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Impact of Logistics Infrastructure on Manufacturing Sector Performancein Africa: Lessons for Nigeria

***Muhammad Bello; *Yusuf Mustapha Muhammed; & **Toba Rachael Funke**
**Procurement Department, National Productivity Centre, Headquarters. **Consultancy and Business Development (CBD) Department, National Productivity Centre, Headquarters.*

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Abstract

In recognition of its role in achieving sustainable growth, which is capable of reducing high unemployment, high poverty rate and poor living standard that characterized African countries, industrialization remains an integral part of development plans of Nigeria and other African countries. In spite of this however, the manufacturing sector, which is a major driver of industrialization, continues to perform abysmally in African countries including Nigeria. The Sub-Saharan Africa average share of manufacturing in GDP of 10.6 percent in 2013 was well below the world average of 16.14 percent in the same period. This situation has resulted to a continued search for policy initiatives needed to address the problem of „manufacturing deficit" in the region. This study assesses the impact of logistics infrastructure, which has received very little attention in literature, on manufacturing sector performance in Africa. An unbalanced panel data for 35 African countries between 2007 and 2016 were analyzed using system GMM estimation technique. The result shows that logistics infrastructure has positive and significant relationship with manufacturing sector performance. An increase in logistic performance index by 1 point or 20% will result to an increase in the performance of manufacturing sector by a range of 3.61% and 7.48% depending on the component of logistic infrastructure used. Thus, logistic infrastructure improvement should constitute one of the industrialization strategies of African countries.

Introduction

Industrialization has continued to receive attention in African countries" development debate. In fact, the idea that countries in the continent should industrialize is obviously not new as leaders in most African countries view industrialization as a strategy towards transforming African societies and reducing its dependence on primary product (Page, 2016). The government of

Rwanda for instance, set a target in 2000 to increase the share of its industry GDP from below 14% in 2000 to 20% in 2020, though it has been revised to 20% since 2012 (AFDB,2014). Government of Ghana has industrial sector adjustment credit and vision 2020 (Enu&Attah-Obeng, 2013), while Tanzania has vision 2025 which aims at moving Tanzania to the middleincome status by 2025 (Page, 2016). Industrialization is at the center of some of the development plans in Nigeria. Notable amongst them are the National Economic Empowerment and Development Strategy(NEEDS) and Vision 2020 which aims at making Nigerian economy among the 20 most industrialized countries in the world by the year 2020.The need for industrialization is also recognized in the recently adopted Sustainable Development Goals (SDGs). Goal 19 of the SDGs emphasizes resilient infrastructure and sustainable industrialization.

Concerned stakeholders see industrialization as a solution to the problems of slow growth, low income and unemployment that characterize the region given its key role in achieving sustainable economic development and generating higher incomes. Rodrik (2015) noted that industrialization impacted on sustainable growth via two channels namely: reallocation of workers from low productive activities to higher productive ones and the relatively strong manufacturing growth experienced by manufacturing over the longer term. The latter channel implies that the development of manufacturing sector is closely linked with industrialization. Thus, improving manufacturing sector performance is synonymous with industrial development which is a major focus of African countries.

Several other studies have highlighted the benefits of industrialization and well-functioning manufacturing sector in an economy. A well-functioning manufacturing sector facilitate better jobs; fosters innovations; and brings about higher productivity as well as improve the living standard (Zhang , 2002)). Diversifying into manufacturing sector will make an economy to be less exposed to exogenous shocks such as climatic conditions. Development of the manufacturing sector is germane for attaining a sustainable period of structural transformation (Rodrik, 2015). Fox, Thomas & Haines (2017) noted that manufacturing sector development is beneficial to the economy of any nation because of its strong potential for increasing value added, potentially important technological spillover effects, access to foreign know-how, stimuli to greater innovation, and a general knock-on effect on other sectors of the economy through created demand for goods and services.

Inspite of the realization of the position of manufacturing sector as a driver of industrialization and as a gateway to attaining sustainable economic growth with the capability of reducing poverty and unemployment, the performance of manufacturing sector remains abysmal in the continent as most countries in the continent suffer from “manufacturing deficit”. The share of manufacturing in the GDP of African countries is generally low. Bhorat, Rooney &Steenkamp (2016) reported that the share of manufacturing sector GDP in Africa, on average between 1980 and 2013 dropped by 0.8 percentage point from an average of 11.3 in 1980s to 10.6% between 2000 and 2013. Recent statistics indicates that the share of manufacturing in GDP of sub-Saharan Africa is the lowest when compared to other regions of the world. The manufacturing sector GDP of 10.56 percent in 2013 is well below world average of 16.14 percent in the same year. When compared to other regions such as Euro area with manufacturing share in GDP of 15.99 percent, Latin America and Caribean with 15.31 percent, North America with 12.21 percent, East Asia with 22.8 percent, Central euro with 20.24 percent and south Asia with a share of 16.29 percent, Sub Sahara Africa has the lowest share of manufacturing in GDP (WDI, 2013). The position of Sub-Saharan Africa is a reflection of the extent of manufacturing deficit in the region. For instance, statistics shows further that none of the African country‟s share of Manufacturing in GDP is up to the world average of 16.16.14% as Nigeria, South Africa, Benin, Chad, Ethiopia, Gabon and Tanzania has manufacturing share in GDP standing at 9.53, 13.22, 13.72, 2.88, 4.08, 3.13 and 5.63 percent respectively (WDI, 2015).

This abysmal performance of the manufacturing sector, despite its crucial role in influencing sustainable growth, has necessitated a continued search for the factors capable of enhancing the success. Though a large body of literature exists on how manufacturing sector performance could be fostered, one area which has received very little attention is the role of logistic infrastructure.

Literature has shown that logistic infrastructure has a role to play in enhancing the performance of manufacturing sector of an economy. An efficient logistics system reduces the cost of transport and transit time (Hayaloglu, 2015). Logistics architecture play a strategic role in countries‟ developmental efforts as it influences the cost, structures and revenues of a country‟s producer, their competitiveness in areas such as delivery time, product quality, and the responsiveness of producers to consumer requirements (BTE, 2001). Mwangangi (2016) noted that logistic system has the potential to positively influence the performance of firms in terms of cost reduction, timely delivery, reduced lead time, demand realization, increased market share, quality products and customer service satisfaction. High indirect costs imposed by inadequate and inefficient logistic infrastructure and services account for a relatively high share of firm‟s costs in poor African countries and pose a competitive burden on African firms. Thus, the entire logistic architecture in an economy affects not only the manufacturing firms‟ supply chain but also the ability to effectively distribute its product. Specifically, it affects the firm‟s ability to efficiently and effectively attract the flow of input and the flow (distribution) of its output to the market. Since production networks require a sufficient transport capacity as well as the ability to manage these flows to ensure reliability and timeliness, global production network will be enhanced if supported by efficient logistic (Rodrigue, 2012). Rodrigue (2012) noted further that

> *" the outcomes of investment in logistic capabilities are numerous and are mainly related to increased integration with global trade, better utilization of natural national transport assets, more competitive exports, lower costs for imports, and increased employment opportunities". In spite of its important role in enhancing manufacturing firm performance, available statistics reveal that logistic architecture of African countries is nothing to write home about. It is also instructive to note that while no African country is among the top ten ranked countries in terms of logistic performance, five African countries are in the least 10 ranked countries as Zimbabwe (151),*

Lesotho (154), SierraLeone, Equatorial guinea and Mauritania are ranked 151, 154, 155, 156 and 157 respectively out of the 160 assessed countries. Only three countries below their ranks are war ravaged countries namely: Somalia (158) , Syrian (160) and Haiti (159) (WDI, 2016). Given the potential role of logistic system on the manufacturing sector in an economy, this study intends to empirically, (i) Examine the state of logistic architecture in African region and (ii) Examine the impact of logistic system on manufacturing sector performance in the region.

To that extent, the research questions of the study are;

- What is the state of logistic infrastructure in Africa?
- Does logistic infrastructure impact on manufacturing sector performance in Africa?

The rest of the paper is arranged as follows: section two presents the literature review, while empirical model and data are presented in section three. Section four is devoted to the presentation and discussion of result obtained using descriptive and econometric techniques, while section five presents the conclusion and recommendations.

LITERATURE REVIEW

This section reviews previous literature (both theoretical and empirical) that relate logistic infrastructure with the manufacturing sector performance.

MANUFACTURING SECTOR PERFORMANCE AND LOGISTIC INFRASTRUCTURE IN AFRICA

The performance of manufacturing sector in Africa stagnated at just around 10 percent in the last decade. The performance of African manufacturing sector contrasts the success story of Asian region with which Africa shared economic structures in the 1970s. The structural transformation of Asia has earned it the enviable accolade “the world Factory”. Fig 1 shows that Africa has the least share of manufacturing sector in GDP compared to other regions. Its performance is even below world average.

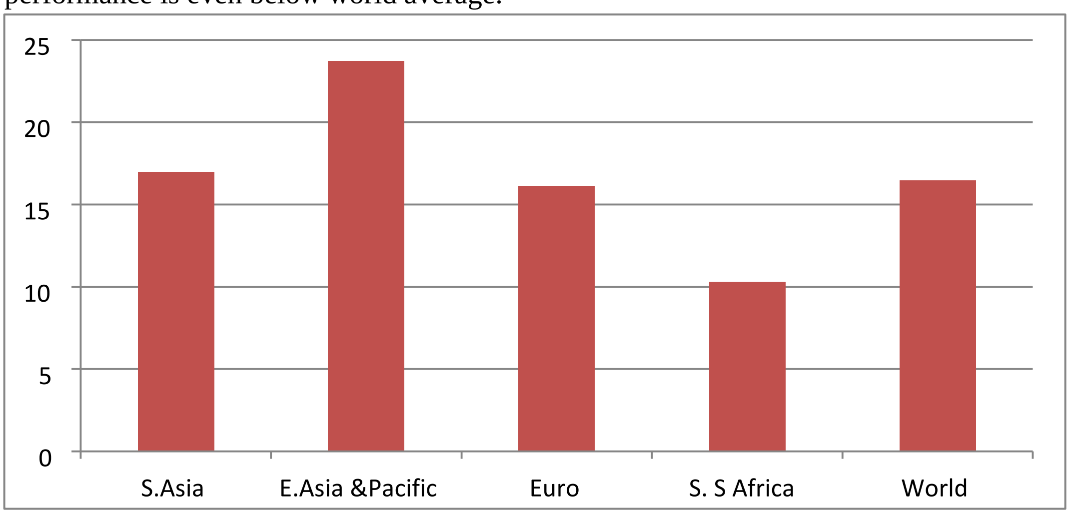

Fig 1.Average Share of Manufacturing sector in GDP between 2007 and 2016

Source: Author‟s computation using data from WDI

The state of logistic infrastructure in Africa compared to other regions and world average is depicted in fig 2 below. The figure shows that African countries have the least performance in terms of logistic infrastructure. According to 2016 edition of the LPI, which measures logistic infrastructure across 160 countries, no African country is among the top ten performers. Instead, 5 African countries (Zimbabwe (151th), Lesotho (154th), Sierra Leone (155th), Equitorial guinea (156th), Mauritania (157th)) are among the least ten performers. The best performer in Africa is South Africa which is ranked 20th in the world, while Nigeria‟s rank (90th) made her 13th in Africa (WDI, 2016). This clearly shows that African countries are still far behind in terms of logistic infrastructure.

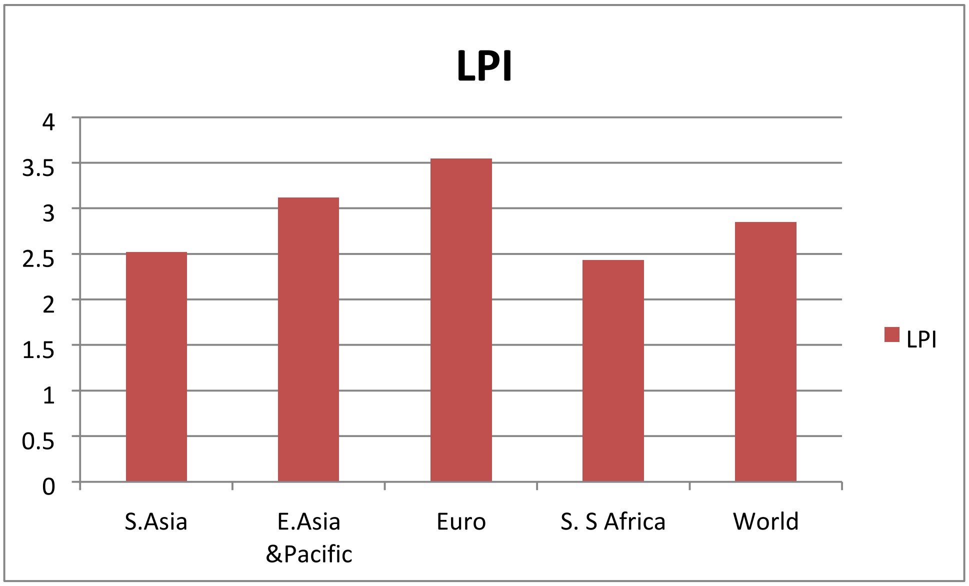

Fig 2. Average Regional Logistic Performance between 2007 and 2016
Source: Author‟s computation using data from WDI.

Conceptual Issues
Logistic Infrastructure

Understanding the term logistic infrastructure is very important, since it has implications for the unit of measurement. In order to properly conceptualize the term, it is pertinent to understand what the terms: infrastructure and logistic mean.

Infrastructure

The term infrastructure is used to broadly cover economic infrastructure, financial infrastructure and social infrastructure. Infrastructure could be broadly defined as physical facilities, institutions and organizational structure which serve as the social, financial and economic base for the operation of a society (UNCTAD, 2008; Snieska&Simkunaite, 2009).While economic infrastructure promotes economic activities, social infrastructure promotes well-being in the society such as health and education (Snieska&Simkunaite, 2009). Infrastructure is also classified into hard and soft infrastructure (Portugal-perez&Wilson 2009). While hard infrastructure includes highways, rail roads and ports, soft infrastructure includes transparency, customs efficiency and institutional reforms among others (Portugal – Perez &Wilson (2009). The implication of the classification above is that infrastructure is not limited to physical facilities, but also includes institutions and organization structure in an economy. Thus, the study conceptualizes infrastructure in terms of economic infrastructure, which is the kind of infrastructure (soft and hard) that promote economic activities.

Logistics

The term logistics has been defined in various ways in academic literature. Logistics include, in addition to information flow, a range of extensive activity that facilitates the transformation and distribution of goods from raw materials source to end market in which the goods are consumed (Rodrigue, 2012). Logistic performance improvement could result to a shift from vicious to virtuous cycle (see Rodrigue, 2012 for details). Logistics investment encompasses enterprises on some components such as various transportation networks, storage systems, information and communication devices, packing services etc. (Hayaloglu, 2015). Logistics infrastructure improvement, according to Rodrigue(2012), encompasses improvement in freight distribution

via:

- ❖ Physical infrastructures, such as terminals, real estate, and telecommunicati
- ❖ Operations, including transport modes and equipment, and;
- ❖ Human resources such as labour, management, and governance, as well as research and development.

Thus, logistic infrastructure in this study encompasses a broad range of economic infrastructure, which could be both soft and hard, that facilitates flow of materials, information as well as distribution of the final product.

Theoretical Review

Among the theories that relate logistics system with manufacturing sector performance are location theory and the theory of firm.

Location Theory

This theory focuses on the territorial allocation of resources within a country and the supply (cost factors) and demand (market factors) variables which affect the distribution process of firms. According to this theory, the location of a firm in an economy depends highly on supply and demand factors. Since logistic system influences the supply via its impact on the production input cost and demand variables via the distributional impact, the theory clearly shows that the state/nature of logistic system will no doubt influence the performance of manufacturing firm in an economy. Zhang (2002) confirmed via empirical studies that logistic development brings about birth of new industries. This impact may be explained in terms of two channels as follows.

Firstly, in deciding whether to locate a firm in an economy, the cost of production is often considered and as such, a firm may be motivated to operate in an economy characterized by low input cost resulting from better logistic architecture.

Secondly, firms consider the distribution channels of their products in deciding the location of the business. An economy with inefficient logistic infrastructure will have an insufficient distribution system and such will put a manufacturing firm that operate in such an economy at a competitive disadvantage when compared to manufacturing firms in an economy with better logistic infrastructure.

Theory of Firm

The theory of firm was developed by the classical economists and was meant originally to identify why firms exist. There are several sub theories emanating from this theory. However, the relevant one to this study is the Transaction cost theory. According to the theory, firms that perform well are those with the most efficiently completed transaction costs and minimum production costs (see Meutzer et al., 2004). While transaction costs are associated with exchange, production costs are associated with various production activities coordination. Since logistic architecture affects both the exchange (Erkan, 2014) and production costs (Erkan, 2014; Mwangangi, 2016), a firm that operates in an environment with efficient logistic system tends to be in a situation where both transaction costs and production costs are at possible minimal level (Fugate et al., 2010).

Review of Empirical Literature.

Though several empirical works exist on manufacturing sector performance and logistic infrastructure, very few studies investigate their direct relationship. Such studies are reviewed in this subsection.

A study by Zhang (2002) found evidence of circular relationship between logistic system and economic development. According to the study, better logistics cause higher development and yet better logistics and other additional positive impacts. He concluded that "modern logistics development also changed the regional economic growth ways and promote the formation of new industries and optimizes the regional industrial structure."

Green et al.(2008) investigated the impact of logistic performance on organizational performance using data gathered from 1,461 selected firms from data base of US manufacturers with 800 or more employees. The study used descriptive statistics, confirmatory factor analysis and nonnormed-fit index and found that positive relationship exists between logistics performance and organizational performance within the manufacturing sector.

In a similar study, using a self-reported survey completed by one representative individual from each of the sampled firm, Keebler & plank(2009) reported that logistic infrastructure has a positive impact on the United States of America manufacturing firms" performance.

Vilmo et al. (2011) conducted a study to investigate the impact of logistic infrastructure on economic development of Finland. The study measured logistics infrastructure with logistic performance index and qualitative method of analysis was adopted. They found that connection exists between economic development and logistic infrastructure.

Coto-millan et al. (2013) used aggregate global production function, expanded with the logistic performance index, to examine the impact of logistic performance on economic growth using data of the world countries between 2007 and 2012. The study found that logistics has positive, significant and important impact on economic growth of the world‟s countries. An increase of logistic performance by 1% results to economic growth ranging between 0.011% and 0.034%.

In a study to investigate the existence of long term relationship between logistic development and economic growth in Turkey, Kuzu and Onder (2014) found - using Granger causality, unit root and cointegation test - that long run relationship exists between logistic development and output growth in the Turkish economy. The study proxied logistic infrastructure with index of transportation and storage. According to the study, a one unit increase in the measure of logistic infrastructure(index of transportation and storage), results in 30 percent increase in the GDP and vice-versa.

Seinchez, Tomassian and Perroti (2014) investigated the performance of logistic on economic development. The focus of the study was to show if the probability of an economy being developed is due to difference in logistic performance (logistic gap). Using probabilistic approach, the study found that the probability of an economy being developed increases with improvement in the logistic performance of the economy. The logistic performance index sourced from World Bankand other variables were used in the study.

Hayaloglu (2015) used annual data for 32 OECD countries between 1994 and 2011 to investigate the impact of development in logistic sector on economic growth. He found evidence of some impact of logistic sector development on economic growth. The study used different variables as indicators of development in the logistic sector and revealed that the relationship between development in the logistic sector and economic growth differs depending on the indicator used.

Mwangangi (2016) examines the influence of logistics on the performance of the manufacturing firms in Kenya. Using both descriptive and exploratory research designs, the study found that three aspects of logistics (transport management, inventory management and order process/information flow management) influence the performance of manufacturing firms in Kenya. He concluded that firms with efficient logistic system will have a competitive edge and that logistic architecture in a firm has the potential to positively influence firm‟s performance via reduction in costs, timely delivery, reduction in lead time, increase market share, quality products and customer service satisfaction.

Thus, empirical evidences have shown that logistic infrastructure is very important in any economy. Some of the reviewed literature above found positive and significant relationship between logistic infrastructure /development on countries and regional economic development. Others equally confirm the existence of positive and significant relationship between logistic infrastructure/system/development on economic growth and manufacturing sector performance. It is however, pertinent to know that (i) majority of the study either focused on economic development and logistic system/development or economic growth and logistic infrastructure, while very few studies investigated the impact of logistic infrastructure on either manufacturing sector performance or industrial growth. (ii)Virtually all the few that investigated the relationship between logistics infrastructure and manufacturing sector performance only focused on one country using either time series or cross sectional approach.

This study therefore contributes to empirical literature on manufacturing sector enhancement as well as importance of logistic infrastructure by investigating the impact of logistics infrastructure on manufacturing sector performance in Africa using Arrelano-Bover (1995) and Blundell-Bond (1998) system GMM estimation technique.

Theoretical Framework

The study adopts the framework of Clarida & Findlay (1992) and Stephen & Golub (2007) on infrastructure and productivity with slight modification. Accordingly, the theoretical framework for this study is based on the following major assumptions: (i) the economy is a small open economy with sector j that produces product j. The implication of this assumption is that the economy will take the J- vector of world price P as given. (ii) The sector uses constant return to scale technologies to produce product j. (iii) Both product and factor market are perfectly competitive and the economy maximizes the value of final output of sector j.

The common formulation of the maximization problem is given as (following Dixit & Norman,

1980): r(P,Ƶ) = Max {P.λ /(λ,Ƶ) feasible} = P.λ(P,Ƶ) - - - (3.1)

Where r(P,Ƶ) is the revenue function of the economy , λ(P,Ƶ) is the vector of net output produces, which maximizes the national income value.

The vector of output produce in an economy can then be expressed as

$$\lambda(\text{P}, \text{Ƶ}) = \frac{\partial\, \lambda(P, Ƶ)}{\partial P_j}, \qquad j = 1, - - - - J. \qquad - \quad - \quad - \quad (3.2)$$

Suppose that sector j production technology can be written as

$$\lambda_j = \varphi_j f_j(z_j) = \varphi_j \lambda_j^*, \qquad j = 1, \quad - \quad - \quad - J, \qquad - \quad - \quad - \quad (3.3)$$

Where φ_j is productivity shift parameter, z_j is an M-vector of factor input by sector j while increase in φ_j represents Hicks" neutral productivity increase (see Stephen & Golub, 2007 for details).

According to Dixit & Norman (1980), equation (3.1) has a form r(ΘP, Ƶ), where Θ = diag (φ_1 , - - - φ_J), such that changes in productivity of sector j"s (φ_j) affects output in the same way as changes in P_j .

The formulation above provides justification for productivity differences across countries and this differences according to Stephen & Golub (2007) results from (i) inherent technological differences and (ii) Stocks of infrastructure.

Since it is assumed that increase in φ_j represents Hicks" neutral productivity increase, then productivity shifter in sector j can be written as

$$\varphi_j = \delta_j\ h_j(\text{I}), \quad - \quad - \quad - \qquad (3.4)$$

Where δ_j is a technological parameter inherent to sector j, I is the stock of infrastructure available in the economy, and h_j(●) is an increasing function that maps the availability of infrastructure into productivity. Following Heckser-Ohlin model that technologies are identical across countries or differ by an equal proportion across countries, it is assumed that h_j(●) is specific to sector j but the same across countries. The implication here is that infrastructure is a source of comparative advantage, as its sector-specific productivity effect interacts with international differences in factor endowments.

Assuming that government provides infrastructure using Leontief technology with a fixed unit input requirement Ω. The net vector of factor endowment that is available for producing infrastructure could be specified, according to Clarida & Findlay (1992), as

$$NV = V - \Omega.I \quad - \quad - \quad - \quad (3.5)$$

Then, the sector revenue function could be written as

$$r(\delta_j \; h_j(I).P, V - \Omega.I) \quad - \quad - \quad - \quad (3.6)$$

The derivative of (3.6) with respect to P yields the sector"s net output in an economy. i.e

$$\lambda_j(\delta_j \; h_j(I).P, V - \Omega.I) = \frac{\partial r(\delta_j \; h_j(I).P, V - \Omega.I)}{\partial P_j} \quad - \quad - \quad - \quad (3.7)$$

An industrialization minded government will thus choose the level of I that maximizes (3.6) above. It is expected that increase in I will increase productivity of sector j. it should be noted that (3.7) above shows that the size of increase in output of sector j associated with an increase in I also depends on other characteristics of the country in which the sector operates namely; its factor endowment (V) and its technology size (δ).

Thus, output of sector j at time t depends on the stock of infrastructure in country i at time t (I_t^i), the country i"s factor endowment at time t (V_t^i), unobserved technological ability of country i at time t (δ_t^i) and a stochastic error component (ε_{jt}^i) such that

$$ln\varphi_{jt}^i = \beta_j I_t^i + lnV_t^i + ln\delta_t^i + \varepsilon_{jt}^i \quad - \quad - \quad - \quad (3.8)$$

Empirical Model Specification and Data

Manufacturing Value Added (MVA) is the most widely used proxy of manufacturing sector performance in literature. There is however no universal way of specifying the model with MVA as the dependent variable in literature as various authors gave variant specification (Muhammad et al., 2013; Timothy & Chigozie, 2015). This study thus, in addition to the theoretical framework presented in the preceeding subsection, relies on previous empirical studies by (Zhang, 2002; Muhammed et al., (2013)) to specify the model. Accordingly, the model is

specified thus;

$$lnMVA_{it} = F(LI_{it}, X_{it}) \quad - \quad - \quad - \quad (3.9)$$

Where: MVA is Manufacturing Value Added which here proxy the performance of the manufacturing sector. LI is the logistic infrastructure while X is the vector of other explanatory (control) variables namely: Gross Fixed Capital Formation (GFCF) with which capital is proxied with (Muhammed et al., 2013 also proxied capital by GFCF) and industrial employee as a percentage of total employees (LAB). Equation (3.9) becomes

$$\ln MVA_{it} = f(LI_{it}, GFCF_{it}, LAB_{it}) \quad - \quad - \quad - \quad (3.10)$$

Equation (3.10) above could then be expressed in form of unbalanced panel model as

$$\ln MVA_{it} = \lambda + \theta LI_{it} + \delta GFCF_{it} + \varphi LAB_{it} + U_{it}, \quad i = 1 - - - N; t1 - - - T - - - (3.11)$$

Where λ is the intercept term, and $U_{it}$is the error term of country i at time t.

In panel regression, one major issue is the possibility of presence of time-invariant unobservable countries characteristics (Cameroon & Travedi, 2009) which may correlates with the explanatory variables $LI_{it}, \ and\ X_{it}$. Such unobservable time-invariant error would be stored in the error term
U_{it} and caused it to be biased. The is expressed as

$$U_{it} = \omega_i + \varepsilon_{it} \quad - \quad - \quad - \quad (3.12)$$

Where ε_{it} is white noise and ω_{it} is the unobservable time – invariant component. In the presence of equation 3, OLS method cannot be used since one of its assumptions has been violated. To overcome the problem, literature suggests the use of fixed- effect estimation technique (Cameroon & Travedi, 2009). Such involves the use of within transformation fixed effect to eliminate the unobservable time invariant ω_{it} in equation (3.11). This would be achieved by demeaning the variables using within transformation as follows:

$$\ln MVA_{it} - \overline{\ln MVA_{it}} = \lambda + \theta(LI_{it} - \overline{LI_{it}}) + \delta(GFCF_{it} - \overline{GFCF_{it}}) + \varphi(LAB_{it} - \overline{LAB_{it}}) + (\omega_i - \bar{\omega}_i) + (\varepsilon_{it} - \bar{\varepsilon}_{it}) \quad - - - (3.13)$$

Since ω_i is constant – because it is time invariant- then $\omega_i = \overline{\omega}_i$ which makes the expression $(\omega_i - \overline{\omega}_i)$ equals zero and equation 5 becomes:

$$lnMVA_{it}^{*} = \lambda + \theta LI_{it}^{*} + \delta GFCF_{it}^{*} + \varphi LAB_{it}^{*} + \varepsilon_{it}^{*} \quad - - - (3.14)$$

Equation (3.14) above is the demean equation which has now eliminated the fixed effect in the relation. Thus, OLS can then be used on equation (3.14) above to obtain the fixed effect estimator.

It may however be possible that the manufacturing value added in this year may be related with its previous value, which will makes it imperative to incorporate dynamics into the model. Thus, the model becomes

$$\ln MVA_{it} = \lambda + \alpha \ln MVA_{it-1} + \theta LI_{it} + \delta GFCF_{it} + \varphi LAB_{it} + U_{it}, \quad i = 1 - - - N; t = 1 - - - T \quad - - - \quad (3.15)$$

The introduction of first lag of MVA as an independent variable results to what is called endogeneity problem in econometric literature since it is an endogenous variable. Thus, the major task then becomes how to account for endogeneity problem in the face of countries level/specific effect. The country level effect in (3.15) above could be eliminated by differencing the equation as

$$\ln\Delta MVA_{it} = \lambda + \alpha \ln\Delta MVA_{it-1} + \theta\Delta LI_{it} + \delta\Delta lnGFCF_{it} + \varphi\Delta LAB_{it} + \Delta U_{it} \quad (3.16)$$

Given (3.10), equation (3.15) becomes

$$\ln\Delta MVA_{it} = \lambda + \alpha \ln\Delta MVA_{it-1} + \theta\Delta LI_{it} + \delta\Delta lnGFCF_{it} + \varphi\Delta LAB_{it} + \Delta\varepsilon_{it} - - - (3.17)$$

Equation (3.17) above has resolved the problem of country level effect but the potential problem of autocorrelation and endogeneity remain given that the term $\ln MVA_{it-1}$ is still in the equation. In order to overcome the problem, Arrellano-Bover (1995) and Blundell-Bond (1998) built on the work of Arrelano & Bond (1991) to develop a GMM instrumental variable estimation method, where the first difference lagged dependent variable is instrumented with further lagged levels. This estimation technique has been reported to be capable of accommodating a dynamic specification and at the same time account for the time-invariant specific characteristics (Cameroon & Travedi, 2009).

VARIABLES DESCRIPTION

A brief description of the variables used in the model is presented below:

MVA:- the Manufacturing Value Added represents the basic indicator of country‟s level of industrialization. It is measured in terms of value rather than volume and it is deflated by population to adjust for the country‟s size. It is obtained by subtracting the values of inputs from the value of output (see WDI, 2015). This variable is sourced from the World Development Indicators data base.

GFCF- Gross Fixed Capital Formation measures gross net investment (acquisition) less disposals in fixed capital assets by enterprises, government and households within an economy in an accounting period. By implications, GFCF shows how much of the new value added in the economy is invested rather than consumed (see UN, 2008). „If GFCF increases, capital is available to enhance the manufacturing sector‟ (Muhammad et al., 2013). The data is sourced from WDI.

LAB- this measures employment in the industrial sector as a percentage of total employed employment. The unavailability of separate data on manufacturing sector necessitated the use of this proxy.

LI- Logistic infrastructure is proxy in this study by Logistic Performance Index. LPI which is available in the World Bank Development Indicators (WDI) has received wide acceptance and is a composite index based on proxy measures for transport and information infrastructure, supply chain management, and trade facilitation capabilities, which are obtained based on a world survey of global freight forwarders and express carriers. The survey scores customs, infrastructure, international shipment, tracking and tracing, and Timelines. The goal of LPI is to assess countries rank in terms of LPI ranges from lowest score of 1 and highest score of 5 (World Bank, 2010) and it shows that " building the capacity to connect firms, suppliers, and consumers is key in a world where predictability and reliability are becoming more important than costs in supply chain management" (Rodrigue, 2012). Each of the components is explained below:

Customs:- this reflects the perception on the efficiency of the clearance process (such as speed, simplicity and predictability of formalities) by border control agencies, including customs.

Infrastructure:- captures the perception of freight forwarders on the quality of trade and transport related infrastructure (e g ports, railway, information technology etc)

Shipment: - reflects the ease with which competitively priced shipments are arranged.

Logistic Competence:- it reflects the perception on the competence and quality of logistics services (such as Transport operators, customs brokers etc)

Tracking and Tracing:- it deals with the perception on the ability to track and trace consignments.

Timeliness:- reflects the perception on timeliness of shipments in reaching destination within thin stipulated or expected time.

The study is based on Logistics Performance Index (LPI) data from 2007 to 2016 as well as annual data on other covariates within the same period. The data was collected from World Development Indicator (WDI) and International Labour Organization (ILO).

Presentation and Discussion of Results

The estimated result obtained using arrellano-Bover/Blundell-Bond dynamic panel system GMM is presented in the table below

Table 2: Dynamic Panel System GMM estimation Result

	Model 1	Model 2	Model 3	Model 4	Model5	Model 6	Model 7	
lnMVA(-1)	0.890***	0.8305***	0.8420***	0.8188***	0.8003***	0.8624***	0.8480***	(0.000)
(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)			
lnGFCF	0.0726***	0.0682**	0.0652 ***	0.0650**	0.0777***	0.0575**	0.0657**	(0.009)
(0.010)	(0.016)	(0.018)	(0.001)	(0.027)	(0.019)			
LAB	0.00071	0.00063	0.00054	0.000467	0.000657	0.00068	0.00988	
		(0.113)	(0.121)	(0.233)	(0.281)	(0.125)	(0.185)	(0.628)
Lpi	**0.06738*** **							
	(0.001)							
TAT		0.0361**						
		(0.038)						
LC				0.0204				
				(0.287)				
SHIP						0.0388**		
						(0.030)		
CSTM							0.0748**	
							(0.002)	
TLNS								0.0376***
								(0.001)
QTTI								
0.00988								
Constant	**1.727***	**1.686***	**1.571***		**2.0103****	**1.973****	**1.284**	**1.460***
	(0.053)	**(0.051)**	**(0.067)**		**(0.035)**		(0.148)	(0.091)
(0.019)								
Observations	**142**	**142**	**142**	**142**		**142**	142	142
(0.628) Ar (1)	-1.981**	-2.051**	-2.157**	-2.015	**	-1.937*	-2.195**	-2.149**
(0.048)	(0.0403)	(0.0310)	(0.0439)	(0.0527)		(0.0282)	(0.0316)	
Ar (2)	**-1.466**	**-1.478**	**-1.543**	**-1.536**		**-1.448**	**-1.558**	**-1.535**
	(0.143)	**(0.140)**	**(0.123)**	(0.125)		(0.148)	(0.119)	(0.125)
Sargan Test	**12.656**		**11.967**	**12.993**	12.045	11.764	13.426	13.412
	(0.244)		(0.2873)	(0.224)	(0.282)	(0.301)	(0.201)	(0.202)

*, **, *** indicates Significant at 10 percent, **Significant at 5percent *** significant at 1 percent.

Probability values are in parenthesis

Source: Author"s Computation

The table presents the results obtained for different model specifications estimated using Arrelano-Bover/Blundel-Bond system GMM. The first column presents the results obtained using the overall logistic performance index, while column two to seven present the result obtained using the components of the LPI since using them together in the same model may result to the problem of multicolinearity.

In model one, the performance of the manufacturing sector measured by MVA is positively related to its previous value (its lag). Model two through seven also show similar results that previous development in the manufacturing sector impacts positively on the contemporary performance of the sector. Similarly, model one to seven indicate that Gross Fixed Capital Formation of a country impacts positively and significantly on the MVA and by extension, the manufacturing sector performance as well as industrialization. Model one indicates that an increase (decrease) in the GFCF by one percent would result in an increase in the MVA by 7 percent. Model two to seven also indicates that the elasticities of MVA with respect to GFCF falls in between 0.058 and 0.0777. The variation in the elasticity is due to different control variables used in each of the models. According to the result, model five has the highest elasticity of 0.0777. This result aligns with the finding of Muhammad et al. (2013) who found a positive relationship between manufacturing sector and GFCF in Pakistan. In addition, Ibadin, Moni&Eikhomun (2014) lent support to the fact that GFCF has positive and significant relationship with Nigerian real sector development.

The result also shows that labour units have positive impact on the MVA in each of the seven models. The associated p-values however indicate that labour unit has no significant influence on the MVA. This is against the classical economists" proposition in the theory of production that labour is an important determinant of output. This result for labour may be attributed to the fact that labour cost in African countries is cheap and the labour is characterized by low skilled manpower. The implication of the above result is that it is capital that matter most in the industrial development struggle of African countries when compared to labour. Moreover, African countries are blessed with high level of manpower albeit majority are not skilled.

The first model test the impact of logistic infrastructure using the overall index, while the remaining models use each of the components of the logistic performance index so as to see which component has the highest influence on the MVA. In model one, overall logistic performance index has a positive and significant influence on the MVA. Ceteris paribus, an increase in logistic performance by one unit , or 20 percent (since it is measured on a 5 points scale) increases the Manufacturing Value Added by 6.7 percent. In the same vein, while track and tracing, Shipment, Customs, and Timeliness performance have positive and significant influence on MVA, both trade and transport related infrastructure and logistic competence have no significant impact on MVA, though the relationship is positive. The change in MVA varies depending on the LPI component used. Ceteris paribus, an increase by one unit or 20 percent of track and tracing, Shipment, Customs, and Timeliness performance will result in an increase in MVA by 3.6, 3.9, 7.5 and 3.8 percent respectively. The implication of the outcome is that customs have the highest impact on MVA.

Post estimation tests were conducted to ensure that the result does not suffer from the problem of autocorrelation and that the instruments used are valid. The correlation test shows that though there is correlation of the first order, there was no second order auto correlation as shown by the ar(1) and ar(2). The Sargan test results fails to reject the null hypothesis of the validity of over identifying restriction in any of the models as none of the p-values of the Sargan test is below 10 percent. The implication of such result is that the instruments used for the estimation of the models presented above are valid.

Concluding

Owing to its potential to promote sustainable growth through reduction in the level of unemployment, income inequalities and low level of living standard, industrialization has, over more than three decades, occupied a central position in the development agenda of African countries, including Nigeria. The manufacturing sector which is recognized in literature as a major driver of industrialization continues to perform abysmally in the region. Thus, policy initiatives are needed to address the menace.

This study thus, assessed the role of logistic infrastructure in enhancing the performance of manufacturing sector in Africa using panel data of 32 African countries between 2007 and 2015. Logistic infrastructure was measured via Logistic Performance Index (LPI) published by the World Bank and available in the World Development Indicators (WDI). Using STATA 12.0 statistical software, the results obtained using Arrelano-Bover/Blundell-Bond system GMM estimation technique revealed that logistic infrastructure has a positive impact on the Manufacturing Value Added which served as a proxy for manufacturing sector performance in this study and as an indicator of the level of industrialization in a country. The result however revealed that the significant and extent of the impact varies depending on the component of the logistic performance index used. The implication of this result is that, if the industrialization target of countries in the continent is to be realized, significant commitment must be made to improve the logistic architecture of the region. Such policy initiatives should include improvement in the efficiency of the clearance process by the border control agencies, ability to track and trace consignment, timeliness of shipment in reaching destination within the scheduled or appointed time and the way international shipments are arranged. The result shows that quality of transport and trade infrastructure and logistic competence are not significant. This implies that quality of transport and trade infrastructure is generally low in the region.

In addition, policy initiative capable of enhancing the gross fixed capital formation must be promoted by countries in the region, including Nigeria. The result shows that labour units have no significant impact on the manufacturing sector development in the region even though the sign of the coefficient signaled a positive relationship. In order to make labour play a significant role in the industrialization process, the skill level of labour in the region must be enhanced. This could be achieved through investment in primary and secondary education as well as research and development (R&D) activities.

Conclusively, for Nigeria to improve its manufacturing sector performance as a means towards achieving its long-term industrialization objective, it must, in addition to other policy initiatives in literature, improve the logistic architecture in the country. The recent move by the federal government of Nigeria to decongest the airports in the country and the recent renovation of Abuja International airport run way are right steps in the right direction which must be sustained. Other areas of logistic infrastructure in the country should also be improved. Finally, to raise the productivity of manufacturing firms in African countries, there must be holistic policy interventions by different stakeholders - such as government, maritime shipping lines, port authorities/ terminal operators, logistics real estate developers among others - aimed at mitigating critical bottlenecks imposed by inadequate logistics infrastructure.

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