

Water is critical to enterprise development and economic growth as well as the health needs of the populace. According to Federal Ministry of Water Resources (2011) report, Nigeria has huge water resources estimated at 267 billion cubic meters of surface water and 92 billion cubic meters of ground water. The current water supply coverage is 58 percent while sanitation is 32 percent while about half of Nigerian population has no access to portable water supply. The poor state of water infrastructure account for 5 percent loss of US$28.4 billion annually and 40 billion work loss annually. NBS general households survey shows that in 2007, 10.4% of Nigerians obtained water supply from pipe borne water, 26.8% from
bore hole, 33.3% from well, 24.4% from streams/ponds and 4.1% from trucks/van, i.e. water vendors (NBS, 2008). Also, between 1990 and 2008, access to improved sanitation in urban areas declined from 39% to 36%. This suggests that water and sanitation infrastructure in the country is grossly inadequate and has implications for wealth creation and economic development. These scenarios show that Nigeria has a long way to go in achieving the 20:2020 visions.

Communications
The decade from 2000 till date had been described as Nigeria’s telecommunications revolution, given the quantum of growth in the diverse fields of telecommunications services delivery, and regulatory advancements. The country witnessed a telecommunications revolution as the number left from a paltry 400,000 telephone lines in 2000, to 130 million active subscriber lines as at June 2014. This leap was massive, phenomenal and marked a paradigm shift from the era of monopoly of NITEL as a national carrier, to the era of easy accessibility to mobile communications with GSM. According to NCC (2014), more than N300 billion has been contributed to the coffers of the federal government through frequency spectrum sales, enabling government to plough back revenues earned from the sector for funding development infrastructure at the various levels of government. Investment levels in the sector are forecast to reach a cumulative $1.4 trillion in the six years between 2015 through to 2020. Operators are likewise, making significant investments in next-generation mobile networks to meet capacity demands and expand coverage. About $32 billion has been invested in the telecoms sector, and this is expected to appreciate as the country strives to deepen broadband infrastructure and access. There is also a forecast that by 2020, almost 60 per cent of the global population will subscribe to mobile services, up from half of the population at the end of 2014. Migration to mobile broadband networks and rising smartphone penetration will see the mobile industry making an increasing contribution to global GDP, public funding and employment, as well as improving the lives of billions of citizens around the world.

Theoretical Framework
The study had its theoretical underpinning on the pioneering works of Cobb and Douglas (1928), Tinbergen (1942) and Solow (1956, 1957), where the authors used investment in form of capital accumulation and postulated that accumulation of capital in form of investment as an important source of firms’ growth. The extended Cobb-Douglas production function was adopted to analyze the effect of infrastructure investments on performance of firms. A generalised Cobb-Douglas production function is assumed to include infrastructure investment as input and the performance of MSMEs as the output. The production function in its general form is purely a technological relationship between quantities of inputs and outputs given as:

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

Where Y is unit of output, K is capital input and L is labour input. When expanded and transformed into a Cobb-Douglas production function, equation (1) can be written as:

\[ Y = AK^\alpha L^\beta \] ............................................................... (2)

Re-specifying equation (2) to include other factors that can hinder the income of MSMEs. These factors are called “externalities”.

\[ Y = AK^\alpha L^\beta E^\gamma \] ............................................................... (3)

Where \( E^\gamma \) represents externalities, that is other factors that can hinder the income of MSMEs. The externalities function is given by;
\[ E^Y = E(E_1^{Y_1}, E_2^{Y_2}, E_3^{Y_3}, E_4^{Y_4}) \] ............................ (4)

To incorporate the various components of externalities into the model, substitute equation (4) into (3):
\[ E = A K^\alpha L^\beta E_1^{Y_1} E_2^{Y_2} E_3^{Y_3} E_4^{Y_4} \] ............................ (5)

Since the Cobb-Douglas production function usually exhibits a non-linear relationship, therefore the appropriate transformation for the estimation is to take the natural logarithm of both sides of the model as represented in equation (6) to yield a linear function expression.
\[ Ln Y = A + \alpha \ln K + \beta \ln L + \gamma_1 \ln E_1 + \gamma_2 \ln E_2 + \gamma_3 \ln E_3 + \gamma_4 \ln E_4 + \mu \] ............................ (6)

The model is expressed in logarithm form for the purpose of linearizing it. This is necessary in order to remove variation in the data and also to minimise bias in the data collected (Damodar and Dawn, 2009).

Following from equation (6), the empirical model to be estimated in this study can be fully specified as thus:
\[ Ln Y = \alpha_0 + \alpha_2 \ln AdqIF + \alpha_3 \ln NEMP + \alpha_4 \ln ACEF + \alpha_5 \ln ASEB + \alpha_6 \ln GOPO + \alpha_7 \ln LOFI + \mu \] ............................ (7)

The definitions and measurements of variables are shown in Table 1.

<table>
<thead>
<tr>
<th>Variable name</th>
<th>Variable description</th>
<th>Measurement</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Y)</td>
<td>Performance of MSMEs</td>
<td>( \leq \text{N20,000 (1), N35,000 (2), N62,500 (3), N87,500 (4), N100,000 and above (5)} )</td>
</tr>
<tr>
<td></td>
<td>Proxied by the annual turnover by the enterprise</td>
<td></td>
</tr>
<tr>
<td>AdqIF</td>
<td>Adequacy of infrastructure</td>
<td>Quite adequate 1, adequate 2, fairly adequate 3, not adequate 4</td>
</tr>
<tr>
<td>NEMP</td>
<td>Number of employees</td>
<td>Units (number)</td>
</tr>
<tr>
<td></td>
<td>This is the number of people engaged in production activities. This also defines the category/size of the firm going by the NBS/SMEDAN definition of MSMEs. Employment generation in Nigeria is likely to have a significant relationship with enterprise performance.</td>
<td></td>
</tr>
<tr>
<td>ACEF</td>
<td>Extent of access to infrastructure</td>
<td>Readily accessible 1, accessible 2, fairly accessible 3, not accessible 4</td>
</tr>
<tr>
<td></td>
<td>Extent of access refers to the degree to which infrastructure is accessible to micro enterprise for efficiency in operations. This variable is expected to have positive relationship with enterprise performance.</td>
<td></td>
</tr>
<tr>
<td>ASEB</td>
<td>Assets base requirements</td>
<td>Value (₦)</td>
</tr>
<tr>
<td></td>
<td>This is also known as asset base financing and it is needed for smooth running of business enterprise. It is a means of</td>
<td></td>
</tr>
</tbody>
</table>
fast growing business entities in order to meet up their short term cash requirements. Average annual working capital is used to proxy ASEB in this study, and is expected to have positive relationship with enterprise performance.

<table>
<thead>
<tr>
<th>GOPO</th>
<th>Government policy</th>
<th>Affected 1, not affected 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Includes- taxation and subsidies are used to regulate the activities of MSMEs in Nigeria. For example, increase in taxation will lead to a fall in the performance of the micro enterprise, while subsides are forms of government support that are expected to enhance their performance.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>LOFI</th>
<th>Location of firm</th>
<th>Within industrial estate 1, Outside industrial estate 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>This describes the area or a place where the MSMEs is located. It is determined by the accessibility and adequacy of infrastructure. This can also be either positively or negatively related to enterprise performance depending on the nature of business.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Methodology**

The research design for this study was a cross-sectional survey approach to collect data from a selected sample of MSMEs in the six geopolitical zones of the country including the Federal Capital Territory (FCT), Abuja. From the Nigerian perspective and for the purpose of this study we adopted the definition of MSMEs given by the National Bureau of Statistics (NBS) and Small and Medium Enterprises Development Agency of Nigeria (SMEDAN) in 2010. The distribution of MSMEs in Nigeria as reported by NBS and SMEDAN (2010) is shown on Table 2.

<table>
<thead>
<tr>
<th>Size Category</th>
<th>Employment</th>
<th>Assets</th>
<th>% National Distribution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Micro</td>
<td>Less than 10</td>
<td>5 million</td>
<td>99.87</td>
</tr>
<tr>
<td>Small</td>
<td>10 to 49</td>
<td>5-50 million</td>
<td>0.12</td>
</tr>
<tr>
<td>Medium</td>
<td>50 to 199</td>
<td>50-500 million</td>
<td>0.01</td>
</tr>
</tbody>
</table>

*Source: NBS and SMEDAN (2010)*

The study employed purposive sampling technique to select one representative state in each of the six geopolitical zones of the country and the Federal Capital Territory (FCT), Abuja. The states selected were Abia (South-East), Cross Rivers (South-South), Lagos (South-West), Sokoto (North-West), Kwara (North-Central), and Bauchi (North-East). The states were selected on the basis of concentration of business enterprises and relative socio-political stability.

Structured questionnaires were used to collect primary data from the owners or representatives of micro enterprises. In each of the six states and FCT, 100 copies of the structured questionnaire were administered on randomly selected micro, small and medium sizes enterprises respectively. This gives a total of 700 micro enterprises as sample for the study. However a total of six hundred and ninety eight (698) micro enterprises provided useful information for the study, giving a response rate of 99.71 percent.

Data was collected on the profile, characteristics, and activities of micro enterprises in relation to infrastructure investment; types of and quantum of infrastructure investment made; and the challenges of infrastructure investment. Data was also collected on the how

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2 There is no universally accepted definition of MSMEs, different regions and countries have defined MSMEs based on local operations and conditions.
infrastructure investment had affected the business performance of the micro enterprises in the following respects: output level, sales volume, employment level, capital stock and profit level.

Regression Analysis of the Relationship between Infrastructure Investments and the Performance of MSMEs in Nigeria

The extended Cobb-Douglas production function was used to analyse the effect of infrastructure investments on performance of surveyed MSMEs. The regression analysis was done to achieve the best functional form for the model earlier specified showing maximum significant variables. The results are presented in table 3 below:

<table>
<thead>
<tr>
<th>Dependent Variable</th>
<th>Independent Variable/Constant</th>
<th>Coefficients</th>
<th>T-Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\ln Y$</td>
<td>$C$</td>
<td>3.589497</td>
<td>8.894008*</td>
</tr>
<tr>
<td>$\ln ADTSR$</td>
<td></td>
<td>-0.040766</td>
<td>-1.089351</td>
</tr>
<tr>
<td>$\ln ADELE$</td>
<td></td>
<td>-0.104467</td>
<td>-1.35942</td>
</tr>
<tr>
<td>$\ln ADWAT$</td>
<td></td>
<td>-0.137596</td>
<td>-2.166262**</td>
</tr>
<tr>
<td>$\ln ADCOM$</td>
<td></td>
<td>-0.125682</td>
<td>-1.681318***</td>
</tr>
<tr>
<td>$\ln ACEF$</td>
<td></td>
<td>-0.017072</td>
<td>-0.116897</td>
</tr>
<tr>
<td>$\ln NEMP$</td>
<td></td>
<td>0.523891</td>
<td>5.899866*</td>
</tr>
<tr>
<td>$\ln ASEB$</td>
<td></td>
<td>9.75E-09</td>
<td>4.405254*</td>
</tr>
<tr>
<td>$\ln GOPO$</td>
<td></td>
<td>-0.463133</td>
<td>-3.000310*</td>
</tr>
<tr>
<td>$\ln LOFI$</td>
<td></td>
<td>-0.101343</td>
<td>-0.769405</td>
</tr>
<tr>
<td>$R^2$</td>
<td></td>
<td>0.183089</td>
<td></td>
</tr>
<tr>
<td>Adjusted $R^2$</td>
<td></td>
<td>0.167836</td>
<td></td>
</tr>
<tr>
<td>F-statistic</td>
<td></td>
<td>12.00307</td>
<td></td>
</tr>
<tr>
<td>D-W stat</td>
<td></td>
<td>1.401744</td>
<td></td>
</tr>
</tbody>
</table>

Source: Data analysis, 2014
Note: below indicates the significant level of t-value.
*significant at 1%, **significant at 5% level and ***significant at 10%.

Table 3 shows the regression result with a positive intercept. This implies that the performance of MSMEs before any investment on infrastructure is made is greater than zero and that the performance of MSMEs largely depends on infrastructure investment. The adequacy of water infrastructure shows a negative beta coefficient which denotes that the higher the adequacy of investment made on water, the lower the performance level of MSMEs. This does not follow the apriori expectation because any investment made on water infrastructure is expected to yield positive effect on the performance of MSMEs. The negative beta coefficient of adequacy of communication infrastructure also implies that the higher the adequacy of investment made on communication infrastructure, the lower the performance level of MSMEs. This as well negates the theory. The negative beta coefficient of extent of accessibility to infrastructure connotes that the lower the degree of access to infrastructure investment, the higher the performance level of MSMEs. This does not conform to the apriori expectation because the more access to infrastructure investment, the greater the performance of MSMEs. However, the positive beta coefficient of number of employees used in production means that the more number of employees employed by firms, the higher the performance level of MSMEs. This is also in line with the apriori expectation because the larger the share of MSMEs employment, the greater the performance level of MSMEs in the country. Similarly, the positive beta coefficient of assets based requirements of an enterprise connotes that the more funds available to finance the enterprise, the greater
the performance level of MSMEs. This also conforms to the apriori expectation because enterprise with more assets has greater opportunities to convert such assets to cash in order to finance the enterprise and thereby brings about better performance of MSMEs. In additional, the negative beta coefficient of government policy implies that the more strict or unfavourable such policies to enterprises, the lower the performance level of MSMEs in the country. Lastly, the negative beta coefficient of location of firm connotes that the less an enterprise is required to be located within the industrial estate, the greater the performance level of MSMEs. This does not follow the apriori expectation because enterprises locating within the industrial estate have greater opportunities to source of raw materials and also enjoy some other economies of scale which thereby transform to the development of MSMEs in the country.

The estimation results show that the variables adequacy of water infrastructure, adequacy of communication infrastructure, number of employees used in production, assets base requirements and government policy are statistically significant in explaining changes in the performance level of MSMEs. However, adequacy of transport (road) infrastructure, adequacy of electricity infrastructure, extent of accessibility to infrastructure and location of firm are not statistically significant in explaining changes in the development of MSMEs. For instance, a percentage increase in adequate investment made on water infrastructure will bring about a decrease in sales turnover or retard the performance level of MSMEs by 14 per cent. Also, a percentage increase in adequate investment made on communication will bring about a decrease in sales turnover or retard the performance level of MSMEs by 13 per cent. More so, a percentage increase in the number of employees used in production will bring about an increase in sales turnover or promote the performance of MSMEs by 52 per cent. In addition, a percentage increase in assets based requirements of an enterprise will bring about an increase in sales turnover or enhance the performance of MSMEs by 97 per cent. Lastly, a percentage increase in government policy on enterprises will bring about a decrease in sales turnover or limit the performance level of MSMEs by 46 per cent.

The F-statistic value (12.00307) shows that the overall model is statistically significant at 1% and 5% levels of significance. This is because it is greater than the critical values of 2.51 and 1.94 at 1 % and 5 % respectively. This means that all the explanatory variables simultaneously explain the variations in the development of MSMEs. Also, the variables are statistically significant at 99% confidence interval with the exception of ADWAT and ADCOM which are significant at 95% and 90% confidence intervals respectively.

The co-efficient of determination (R²) reveals that about 18 per cent of the change that occurred in the development of MSMEs can be explained by the explanatory variables in the model.

Furthermore, the DW-statistic which is a measure of auto correlation shows that the model is free from the problem of serial correlation with the value of 1.40. As a result of this, the model estimated can be confidently relied upon for making inferences.

**Conclusion and Recommendations**

Electricity, transport (road), water and communications are critical infrastructure necessary for the growth and development of MSMEs. These critical infrastructure are important for enterprise growth irrespective of firm size. Our research findings showed that these infrastructure, particularly electricity and transport (roads) remain inadequate and poorly maintained in Nigeria. The conclusion is that infrastructure investment made by MSMEs in Nigeria has an adverse effect on MSMEs development. This is because transport (road) and electricity infrastructure are public goods and capital intensive in nature. Undertaking such investment by the MSMEs might not contribute significantly to their performance and this will shrunk their available resources (capital) that meant to boost their businesses.
The study therefore recommends that through the Small and Medium Enterprise Development Agency of Nigeria (SMEDAN), government is charged to play its role in infrastructure investment and to provide required infrastructure. SMEDAN is charged to revisit the objectives of the set-up of industrial parks to nurture MSMEs within an environment with the critical infrastructure required for a convenient take-off. Also, there should be full implementation of public-private partnership (PPP) for the provision of critical infrastructure in Nigeria. Non-governmental organizations (NGOs), international agencies and philanthropists should be encouraged to complement government efforts in the provision and repair of existing infrastructure.

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