Infrastructure Investment and Industrial Development in Nigeria: The Critical Nexus

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Abstract

Many studies have established the critical role played by infrastructure in economic growth and development of nations globally, but relatively few studies have considered the relationship between infrastructure and industrial development. The few studies done in this area especially in Nigeria emphasized the hard core infrastructure-industry relationship. This justifies the study of relationship of both soft and hard core infrastructure with industrial development in Nigeria, using co-integration and error correction mechanism (ECM); with data spanning 1985 and 2015. Findings indicated that all the variables employed in the study contained unit root properties; and were stationary at level. A long run equilibrium relationship was established between infrastructure investment and the index of industrial production in the country. The study also revealed that 12.9% speed of adjustment is required to adjust towards equilibrium in the long run. The study therefore concluded that in the long run investment in both hard and soft core infrastructure would contribute significantly to the level of industrial development in the country, through high quality work force and improvement in life expectancy of average Nigerians.

Indexing terms/Keywords: ECM; Industry; Development; Government Expenditure; Infrastructure; Nigeria

JEL Classification: H540

Introduction

The World development report strongly argued for the role of infrastructure in development [53]; a message which was repeated in its growth commission report [54] and also taken up by UNCTAD's Less Developed Economies Report series [51]. For instance, in the Growth Commission Report, it was clearly stated that countries that devote more of their GDP to public investment, notably countries in Asia, also grow faster than those that invest a little. The implication of this statement is that investment in public capital is believed to crowd in private investment [51]. This explains why the role of infrastructure in the industrial development of any nation cannot be over emphasized. Many developed countries in the world thrive on the provision of necessary infrastructure to drive their economies [37]. The acute shortage or deplorable state of infrastructure in any nation is believed to have negative effect on individuals and organizations in that country, which also confirm its utmost importance for the development of any economy [4]. Many studies have also established the importance of infrastructure to economic growth and development e.g. [43]; [27]; [21]; [1]; [31] among others. While making reference to of infrastructure as a major factor in industrial growth and development, [37] also assert that players in Nigeria's industrial sector are not motivated simply because the operating environment is harsh and not conducive, a situation they blame primarily on the lack of basic infrastructure across the country. [37] further decried the poor state of infrastructural facilities which has been the bane of Nigeria's economic development. There is a near collapse of public infrastructure in the country occasioned by years of neglect by the government as well as lack of maintenance culture and effective planning. For instance, real meaningful infrastructural investment and development in public electricity such as power generation and supply dates back to the 1970s and 1980s. Also stressed by [37] that a durable and sustainable socio-economic development can never be possible without paying due attention to the development and improvement of infrastructure; explaining that infrastructural investment and development are of key strategic importance and constitute the bedrock and catalyst for sustained economic growth and development. This is

because infrastructure development creates the enabling environment to stimulate business and industrial activities; and thereby enhancing productivity, reducing operational cost, creating jobs, generating income and wealth, reducing poverty and creating new ventures as well as business opportunities [37].

Although many studies have been conducted on the relationship between infrastructure and economic growth e.g. [21]; [40]; [30]; [43], while a few ones on infrastructure and industrial development [27 and 28]. The few studies done in this area especially in Nigeria emphasized the relationship of hard-core infrastructure with industrial development. This is a clear departure from this study, which examined the role of both soft and hard core infrastructure in Nigeria's industrial development. The choice of this particular area of the study is borne out of total neglect of the country's infrastructure especially in education and health sector, which for a long time have suffered in the hands of both successive federal and state government. The country's educational and health institutions had been beset by inadequate funding, poorly-motivated and unqualified staff and dilapidated structures. This has resulted in steep declines in educational performance, growing illiteracy level and increased vulnerability to diseases.

These challenges have resulted into a very unflattering estimate of the quality of life in the country e.g. the World Development Indicators puts the life expectancy in Nigeria at 48 years and equally states that 8% of the population is undernourished [55]. Also, according to the index, a meagre 0.9% of the Country's Gross Domestic Product [GDP] is spent on education. All these will also be considered in relation to the level of industrial development in Nigeria.

Review of Literature

The Concept of Infrastructure and Industrial Development

With reference to Fox [24], infrastructure is viewed as service derived from the set of public works, traditionally supported by the public sector to enhance private sector production and to allow for household consumption. These services include mass transportation, water supply systems, sewerage and other sanitation systems, solid waste management and flood protection, electric installations and telecommunications among others. Development economist have also considered infrastructure, both in physical and social terms to be a precondition for industrialization and economic development [27]. Physical infrastructure consists of two parts: economic infrastructure such as telecommunications, roads, irrigation, electricity; and social infrastructure such as water supply, sewage systems, hospitals and school facilities among others [35].

According to [53] infrastructure is an umbrella term for many activities referred to as "social overhead capital" which includes services from:

(i) public activities such as power, telecommunications, piped water supply, sanitation and sewerage, solid waste collection and piped gas; and

(ii) public works such as road and major dam and canal works for irrigation and drainage, ports and water ways and air ports [see 11; 16; 47; 29; 13; 41; 14]

[38] also categorizes infrastructure into two complementary parts, namely; social or "soft-core" infrastructure and physical or "hard-core" infrastructure. Soft-core infrastructure refers to the provision of health care and education, types of governance, accountability and property right and is often viewed as the driving force to economic activities; while hard-core infrastructure involves physical structures such as telecommunications, power, transport (roads, railways, port and airports), water supply and sewerage among others.

On the other hand, industrial development according to [7] deeply involves extensive technology based development of the production sector of the economy. In other words, it 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 [7].

According to [5] industrial development was described as a way of transforming raw materials into finished consumer goods or intermediate or producer goods, create means for employment, helps to boost agriculture and diversify the economy, helps the nation to increase its foreign exchange earnings, enables local labour to acquire skills, minimize the risk of overdependence on foreign trade and leads to the maximum utilization of available resources. Industrial development could also build a greater sense of confidence and self-reliance among nations that have once suffered from excessive dependence on others. One of the merits of this development is that while it makes it possible for countries to satisfy their own requirements to a greater degree, it also creates through the very complexity of the process involved a web of interrelationships which over a period of time bring the countries closer together and makes them more dependent on one another [51].

However, the divergent views on infrastructure and industrial development have given a positive insight into the relationship between infrastructure and industrial development. Also, a strong and positive relationship has been established between the two concepts. [3] further explains the capability of infrastructure to provide the conducive environment for productive activities to take place and facilitate the generation of economic growth and development.

This implies that, in the absence of adequate power supply, water, transport and communication facilities; production process or locational advantages may not be optimized. But on the other hand, availability of an efficient infrastructure network can stimulate new investment in other sectors of the economy.

Theoretical Review

This study reviewed some economic theories which support the relationship between infrastructure and industrial development. One of such theories is the neo-classical (exogenous) growth model. The major proponents of the theory are [25] and [46]. The theory described developed economies better than developing ones and remains the basic reference point for growth and development which allows substitution between capital and labour in the determination of output such that;

$$Y = f\,[K, L] \qquad 2.1$$

Exogenous growth theory argues further that public capital enhances the productivity of private capital, raising its rate of returns and encouraging more investment. However, increase in the stock of infrastructure will only have transitory effect on output growth.

Another approach to neo-classical growth model is the endogenous model, with [9]; [42]; and [33] as major proponents. [9] major contribution to the endogenous growth is the introduction of government expenditure on infrastructure (*G*) as public good into the model in *eq. 2.1* to form;

$$Y = f\,[K, L, G] \qquad 2.2$$

The theory also stress further that public capital is the foundation upon which the economy is built and that steady-state income *per capita* can equally increase through investment in infrastructure. In other words, investment in infrastructure acts as a network that connects spatially separated economic agents. [42] expression of the model emphasized the significance of technological spillovers in the process of industrialization. The model was further extended with the inclusion of technology factor into eq.2.2 to form;

$$Y = A\,(t)\,K^{\alpha 1}\,L^{\alpha 2}\,G^{\alpha 3} \qquad 2.3$$

[42] further proposes human capital investment, as a driver and means of achieving economic growth and development. [33] also believe that human capital investment (education and health) remain an impetus to

produce spillover effect, which increases the level of technology and bring about increase in aggregate output. The expressions of [42] and [33] are reflected in the following equation after the inclusion of human capital investment (*H*) into eq.2.3.

$$A(t)\, K^{\alpha 1} L^{\alpha 2} G^{\alpha 3} H^{\alpha 4} \qquad 2.4$$

Where; Y =Aggregate Output; K = Physical stock of capital; L = Quality of Labour;

G = Government Expenditure; H= Human Capital Investment;

A = Level of Technology; t = Time Dimension; α1, α2, α3, α4 = Parameters

[42] also maintained a clear departure from Solow's idea by assuming that "A", the level of technology is constant rather than rising over time; that is there is no technological progress or change in the economy; that economy wide capital stock 'K', positively affect all outputs at the industry level so that there may be increasing returns to scale at the economy wide level.
This also explains why growth might depend on the rate of capital investment (i.e. capital stock 'K'); and the aggregate production function can as well change with the assumption of symmetry across industries for simplicity, whereby each industry will have to use the same level of capital and labour as shown in the following equation;

$$Y = Ak^{\alpha - \beta} Li^{1-\alpha} \qquad 2.5$$

Apart from the review of neo-classical growth model, the study also review the theoretical inferences of [48] and [15], which is based on the efficiency of resource allocation, accumulation of productive resources and technical progress as fundamental functions of growth and development. The authors argue that government expenditure on basic infrastructure is capable of influencing the dynamics of industrial growth through efficiency of resource allocation and accumulation of productive resources, which further assumes influence on the productivity level of private sector. For instance, an increase in government expenditure on public intermediate goods such as roads, bridges, education among others, which is financed at the first instance through taxes or borrowing, withdraws financial resources from the private sector. Secondly, by the time the public goods become fully available and effectively utilized, it will positively affect the productivity of the companies and labour force using the facilities. This can also lead to reduction in production costs, (especially transaction cost) and mop up funds for new investments in physical and human capital, which further enhances the productivity of existing factors of production. This is at variance with the theoretical analysis of [15] that underdeveloped infrastructure in the economy often distorts the industry structure, which lead to unproductive centralization and vertical integration of the production process, and consequently produce an overwhelming negative effect on industrial growth of the economy.

Empirical Review

Extant studies were reviewed in some developed and developing countries to establish the nexus between infrastructure and industrial development. It is worthy of note that while some studies established positive relationship others reported negative. One of the leading empirical literature on the role of public infrastructure in growth and development of economies of the world is [6] study on the United States, in which the impact of public infrastructure on growth was discovered to be too large. On the other hand, in the case of developing countries, [17] discovered that public infrastructure expenditure had a negative effect on growth. This result, according to the authors, was based on the explanation that expenditures that are normally considered productive could become unproductive if they are in excess.

[39] in a study on "infrastructure investment and manufacturing sector in Venezuela", used an exogenous instrument for public infrastructure and considered of eight thousand, eight hundred and sixty-five (8865) firms. The result shows that a 10% increase in infrastructure investment leads to an increase of between 2%

and 3.5% in productivity of the manufacturing sub-sector in the country. This also implies that the government of Venezuela recovers 72% of the initial investment on infrastructure every year which according to the authors is excessively large.

In another study in South Africa, [22] investigate the impact of infrastructure (measured as fixed capital stock) on productivity growth. The study employs panel data estimation technique on the aggregate and three digit manufacturing data from 1970 to 1993. The study also distinguishes between direct and indirect effect where the direct effect relates to labour productivity growth and indirect effect concerns the total factor productivity (TFP) growth based on value added. The result shows the elasticity of public capital as 0.19, which suggest a strong and economically important direct effect, while the elasticity of total factor productivity TFP growth indicates -0.05 which is negatively not significant. The implication of this result is that public infrastructure positively affects productivity growth through factor accumulation but has a negative effect on technological progress in South Africa. [34] studies the role of public infrastructure in Greek manufacturing industries at the International Standard for Industrial Classification (ISIC) 2 level, using the iterated three stage least square as estimation technique. The study finds that public infrastructure (capital) is cost-saving for most industries in the country. Also, closely related to the work of [34] was the study by [26], which estimates the relationship between public infrastructure and TFP in both meta-countries and the Asian Tigers. The study employs several analytical techniques ranging from OLS to instrumental- variable version of fixed and random effects. The outcome of the study show a positive relationship between public infrastructure and TFP in the meta-countries while a negative relationship was obtained between public infrastructure and TFP for the Asian Tigers. [18] brought into focus the idea of regional differences in TFP in relation to public infrastructure in the southern region of Italy from 1970 to 1998. The study was actually interested in the ability of public infrastructure to raise the productivity of private capital, and favour specialization resulting in higher productivity in the industry. The study obtains elasticity values of 0.17 and 0.12 for core and total infrastructure, respectively which represent a larger impact on the southern region of Italy. This result, according to the authors, was in sharp contrast to many findings in similar studies carried out in the United States with non-significant impact. [23] adopted a different approach to the study of the impact of public infrastructure on the level of productivity in Spanish provinces between 1985 and 2001, using spatial model with fixed time and province effects. The study finds a positive impact of public infrastructure on productivity level; as well as creating negative spillover effect.

[30] Investigate the impact of government spending on basic social infrastructure on industrial growth in Tanzania, using time series data spanning 32 years with the analytical technique of simple growth accounting model. The study finds a negative effect of public infrastructure investment on industrial growth in Tanzania. This implies that investment in social infrastructure in Tanzania has not in any way been Productive. The findings contradict the outcome of a similar study carried out by [40].

In another related study by [30] on the effect of government spending on infrastructure on the growth of industrial output using a panel of thirty developing countries including Nigeria between 1970 and 1980, the study employee disaggregated approach and finds that the share of government expenditure on social infrastructure in GDP is positively and significantly related with industrial output in developing countries within the period studied. The study also reveals at sectoral level, that government investment and total expenditure on education remain the only outlays that significantly related with the growth of industrial output in developing countries.

[33] also in a study of relationship between human capital investment (as soft core infrastructure) and the overall productivity of the economy. The major finding of the study reveals that human capital investment is positively related to productivity i.e. investment in human capital leads to improved productivity in all sectors of the economy. This accordingly to Lucas [1998] allow for operating more complicated tasks and producing outputs with “high-skill”. The study also discovers human capital as positive externalities as widespread human capital increases the scope of new technologies, whereby industries are able to learn, adopt and adapt new techniques and technologies to move up value chains [see 10].

Meanwhile, there are relatively few studies related to infrastructure and industrial development in Nigeria. One of such studies was carried out by [27] on the long-run effect of infrastructure on industrialization in Nigeria. The study adopts co-integration and error correction mechanism, with data spanning 1980-2005. The study, which considers electricity, water, transport and communication as infrastructural facilities, discovers a long run relationship between infrastructure and industrial development in Nigeria. The study also reveals a negative response from both electricity supply and communication facilities towards industrial production in the country. Similarly, in a study on the poor state of infrastructure in terms of the cost of power outrages to the industrial and commercial sectors in Nigeria,[50] used the production function approach to evaluate the cost of power outrages between 1965 and 1966 using selected firms. The study discovers that the unsupplied electrical energy were 130kwh and 172kwh between the period; and the corresponding costs implication of the power outages to the industrial sector during the period are estimated at ₦1.68 million and ₦2.75 million respectively. This unsupplied electrical energy according to the study has a negative implication on the manufacturing productivity growth in Nigeria [see 49; 45].

Also, in another related study, [52] estimates the adaptive cost of electricity failure in Nigeria as USD 380 million and the estimated revenue lost to unsupplied consumer energy as USD 140million, respectively. The study also reveals that less than 50% of electricity is supplied nationwide in Nigeria and which is quite unreliable. The study further establishes that only 34% of the Nigerian population has access to public power supply which is always in short supply and carries negative implications for both household and manufacturing sub-sector [45].

However, the established gap from the literature was based on the fact that most of the reviewed studies dwelled extensively on the relationship between the physical or hard-core infrastructure (such as telecommunications, power, transport, water supply) and industrial development; with relatively few studies centered on social or soft-core infrastructure (such as education, health, accountability governance etc) in relation to industrial development. Hence, this study considers the long-run relationship of both physical (hard-core) and social (soft-core) infrastructure with industrial development in Nigeria.

Methodology

Theoretical Underpinning and Model Specification

The study adopts the endogenous neo-classical growth model to specify the model used in this study. Meanwhile, [9]; [42] and [33] had identified the substitution between capital and labour, introduction of government expenditure on infrastructure as public goods, and human capital investment in *eq. 3.1, 3.2 and 3.3* respectively as co-variables in the determination of output as follows;

$$Y = f[K, L] \qquad 3.1$$

$$Y = A(t)\, K^{\alpha 1} L^{\alpha 2} G^{\alpha 3} \qquad 3.2$$

$$Y = A(t)\, K^{\alpha 1} L^{\alpha 2} G^{\alpha 3} H^{\alpha 4} \qquad 3.3$$

Based on the major objective of the study and in line with [42] and [33] endogenous model specifications, the model used in this study is specifically derived to accommodate both physical (hard-core) infrastructure and social (soft-core) infrastructure, which include the physical structures such as telecommunications, power supply, transport, water projects; and the social elements of infrastructure like provision of health care and education, governance, accountability and property right among others. Therefore, the model used in the study is specified thus:

$$IND = f[GXED, GXHE, GXTC, GXES] \qquad 3.4$$

$$IND = \beta_0 + \beta_1 GXED + \beta_2 GXHE + \beta_3 GXTC + \beta_4 GXES + \mu i \qquad 3.5$$

Where, IND = Index of Industrial Production; GXED =Federal Government expenditure on Education GXHE= Federal Government expenditure on Health; GXTC= Federal Government expenditure on Transport and Communication; GXES=Federal Government expenditure on electricity Supply. The parameters of the model include β0, β1, β2, β3, β4 while μi represent the Stochastic Variable or Error term.

Data Source and Analytical Method

The method of analysis adopted in this study was co-integration and Error Correction Mechanism (ECM). The choice of it was informed by the need to determine the characteristics of variables used in the study; and also to determine whether a stable long- run relationship exists between the variables. The ECM techniques involved three different successive tests namely unit root test, co-integration test and the short run dynamic test, which also known as error correction mechanism (ECM). The unit root test was conducted to determine the stationary status and the order of integration of variables employed; the co- integration test determined the long run equilibrium relationships among the variables while the error correction test was to determine the percentage of error that must have been committed in the process of estimating the long run equilibrium equation, and which can be corrected. The Johansen co-integration test was employed to determine the long-run equilibrium relationship among the variables simply because of the advantage of its intuition and ease of estimation than other co-integration tests [20]. The study identified data on Federal government expenditure on education, health, transport and Communication, electricity supply as well as the index of industrial production for model estimation. The data spanning 1985 and 2015 were all sourced from the Central Bank of Nigeria Statistical Bulletin; Central Bank Annual Report and Statement of Accounts [12]. Nigeria Public Capital Expenditure, 1980-2015 [36].

Results and Discussion

Unit Root Analysis

The study conducted a unit root test to ascertain whether the variables used were stationary; and also to determine the order of integration of the variables. The Augmented Dickey –Fuller (ADF) test was used [19].

Table 1: Result of Augmented Dickey-Fuller Test

Variables	ADF Statistic	Critical Value at 5%	Order of Integration	Remarks
IND	-4.747487	-2.998064	1(0)	Stationary
GXED	-5.194999	-2.991878	1(0)	Stationary
GXHE	-5.433894	-2.991878	1(0)	Stationary
GXTC	-6.209702	-2.991878	1(0)	Stationary
GXES	-5.989453	-2.991878	1(0)	Stationary

Source: Author's Computation, 2017

Table 1 presents the result of Augmented Dickey-Fuller test, which shows that all the variables used were stationary at their level. In other words, industrial growth captured by the growth index of industrial production (IND),Federal government expenditure on education (GXED), health (GXHE), transport and communication (GXTC) and electricity supply (GXES) were all integrated of order zero. Hence, all the variables contained properties of a unit root. Also, the unit root tests show all the variables stationary at their level.

Co-integration Analysis

In order to determine the long run relationship between the index of industrial production and the government expenditure on education, health, transport and communication and other social infrastructure, a Johansen co-integration rank test (Trace) was conducted.

Table 2: Result of Johansen Co-integration Rank Test (Trace)

Hypothesized Number of Co-integrating equation	Eigen value	Trace Statistic	Critical Value at 5%	Probability
None *	0.805024	86.09961	69.81889	0.0015
At most 1*	0.612697	48.49733	47.85613	0.04325
At most 2	0.405249	26.68072	29.79707	0.1097
At most 3	0.320191	14.72964	15.49471	0.0650
At most 4*	0.224677	5.852933	3.841466	0.0155

Source: Author's Computation, 2017

Trace test indicates 2 co-integrating equations at the 0.05 level.

* Denotes rejection of the hypothesis at 0.05 level.

** Mackinnon-Haug-Michelis [1999] p- values.

Table 2 presents the result of Johansen co-integration rank test showing the two (2) co-integrating equations at 5% level. This tests show the long run equilibrium relationship between the index of industrial production and Federal government expenditure on education; health; transport and communication and electricity supply in Nigeria.

Table 3: Normalized Co- integrating Equation

IND	GXED	GXHE	GXTC	GXES
1.000000	0.046359	-0.050325	0.002855	0.003598
	(0.01079)	(0.01276)	(0.00327)	(0.00718)

Source: Author's Computation, 2017

Log likelihood = -148.3442

Table 3, presents the normalized co-integrating coefficients with the highest log-likelihood ratio to represent the long run equilibrium equation specified as follows:

IND = 0.046359GXED – 0.050325GXHE + 0.002855GXTC + 0.003598GXES

(0.01079) (0.01276) (0.00327) (0.00718)

The normalized co-integrating equation indicates long run equilibrium relationship between the index of industrial production (IND) and government expenditure on education, health, transport and communication and electricity supply in the economy during the period under review. It can be inferred that infrastructure investment produced a long run effect on industrial development in Nigeria [27]. The long run equilibrium equation indicates that government expenditure on education (GXED), transport and communication (GXTC) and electricity supply (GXES) had positive relationship with the index of industrial production (IND) while government expenditure on health (GXEH) responded negatively to the index of industrial production in Nigeria. One percent increase in government spending on education, transport and communication and electricity supply translated to a 4.64%, 0.29% and 0.36% growth in industrial production while one percent increase in government spending on health negatively reduced industrial production by 5.03% in Nigeria. The positive response of government expenditure on education, transport and communication and electricity supply towards industrial production in Nigeria conformed to expectation of the study and also in agreement with [30]; [8] and [2]. On the other hand, government expenditure on health as a social infrastructure responded negatively towards industrial production, which contradicts the expectation of the study. However, the result was in agreement with [32]; [44].

Error Correction Model

In order to capture the short run deviation that might have occurred in estimating the long run equilibrium equation, a dynamic error correction model was considered. The error correction estimates showed the speed of adjustment and convergence to equilibrium. The study adopted the parsimonious error correction model for the adjustment of shock in the equation.

Table 4: Parsimonious Error Correction Estimates

Variable	Co efficient	Standard error	T- statistic	Probability
C	-0.017036	0.008382	-2.032363	0.0649
D [IND (-2)]	0.364396	0.141439	2.576343	0.0243
D(GXED)	0.057913	0.012345	4.691129	0.0005
D[GXED(-1)]	0.026753	0.011992	2.230920	0.0455
D(GXHE)	-0.072157	0.015137	-4.767093	0.0005
D[GXHE(-1)]	-0.032430	0.014205	-2.282924	0.0415
D(GXTC)	0.006268	0.002565	2.443655	0.0310
D[GXTC(-2)]	-0.003268	0.002751	-1.187766	0.2579
D(GXES)	-0.008634	0.004908	-1.758966	0.1040
ECM (-1)	-1.291505	0.249277	-5.181008	0.0002

Source: Author's Computation, 2017

R^2 = 0.871974

DW Statistic = 2.228799

F- Statistic = 9.081192

Prob. (F- Statistic) = 0.000397

The results of the parsimonious (restricted) error correction estimates is shown in Table 4 with the coefficient of the ECM (-1) [-1.291505] showing a negative value as expected. The implication of the result is that about 12.9% speed of adjustment is needed in each period to adjust towards long run equilibrium. The probability value (0.02% < 10%) of ECM (-1) coefficient also confirmed its statistical significance. The parsimonious error correction model is therefore presented thus;

$$IND = -0.017036 + 0.364396IND_{t-2} + 0.057913GXED_t + 0.026753GXED_{t-1} - 0.072157GXHE_t$$
$$(0.008382) \quad (0.141439) \quad (0.012345) \quad (0.011992) \quad (0.015137)$$

$$0.032430GXHE_{t-1} + 0.0066286GXTC_t - 0.003268GXTC_{t-2} - 0.008634GXES_t - 1.291505ECM_{t-1}$$
$$(0.014205) \quad (0.002565) \quad (0.002751) \quad (0.004908) \quad (0.249277)$$

The presented parsimonious error correction model result shows that industrial production in the two previous years, government expenditure on education in both current and the previous one year, as well as government expenditure on transport and communication in the current year increased the level of current industrial production in the country by 36.4%, 5.79%, 2.68% and 0.66% respectively.

On the contrary, government expenditure on health in both the current and the previous one year, government expenditure on transport and communication in the two previous years, as well as the government expenditure on electricity supply in the current year reduced the level of industrial production in the current year by 7.22%, 3.24%, 0.33% and 0.86% respectively in Nigeria. The implication of the result is that there exists a relationship between the index of industrial production in both current and previous periods and government expenditure on physical and social infrastructure in the current and previous periods. The F-statistic value of 9.08 also shows that the model fitted the dataset

Conclusion

The objective of the study was based on the premise that most of the reviewed studies dwelled extensively on the relationship between investment in physical infrastructure and industrial growth and development with relatively few studies centered on social infrastructure and industrial development relationship. Therefore, the study considered the relationship between investment in both social and physical elements of infrastructure and industrial development in Nigeria. Using co-integration and error correction techniques of analysis, the study discovered that all the variables used were stationary at level. A long run equilibrium relationship was also established between infrastructure investment and industrial development in Nigeria. The study therefore concluded that in the long run investment in both hard and soft core infrastructure would contribute significantly to the level of industrial development in the country, through high quality work force and improvement in life expectancy of average Nigerians.

Conflicts of Interest

The author has not declared any conflicting interest in the course of writing the manuscript.

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