

# Effect Of Infrastructural Development on Foreign Direct Investment in Nigeria.

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*Abstract- The purpose of this study is to examine the effect of infrastructure on FDI inflow in Nigeria for the period of 1988-2018. The study used annual time series data sourced from Central Bank of Nigeria, World Bank, IMF and International Financial Statistics; using time's series data analytical techniques that solve the problems of non-stationarity. Infrastructure and other determinant of FDI inflow such as trade openness and economic growth are used to analyze their effect on FDI inflows; the Phillips-Perron (PP) unit root test was used to see whether the variables are stationary. The result revealed that only one variable was stationary at level while the rest variables are integrated of order one I(1) series. Since the variables are of different order of integration; it necessitate the use of the ARDL Bound test method to test for co-integration relationship among the variables. The result shows that the null hypothesis is rejected since the f-statistic is greater than the upper bound limit at 5%, indicating a long run relationship among the series in the model. Also ARDL technique was chosen for analysis because it is more appropriate for analysis when the variables used in a model are of different order of integration, the result of the ARDL analysis reveals that there will be no improved and sustainable FDI inflow into Nigeria if there is no effective tackling of the challenges of basic infrastructural needs of the country by ensuring efficient, stable and reliable power supply, safe potable water, effective, efficient and functional public transportation system, effective communication system, good trade openness relationship and efficient and stable economic growth in Nigeria, as these variables are the prerequisite for FDI inflow. The following recommendations were made: Trade openness coupled with ease of doing business was found to be a key prerequisite to attracting FDI inflow in Nigeria; so the government should work towards improving the investment climate. Strengthen*

*institutional infrastructures and governance, as they play a critical role in attracting FDI. Economic growth and a strong currency are key determinants of FDI inflows; hence, macroeconomic stability should be a priority for the government. The Central Bank of Nigeria should strive to retain inflation and interest rates as low as possible, and to maintain a strong currency. The government should increase broadband Internet connectivity, expand technical training institutes and harness innovative ideas for increased export of ICT goods and services and increase mobile cellular subscriptions, this will improve communication structure thereby attracting FDI inflows. Government should endeavour to increase and modernize air transport (passengers and Freight), more kilometers of tarmacked roads as a percentage of total road networks, more kilometers of rail line constructed and improve port infrastructure to increase container port traffic in order to attract FDI inflows. The government should construct and rehabilitate portable water systems in order to attract FDI inflows.*

*Indexed Terms- FDI inflow, Infrastructural development, Economic growth,*

## I. INTRODUCTION

### 1.1 Background to the Study

Foreign direct investment (FDI) is regarded as one of the fastest growing economic activities around the globe. It is one factor that adds to the quantum of economic activities that enable economic growth and development. Every country of the world, especially developing economies, strives to attract foreign direct investment (FDI) because it is a major source of external finance. The inflow of foreign capital is assumed to be beneficial to the receiving or host country in the sense that it contributes to local capital, managerial expertise and technological improvement. The developing countries are not an exception to this.

Cohen, (2007) opined that there are inexhaustible benefits associated with the inflow of FDI that are put to optimal use among which are the opportunity it affords developing countries to have access to modern technology and key administrative ingenuity which are capable of increasing domestic output, creating more jobs, lowering cost of production and raising workers' wages and standard of living, among others. FDI and international capital flows are closing the savings gap in developing countries Harunadanja (2012). The increasing FDI flows to developing countries since 1990 indicates that multinational companies have considered the host countries as the profitable investment destinations (Kokko, 1994). FDI plays a very important role in enhancing the welfare of host country due to benefits related to new innovation, new technology, new managerial techniques, development of skills, increased capital, creation of job opportunities and improvement in the working condition of employees and development of industrial sector in the host country (Markusen and Venables, 1999). According to Dunning (1990) for a country to attract FDI, it should take into considerations the following conditions: Firstly, the FDI firms must possess ownership advantages, which enable them to compete efficiently in the local market. Secondly, the host countries should possess some locational advantages which encourage outside firms to serve local market directly rather than going for exports.

Studies on the relationship between FDI and economic development reveal that the effects of FDI are complex especially when viewed from a macro perspective; FDI is seen to generate employment, high productivity, competitiveness, and technology spillovers. Denisia, 2010; Sichei and Kinyondo (2012) observe that Africa's inability to attract FDI is troubling because it presents a potential solution to the continent's growth and development challenges. They stress further that FDI provides the needed capital for investment, brings with it employment, managerial skills and technology and at the end accelerates growth and development.

On other hand, Infrastructural development in the national space provides the enabling environment for FDI's investments and to a great extent contributes to the safety of such investment. It is one of the major factors of development of any nation; the reason being

that it makes life easier by adding to the quality-of-life people live and enables seamless performance of business and economic activities. However, the major problem to Nigeria's low level of FDI attraction is primarily due to low level of savings and investment in infrastructure.

The rarity of infrastructure in Nigeria and Africa as a whole is a serious issue that is hindering the development of the African continent in general and Nigeria in particular. Carol, Nelson and George (2017) opined that evidence shows that quality infrastructure lowers the cost of doing business and thus attracts FDI. In Nigeria there are visible signs of infrastructure inadequacy and inefficiencies despite the fact that over the years there has been increased budgetary allocation to the infrastructure sector.

The most important and in fact, most challenging of the infrastructural gap is power, transportation and communication and distribution network.

Energy drives development and if the quantum of energy supply in Nigeria hardly carries domestic needs talk-less of industrial and commercial needs. The various self-help employments such as fashion and designing, hair dressing, welding, to mention but a few suffer greatly from inadequate power supply. If it is paucity to power micro and small businesses, one would imagine how the macro and big enterprises, especially manufacturing trepidations pass through in the face of power problem in the country. Outside power, other vital infrastructures such as effective communication (including internet broadband), transportation (roads, railway, airways and waterways); roads are only recently getting better and railways that have been moribund for decades are just coming back to life). Another critical infrastructural deficit is in the area of ports development. Nigeria originally have ports in Lagos(Tincan and Apapa),Rivers State(Onne and Port Harcourt ports), Delta(Warri port) and Cross River(Calabar port), but today it is only Tincan Island and Apapa ports that is working effectively and efficiently. The Tincan Island and Apapa ports are simply inadequate to carry the demands of a highly import-dependent and export aspiring economy like Nigeria. The dredging of Calabar port and the envisaged development of deep sea port in Lagos and Delta states with the attendant

easing of ports congestion, are however good omen). The low level of infrastructural development in the country, if we must conjecture, is a developmental challenge and a factor that deterred investor's inflow. Ogunjimi and Amune (2017) said the availability of infrastructure promotes FDI because it reduces operational costs of production. It is thus apparent that FDI is important in a country to bridge resources gap, saving-investment gap, technological gap, revenue-expenditure gap, and output and export gap, among others. The aforementioned benefits of FDI are crucial for sustainable economic growth in developing countries.

Although literature is awash with the concept of the determinants of FDI which mainly centered on resource endowment and other macro-economic variables as the factors encouraging or deterring investors. Among such other factors include: Return on investment, infrastructural development, human capital, political risk, government size, and openness of the economy to trade. Eze, Ndubuisi and Anekwe (2017) opined that the flow of FDI to Africa is less than that going to other individual parts of the globe; they further explained that Africa's share of global FDI inflows declined from 9.5 per cent in 1970 to 5.3 per cent in 2009. FDI flows in the world have increased dramatically from \$ 13.3 billion in 1970 to \$ 2.1 trillion in 2007 before declining to \$1.1 trillion in 2009 due to the global financial crisis in 2008-2009. However, Africa, as a region, has not benefited from the FDI boom since the volume of FDI inflows to the continent is not only low as a share of global FDI but is also on a downward trend for the last three decades as the above figures show (Denisia, 2010, Sichei & Kinyondo, 2012). They observe that FDI inflows to Africa have been to countries that are classified by the World Bank as oil and mineral dependent such as South Africa, Angola, Nigeria, Equatorial Guinea, and Egypt, among others. This phenomenon raises the questions, has Africa been attracting an asset or resource seeking FDI? The following facts they present speaks volume in this regard: FDI to Africa has been attracted to countries endowed with natural resources Eze, Ndubuisi and Anekwe (2017). 24 countries classified by the World Bank as oil- and mineral dependent have, on average, accounted for close to 75% of annual FDI flows to Africa. 10 leading recipients of FDI inflows in 2009 are Angola, Egypt,

Nigeria, South Africa, Sudan, Algeria, Libya, Congo, Tunisia, Ghana and Equatorial Guinea and these countries have large mineral and petroleum reserves.

According to Denisia (2010) a well-established and quality infrastructure is the most important determinant of FDI inflows. And this cannot be wished away in Africa with a lot of other impediments to development. This paper agreed with him that in addition to political and social instability this scenario can be, to a great extent, attributed to the fact that Africa, and Sub-Saharan Africa in particular, has less developed infrastructure. The reason is obvious: any investor would like to invest in an environment with well-developed infrastructure that would promote business operations.

## 1.2 Statement of the Problem

The acceleration of economic development is enhanced by the quantum of infrastructure available, which promote activities that enlarge the economy of any nation. Equally, in today's world no nation can develop as a closed system that is not allowing the inflow of resources from outside. This is why the contribution of foreign direct investment in accelerating development especially in a developing country can hardly be over-stressed. In Africa, and in particular the sub-Saharan Africa, there is a general low level of infrastructural development, and from our introductory background we have conjectured that this scenario might be one of the reasons Africa shares of FDI is very low. Consequently, it is averred here that this might be contributing in slowing down the economic development of African continent as a whole and Nigeria in particular.

Nigeria as a nation has found out that the low level of infrastructural development is hindering her development and the ability to occupy her place among the committee of nations, despite being the largest economy in Africa. Nigeria, having about 27 percent of Africa's GDP and 76 percent of GDP of the West African sub-region, holds a lot of potential to unlock Africa's development. This cannot happen without adequate infrastructure, including credit market as mentioned by Blonigen & Piger (2011) and the inflow of appropriate level of foreign capital.

Though there are other several factors determining the flow of foreign direct investment, but this paper tries to x-ray the place of infrastructure in attracting foreign direct investment. Government policy direction in attracting foreign direct investment is important and it is necessary to also gauge the extent such policies are yielding the desired result.

### 1.3 Objectives of the Study

The broad objective of this study was to examine the effect of infrastructure development on FDI inflow for economic development in Nigeria. The specific objectives of the study are to:

- i. Examine the effects of transport infrastructure development on FDI inflows to Nigeria.
- ii. Examine the effects of energy infrastructure development on FDI inflows to Nigeria.
- iii. Examine the effects of communication infrastructure development on FDI inflows to Nigeria.
- iv. Find out the effects of water infrastructure development on FDI inflows to Nigeria.

### 1.4 Statement of Hypotheses

This study was guided by the following hypotheses:

Ho<sub>1</sub>: There is no significant relationship between transport infrastructure development and FDI inflows to Nigeria.

Ho<sub>2</sub>: There is no significant relationship between the energy infrastructure developments and FDI inflows to Nigeria.

Ho<sub>3</sub>: There is no significant relationship between the communication infrastructure development and FDI inflows to Nigeria.

Ho<sub>4</sub>: There is no significant relationship between the water infrastructure development and FDI inflows to Nigeria

## II. LITERATURE REVIEW

The literature review is carried out under the following sub headings:

- Theoretical Literature
- Conceptual framework
- Empirical Literature
- Evaluation of Literature Reviewed

### 2.1 Theoretical Literature

The study was carried out under the combination of factors that determine FDI such as ownership-specific advantages and location-specification factors. And some theoretical models of multinational enterprise's (MNE's) such as theories of multinational activities, new trade theory and the Knowledge Capital theory.

#### 2.1.1 Ownership-Specific Advantages Factor

Eze, Ndubuisi and Anekwe (2017) opined that FDI inflows are largely as a result of a number of factors. According to Neil and Stephen (1979) foreign direct investment is a product of imperfection in goods and factors markets throughout the world, but some advantage is required to enable the MNE to produce and compete successfully in an unfamiliar foreign environment. FDI theories have suggested numerous ownership-specific advantages or factors such as technology and marketing skills, oligopolistic market structure and behavior, excess managerial capacity, financial and monetary factors, including access to raw materials. But they further argued that, the possession of ownership-specific advantages alone would not explain why a firm should engage in foreign production since it could exploit its unique advantage by say licensing a foreign producer. Neil and Stephen (1979) concluded that ownership-specific advantages represent only a necessary and not a sufficient condition for foreign direct investment (FDI) inflow in any nation.

#### 2.1.2 Location-Specification Factors

To explain the preference for investment abroad over exporting from home country, the location-specification factors needs to be taken into account; such factors are trade barriers, host government policies, relative labour cost and market size and growth. The theory of FDI provides certain pointers to the efficiency of MNEs in resource allocation but it cannot predict unambiguously; Neil and Stephen (1979). They explained that survey of businessmen have indicated that the host government's attitude to inward foreign investment, political stability and the prospects of market growth are the most important factors in determining the location of manufacturing facilities.

On the other hand, Udjo, Simelane and Booysen (2000), Bergstrand and Egger (2007), and Blonigen &

Piger (2011) independently developed theoretical models of multinational enterprise's (MNE's) of foreign investment decisions that explained that there are additional possible factors that determine FDI patterns or inflow into a nation.

Neil and Stephen (1979) explained that foreign direct investment might be viewed as a process allied to twentieth-century developments in transport and communication including air services, telephone and telex links etc.

To explain the choice of FDI over the alternatives of exporting and licensing, it is necessary to take into account (at least in some cases) location-specific factors such as relative cost of production (such as transportation, energy and communication costs), trade barriers, market characteristics and the likes. Note; it is the association of ownership and locational-specific factors which determines whether firstly a particular firm has an advantage over other firms, and secondly whether the firm will exploit that advantage by producing abroad, by exporting or by licensing.

### 2.1.3 Theories of Multinational Activities

The development of theories of the multinational enterprise occurred in three stages (Protsenko, 2003). The first models of multinational firms emerged from the traditional literature on international trade with competitive and constant-return models. Early analysis viewed multinational activities as a part of the theory of capital flows (Caves, 1971). This theory generated clear results that headquarter activities should be placed in capital-abundant countries with subsidiaries in capital-scarce countries. Thus, there was no motive for FDI to occur between identical countries. This was in contrast to empirical observations and led in the next stage to the "new trade theory".

### 2.1.4 New Trade Theory

The new trade theory incorporated the idea of increasing returns to scale and imperfect competition to the traditional models. Subsequently, the theory of the multinational enterprise was split into two parts. In the first, the theory of "vertical" FDI emerges, when the firm geographically separates the stages of production. It builds on the theory of capital flows, where direct investment was essentially a foreign

production branch. The other strand consists of "horizontal" FDI models, where the firm produces the same goods or services in different locations. Neil and Stephen (1979) explained that gravity variables may adequately capture "horizontal" motivations for FDI, where firms look to replicate their operations in other countries to be more proximate to consumers in those markets, additional controls are necessary to allow for "vertical" motivations of FDI, where firms look for low-cost locations for labor-intensive production. For example, these studies introduce measures of relative labor endowments in the host country with the expectation that countries with relatively high shares of unskilled labor will be attractive locations for MNEs due to lower wages.

### 2.1.5 The Knowledge Capital Theory

The third stage the new models tried to combine the two branches. The respective theory was called the "Knowledge Capital" model (KC). Certain characteristics of knowledge have been stressed by various authors as being particularly pertinent to an explanation of why MNEs choose international production rather than exporting or licensing. H.G. Johnson in Neil and Stephen (1979) suggested that knowledge has the characteristics of public goods to the firm. That is once the know-how has been achieved foreign subsidiaries can draw on it for examples knowledge from research and development (R&D) results, knowledge of market, access to cheaper inputs, etc. for this to be important in promoting direct investment however, there must either be no other potential buyers of the know-how or alternatively the MNE must be able to earn higher return by retaining the knowledge within the firm. Again since production differentiation is that it cannot easily be separated from the production process nor marketing activities of the firm; meaning licensing would not be feasible, since the information relating to differentiating the production could not be transferred independently of the firm and its managements.

### 2.1.6 The Relationship between the Theories and the study

The insights into the general combination of factors that determine FDI provided by the ownership-specific advantages and location-specification factors has led to a re-examination of FDI inflow into the development of sub-Saharan Africa. An empirical

evidence revealed that rather than the traditional determinants of FDI there are other major factors that determine FDI inflow into any country, for instance Anyanwu (2011) argued that the massive flow of FDI to the first world do not occur by chance, rather, it occurs by them having the absorptive capacities to attract FDI. This is what the literature calls the determinants of FDI, but a close inspection highlights the magnificent public utilities development ranging from state-of-the-art transportation, energy and communication facilities in developed countries, which is attributed to the massive public investment in those sectors. Moses, Anigbogu, Okoli and Anyanwu (2013) working on Domestic Investment and Foreign Direct Investment Inflow in Nigeria (the traditional or contemporary determinant of FDI). Adopting a decomposed, single-linear econometric model estimated by the OLS methodology within four decade {1970-2009}, and after subjecting the data set through series of preliminary tests, the findings were robust: private and public domestic investments as well as human capital and market size are negatively related to FDI inflows, while trade openness, transportation, energy, communication and natural resource are positively linked to FDI inflow. World evidence reveals that China is becoming the world best destination of FDI flows due to its investment-friendly climate, backed by huge transportation, energy, communication and trade openness infrastructural investment, low wage, and transition to a market economy (Wei, 2008). Other developing countries that have benefited by attracting significant FDI flows through upgrading their public utilities or infrastructural development are the Asian Tigers, such as Malaysia and Singapore.

On the other hand, the theory of Knowledge Capital” model approach like the above theories has been utilized as a framework for examining why MNEs choose international production rather than exporting or licensing. H.G. Johnson in Neil and Stephen (1979) suggested that knowledge has the characteristics of public goods to the firm. That is once the know-how has been achieved foreign subsidiaries can draw on it for examples knowledge from research and development (R&D) results, knowledge of market, easy communication method, openness to trade, access to cheaper inputs, cheaper energy, etc. attracts or repel the inflow of MNEs.

1. The study examines the contribution of each explanatory variable (Transport Infrastructure Development (TID), Energy Infrastructure Development (EID) and Communication Infrastructure Development (CID) to the inflow of Foreign Direct Investment (FDI) in Nigeria.
2. The theories were able to investigate the dynamics relationship between infrastructural development and inflow of Foreign Direct Investment (FDI).
3. The theories lay emphasis on factors that determine FDI (the contemporary determinant rather than traditional determinants) of FDI as one of the major factors that influences the inflow of FDI into sub-Saharan Africa.

Interestingly the theories of the multinational enterprise approach has resulted in extensive investigation why the headquarter activities should be placed in capital-abundant countries with subsidiaries in capital-scarce countries. Thus, there was no motive for FDI to occur between identical countries.

## 2.2 Conceptual Framework

### Meaning of Foreign Direct Investment

Foreign direct investment (FDI) is therefore defined “as an increase in the book value of the net worth of investment in one country held by investors of another country where the investments are under the managerial control of the investor” (Caves, 1996). To buttress the definition above, Todaro and Smith (2003) noted that most FDI are in fact subsidiaries of Multinational Corporations (MNCs) such that the investors are the parent organizations affirm. Thus, foreign direct investment inflows represent the expansion of the international activities of Multinational Corporations. According to Todaro and Smith (2011), foreign direct investments (FDI) can be defined as the overseas investments by private Multinational Corporation. It is a process where an investor acquiring substantial controlling interest in a foreign firm or sets up a subsidiary in a foreign country Sichei & Kinyondo (2012). Also Kozenkow (2014) described FDI as a company's physical investment into building a plant in another country, acquisition of a foreign firm or investment in a joint venture or strategic alliance with a foreign company in its local market. Eze, Ndubuisi and Anekwe (2017) opined that Foreign direct investment is an important component of economic growth and development for any nation.

Its impact is even more relevant in the developing countries yearning for the inflow of capital to finance activities and businesses that promote their development. According to OECD library, “FDI is defined as cross-border investment by a resident entity in one economy with the objective of obtaining a lasting interest in an enterprise resident in another economy. The lasting interest implies the existence of a long-term relationship between the direct investor and the enterprise and a significant degree of influence by the direct investor on the management of the enterprise. Ownership of at least 10% of the voting power, representing the influence by the investor, is the basic criterion used”

An overview of the typology of FDI would reveal a number of categorizations. There are three types of FDI. The first type is called market-seeking (horizontal) FDI, where investor’s purpose is to serve local markets. The reason for market-seeking FDI is market size and market growth. The second type of FDI is asset-seeking or resource-seeking FDI; this takes place when a company’s purpose is to gain access or acquire the resources in the host country which are not available in home country such as raw materials, natural resources or low-cost labour. The third type of FDI is efficiency-seeking FDI, which takes place when the company can gain when there is a common governance of geographically dispersed activities and presence of economies of scope and scale (Demirhan & Masca, 2008; Sichei & Kinyondo, 2012).

According to Protsenko (2003), four main definitions of vertical and horizontal FDI have been used in the previous literature. The first definition is based on the motivation of investment. Here, FDI is classified to be vertical or horizontal depending on the motive for affiliate operations. Thus, vertical FDI is conducted in order to benefit from factor price differences between countries Hanson, Mataloni, & Slaughter (2003). The second way to distinguish between the two types of FDI was proposed by Brainard (1993), who uses the term “factor proportion” in order to explain foreign activities of MNE. This methodology is derived from the empirical estimation of international trade flows. The third definition employs the geographical distribution of sales of the foreign affiliate (Brainard, 1993, 1997, and Lankes and Venables, 1997). Finally, Markusen (1995) defines vertical FDI as a

geographical separation of the production process by stages, which is very similar to fragmentation.

Eze, Ndubuisi and Anekwe (2017) said there are two main reasons for firms to go multinational (thus engaging in FDI): To serve a foreign market and to get lower cost inputs. This distinction is used to differentiate between two main types of FDI: horizontal and vertical. Horizontal FDI refers to the foreign manufacturing of products and services roughly similar to those the firm produces in its home market. This type of FDI is called “horizontal” because the multinational duplicates the same activities in different countries. Horizontal FDI arises because it is too costly to serve the foreign market by exports due to transportation costs or trade barriers. Vertical FDI refers to those multinationals that fragment production process geographically. It is called “vertical” because MNE separates the production chain vertically by outsourcing some production stages abroad. The basic idea behind the analysis of this type of FDI is that a production process consists of multiple stages with different input requirements. If input prices vary across countries, it becomes profitable for the firm to split the production chain (Protsenko 2003).

He further highlights that vertical FDI “consists of two groups: backward and forward vertical FDI. In case of backward FDI a multinational enterprise establishes its own supplier of input goods which delivers inputs to the parent company. Conducting forward FDI, the firm builds up a foreign affiliate, which draws inputs from the parent company for own production, thus staying after the parent in the production chain” (Protsenko 2003).

On another note he contends that a clear separation between horizontal and vertical FDI is not possible, because in case of horizontal FDI affiliates draw some headquarter services from the parent company, even when the firm duplicates the same production activity in several countries. Thus, each horizontal MNE has some vertical traits. Closely related to the term vertical FDI is the literature on outsourcing and fragmentation. These terms are more general and include often the geographical separation of production that takes place outside the firm.

### 2.2.2 Meaning of Infrastructure and Development

Todaro and Smith (2011) defined infrastructure as those facilities that enable economic activity and markets such as transportation, communication and distribution network, utilities, water, sewer and energy supply systems. Infrastructure covers many dimensions, ranging from roads, ports, railways, and telecommunication systems to institutional development (e.g., accounting, legal services) Kozenkow (2014). Frischmann 2007 and Pendse 1980 defined infrastructure as the resource systems that have been harnessed for the development of a society. The American Heritage Dictionary defines infrastructure as “The basic facilities, services, and installations needed for the functioning of a community or society, such as transportation and communications systems, water and power lines, and public institutions including schools, post offices, and prisons”.

Ogunleye (2014) said many authors have reviewed the concept of infrastructure but basically the whole definitions are always base on the same issues, which are roads, telecommunications, educations, water supply, energy, power grids and hospitals. Udjo, Simelane and Booyesen (2000) identifies infrastructure as having both direct and indirect impact on the growth of an economy. Infrastructure is said to add to economic growth and development by raising efficiency and providing facilities, which enhance the quality of life. Ogunleye (2014) defined infrastructure as the unpaid factor of production which tends to raise productivity of other factors while serving as intermediate inputs to production. The services engendered as a result of an adequate infrastructure base will translate to an increase in aggregate output. Canning and Fay (1993) also found that the developing countries demonstrated a high rate of return on transport infrastructure, which compared favorably with those of developed countries. Todaro and Smith (2011) defined economic infrastructure as those capitals embodied in roads, railways, waterways, airways and other forms of transportation and communication plus water supplies, electricity, and public services such as health and education.

On the other hand infrastructure development is the construction and improvement of foundational

services with the goal of sparking economic development and growth and improvement in quality of life. It improves efficiency and productivity in the economy. Asiedu (2002) stated that good infrastructure increases the productivity of investment and can therefore stimulate FDI inflows. But poor infrastructure is one of the main hindrance and obstacles of the FDI inflow in any country and good infrastructural facilities will sure make a nation more attractive to foreign investors as well improve the qualities of the domestic investment. Bad roads, delays in shipments of goods at ports, and unreliable means of communication have added to these disincentives Kozenkow (2014). FDI depends only on the infrastructure of the host countries so it is very imperative for every nation to develop her infrastructure in order to improve her domestic investments and also to attract the foreign investors. The Infrastructure Fund of the Nigeria Sovereign Investment Authority (NSIA) in its Investment Policy Statement has it that the Fund will invest in infrastructure projects in sectors which have the potential to contribute to the growth and diversification of the Nigerian economy, create jobs within Nigeria and where possible attract foreign investment. One of the objectives of the Nigeria Sovereign Investment Authority is to enhance the development of the Nigerian infrastructure sector. The Act establishing the Authority provides for the establishment and management of an infrastructure fund by the NSIA. The Infrastructure Fund as one of the three funds of the Authority seeks to make a positive financial return on its investments in the infrastructure sector in Nigeria. It also aims to attract and support foreign investment and enable growth and development. This is obviously in realization of the fact that without infrastructure, Nigeria’s development would be a mirage.

### 2.2.3 Rationale for Attracting Foreign Direct Investment:

Todaro and Smith (2009) proffer a comprehensive rationale for attracting FDI, which they tagged traditional economic argument in support of foreign private investment. To them, the main reasons for attracting FDI inflows are to fill the savings, foreign exchange, revenue, and management gaps. The first and most often cited rationale of FDI to national development (i.e., when development is defined in

terms of GDP growth rate) is its role in filling the resource gap between targeted or desired investment and locally mobilized savings. When the domestic resources (savings) fall short relative to the potential investment, FDI is seen as an alternative to fill-up that gap; second, it contributes to filling the gap between targeted foreign exchange requirements and those derived from net export earnings plus net foreign aid. This is the so-called foreign exchange or trade gap. An inflow of foreign capital cannot only alleviate part or the entire deficit on the balance of payment current account but also function to remove that deficit over time if the foreign-owned enterprise can generate a net positive flow of export earnings. Furthermore, FDI augment the revenue of the host country. By taxing MNCs profit, the host nation is thought to be better able to mobilize public financial resources for development projects. Also, foreign investments bring with them advanced management, entrepreneurship, technology and skills that can be transferred to their local counterparts by means of training programs and the process of learning by doing. In addition, FDI is said to be socially desirable in LDCs because it leads to a net increase in capital formulation, output, and employment. However, it is pertinent to know that this rationale differ from country to country. This explains why some countries are making concerted effort to accelerate economic growth by encouraging inflows of foreign capital while others are indifferent

#### 2.2.4 Impact of FDI on Nigerian Economy

Generally, the literature on FDI and economic growth in Nigeria show a positive relationship between the two variables. Researchers have tried to gauge the impact that FDI has on the Nigerian economy with mixed results. For example, Ehimare (2011) found out that FDI has positive and significant impact on current account balance in the balance of payment, but maintains that there is no strong empirical evidence to support the notion that FDI has been pivotal to economic growth in Nigeria. Asiedu (2002) outlines various findings on this matter. Brown (1962) and Obinna (1983) report positive linkages between FDI and economic growth in Nigeria. Endozien (1968) discusses the linkage effects of FDI on the Nigerian economy and submits that these have not been considerable and that the broad linkage effects were lower than the Chenery-Watanabe average (Chenery and Watanabe, 1958). Oseghale and Amonkhianan

(1987) found that FDI is positively associated with GDP, concluding that greater inflow of FDI will spell a better economic performance for the country. Ariyo (1998) studied the investment trend and its impact on Nigeria's economic growth over the years. He found that only private domestic investment consistently contributed to raising GDP growth rates (public domestic investments were generally wasteful and had negative impact) during the period considered (1970-1995). Furthermore, there is no reliable evidence that all the investment variables included in his analysis have any perceptible influence on economic growth. He therefore suggests the need for an institutional rearrangement that recognizes and protects the interest of major partners in the development of the economy. Kurtishi-Kastrati (2013) rightly observed that the world economy is changing very rapidly. Many countries in 60s and 70s were hostile toward foreign investment but as they realize the positive contribution foreign direct investment is making to their development their attitude toward FDI has changed. Asiedu (2002) analyzed the power of FDI on the economic growth of the developing countries and found that foreign investments increases the productivity levels due to higher capital stock and at the same time improves the balance of payment position. Ayanwale and Bamire (2001) assess the influence of FDI on firm level productivity in Nigeria and report a positive spillover of foreign firms on domestic firm's productivity. Ayanwale (2007) also observed that many countries and continents (especially developing ones) now see attracting FDI as an important element in their strategy for economic development. This he attributes mainly to the fact that FDI is seen as an amalgamation of capital, technology, marketing and management.

A lot of researches on the impact of FDI on the economy of host country vary in their findings depending on the focus and methodology of the research. But there appears to be a consensus that FDI impact on economic growth. Earlier researches favour short-run benefits, in which case the impact on economic growth appears not to be sustainable. For example, the following analysis by Kurtishi-Kastrati (2013) is instructive.

“Moreover, Kemp (1961) examined FDI and the advantages that the national economy receives from

this type of external financing. According to Diamond (1965) the prospect of people in the countries which import capital is bright and vice versa for people in the countries which export capital, their prospect is depressing. He placed special emphasis on the productivity of foreign investment. If not, the countries receiving it might not get real benefits. From these analyses or in other words from the early literature of the 1960s it is revealed that in the short run the effect of foreign investment on economic growth are positive, but in the long run the benefits are not sustainable.

The effects of FDI regarding economic growth are examined for different regions. According to the data gained, only Africa has improved its economic growth via FDI. However, the evaluations for other regions to confirm a positive relationship were not significant. Findlay (1978) verifies the influence of foreign investments on host country's technological progress rate, which takes place through a contagion effect involving factors employed by foreign firms such as more advanced technology and management practices. The impact of FDI with special reference to international trade was analyzed by Ayanwale and Bamire (2001). According to him, countries actively pursuing an export led growth strategy can reap enormous benefits from foreign investment. Export led policy is one which connects average effective exchange rate on exports to the average effective exchange rate on imports. Whereas, import substitution policies are worked out in such a way that the two exchange rates are not equal. The previous policy favors free trade and emphasizes the need to boost export, while the latter underlines self-sufficiency through import substitution."

### 2.3 Empirical Literature

Several myriads of empirical studies have been conducted on the relationship between infrastructures and foreign direct investment (FDI) inflow for different countries of the world. The objective of their studies was to investigate or examine the relationship between infrastructure and FDI inflow; as well as how this relationship influences economic development. Although attraction of foreign investment is not an end in itself but a means to an end as its ultimate goal is to achieve economic development.

Working on the roles of infrastructure in attracting FDI between the period of 1981 and 2014, Ogunjimi, and Amune (2017) using the unit root method; which result revealed that none of the variables in the study is integrated of order two, that is,  $I(2)$ , a condition which justifies the use of Autoregressive Distribution Lag (ARDL) framework. The result of the estimation of the selected ARDL Error Correction Model shows that none of the infrastructural variables (Tractor, Telephone lines and Electricity) employed in the study was significant to attract FDI into Nigeria in the short-run although electricity production (power supply) was found to influence FDI in the long-run. The study thus recommends that the power sector be revitalized and should be given priority as it will attract FDI. Moses, Anigbogu, Okoli and Anyanwu (2013) working on Domestic Investment and Foreign Direct Investment Inflow in Nigeria (the traditional or contemporary determinant of FDI).

They Adopted a decomposed, single-linear econometric model estimated by the OLS methodology within four decade {1970-2009}, and after subjecting the data set through series of preliminary tests, the findings were robust: private and public domestic investments as well as human capital and market size are negatively related to FDI inflows, while natural resource and contemporary determinant of FDI (such as trade openness, transportation, energy and communication) are positively linked to FDI inflow. Disagreeing with Moses, Anigbogu, Okoli and Anyanwu (2013) that contemporary determinant of FDI is the major factors that determine FDI inflow in any nation; Fung et al (2005) examine which type of infrastructure (hard or soft) draws the attention of foreign investor and attracts FDI to China. Analyzing a time series data drawn from China Foreign Economic Statistical Yearbook 1994 and Almanac of China Foreign Relations and Trade, the empirical result of the estimation of the regression model shows that both soft and hard infrastructure have a significant positive effect on FDI inflow although that soft infrastructures persistently outpace hard infrastructure in attracting FDI. Soft infrastructure was found to be the most instrumental variables for attracting FDI to China. The result implies that initiating and implementing market reforms (soft infrastructure) have more positive significant effect on FDI attraction

than constructing more hard infrastructures like roads and railways.

In another vein; Carol, Nelson and George (2017) examine the effect of infrastructural development on foreign direct investment (FDI) inflow in Kenya. The study used annual time series data sourced from Central Bank of Kenya, World Bank and the United Nations Conference on Trade and Development (UNCTAD). The result of the multiple regression analysis revealed that quality infrastructure lowers the cost of doing business and thus attracts FDI in Kenya and also an improved transport infrastructure; communication infrastructure, water and waste infrastructure, exchange rate, economic growth and trade openness are important determinants of FDI inflows into Kenya. Hence, for Kenya to attract more FDI, continued infrastructural development is key since quality infrastructure affords investors a conducive investment climate in which to operate.

Ebekozien, Ugochukwu and Okoye (2015) investigate the inflow trends of Foreign Direct Investment in Nigerian construction industry with a view to studying the pattern of flow and assessing the effect of increased flow of FDI on the industry. Annualized time series archival data from the central bank of Nigeria and the National Bureau of Statistics served as the data source. Duncan Multiple Range Test and Granger Test were used, while the hypotheses were tested with the aid of the *f* test. The results revealed that there is poor flow (or an insignificant flow) of FDI into construction sector when compared to other sectors of the economy. According to Granger sense, the Granger Causality is bi-directional, suggesting that FDI is an important prerequisite and catalyst for sustainable growth and development in construction and on the other hand, the level of infrastructural facilities available on ground is a prerequisite for attracting foreign direct investors (FDI).

Adopting a co-integration and Error-Correction Model to examine the primary benefits of transport infrastructural development on FDI, Houghwout (2001) result revealed that transport infrastructural development increased accessibility and reduced cost of doing business; meaning is the major determinant of FDI. Houghwout argued that even if such infrastructure has no direct role in the cost structure,

evidence suggests that the indirect spillovers from agglomeration and clustering created by public infrastructure lower the costs of firms.

Voorpijl (2011) analyzed FDI in Kenya, with an emphasis on the gains and losses associated with foreign involvement. Using a qualitative approach with a sample of investors who had made a long-term investment, the study unearthed the strengths of analyzing the investment climate.

This was necessary since the investment climate determines the economic stage of a country and is a reflection of the type of FDI. According to Voorpijl, the most important investment motives are the presence and access to a good infrastructural network and a highly educated and relatively cheap but qualified labour force.

Working on the relationship between infrastructure and FDI in India between the year 2002 and 2007; in his work the effects of infrastructure on FDI inflow, Chakrabarti (2012) using OLS, cointegration and Error-Correction Model methods, finds out that there is a considerable variation in the level of public infrastructure in 2001 among the various Indian states together with the FDI inflows between 2002 and 2007. He also discovered that there is a positive relationship between physical infrastructure and FDI inflow. However, FDI inflow was found to remain insensitive to changes in infrastructure till a threshold is reached after which it increases steeply with an increase in infrastructure. The result also showed that there is a non-linear positive relationship between physical infrastructure and FDI inflows.

Ang (2012) ) identified the main determinants and impacts of FDI on China's economy by considering five key aspects including total inward and outward FDI flows; FDI inflows in comparison with other capital sources; main countries of origin and destination of investment; sectorial and geographical distribution of FDI; and forms of investment. On fitting a time series econometric model, the study found out the following to be the main determinants of FDI inflows: size and growth of the Chinese economy; natural and human resource endowments; physical, financial and technological infrastructure; openness to international trade and access to international markets;

regulatory framework; and investment protection and promotion. In the study, physical, financial and technological infrastructure was found to be highly correlated with FDI inflows and this was attributed to the multiplier effect of infrastructure development, key to this being openness to international trade and access to international markets, which depends on sound infrastructural facilities.

This work updated the work of Cheng and Kwan (2000) who found support for good infrastructure (density of roads) as a determinant of FDI in 29 Chinese regions from 1985 to 1995. Also the scope of the study (year) was extended to reflect the Chinese current state of affair.

Wheeler and Mody (1992) found that infrastructure quality is an important variable for developing countries seeking to attract FDI from the United States. Further, using a self-reinforcing model of FDI, Seetanah (2009) used time series data between the period 1981-2005, examining the link between FDI and transport infrastructure in Mauritius with a view to investigating the role of transportation infrastructure in attracting FDI to the manufacturing and services sector of Mauritius. He adopted two models: Distributed Lag-Error Correction Model (DL-ECM) and Distributed Model. The result of his investigation revealed that both non-transport and transportation infrastructure are important determinants of FDI inflow to the sectors of the Mauritius economy. However, the manufacturing sector's investors pay more attention to these infrastructural capitals than the services sector's investors.

In a study examined by Dumon (2014) on the importance of infrastructural resources; the study make use of OLS techniques and variables such as Roads, highways, bridges, airport and seaport. He concludes the result of his analysis by saying every economy requires infrastructural resources in order to facilitate the sale of goods and services. Roads, highways, bridges and other forms of physical infrastructure should be present and well maintained to provide sufficient safety for the transportation of goods as well as for the commuting of employees. Lower transaction costs enable investors to earn

returns on their investments as their enterprises are able to generate profits.

Yasmin, Hussain and Chaudhary (2003) analyzed the volume and determinants of FDI in developing countries. Basing the analysis on a sample of 15 developing countries, 5 each from upper-middle, lower middle and lower-income countries, the study established that the flow of FDI to developing countries has followed an uneven path. The analysis further showed that urbanization, GDP per capita, standard of living, inflation, current account and wages affect FDI inflows in low-income countries; urbanization, labour force, domestic investment, trade openness, standard of living, current account, external debt and wages affect FDI inflows in lower-middle-income countries; and urbanization, labour force, GDP per capita, domestic investment, trade openness and external debt affect FDI inflows in the sampled upper middle- income countries. The study attributed variations in FDI to institutional and structural differences among the countries analyzed. From the three segments, it is evident that urbanization is a key determinant of FDI inflows; hence, well-planned urban areas with the necessary infrastructure facilities are likely to attract more FDI.

Omezzine and Hakro (2011) carried out a study on the link between FDI flows and governance infrastructure in Mena Region countries to investigate the extent to which governance infrastructure affects FDI inflows to North African and Middle East countries. Subjecting the time series data collected from UN Statistical Yearbooks, World Investment Reports and World Bank to Augmented Dickey Fuller (ADF) test and Johansen cointegration test, the result revealed that governance infrastructure has a significant positive impact on FDI flows to the regions. It was also found that improvement in governance increases the returns on investments.

Cordero and Paus (2008) in a study on foreign investment and economic development in Costa Rica; the cointegration test result established that the Costa Rican government's efforts to address concerns on improved road access, telecommunications, uninterrupted access to reliable electricity and water at reasonable prices had contributed towards attracting more FDI to the country. Cordero and Paus's findings

were similar to Kazembe and Namizinga's (2007) findings.

Jordaan (2010), while studying FDI and neighboring influences, established that good-quality and well-developed infrastructure increases the productivity potential of investments in a country and therefore stimulates FDI flows towards the country. Consistent with Asiedu (2002) and Ancharaz (2003), Jordaan argued that the number of telephones per 1,000 inhabitants is a good measure for infrastructure development. The study, however, noted that this measure falls short and only captures the availability and not the reliability of the infrastructure. The study only included fixed-line infrastructure and not cellular telephones, and omitted other important infrastructure facilities, such as roads and rail transport, water and energy supply and sources.

Behname (2012) used cross-sectional data of Southern Asia countries between 1980 and 2009 to investigate the effect of urban infrastructure on FDI; the cointegration test result, found out that urban infrastructure impacts FDI positively and recommended that the governments in the southern Asia countries should give priority to infrastructural development for FDI attraction.

Using cross-sectional data covering 18 Arab countries, Moosa (2012) argued that FDI can be explained in terms of the GDP growth rate, enrolment in tertiary education, spending on research and development, country risk and domestic investment. Countries that are more successful in attracting FDI are those that have growing economies that pay attention to education and research. Additionally, Moosa argued that openness of the economy represents the FDI and exports relationship, while telephone lines per 1,000 inhabitants is a measure of availability and cost of telecommunications. Moreover, energy availability and sustainability is of particular importance to efficiency-seeking investors.

On this note, Asiedu (2002) empirically investigate 34 African countries over the period 1980–2000 using cointegration and error correction model of times series data analysis of number of telephones per 1,000 populations to measure infrastructure development; concluded that countries that improved their

infrastructure were rewarded with more investments. He estimated that a one-unit increase in infrastructure led to a 1.12 per cent increase in FDI/GDP in the 1980s.

In a study by Bhinda, Griffith-Jones, and Martin (1999), it was found that problems related to funds mobilization were on the priority list of the factors discouraging investors in Uganda, Tanzania, and Zambia. Surveys in sub-Saharan Africa indicate that poor accounting standards, inadequate disclosure, and weak enforcement of legal obligations have damaged the credibility of financial institutions to the extent of deterring foreign investors.

As argued by Loree and Guisinger (1995), there is a growing literature on the link between political risk and FDI inflow. The unit root and the cointegration test result found out that political risk had a negative impact on FDI. While Hausmann and Fernandez (2000) found no relationship between FDI flows and political risk. Edwards (2010) studying on capital flows and FDI in developing countries established that political instability had an effect on FDI inflow, while political violence did not have an effect on FDI inflows.

In other hand, Jerome and Ogunkola (2004) assessed the magnitude, direction and prospects of Foreign Direct Investment (FDI) in Nigeria. The result of the cointegration analysis noted that while the Foreign Direct Investment (FDI) regime in Nigeria was generally improving, some serious deficiencies remain. These deficiencies are mainly in the area of the corporate environment (such as corporate law, bankruptcy, labour law etc).

Using cross-section data, Alfaro (2001) found that poorly developed financial infrastructure can adversely affect an economy's ability to take advantage of the potential benefits of FDI. Adelegan (2008) further explored the seemingly unrelated regression model to examine the impact of FDI on economic growth in Nigeria and found out that FDI is pro-consumption and pro-import and negatively related to gross domestic investment.

Fleshman (2009) investigated the empirical challenges of FDI in the construction sector in South Africa. The

result of the OLS techniques conclusively identified six factors responsible for the hindrances of FDI in construction sector in South Africa as: discrimination, policy framework, market, cost consideration, corruption and insecurity of investment.

From the forgoing myriads of empirical studies above it is now palpable that FDI depends mostly on the infrastructural development and any nation with strong infrastructural institutions will become a host country to FDI. These become very imperative for every nation to develop her infrastructure in order to attract the foreign investors which in turn influences the economic development of the nation.

#### 2.4 Evaluation of Literature Reviewed

This study specifically examines the effect of Infrastructural Development on foreign direct investment in Nigeria; using the following explanatory variables Transport Infrastructure Development (TID), Energy Infrastructure Development (EID) and Communication Infrastructure Development (CID) which affect the inflow of Foreign Direct Investment (FDI) in Nigeria.

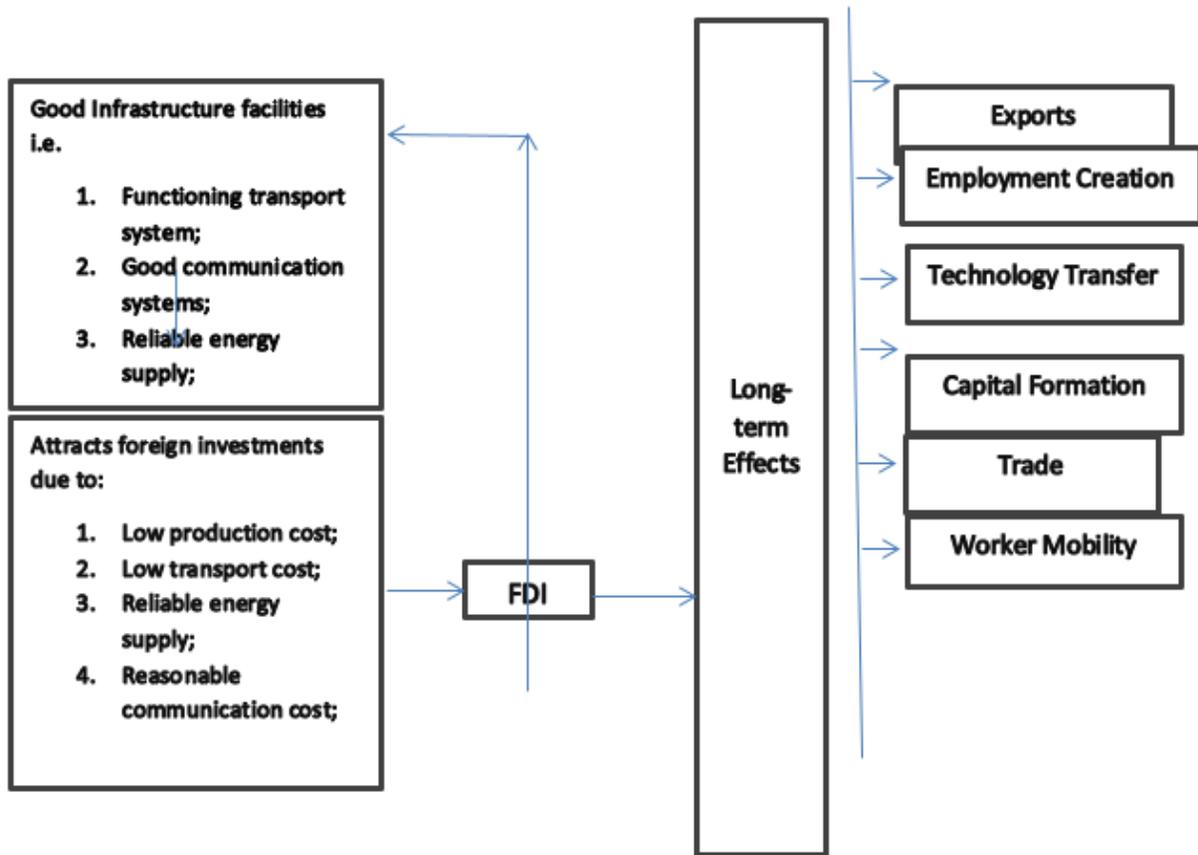
From the literature reviewed, it is evident that the determinants of FDI inflows are many and varied. Most of these factors have been captured by Chakrabarti (2003). It is also evident that most of the studies are in agreement on the levels of variable measurement and description. It has been established that the different perspectives employed by the different studies, methodologies, sample selection, data horizons and the fitted models coupled with the analytical tools cause most of the variations. However, a sizable number of the results are in consonance. For example, factors, such as labour costs, trade tariffs and

barriers, trade openness and balance, exchange rate, quality infrastructure, economic growth and tax regimes, have been found to be significant determinants of FDI inflow. However, the level of significance has been found different for different regions and income cohorts. Hence, there are concerns on the reliability of the results of previous studies, in relation to their robustness.

One notable factor that has been narrowly captured in most of the studies has been infrastructure. Ancharaz (2003), Asiedu (2002), Jordaan (2010) and Moosa (2012) have all used telephone lines per 1,000 inhabitants to represent the whole infrastructure spectrum. To them, this is part of the infrastructure needed to conduct international business and is a measure of availability and cost of telecommunications, which is important for multinationals to coordinate cross-border activity. Nyaosi (2011) established that infrastructure affects FDI inflows significantly and these findings were similar to those of Calderon (2009), Mwega (2009), UNCTAD (2005) and World Bank (2009). All these studies used a few variables to represent the whole spectrum of infrastructure development.

This study, therefore, takes cognizance of the fact that infrastructure comprises many sub-indicators and thus takes into consideration most of the variables considered in previous studies, in addition to other selected sub-indicators, to construct infrastructure indices using principal component analysis (PCA). Together with the infrastructure indices, other variables as presented in the conceptual framework (see Figure 1) were included in the study.

Figure 1: Long Run Effect of Infrastructure on FDI Inflow in a Less Developed Nation.



Source: Carol, Nelson and George (2017).

### III. METHODOLOGY

#### 3.1 Research Design

Research design according to Arthur (2004) is a framework used as a guide for collection and analyzing data for a study. A quasi-experimental research design was used for the study which included both descriptive and analytical. Descriptive research is that research which specifies the nature of a given phenomenon. This involves a systematic explanation of a situation while analytical analysis involves the use of dependent and explanatory variables in a regression model.

#### 3.2 Methods of Data Collection and Sources

This study was basically time series base. The data was sourced from the publications of the World Bank, IMF, International Financial Statistics and Central Bank of Nigeria. The above sources were augmented from sources such as text books, Journal of Economic

and Finance and text books. Time series data for foreign direct investment (FDI) inflow in Nigeria and infrastructure (Air transport, Urban Electricity consumption in Nigeria and Mobile cellular subscribers in Nigeria) were obtained from World Bank, IMF, International Financial Statistics and Central Bank of Nigeria.

#### 3.3 The Model Specification

Several myriads of empirical studies have been conducted on the relationship between infrastructures and foreign direct investment (FDI) inflow for different countries of the world. The objective of their studies was to investigate or examine the relationship between infrastructure and FDI inflow; as well as how this relationship influences economic development. Although attraction of foreign investment is not an end in itself but a means to an end as its ultimate goal is to achieve economic development of a nation. For instance, as proposed by Kinda (2010), determinants of FDI and the decisions to invest in a certain country

depend on the return on investment measured by profit. However, factors that determine profit also determine FDI. These factors include economic factors (transport infrastructure, energy infrastructure, communication infrastructure, economic growth and exchange rate), social factors (water and waste management infrastructure, wage) and political factors (security and openness to trade). Using an annual time series data Chakrabarti (2012) examined the effects of infrastructure on FDI inflow in different Indian states; Carol, Nelson and George (2017) determine the effect of infrastructure development on foreign direct investment inflow in Kenya. Seetana (2009) examining the link between FDI and transport infrastructure in Mauritius.

Infrastructure comprises many sub-indicators and thus in this study, the selected sub-indicators were used to construct four infrastructure indices using principal component analysis (PCA). The index was calculated using the formula:

$$I_i = W_1 X_{j1} + W_2 X_{j2} + \dots + W_n X_{jn} \quad (1)$$

Where  $I_i$  is the infrastructure index for the  $i$ th category (TI, EI, CI and WI) and  $W_i$  is the weight of the  $j$ th indicator. In general, the FDI inflows model takes the form:

$$FDI = X\beta + \varepsilon \quad (2)$$

Where FDI inflows are a function of a  $1 \times n$  vector of observations of  $n$  exogenous variables ( $X$ ) with  $\beta$  coefficients and the regression error term ( $\varepsilon$ ); all variables were introduced in logarithmic

transformations. Therefore, the econometric model was specified in a multiplicative form:

$$FDI_t = \beta_0 T_i^{\beta_1} E_i^{\beta_2} C_i^{\beta_3} W_i^{\beta_4} EG_t^{\beta_5} TO_t^{\beta_6} e^{\varepsilon} \quad (3)$$

- Where
- FDI=Foreign Direct Investment Inflow Index
- TI=Transport Infrastructure Index
- EI=Energy Infrastructure Index
- CI=Communication Infrastructure Index
- WI=Water Infrastructure (Access to good drinking water) Index
- EG=Economic Growth
- TO=Trade Openness (Real Trade Share (Import + Export) per real GDP)
- $\varepsilon$ = Regression Error Term
- $t$ = the year.

Assuming a linear relationship among explanatory variables the explicit form of equation (3) becomes:

$$\ln FDI_t = \beta_0 + \beta_1 \ln T_i + \beta_2 \ln E_i + \beta_3 \ln C_i + \beta_4 \ln W_i + \beta_5 \ln EG + \beta_6 \ln TO + \varepsilon \quad (4)$$

The variables expressed in equation 4 are in logarithm form; they express the elasticity of FDI inflow with respect to the variables to which each is attached.

In terms of Apriori expectations regarding the signs of the coefficient estimates of the variables in equation 4; we expect a positive sign for each of them.

(For definitions and measurement of variables, see Table 1.)

Table 1. Variable Definition and Measurement

Variable	Definition and Measurement	Scale
Foreign Investment (FDI)	This is a measure of net inflows in Nigeria. It was the dependent Variable.	Ratio
Transport Infrastructure Development Index (TID)	Transport infrastructure. Air transport (number of passengers and freight), kilometers of tarmacked roads as a percentage of total road network in Nigeria, kilometers of railway line, port infrastructure (container port traffic in numbers), and number of passenger cars (per 1,000 people).	Ratio

Energy Infrastructure Development Index (EID)	Energy infrastructure	Electric power consumption per kWh; per capita consumption of kilometers of oil equivalent; energy generation in MW as a percentage of demand; renewable energy generation in MW as a percentage of total generation; and percentage connection to the national grid (access to electricity in the urban and rural area).	Ratio
Communication Infrastructure Development Index (CID)	Communication infrastructure:	Fixed broadband Internet subscribers per 1,000 people; telephone lines per 1,000 people, ICT goods exports (as a percentage of total goods exports) ICT goods imports (as a percentage of total goods imports); and No of mobile cellular subscriptions (per 100 people).	Ratio
Water Infrastructure Development Index (WID), Economic Growth (EG)	Water management infrastructure:	water availability measured in M <sup>3</sup> as a percentage of demand in M <sup>3</sup> ; and improved water source in urban areas (% of urban population with access). The level of economic growth expressed as a percentage.	Ratio Ratio
Trade Openness (TO).		Trade openness expressed as the sum of export and import to GDP.	Ratio

Source: Author’s construction.

### 3.4 Data Analysis Techniques

This study employed both descriptive and analytical statistics to analyze the trend and flows of the variables. A standard procedure for investigating the stationarity of a time series is via unit root tests using the Phillip Peron (PP), Dickey Fuller (DF) or Augmented Dickey Fuller (ADF) approaches, among many others. Also, the Co-integration was used to test for the long run relationship among the variables in the model and the ARDL to correct the pitfall of the short run model.

This study adopts the Phillip Peron (PP) and ADF approach which appears to be in common use. The econometric software of E-view 10 was used in running the model. Some test of significance were conducted as explained above, they include

- 1) Coefficient of Determination Test (R<sup>2</sup>): R<sup>2</sup> measures the percentage variation in the dependent variables that is explained by the explanatory or independent variables. It measures the goodness of fit, the higher the R<sup>2</sup>, the better the goodness of fit.
- 2) F-Statistic: in this study, the F-test is the test for the overall significance of the model estimated. The decision rule is that if the F-Calculated > F-Critical, it establishes an acceptance of the alternative

hypothesis. The reverse is the case if the Calculated < F-Critical.

- 3) Durbin Watson Test: in this study, the D/W test is used to detect the presence of auto correlation from the analysis. The decision rule is that if the DW calculated > 2: is Negative serial Correlation  
DW calculated < 2: is Positive serial Correlation  
DW calculated = 2: is No serial Correlation

#### 3.4.1 Pre-Estimation test Used

The following are the pre-estimation test used in the work

- 1) Unit Root Test (Augmented Dickey-Fuller (ADF) Unit Root Test and Phillip Peron (PP) Unit Root Test
- 2) Co-integration Test (Bound Test)

##### 3.4.1.1 UNIT ROOT TEST:

The name unit root is due to the fact that the probability value  $\rho = 1$ .

Technically speaking: If  $\rho = 1$ , we can write Equ (1) as  $Y_t - Y_{t-1} = ut$ . Using the lag operator  $L$  so that  $LY_t = Y_{t-1}$ ,  $L^2Y_t = Y_{t-2}$ , and so on, we can write Equ (1) as  $(1 - L)Y_t = ut$ .

The term unit root simply means the root of the polynomial in the lag operator. If you set  $(1 - L) = 0$ , we obtain,  $L = 1$ , hence the name unit root.

If in Equ (1) it is assumed that the initial value of  $Y$  ( $=Y_0$ ) is zero,  $|\rho| < 1$ , and  $ut$  is white noise and distributed normally with zero mean and unit variance, then it follows that  $E(Y_t)=0$  and  $\text{var}(Y_t)=1/(1-\rho^2)$ . Since both are constants, by the definition of weak stationarity,  $Y_t$  is stationary.

On the other hand, as we saw before, if  $\rho = 1$ ,  $Y_t$  is a random walk or nonstationary.

Thus the terms nonstationarity, random walk, unit root, and stochastic trend can be treated synonymously. If, however,  $|\rho| < 1$ , that is if the absolute value of  $\rho$  is less than one, then it can be shown that the time series  $Y_t$  is stationary in the sense we have defined it.

A test of stationarity (or nonstationarity) that has become widely popular over the past several years is the unit root test. We will first explain it, then illustrate it, and then consider some of its limitations.

We start with unit root (stochastic) process. Which is  $Y_t = \rho Y_{t-1} + ut \quad -1 \leq \rho \leq 1$  -----  
-1

Where  $ut$  is a white noise error term.

We know that if  $\rho = 1$ , that is, in the case of the unit root, Equ (1) becomes a random walk model without drift, which we know is a nonstationary stochastic process. Therefore, if we regress  $Y_t$  on its (one-period) lagged value  $Y_{t-1}$  and find out that the estimated  $\rho$  is statistically equal to 1? If it is, then  $Y_t$  is non stationary.

NOTE: This is the general idea behind the unit root test of stationarity.

However, we cannot estimate Equ (1) by OLS and test the hypothesis that  $\rho = 1$  by the usual  $t$  test because that test is severely biased in the case of a unit root. Therefore, we manipulate Equ (1) as follows:

We Subtract  $Y_{t-1}$  from both sides of Equ (1) to obtain:

$$Y_t - Y_{t-1} = \rho Y_{t-1} - Y_{t-1} + ut$$

$$= (\rho - 1) Y_{t-1} + ut$$

-----2

Which can be alternatively written as:

$$\Delta Y_t = \delta Y_{t-1} + ut$$

-----3

Where  $\delta = (\rho - 1)$  and  $\Delta$ , as usual, is the first difference operator.

NOTE: In practice, therefore, instead of estimating Equ. (1), we estimate Equ. (3) and test the (null) hypothesis that  $\delta = 0$ , the alternative hypothesis being that  $\delta < 0$  (Since  $\delta = (\rho - 1)$ , for stationarity  $\rho$  must be less than one. For this to happen  $\delta$  must be negative).

NOTE: If  $\delta = 0$ , then  $\rho = 1$ , that is we have a unit root, meaning the time series under consideration is nonstationary. Before we proceed to estimate Equ (3), it may be noted that if  $\delta = 0$ , Equ. (3) will become  $\Delta Y_t = (Y_t - Y_{t-1}) = ut$  -----  
---4

Since  $ut$  is a white noise error term, it is stationary, which means that the first differences of a random walk time series are stationary.

We take the first differences of  $Y_t$  and regress them on  $Y_{t-1}$  and see if the estimated slope coefficient in this regression ( $=\hat{\delta}$ ) is zero or not. If it is zero, we conclude that  $Y_t$  is non-stationary. But if it is negative, we conclude that  $Y_t$  is stationary.

In applying the unit root tests one should therefore keep in mind the limitations of the tests. Of course, there have been modifications of these tests by Perron and Ng, Elliot, Rothenberg and Stock, Fuller, and Leybourne. Because of this, Maddala and Kim advocate that the traditional DF, ADF, and PP tests should be discarded. As econometric software packages incorporate the new tests that may very well happen. But it should be added that as yet there is no uniformly powerful test of the unit root hypothesis.

NOTE: For this study we used the Augmented Dickey-Fuller (ADF) Unit Root Test and Phillip Peron (PP) Unit Root Test

### 3.4.1.1.1 Augmented Dickey-Fuller Unit Root Test

This involves testing the order of integration of the individual series under consideration. Thus, a variable is considered to be integrated of a particular order if the ADF critical value is greater than the variable critical value at 1%, 5% and 10%. Augmented Dickey-Fuller test relies on rejecting a null hypothesis of unit root (the series are non-stationary) in favor of the alternative hypotheses of stationarity. The tests are conducted with and without a deterministic trend (t) for each of the series. The general form of ADF is estimated by the following regression

$$\Delta YDt = \theta_0 + \theta_1 YDt-1 + \sum \theta_i \Delta YDi + \alpha t + Ut \quad (3.4)$$

Where: YD is a time series, t is a linear time trend,  $\Delta$  is the first difference operator,  $\theta_0$  is a constant, n is the optimum number of lags in the independent variables and U is random error term.

### 3.4.1.1.2 Phillip Peron (PP) Unit Root Test

Compared with the Augmented Dickey-Fuller test, Phillips-Perron test makes correction to the test statistics and is robust to the unspecified autocorrelation and heteroscedasticity in the errors. There are two types of test statistics,  $Z\rho$  and  $Z\tau$ , which have the same asymptotic distributions as Augmented Dickey-Fuller test statistic, ADF.

The calculations of each type of the Phillips Perron test is explained thus; If the lag.short = TRUE, we use the default number of Newey-West lags floor ( $4 * (\text{length}(x) / 100)^{0.25}$ ), otherwise floor ( $12 * (\text{length}(x) / 100)^{0.25}$ ) to calculate the test statistics. In order to calculate the test statistic, we consider three types of linear regression models.

The first type (type1) is the one with no drift and linear trend with respect to time:

$$x[t] = \rho * x[t-1] + e[t],$$

Where e[t] is an error term.

The second type (type2) is the one with drift but no linear trend:

$$x[t] = \mu + \rho * x[t-1] + e[t].$$

The third type (type3) is the one with both drift and linear trend:

$$x[t] = \mu + \alpha * t + \rho * x[t-1] + e[t].$$

The p.value is calculated by the interpolation of test statistics from the critical values tables (Table 10.A.1

for  $Z_{\rho}$  and 10.A.2 for  $Z_{\tau}$  in Fuller (1996)) with a given sample size

$$n = \text{length}(x).$$

A matrix for test results with three columns (lag,  $Z_{\rho}$  or  $Z_{\tau}$ , p.value) and three rows (type1, type2, type3). Each row is the test results (including lag parameter, test statistic and p.value) for each type of linear equation.

### 3.4.1.3 Co-integration Test

Co-integration is a statistical property of a collection ( $X_1, X_2, \dots, X_k$ ) of time series variables. NOTE:

- Firstly, all of the series must be integrated of order  $d$ .
- Secondly, if a linear combination of this collection is integrated of order less than  $d$ , then the collection is said to be co-integrated.

Formally, if ( $X, Y, Z$ ) are each integrated of order  $d$ , and there exist coefficients  $a, b, c$  such that  $aX + bY + cZ$  is integrated of order less than  $d$ , then  $X, Y$ , and  $Z$  are co-integrated.

The basic argument of Johansen's procedure is that the rank of matrix of variables can be used to determine whether or not the two variables are co-integrated. A lack of Co-integration suggests that such variables have no long-run relationship. Co-integration is conducted based on the test proposed by Johansen (1998). Johansen's methodology takes its starting point in the vector auto regression (VAR) of order P given by

$$YDt = \mu + \Delta 1 YDt-1 + \dots + \Delta P YDt-p + Ut$$

Where:

$Y_t$  is an  $n \times 1$  vector of variables that are integrated of order commonly denoted (1) and  $U_t$  is an  $n \times 1$  vector of innovations.

The VAR model can be rewritten as

$$\Delta YDt = \mu + \eta Yt-1 + \sum \tau_i \Delta YDt-1 + Ut$$

To determine the number of co-integration vectors, Johansen (1998) and Johansen and Juselius (1990) suggested two statistic tests, the first one is the trace test and the second is max-Eigen test. It tests the null hypothesis that the number of distinct co-integrating vector is less than or equal to  $q$  against a general unrestricted alternatives  $q = r$ .

The test will be calculated as follows:

$$\lambda_{\text{trace}}(r) = -T \sum \ln(1 - \lambda_i) \quad (3.7)$$

Where:

T is the number of usable observations, and the  $\lambda_{1,s}$  are the estimated eigenvalue from the matrix.

### 3.4.1 Post Estimation test Used

These tests were carried out as a post estimate test to ascertain if the statistical criteria of the estimated model are met and as well as certain if the general model is good for policy recommendation. Thus, the various test conducted include; heteroskedasticity test via ARCH, normality test via Jarque-Bera.

#### 3.4.1.1 HETEROSKEDASTICITY TEST

A time-series model can have heteroscedasticity if the dependent variable changes significantly from the beginning to the end of the series. if you're modeling time series data and measurement error changes over time, heteroscedasticity can be present because regression analysis includes measurement error in the error term. For example, if measurement error decreases over time as better methods are introduced, you'd expect the error variance to diminish over time as well.

Therefore, Heteroskedasticity means that the spread of the error term's probability distribution differs from observation to observation.

Recall the error term equal variance premise:

- Error Term Equal Variance Premise: The variance of the error term's probability distribution for each observation is the same; all the variances equal  $\text{Var}[e]$ :

$$\text{Var}[e_1] = \text{Var}[e_2] = \dots = \text{Var}[e_T] = \text{Var}[e]$$

The presence of heteroskedasticity violates the error term equal variance premise.

White (1980): said if the probability value  $p$  of a test statistics is greater than 0.05 (5%), it implies no evidence of heteroscedasticity at 5% level of significance.

Testing for Heteroskedasticity essentially mean to test  $H_0: \text{Var}(e|x_1, x_2, \dots, x_k) = \sigma^2$ , which is equivalent to  $H_0: E(e^2|x_1, x_2, \dots, x_k) = E(e^2) = \sigma^2 n$

If assume the relationship between  $e^2$  and  $x_j$  will be linear, can test as a linear restriction So, for  $e^2 = \delta_0 + \delta_1 x_1 + \dots + \delta_k x_k + v$  this means testing  $H_0: \delta_1 = \delta_2 = \dots = \delta_k = 0$ .

The Breusch-Pagan Test Don't observes the error, but can estimate it with the residuals from the OLS regression. After regressing the residuals squared on all of the  $x$ 's, can use the  $R^2$  to form a Lagrange Multiplier (LM) test. The LM statistic is  $LM = nR^2$ , which is distributed  $\chi^2_k$ .

#### 3.4.1.2 NORMALITY TEST:

It is used only if rapid decision is to be taken for the normality of the distribution

- It is used to determine the normal distribution of the residual terms.
- It determines whether sample data has been drawn from a normally distributed population (within some tolerance).

The following are the statistical tests used for normality test

- The Jarque – Bera (jb) test
- The W/S test
- The Student's t-test
- The one-way and two-way ANOVA

We used the Jarque-Bera test for this study

3.4.1.2.1 JARQUE – BERA (JB) TEST: This test gives the value of  $X^2$  for  $df = 2$  to test the normality of distribution. If  $X^2$  observe value <table value of  $X^2$  for  $df = 2$  at 0.05(5%) level of significance, we concluded that the data is taken from normally distributed population. If it is not, non-parametric test has to be used to analyze the data to test research hypotheses.

The following formula is used to calculate  $X^2$  in this method.

$$X^2_{JB} = n (SK^2/6 + Kurt^2/24)$$

Where,

$X^2_{JB}$  = Observe  $X^2$  for JB test.

n = Number of observations in sample.

SK = Skewness Kurt = Kurtosis (Excess Kurtosis).

#### 3.4.3 Analytical Techniques Used

The following are the Analytical Techniques used in the work

1) Auto Regression and Distribution-lag (ARDL)

3.4.3.1 Auto Regression and Distribution-lag (ARDL)

Auto regression and distribution-lag (ARDL) model allows the researcher to include the lag values of the dependent and independent variables of a model while carrying out regression analysis.

The literature behind this method states that if the series are of different order of integration  $I(0)$  and  $I(1)$  but not  $I(2)$ , then the Engle-Granger integration test which supports uniformity in the order integration breaks down hence, ARDL is the appropriate cointegrating techniques for possible long run relationship among the series.

In the other hand, in economics the dependence of a variable  $Y$  (the dependent variable) on another variable(s)  $X$  (the explanatory variable) is rarely instantaneous. Very often,  $Y$  responds to  $X$  with a lapse of time. Such a lapse of time is called a *lag*.

In regression analysis involving time series data, if the regression model includes not only the current but also the lagged (past) values of the explanatory variables (the  $X$ 's), it is called a distributed-lag model. If the model includes one or more lagged values of the dependent variable among its explanatory variables, it is called an autoregressive model.

Thus,  $Y_t = \alpha + \beta_0 X_t + \beta_1 X_{t-1} + \beta_2 X_{t-2} + ut$  represents a distributed-lag model, whereas

$Y_t = \alpha + \beta X_t + \gamma Y_{t-1} + ut$  is an example of an autoregressive model.

IV. RESULTS

4.0 Data Presentation and Analysis

4.1 Data Presentation

This chapter focuses on the presentation, analysis of data and results of the study. Findings and testing the relevance of the stated hypotheses were also carried out here.

In carrying out this analysis we recognize that there is a need to assess the stationarity or otherwise of the data series. This is because an attempt to regress a non-stationary series on another non-stationary series leads to spurious regression. Furthermore, statistical tests of the parameters resulting from the regression may be biased and inconsistent. A standard procedure for investigating the stationarity of a time series is via unit root tests using the Phillip Peron (PP), Dickey Fuller (DF) or Augmented Dickey Fuller (ADF) approaches, among many others. This study adopts the PP, approach which appears to be in common use.

The PP test consists of testing the null hypothesis ( $H_0$ ) that  $\rho = 0$  in the regression equation above. The hypothesis is rejected if the pseudo t-statistics resulting from the above equation is below the absolute value of the critical value reported in Engle and Yoo (1987). We used the E-Views 10 econometric software for all the data analyses carried out in this study.

Table 2: Presentation of Data Set

Data Set on Foreign Direct Investment (FDI) Inflows, Transport Infrastructure Development (TID), Energy Infrastructure Development (EID) Communication Infrastructure Development (CID), Water Infrastructure Development (WID), Economic Growth (EG) and Trade Openness (TO).

Observed Years (obs)	Transport Infrastructure Development (TID)	Energy Infrastructure Development (EID)	Water Infrastructure Development (WID),	Economic Growth (EG)	Trade Openness (TO).	Communication Infrastructure Development (CID)	Foreign Direct Investment (FDI)
1988	19,700	82.1	80.12	49.648	16.94	9,017	0.76
1989	15,900	82.4	80.23	44.003	34.18	9,020	4.28
1990	17,400	82.4	80.21	54.036	30.92	9,021	1.09

1991	14,900	83.395	80.42	49.118	37.02	9,029	1.45
1992	12,500	83.499	80.51	47.795	38.23	9,031	1.88
1993	11,900	83.599	80.43	27.752	33.72	9,049	4.85
1994	11,200	83.691	80.34	33.833	23.06	12,800	5.79
1995	6,600	83.772	80.123	44.062	39.53	13,000	2.45
1996	5,600	83.838	80.13	51.076	40.26	14,000	3.12
1997	6,400	83.885	80.11	54.458	51.46	15,000	2.83
1998	7,500	83.911	80.32	54.604	39.28	20,000	1.93
1999	8,400	84.3	80.67	59.373	34.46	25,000	1.69
2000	12,761	83.917	80.445	69.449	49.00	30,000	1.64
2001	10,667	83.908	80.78	74.03	49.68	266,461,	1.61
2002	13,151	83.899	81.48	95.386	40.04	1,569,050	1.96
2003	8,987	84.9	82.041	104.912	49.33	3,149,473	1.91
2004	8,254	83.9	82.594	136.386	31.9	9,147,209	1.37
2005	16,227	83.92	83.962	176.134	33.06	18,587,000	2.83
2006	16,045	83.953	84.477	236.104	42.57	32,322,202	2.06
2007	16,936	86.163	84.986	275.626	39.34	40,395,611	2.19
2008	18,005	84.8	85.495	337.036	40.8	62,988,492	2.43
2009	16,851	84.129	85.99	291.88	36.06	74,518,264	2.93
2010	61,789	79.8	86.48	363.36	43.32	87,297,789	1.66
2011	68,014	87.1	86.893	410.335	53.28	95,167,308	2.15
2012	65,631	84.419	87.364	459.376	44.53	112,777,785	1.54
2013	59,182	83.6	87.832	514.966	31.05	127,246,092	1.08
2014	61,512	84.659	88.302	568.499	30.89	138,960,308	0.82
2015	61,474	81.5	88.761	494.583	21.45	150,830,089	0.63
2016	53,971	86.0	89.195	404.65	20.72	154,342,168	1.10
2017	53,696	86.8	89.599	375.745	26.35	144,920,170	0.93
2018	77,482	86.4	89.601	397.27	26.43	172,730,603	0.50

Source: Central Bank of Nigeria, World Bank, IMF and International Financial Statistics

4.2.1 Descriptive Statistics

4.2 Empirical Data Analysis

Table 3: Descriptive Statistics of variables

	CID	EG	EID	FDI	TID	TO	WDI
Mean	73779354	312.6134	84.32112	1.719412	11504445	37.27588	85.64094
Median	74518264	337.0360	84.12900	1.660000	18005.00	39.34000	85.99000
Std. Dev.	57321495	156.7332	1.777248	0.679912	25577393	9.526325	2.811308
Skewness	0.056055	-0.096620	-0.775373	0.140710	1.705388	-0.167890	-0.346506
Kurtosis	1.503028	1.831332	3.984211	2.115261	3.922116	2.154146	1.995936
Jarque-Bera	1.596225	0.993882	2.389550	0.610556	8.842610	0.586654	1.054290
Probability	0.450178	0.608389	0.302772	0.736919	0.012019	0.745778	0.590288
Observations	17	17	17	17	17	17	17

Source: Author’s computation, 2020.

Table 3 shows the analysis of seven variables used in this research model. The result from the table shows that CID recorded a mean value of 73779354, EG

recorded a mean of 312.6134, EID recorded a mean of 84.32112, FDI, TID, TO and WDI recorded mean of 1.719412, 11504445, 37.27588 and 85.64094 respectively. CID, FDI and TID recorded positive skewness while for EG, EID, TO and WDI recorded

negative skewness. The Jarque-Bera probability values show that all variables are statistically significant at 5% level of significance except for TID whose probability value is less than 0.05 hence, it is not statistically significant at 5%. . This implies that it is not normally distributed and this is not healthy for statistically inference. Phillips-Perron unit root test

was used to test for stationary of the variables in order to correct the above named implication. The total number of observations for each variable is 17.

4.2.2 Unit Root Test Results

Table 4: Phillips-Perron (PP) Unit Root Test Result for level

Vardiables	Phillips-Perron Test Methods				Decision
	Calculated values	Critical Values	Order of Integration	I(d)	
	Level 5%	1%			
TID	-1.675433	-3.568379	-4.296729	-	Non-stationary
EID	-8.059407	-3.568379	-4.296729	I (0)	Stationary
WID	-1.901206	-3.568379	-4.296729	-	Non-stationary
EG	-1.806559	-3.568379	-4.296729	-	Non-Stationary
TO	-3.540476	-3.568379	-4.296729	-	Non-stationary
CID	-0.904592	-3.568379	-4.296729	-	Non-stationary
FDI	-4.796765	-3.568379	-4.296729	I (0)	stationary

Source: Author’s computation, 2020.

Table 4 shows the result of the Phillips-Perron unit root test result conducted on the seven variables at level form. It is observed from the table that EID and FDI are stationary at level form given their calculated values which is greater than their critical values at 5%

level of significance. This means that they are integrated of order zero I (0) series while other variables were not stationary at their level form, this lead to first differencing them.

Table 5: Phillips-Perron (PP) Unit Root Test Result for I<sup>st</sup> Difference

Variables	Augmented Dickey-Fuller Test Methods			Order of Integration	Decision
	Calculated values	Critical Values	I(d)		
	I <sup>st</sup> difference	5%			
TID	-4.410179	-3.568379	-4.296729	I (1)	Stationary
EID	-	-	-	-	-
WID	-5.564581	-3.733200	-4.667883	I (1)	Stationary
EG	-3.489858	-2.967767	-3.679322	I (1)	Stationary
TO	-18.84293	-3.580623	-4.323979	I (1)	Stationary
CID	-4.283267	-3.595026	-4.356068	I (1)	Stationary
FDI	-	-	-	-	-

Source: Author’s computation, 2020.

Table 5 shows the result of the first differenced variables. It is observed that TID, WID, EG, TO and CID that were not stationary at level form became stationary after first differencing given their calculated values which is greater than their critical values at 5% level of significance. These variables are integrated of order one I (1) series. This simply implies that the variables used in this study are of different order of integration and this necessitated the use of the ARDL Bound test method to test for co-integration relationship among the variables.

4.2.3 Co-integration Test Result

Table 6: Bounds Test Co-integration Result

Significant Level	I(0) Bound Test	I(1) Bound Test	Statistics
5%	2.27	3.28	f-Statistics =19.21507

Table 7: ARDL Model Result

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
FDI (-1)	0.631299	0.255468	2.471146	0.1321
CID	1.44E-08	1.68E-08	0.852705	0.4836
CID (-1)	-2.06E-08	1.31E-08	-1.577038	0.2555
EG	-0.005909	0.001548	-3.818109	0.0623
EG (-1)	0.009994	0.001958	5.102899	0.0363
EID	0.162388	0.054379	2.986235	0.0962
TID	-1.08E-08	3.53E-09	-3.055429	0.0925
TID (-1)	-1.23E-08	3.19E-09	-3.862483	0.0610
TO	0.038827	0.011138	3.486144	0.0733
TO (-1)	0.030892	0.011748	2.629505	0.1193
WID	2.674567	0.344272	7.768766	0.0162
WID (-1)	-2.584293	0.464257	-5.566516	0.0308
C	-25.45132	14.43653	-1.762980	0.2200

Source: Author’s Computation, 2020.

R<sup>2</sup> = 0.908750; ADJ R<sup>2</sup>=0.858744; F-statistics = 22.59482; Prob. (0.043137);

D-W =1.567151

k = 6

Source: Author’s computation, 2020.

Table 6 gives a breakdown of the ARDL bound test of co-integration conducted on the variables in order to examine if long run relationship exist among them. The hypothesis was tested in the null form which states that there is no long run relationship among the series in the model. The result shows that the f-statistics value of 19.21507 is greater than the lower and upper bound limit values of 2.27 and 3.28 at 5% respectively. The null hypothesis is rejected when the f-statistic is greater than the upper bound limit at 5%, hence we conclude that there is long run relationship among the series in the model.

4.2.4 Regression Result Analysis

Table 7 reveals the result of the Autoregressive Distributive Lag Model. ARDL technique was chosen for analysis because it is more appropriate for analysis when the variables used in a model are of different order of integration (Pasaran, Shin and Smith (2001). It is observed from the result that the coefficient of Communication Infrastructure Development (CID) is positive in the current year but negative after one year lag. The probability values for both years is not significant at 5%, this conforms with the study of Ogunjimi and Amune (2017) who also used ARDL technique and found out that Communication infrastructure development has no significant relationship with foreign direct investment in Nigeria. This implies that development of Communication Infrastructure has a positive but insignificant effect on Foreign Direct investment in the current year but a negative and insignificant effect on Foreign Direct Investment after one year lag.

Economic Growth (EG) is seen to have a negative and insignificant relationship with foreign direct investment in the current year but after one year lag, the relationship becomes positive and significant. This is in line with the studies of Ang (2017) and Moosa (2012) who found a positive and significant relationship between Economic Growth and Foreign Direct Investment. This implies that economic growth is needed for foreign direct investment inflow.

Energy Infrastructure Development (EID) has a positive but insignificant relationship with Foreign Direct Investment. An increase in Energy Infrastructure Development will lead to an increase in foreign direct investment. Ogunjimi and Amune (2017) also had similar results in their study. Energy infrastructure did not have a significant relationship with FDI in the short run but a significant relationship was recorded in the long run. This implies that the development in the energy sector does not have immediate effect on foreign direct investment but when the development must have matured after some years, then foreign direct investment inflows begins to flourish.

Transport Infrastructure Development (TID) has a negative and insignificant relationship with foreign

direct investment both in the current year and after one year lag. This implies that an increase in the development of transport infrastructure will lead to a decrease in foreign direct investment. This is not in line with the studies of Seetanah (2009) and Dumon (2014) who found a significant relationship between transport infrastructure development and foreign direct investment. This insignificant relationship could be attributed to the poor conditions of our roads, presently, not so much effort is being put into the development of transport infrastructure.

Trade Openness (TO) is seen to have a positive but insignificant relationship with foreign direct investment in the current year and after one year lag. An increase in trade openness will lead to an increase in foreign direct investment both in the current year and after one year lag. This result conforms to the studies of Ang (2012) who did his study in China and Carol, Nelson and George (2017) who did their study in Kenya. Both studies found a positive relationship between trade openness and foreign direct investment. Meaning that trade openness is a necessary ingredient for foreign direct investment inflows.

Water Infrastructure Development (WID) is seen to have a positive and significant relationship with foreign Direct Investment in the current year. This means that an increase in the development of water infrastructure leads to an increase in foreign direct investment inflows.

The coefficient of determination ( $R^2$ ) is (0.908750) which shows that 90.9% of changes in the dependent variable were explained by the independent variables while the remaining 9.1% were captured by the error term. The Durbin-Watson statistics value of 1.567151 or 1.567 falls in the acceptance region of no autocorrelation; meaning that there is no autocorrelation in the model.

The probability value of the F-Statistic in this study is 0.043137, and is less than 0.05%, which shows the overall significance of the model estimated.

#### 4.2.5 Diagnostic Tests

Table 8: Summary of Diagnostic Test Reports

Test/Hypothesis are in null form)	Test type	Test-stats.	Prob.	Decision
Residual Normality (Residuals are Normally Distributed)	Jarque-Bera	1.737532	0.41946	Accept
Serial Correlation (there is no serial correlation)	Breusch-G LM Test	15.22220	0.1597	Accept
Heteroskedasticity (there is Homoskedasticity)	Breusch-Pagan-Godfrey Test	0.230964	0.9616	Accept
Functional form (Model is Correctly Specified)	Ramsey RESET Test	4.557192	0.2789	Accept

Source: Author’s Computation, 2020.

Table 8 is a summary of all the diagnostic tests conducted on the regression results in order to examine if the regression is a spurious one.

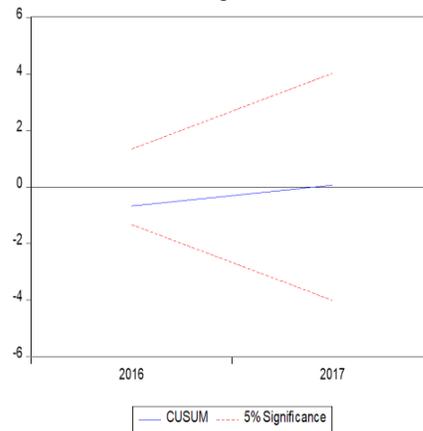
Row one in the table is the result of the Jarque-Bera normality test which was conducted in order to examine if the residuals are normally distributed. The Jarque-Bera probability value of 0.41946 which is greater than 0.05 indicates that the residuals are normally distributed.

Row two is the result of the Breusch-Godfrey LM Test for serial correlation. The test is conducted in order to examine if there is serial correlation between the residuals in the model. The Chi-square probability value of 0.1597 is greater than 0.05, this means that the residuals are not serially correlated.

Row three of table 8 reveals the result of the Breusch-Pagan-Godfrey Heteroskedasticity test which is used to test if the variance of the error term is constant over time (Homoskedastic). This is one of the assumptions of the Ordinary Least Squares. The Chi-square probability value of 0.9616 is significant at 5% level of significance hence; we conclude that the variance of the error term is constant.

Ramsey Reset test was used to check if the functional form of the model is properly specified. The probability value of 0.2789 which is significant at 5% indicates that there is no error of miss-specification of the functional form of the model.

Fig2: Cusum Test



Source: Eview’s Analysis.

Figure 2 is the result of the cumulative sum test which is used to test the stability of the coefficients in the regression result. The CUSUM line which is at the middle, does not go beyond the 5% lines of significance, this implies that the coefficients gotten from the regression results are stable hence, they can be relied on.

## CONCLUSION AND RECOMMENDATION

### 5.1 Conclusion

This study examined the effect of infrastructure on foreign direct investment inflow to Nigeria between 1988 through 2018. In conclusion the result of the long-run coefficient reveals that Economic Growth (EG) is seen to have a negative and insignificant relationship with foreign direct investment in the current year but after one year lag, the relationship

becomes positive and significant. This implies that economic growth is needed for foreign direct investment inflow. Energy infrastructure did not have a significant relationship with FDI in the short run but a significant relationship was recorded in the long run. This implies that an increase in Energy Infrastructure Development (Megawatts usage) will lead to an increase in foreign direct investment inflow in Nigeria. Transport Infrastructure Development (TID) has a negative and insignificant relationship with foreign direct investment both in the current year and after one year lag. This implies that the insignificant relationship could be attributed to the present poor conditions of our transport system (roads, railway, airway and waterways) not so much effort is being put into the development of transport infrastructure. And if there is an improvement it will boast FDI inflow to Nigeria. Trade Openness (TO) on the other hand is seen to have a positive but insignificant relationship with foreign direct investment in the current year and after one year lag. An increase in trade openness will lead to an increase in foreign direct investment both in the current year and after one year lag. Meaning that trade openness is a necessary ingredient for foreign direct investment inflows. Water Infrastructure Development (WID) has a positive and significant relationship with foreign Direct Investment in the current year. This means that an increase in the development of water infrastructure leads to an increase in foreign direct investment inflows. Communication infrastructure development (CID) has no significant relationship with foreign direct investment in Nigeria. This implies that development of Communication Infrastructure has a positive but insignificant effect on Foreign Direct investment in the current year but a negative and insignificant effect on Foreign Direct Investment after one year lag.

In other words, there will be no improved and sustainable FDI inflow into Nigeria if there is no effective tackling of the challenges of basic infrastructural needs of the country by ensuring efficient, stable and reliable power supply, safe potable water, effective, efficient and functional public transportation system, effective communication system, good trade openness relationship and efficient and stable economic growth in Nigeria..

## 5.2 Recommendations

Based on the findings, the study recommends:

### 5.2.1 Recommendation for policy

Carefully perusing from the forgoing research finding and the conclusion above we made the following recommendations

- 1) Trade openness coupled with ease of doing business was found to be a key prerequisite to attracting FDI inflow in Nigeria; so the government should work towards improving the investment climate. In this regard, the government should strengthen institutional infrastructures and governance, as they play a critical role in attracting foreign investments.
- 2) Economic growth and a strong currency are key determinants of FDI inflows; hence, macroeconomic stability should be a priority for the government. The Central Bank of Nigeria should strive to retain inflation and interest rates as low as possible, and to maintain a strong currency.
- 3) The government should increase broadband Internet connectivity, expand technical training institutes and harness innovative ideas for increased export of ICT goods and services and increase mobile cellular subscriptions,. This will improve communication structure thereby attracting FDI inflows.
- 4) The results imply that the government should endeavour to increase and modernize air transport (passengers and Freight), more kilometres of tarmacked roads as a percentage of total road networks, more kilometres of rail line constructed and improve port infrastructure to increase container port traffic in order to attract FDI inflows.
- 5) The government should construct and rehabilitate portable water systems in order to attract FDI inflows.

### 5.2.2 Recommendation for further studies

Further study should be conducted by disaggregating FDI inflow (investment) into specific sector.

### 5.3 Contribution to Knowledge

The finding of this study has contributed or added to the stock of existing knowledge as follows

- 1) From the study we have identify that Trade openness (TO), Economic growth (EG), are key prerequisite to attracting FDI inflow in Nigeria.
- 2) This study has revealed that for Nigeria to attract FDI inflow she have to increase and modernized the Transport infrastructure (TID), Communication infrastructure (CID), Energy Infrastructure (EID), and Water infrastructure (WID) development.
- 3) The study had provided a yardstick by which policy makers will assess how lack of good and modernized infrastructural development have reduced FDI inflow into Nigeria and had accounted for the reduction of our domestic and foreign investment in Nigeria over the years.
- 4) This study had provided useful information to future researchers and those may be interested in the subject matter of this study.

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