

# Infrastructure in the Context of Economic Growth and Development in Nigeria: Implications for the Sustainable Development Goals (SDGs)

Chris. U. Kalu<sup>1,2</sup>, Fidelia, N. Onuigbo<sup>2</sup>, Chika P. Imoagwu<sup>1</sup>, Chukwuemeka Njemanze<sup>1</sup>

<sup>1</sup>Department of Economics, Nnamdi Azikiwe University, Awka, Nigeria

<sup>2</sup>Department of Economics, Enugu State University of Science & Technology, Enugu, Nigeria

Email of corresponding Author: chriseconskalu@gmail.com

## Abstract

Infrastructure has a critical role to play in achieving the Agenda 2030- the Sustainable Development Goals (SDGs). Meanwhile, the contributions of infrastructure to growth and development in Nigeria are far below that of the emerging markets. This paper examined infrastructure in the context of economic growth and poverty reduction for achieving the SDGs. The paper employed the descriptive analytical approach in addressing the objectives of the paper. The paper revealed among other policy implications that poor public investment governance and inefficiency are major challenges to the Nigerian economy achieving the 2030 Agenda. Therefore, policy efforts that enhance private sector participation, majorly, the public-private partnership arrangement in infrastructure financing should be initiated by Nigerian policymakers. Furthermore, public investment, governance and efficiency in financing investment should be strengthened. This is because, it would help to reduce the financing needs of infrastructure in Nigeria for economic growth and overall human development.

**Keywords:** *Economic growth, electricity, development, infrastructure, Nigeria, sanitation, water*

**JEL Codes:** *F43, H54, Q20, Q25*

## Introduction

Infrastructure is essential for development prospects. The role of infrastructure in development has been well documented in numerous literature (Cellini, & Torrisi, 2009; Strauss, 2012). The emphasis on infrastructure draws inspiration from the East Asian economic miracle during which large scale infrastructure investment were made as a panacea for sustainable development. With an average annual infrastructure budget allocation of 30 per cent, accumulation of infrastructure stocks (in this region) have outpaced investments in other regions. Consequently, between 1975 and 2005, East Asia's GDP increased tenfold, South Asia's GDP increased fivefold, and all other regions' economies grew by factors between two and three (Strauss, 2012). More recent debates to promote sustainable development and growth, poverty reduction and improved standard of living in low and middle income countries have been centered on the need to promote large scale expenditure in infrastructure (African Development Bank, 2016; Ibrahim, 2019).

The common argument for increased government spending on infrastructure is its growth- developing enhancing effect via higher productivity of production factors. This is specifically the scenario with developing countries in the sub-Saharan Africa. In Nigeria, for example, less than 20 per cent of roads are paved, and less than one in five Nigerians has access to electricity consumption. In addition to this, the average waiting time for fixed telephone connection is three and half years (World Bank, 2015), while transport costs in Nigeria are the highest of any other region. A study by the African Development Bank (AfDB) on infrastructural development in the region argued that the biggest financial institution in Africa is worth over 200 billion USD in total assets while it is estimated that the amount needed annually until 2020 to close Africa's infrastructural gap is 93 billion USD. Nigeria's infrastructural financing need is likely to grow from 23 billion USD in 2013 to an estimated 77 billion USD by 2025 (Aremu, 2016).

Infrastructure is at the very heart of domestic and global efforts to meet the Sustainable Development

Goals (SDGs), encompassing everything from health and education for all to access to energy; from clean water to sanitation. Most of the SDGs imply improvements in infrastructure (The Economist Intelligence Unit, 2019). Infrastructure plays a key role in all three dimensions of the SDGs: the economy, the environment and the society. In terms of the economy, infrastructure dividends range from the jobs created during construction and maintenance to the ability of infrastructure to generate economic activity (such as a bridge that links a rural village to urban markets). By connecting communities to cities, education and employment, infrastructure such as transportation and telecommunications underpins national economic goals. Increasing investment in line with economic needs could add about 0.6 percent to global GDP (economic growth), according to the McKinsey Global Institute study (2017). In protecting the environment, infrastructure assets play a key role in conserving natural resources and reducing the impact of climate change. Again, clean energy generation are critical in reducing dependence on fossil fuels. Transport infrastructure performs comparatively well but remains a hurdle. Roads are lagging far behind in investment and rail infrastructure is falling behind too. Port infrastructure has seen major improvements in recent years following terminal concessions and comprehensive reforms. Still, a number of key challenges remain, such as poor customs performance and corruption.

With over 160,000 hospital beds as at 2018, Nigeria suffers from a very low bed per thousand population of 0.9 percent in comparison to countries such as South Africa at 2.29 percent and Japan at 13.32 percent in 2017. In addition, there is also lack of physical infrastructure required to adequately address the population base, existing structures suffer from obsolete equipment and lack of requisite infrastructure to expand/deepen medical specialization, in particular the public sector hospitals (Akinsete, Ogundare & Akinbiyi, 2016). The dearth and the near collapse of infrastructure no doubt affects the social welfare of the Nigerian masses.

The aim of the paper is to x-ray the role of infrastructure in relation to economic growth and development. The descriptive analytic approach was employed in the analysis over the period of 1999 till 2021 in Nigeria. Analytical data were sourced from

World Bank Development Indicator (2020) and African Development Bank (AfDB) database (2020). Some salient questions shaped the discussion:

- What are the roles of infrastructure on growth and development prospect for Nigeria?
- With the trends and profile of developments; what are the prospects for Nigeria achieving the infrastructure goals of the SDGs by 2030 and 2063?
- What are the critical policy measures to promote infrastructure investment in Nigeria while sustaining and achieving the infrastructure goal of the SDG?

### **The Sustainable Development Goals (SDGs) and Infrastructure Development**

In September 2015, the United Nations adopted the 2030 Agenda for Sustainable Development Goals (SDGs) and the African Union adopted the 2063 Agenda-*The African We Want*. Both of them view human advancement as a combination and inter-connectedness between economic development, social inclusion and environmental sustainability. In view of these, both Agendas sees development as a collective responsibility that addresses the interest of all nations by upholding principles of human dignity, shared prosperity and global equity (Odusola, 2017). The SDGs and Agenda 2063 are action plan for people, planet, peace, prosperity and partnership that reflect the core values and tenets enshrined in the charters of the African Union and the United Nations. The 2030 Agenda focuses on the sustainability of development underpinned in the inter-linkages and interconnections of the economic, social and environmental pillars. Its 17 Goals, 169 targets and 230 indicators supports the inter-dependence of domestic and international policymaking, which enhances the imperative of global public goods as a key strategy of continental and global development management.

Investments in infrastructure will be instrumental in meeting the SDGs. By creating jobs and economic activities, infrastructure enables development. It also provides the services that underpins the ability of people to be economically productive. Infrastructure investments help stem economic losses arising from problems of power outages or traffic congestion. The

World Bank estimates that sub-Saharan Africa and Nigeria in particular, closing the infrastructure quantity and quality gap relative to the world's best performer could raise GDP growth per head by 26 percent per year (World Bank, 2017). Technology will facilitate significant environmental gains. In power infrastructure, for example, smart meters allow energy utilities to manage consumption patterns, creating price incentives to use electricity outside peak times, enabling them to reduce reliance on the more polluting peaker plant that supplement supply at peak demand times and that usually generate power using fossil fuels. Integrating green infrastructure such as tree planting and forests into the portfolio of assets can improve air quality and contribute to removing carbon dioxide from the atmosphere or, in the case of mangroves, increasing flood protection and preventing soil erosion. From schools, hospitals and roads to power and water networks, sustainable infrastructure enables governments and the private sector to provide services that contributes to sustainable individual livelihoods, as well as broader economic growth, while improving quality of life and enhancing human dignity.

With respect to gender, empowerment and reducing inequality between the men and women, infrastructure plays an important role, both by protecting women and accelerating their advancement. For example, public transport systems both enable women to not only enter the workforce but also, when designed properly, provides them with safety and security and ensures that they have equal access to opportunities and services. Sanitation infrastructure is also crucial in ensuring equal participation in economic and education opportunities. If safe toilets or private hygiene facilities in school or workplace are unavailable during menstruation, women and girls are often forced to stay at home or leave school or their jobs altogether. The World Bank estimates that at least 500 million women and girls globally lack adequate facilities for menstrual hygiene management (World Bank, 2018). Infrastructure is a tool in increasing social mobility. For example, introducing solar power to schools in Sudan and Tanzania enabled an increase in completion rates at primary and secondary schools from less 50 per cent to almost 100 per cent (UNDESA, 2014). Infrastructure that can withstand the shocks and stress experienced over its lifetime provides resilience and protects developments by having a positive impact across all three pillars of sustainability. Resilient

infrastructure protects the economy by reducing disruptions to industry from shocks, such as severe storms. Again, when resilient infrastructure ensures the continuity of critical services such as power and water during a crisis, it offers greater stability to communities and reduced disruption to their livelihood.

Among the SDGs, SDG 9 explicitly refers to building resilient infrastructure. Infrastructure is really at the center of the delivery of the SDGs. Achieving SDG 10 –reduced inequalities means meeting a number of the other SDGs; for SDG 6 –availability and sustainable management of water and sanitation for all –demands investment in infrastructure of at least 114 billion USD a year (World Bank, 2016). For SDG 7 –access to affordable, reliable, sustainable and modern energy for all –investments needed include 52 billion USD per year to achieve universal electrification by 2030, only half of which is covered by planned investment (UNDP, undated); and by helping to empower women and girls, infrastructure contributes to meeting the objectives of SDG 5.

But what do we mean by sustainable infrastructure? First, while they offer solutions to sustainable development, infrastructure assets can have negative impacts. For example, infrastructure is responsible for more than 60 per cent of global greenhouse gas (GHG) emission (World Economic Forum, 2016). The construction of large infrastructure assets, such as dams and railways can disrupt and displace communities. Sustainable infrastructure therefore needs to be planned, delivered, managed and decommissioned to minimize its negative impacts and maximize its positive impacts. Meanwhile, infrastructure assets –throughout their entire lifecycle –should have positive impacts on the economy, society and the environment.

### **Conceptual and Empirical Evidence**

The concept of infrastructure within the context of economic growth and development and existing empirical evidence is presented in this section. The aim is to enhance deeper and broader understanding of the subject matter.

#### **Concept of Infrastructure**

The concept of infrastructure has passed through a number of stages in its development: **Stage 1:** The

writings of the 18<sup>th</sup> and 19<sup>th</sup> century economists. Adam Smith in justification the principles of the “invisible hand of the market”, assigned to the state the function as an infrastructure investor (i.e. the obligation to maintain public facilities and public facilities and public institutions). **Stage 2:** Infrastructure as social overheads. Paul Samuelson in the theory of public goods recognized infrastructure as large investments made solely by the state and laying the preconditions for the successful development of the private sector as they clear the way for production, and trade. **Stage 3:** Rosenstein-Rodan and Rostow in the theory of the Big Push and theory of stages of economic development viewed social overhead capital as one of the key sources of economic growth. **Stage 4:** Transformation of the concept by researchers over the years. The term has been used by researchers as “Superstructure” and “suprastructure” at various occasions. At present, infrastructure is characterized by three attributes: technological (capital goods); economic (public/merit goods) and institutional (infrastructure goods and services (as an object of state provision and state control)).

Although, there is no ironclad definition of infrastructure, from the highlights above, it could be safely inferred that infrastructure refers to basic inputs into and requirements for the proper functioning of the economy. It includes all public services from law and order through education and public health to transportation, communication, power and water supply as well as agricultural overhead capital as irrigation and drainage systems (Horschman, 1958; Baskakwa & Malafeev, 2017). It now embraces what has been tagged “soft infrastructure”, such as information and communication technology (ICT) and governance (Afeikhena & Ariyo, 2004). Economic infrastructure is part of an economy’s capital stock that produces services to facilitate economic production or serve as inputs to production (e.g. electricity, roads, and ports) or are consumed by households (e.g. water, sanitation and electricity). Following World Bank (2018), economic infrastructure can further be subdivided into three categories: utilities (electricity, gas and water, telecommunications, sanitation, sewerage and solid waste disposal), public works (water catchments in dams, irrigation and roads) and other transport sub-sectors (railways, roads, seaports, airports and urban transport systems). In national accounts statistics, these are found in two sub-headings of the gross domestic product (GDP), electricity, gas and water are located in

the secondary sector; and transport, storage and communication in the tertiary sector.

Social infrastructure encompasses services such as health, education and recreation and has both a direct and indirect impact on the quality of life. Directly, it supports production and trade; indirectly, it streamlines activities and outcomes such as recreation, education, health and safety. The indirect benefit of improved healthcare, for example, is improved productivity, which in turn leads to higher real income and reduction in poverty. Social infrastructure also facilitates investment in human capital by using some of the economy’s physical capital stock to raise the productivity of the workforce. The impact on growth is similar to an increase in the supply of capital –a higher capital to labour ratio which enables a given number of workers to produce more per capita. It also enhances the economic, political and social empowerment of the populace, with the attendant positive effects on poverty alleviation and efficient use of national resources.

The concern of the paper on the concepts of economic growth and development focuses on how infrastructure can benefit poor people since alleviating poverty is the primer of growth and development. The World Bank original study on infrastructure (World Development Report, 1994) highlighted the critical role of infrastructure in the development process and laid out an agenda for public-private partnerships in the provision of utility. Not only does development of infrastructure services contribute to growth, but growth also contributes to infrastructure, in a virtuous circle. Moreover, investments in human capital and in infrastructure interact, each increasing the returns to the other. Ariyo and Afeikhena (2004) identified the various channels through which investment in infrastructure can contribute to sustainable growth and economic growth. These are: i) reducing transaction costs and facilitating trade flows within and across border; ii) enable economic actors-individuals, firms, governments-to respond to new types of demand in different places; iii) lowering the costs of inputs for entrepreneurs, or making existing businesses more profitable; iv) creating employment, including in public works (both as social protection and as a counter-cyclical policy in times of recession; v) enhancing human capital, by improving access to schools and health centers; and vi) improving environmental conditions, which link to improve

livelihoods, better health and reduced vulnerability of the poor.

### **Empirical Evidence**

This section reviews empirical evidence on infrastructure, growth and economic development. The review centers on empirical research focusing on papers that utilized the autoregressive econometric approaches of autoregressive distributed lag (ARDL), vector autoregression (VAR) and structural VAR. Sahoo (2010) examined the relationship between the gross domestic product and stock of infrastructural services in India by estimating a vector autoregressive (VAR) model for the period 1970-71 to 2000-01. The variables used are electricity, gas and water supply, railways, other transport, storage facilities and communication. The results reveal that though the initial effect of increase in the stocks of infrastructure is diminishing, it continues to have positive impact on real output in the medium-to-long run. The paper concluded that the infrastructure sectors; electricity, gas, water supply and communication sectors play a key role in explaining the movements in the gross domestic product. Ogun (2010) investigated the impact of infrastructure development on poverty reduction in Nigeria. Specially, the relative effects of physical and social infrastructure on living standards or poverty indicators were examined. The paper employed the structural vector autoregressive (SVAR) technique from the period 1970:1 to 2005:4. Results show that though infrastructure in general reduces poverty, social infrastructure explains a higher proportion of the forecast error in poverty indicators relative to physical infrastructure. The conclusion is that massive investment in social infrastructure in cities would drastically reduce poverty in the urban areas. Enimola (2011) analyzed the influence of infrastructure investment on economic growth in Nigeria from 1980-2006. The variables used are economic growth, electricity consumption, gross fixed capital formation and foreign direct investment. The paper employed the vector error correction estimate (VECM). The result showed a long-run relationship between infrastructure and economic growth. The conclusion is that the government should intensify their efforts in mobilizing more resources towards the provision and improvement of basic infrastructure.

Banerjee, Duflo and Qian (2012) estimated the effect of access to transportation networks on regional economic outcomes in China over a twenty-period of rapid income

growth. The results show that proximity to transportation networks have a moderate positive causal effect on per capita GDP levels across sectors, but no effect on per capita GDP growth. Sojoodi, Zonuzi & Nasim (2012) investigated the role of infrastructure in promoting economic growth in Iran over the period of 1985 to 2008. Employing the autoregressive distributed lag (ARDL). The findings indicate that transportation facilitates distinctively length of railway and roadway, also telecommunication infrastructure (fixed phone line) have positive and significant effect on economic growth of Iran but electricity production capacity does not have significant effect on per capita output growth.

Osundina & Osundena (2014) examined the relationship between government spending on infrastructure and poverty reduction in Nigeria. The variables used are per capita income, government spending on infrastructure, government spending on building and construction, government spending on transportation, education and on health, covering a period of 43 years. The vector autoregressive model was used in the study. The regression result showed that government spending on transportation has a negative and significant effect on poverty reduction. The effect of government spending on education and health were insignificantly negative and positive respectively. The paper concludes that the government should increase spending on building and construction as poverty reduction responds to infrastructure development. Abdullahi & Mutiu (2019) examine the synergy between infrastructural expenditure in promoting economic growth and poverty reduction in Nigeria between the 1981 to 2017. The variables used are per capita income as proxy for poverty, real gross domestic product, education as proxy for social infrastructure expenditure, expenditure on road construction, transport and communication for economic infrastructure and employing the ARDL approach. The results show that, the relationship between infrastructure expenditure, economic growth and poverty reduction in Nigeria is inclusive, as the F-statistics value is not greater than the upper bound of the Narayan critical values at 5 percent but rather, falls in between the upper and lower bound values. The result further showed that negative relationship exists between poverty, social and economic infrastructure expenditure in Nigeria. The paper concluded that emphasis should be given to economic infrastructure in Nigeria not only because it brings

economic growth but also that it exerts greater influence on poverty reduction in Nigeria.

Garza-Rodriguez (2019) investigated the relationship with respect to tourism and poverty reduction in Mexico between the periods, 1980-2017, using the ARDL approach with a structural break. It was revealed that for every 1 percent increase in international tourism, household consumption per capita increases 0.46 percent and poverty reduces. Chotia & Rao (2020)

analyzed the relationship between infrastructure development and poverty reduction for India using the yearly data from 1991 to 2015 using the ARDL bound testing approach. Findings show that infrastructure development and economic growth reduces poverty in both long run and short-run. The causality test confirms that there is a positive and unidirectional causality running from infrastructure development to poverty reduction.

**Table 1: Summary of Empirical Literature Reviewed on Infrastructure, Economic growth and Poverty using the Dynamic Econometric Approaches**

Author(s)/Year	Country of Study/Period	Topic	Technique/Variable used	Findings	Conclusion(s)
Sahoo (2010)	India (1970-71-2000-01)	Economic growth and infrastructure	Vector autoregressive (VAR), electricity, gas, water supply, railway lines, transport, storage facilities and communication	Infrastructure continues to have positive impact on real output in the medium to-long-run	Infrastructure plays a vital role in explaining the movements in the gross domestic product
Enimola (2011)	Nigeria (1980-2006)	Infrastructure and Economic Growth	Vector error correction model (VECM), infrastructure, economic growth.	Long-run relationship between infrastructure and economic growth	Government mobilization of more resources towards the provision and improvement of basic infrastructure
Sojoodi <i>et al.</i> , (2012)	Iran (1985-2008)	Infrastructure and economic growth	Autoregressive Distributed Lag, (ARDL), transportation facilities, economic growth, telecommunication lines	Infrastructure have positive and significant effect on economic growth	Electricity production capacity does not have significant effect on per capita output growth.
Ogun (2010)	Nigeria (1970:1-2005:4)	Infrastructure and poverty reduction	Structural vector autoregressive (SVAR), physical, social infrastructure; standard of living	Though infrastructure in general reduces poverty, social infrastructure explains a higher proportion of the forecast error in poverty indicator relative to physical infrastructure	Massive investment in social infrastructure in cities would drastically reduce poverty in the urban areas.

**Table 1: Summary of Empirical Literature Reviewed on Infrastructure, Economic Growth and Poverty using the Dynamic Econometric Approaches (Cont'd)**

Author(s)/Year	Country of Study/Period	Topic	Technique/Variable used	Findings	Conclusion(s)
Osundina & Osundina (2014)	Nigeria (43 years)	Government spending on infrastructure and poverty reduction	VAR, per capita income, government spending on building and construction, transportation and health	Government spending on transportation has a negative and significant effect on poverty reduction. Spending	Government should increase spending on building and construction as poverty reduction

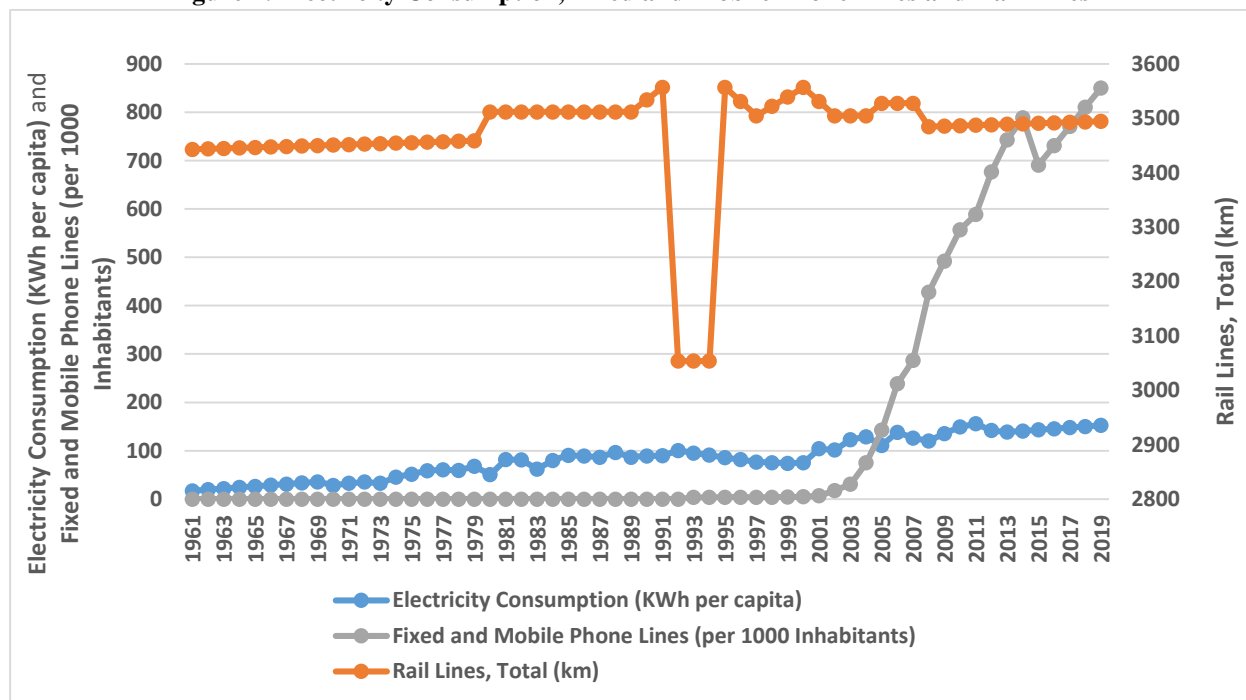
				on education and health were insignificantly negative and positive respectively	responds to infrastructure development.
Abdullahi & Mutiu (2019)	Nigeria (1981-2017)	Infrastructure, economic growth and poverty reduction	ARDL, expenditure on construction, transport, communication, per capita income	The relationship between infrastructure, economic growth and poverty reduction is inclusive	Emphasis should be given to infrastructure development in Nigeria
Garza-Rodriguez (2019)	Mexico (1980-2017)	Tourism and poverty reduction	ARDL with a structural break, tourism, per capita income	Every 1% increase in international tourism increases household consumption per capita by 0.46%	No conclusion
Chotia & Roa (2020)	India (1991-2015)	Infrastructure Development and Poverty Reduction in India	ARDL	Infrastructure development and growth reduces poverty in both the long-run and short-run	A positive and unidirectional causality running from infrastructure development to poverty reduction.

Source: Authors Compilation (2021)

### Stylized Facts on Infrastructure, Economic Growth and Poverty in Nigeria

In this section, the trend and profile of the infrastructure indicators are presented. The aim is to enhance pictorially infrastructure variables in Nigeria in terms of movements, challenges and policy actions to promote infrastructure for growth and poverty reduction.

**Figure 1: Electricity Consumption, Fixed and Mobile Phone Lines and Rail Lines**



Source: WDI (2020), AfDB (2020)

Figure 1 shows the movements of electricity consumption, (Kwh per capita) fixed and mobile phone lines (per 1000 inhabitants) and rail lines, total (km) in Nigeria between 1961 to 2019. From the figure, it was revealed that fixed and mobile lines in Nigeria has been on the increase from zero level in 1961 to 850 in 2019, although, it has not meet the per 1000 inhabitant. The movement shows that mobile/fixed lines started improving between 2002 and 2003 following the deregulation of the telecommunication sector in Nigeria. The return of democracy in 1999 brought a full deregulated telecommunication sector: by auctioning 3 GSM licenses in January 2001 for ₦285m each and a license for Nigerian Telecommunications (NITEL). At the end of the auctioning, MTN communications and ECONET wireless and NTEL were awarded full GSM licenses. The development was further spiced when the Nigerian Communications Commission (NCC), telecommunication regulator in Nigeria granted a license for second National Operator to GLOBACOM Nigeria

on August 12, 2002. The motive was to create an alternative network to the government owned NITEL and the other two existed operators MTN and ECONET. Before now, access to telephone was exclusively reserved for the rich and privileged few in the country until 2001 when the GSM was introduced in Nigeria (see the trend). The effects of the GSM innovation to economic growth and poverty reduction cannot be overemphasized. This is as the rural populace has been involved in small businesses such as recharge card sells and GSM call centers, thereby creating jobs and employment, livelihood sustainability, internet services and cost of travel reduction among others. However, challenges still exist. Some of these challenges include: energy/electricity, multiple taxation for masts located in various parts of the country by the government and the host communicates, the high foreign exchange and interest rates, charged by government (Bakare, Ekanem & Allen, 2017). Nigeria is now the largest economy in Africa and has the largest mobile market in the continent

in terms of subscribers. Since the introduction of mobile services in 2001, the Nigerian market has grown to over 83 million subscribers or 45% of the population. The sector's growth has been supported by a competitive market, the introduction of 3G services in 2007 and regulatory reforms such as the introduction of mobile number portability in 2013. All four major mobile operators (MTN, Global com, Airtel, and Etisalat/9mobile) now provide both 2G and 3G services. 4G is still new in Nigeria, representing only 0.15 percent of total connection (Deloitte, 2015).

Electricity consumption (Kwh per capita) has remained relatively flat over the years. Despite the potential of energy, and electricity consumption in particular to growth and poverty reduction, Nigeria energy crisis has stymied the socio economic activities of the country, which has brought untold hardship to Nigerians. Currently, electricity is not only epileptic in supply; it does sometimes not exist especially in the rural areas. The projected electricity demand has been translated into demand for grid electricity and peak demand on the bases of assumptions made for transmission and distribution losses, auxiliary consumption, load factor and declining non-grid generation (Energy Information Administration, 2012). The demand is projected to rise from 5,746 MW in 2005 to 297, 900MW in the year 2030 which translate to construction of 11,686MW every year to meet this demand (Sambo, 2008). Meanwhile, to solve the problem of electricity sub-sector, the government owned monopoly company (Power Holding Company of Nigeria) was unbundled into three hydro and seven thermal generating plants and eleven distribution companies that undertake the wires, sales, billing, collection and customer care functions within their area of geographical monopoly. Save for the transmission function, the others have been out rightly privatized. The epileptic nature of electricity has led to scarcity of petroleum products and kerosene because the citizens have resulted to using generator and kerosene powered equipment to provide energy for use at home. Again, the import content of the domestic fuel usage has grown over the years to about 75 percent (International Energy Agency, 2012; Onakoya *et al.* 2013). The resultant effect is the dependence on fuel-wood leading to deforestation and degradation of the environment and worsening desertification (Babanyara & Saleh, 2010). Electricity pricing in Nigeria is divided into two. One, for

generation and the other distribution, which is regulated by the Nigerian Electricity Regulatory Commission (NERC) under the principle called Multi-Year-Tariff-Order (MYTO). According to the NERC, the principles and assumptions on which electricity pricing is based include cost recovery, attraction for investment, security, certainty, return on investment, efficient use of the network and allocation of risk (CBN, 2015).

In terms of policy, the *Electric Power Sector Reform Act* that was passed in 2005 aimed at repositioning the sector by changing its structure, and privatizing generation and distribution while retaining transmission under Government control. With about 12.5 GW of installed capacity, but less than one-third of operational averages compared to 3.9 and 3.2 of the yester-years (FGN, 2017). Overall, only about 15 per cent of installed capacity is eventually distributed to end users, resulting in a huge shortage of electricity supply across the country. The Economic Recovery and Growth Plan (ERGP) tried addressing the problems in the power value chain by overcoming governance, funding, legal, regulatory and pricing constraints across the four main segments in the power value chain (gas supply, generation, transmission, and distribution). The sole aim among others is to: i) improve energy efficiency, ii) facilitate private sector investment in generation, transmission, and distribution, iii) improve electricity to all Nigerians, iv) increase rural electrification, v) restore financial viability in the energy market and vi) eliminate sabotage of gas and power infrastructure.

Rail transport was established and developed in Nigeria by the colonial British authority based on its strategic and capacity advantages. The railway system was established and nurtured to serve colonial transport and logistics interests. The hallmark of colonial development plan as it concerned communication and transport infrastructure is that every economic activity was channeled to the sea through railway and road network. One important aspect of the British colonial economic development visions on transport policy was that it opened up the country as it created urban centers with the youth and those of the working class migrating to the cities for white collar jobs. It contributed a lot to the general economic development of Nigeria during the colonial and early independence period by making possible the development of all parts of the country for agricultural exports, especially cocoa in the west,

groundnuts and cotton in the North and palm produce in the Southeast. It facilitated the evaluation of minerals for export from the interior parts of the country (such as coal from Enugu, and tin from Jos).

Unfortunately, there has been a continuous decline in the performance of the railway system in Nigeria since 1960 the deficit in its operating account has been increasing. The decline in the Nigerian railway system can be attributed partly to increased competition from road transport (for goods and passengers) which is faster and more flexible, and partly to the deterioration of the railways transport services. It can also be partly attributed to a general decline in those traditional export commodities which formed a major part of the freight handled by the rail in particular groundnuts. The failure of the system has also been attributed to the decline and obsolescence of the rail infrastructure built during the colonial era. The Nigerian Railway Corporation (NRC) has been moribund and ineffective.

The intensified effort of the government seems to be changing the narrative, supported by recent investments in the rail line such as the Abuja Light Rail, Abuja- Kaduna, Lagos-Ibadan, Ibadan-Kano rail lines. Much progress has been recorded in the sector as witnessed in the sector in Q2-2021. Specifically, the rail transport grew by 53.3 percent year-on-year(y/y), the highest on record, as cargo and passenger volume increased by 329.4 percent and 442.4 percent y/y. Despite the recent improvements in the sector, funding remains a major bottleneck as many rail projects are suffering a delay in completion due to lack of funds. Nigeria’s transport infrastructure stock is inadequate for

the size of the economy and constitutes a major cost and constraint for both large and small businesses. It lags behind its peers in terms of scale (i.e. road and rail density) and quality. Poor sector governance (project selection, funding, models and oversight) and weak project execution further hampers efforts to expand the stock and improve the quality of infrastructure. Unarguably, much has been achieved through the Economic Recovery and Growth Plan (ERGP). Within the ambit of this infrastructure plan, the Abuja-Kaduna passenger rail services have been completed; also the Lagos-Ibadan and Port Harcourt-Calabar railway projects have been signed off. Additionally, eighty-five major road projects are ongoing and have been mobilized while concession process for four major airports have started. Although these are steps in the right direction, much more is needed to overcome the backlog in transport infrastructure that is hampering economic growth and development and in general the SDGs. Given the scale of investment required, partnering with the private sector is of necessity to remove the structural bottlenecks that prevent private companies from investing in and operating backbone infrastructure projects. Due to resource and time constraint, the ERGP prioritize a sub-set of the most critical infrastructure projects. Mainly via leveraging private sector infrastructure investment; de-risking priority projects to increase their bankability and ensure financial closure; ensuring efficient and effective use of capital and holding Ministries, Departments and Agencies (MDAs), contractors and partners accountable for execution. Table 2 presents rail infrastructure and fund arrangement in Nigeria as at 2021.

**Table 2: Rail Infrastructure and funding arrangement**

S/N	Rail Line	Cost(USD)	Funding Model
1	Abuja- Kaduna	876m	500m in loan from the Exim Bank of China, balance funded by Federal Government of Nigeria (FGN)
2	Lagos-Ibadan	2.53bn	Loan from the Export-Import (Exim) Bank of China
3	Ibadan-Kano	5.3bn	FGN to provide an equity stake of 15% with the remaining funded by China Exim Bank
4	Abuja-Warri	3.9bn	FGN to provide an equity stake of 15%, China Railway Construction Corporation Limited (CRCC), an equity stake of 10%, and the remaining 75% borrowed from China Exim’s Bank. The CRCC will operate and the port to recover its investments.
5	Kano-Maradi	1.96bn	To be financed by bilateral loan arrangement.

6	Lagos-Calabar	11bn	Originally intended to be funded from loans from China Exim Bank; however, following indications that the funding that the funding is not available and continuous delays to the commencement of the project (which was expected to be completed in 2018), the FGN is currently exploring other funding options.
7	Port Harcourt-Maiduguri	3bn	FGN to provide about 15% of cost, while the balance will be provided by a syndicate of Chinese financiers

Source: NRC (2021), NBS (Q2, 2021)

The exploration and trade-related activities of European missionaries and business people necessitated the creation of seaports both in Lagos and Calabar. Nigeria has a few major seaports namely: Apapa, Tin can Island, Onne, River ports, Calabar, and Warri. However, according to Taaeffe, Morril and Gould (1963), Nigeria has close to 100 small, developed seaports. Historically, Tin can Island, was commissioned in 1977, while new Sapele was completed in 1982 and because of the adverse effect of the civil war (1967-1970), Port Harcourt seaport was closed and Lagos seaport became over-used, which automatically led to the development of the Warri, Burutu, and Calabar, which were privately operated by private entrepreneurs. There are other seaports like Koko, Federal Lighter Terminal (FLT), and Federal Ocean Terminal (FOT), Bonny, apart from jetties and other smaller seaports.

The seaport is the fulcrum where the exchange of goods and services and other international logistics and supply chain activities are executed. Seaport development in Nigeria became paramount because of the logistics requirements for certain commodities to be moved out of the country. It was mainly in an attempt to evacuate goods and mineral resources to the coast for exploration. The discovery and exploration of crude oil caused the Nigerian seaport to become overburdened and the rapid development of seaports without viable analysis of the implications and challenges in the near future. Many of the products that necessitated the demand for sea transport are textile material, tobacco, steel, tin, coal, bauxites, paper mills, beverages, cement, petrochemicals and wheat, among others. PWC and Panteia (2013) has shown that the challenges of seaport in Nigeria which includes: insufficient depth of water; lack of quay space, resulting in vessels having to wait for a berth; a lack of storage space behind the quay, often caused by the “city center” locations of older ports; and insufficient (or outdated) mechanical equipment.

For container ships, the most common problems are too few cranes (preventing the ship from working as many holds as the operator would like) or the absence of ship-to-shore gantry cranes. Yard congestions caused by a lack of space can also slow down crane handling rates on the berth; for bulk ships, the most common problem is a lack of automation, poor interface arrangements for rail and inland waterway transport. Again, part of the problem is when customers or shippers want to reserve berthing windows so that scheduled services are not disrupted. Others are lower capacity utilization, and incessant inventory delays; loss of custom revenue because of cargo diversion to neighbouring countries. High demurrage charges as a result of the burdensome clearance process.

To solve the problems of seaport development in Nigeria, the Nigerian Government had embarked upon port reforms aimed at increasing efficiency in port operation, decrease cost of port services to stakeholders, decrease cost to the government for the support of the port sector and to attract private sector participation. The maritime industry is also regulated for both port facilities and ship. Concession is more common in Nigeria port deregulation (Onwuegbuchunam, 2020). The Federal Government of Nigeria embarked on the concession of the six major ports viz: Apapa, Calabar, Onne, Port Harcourt, Tincan island and Warri, between 2004 and 2006 which culminated in the transfer of terminal operations from the public to the private sector through concession contract and the adoption of landlord model of port administration.

It is imperative to note that deepening investment in telecommunications, electricity, rail transport and strengthening of the port reforms among other infrastructure will be instrumental in promoting the sustainability and achievement of the SDGs in Nigeria since improvement in these various components of infrastructure are really at the center of the delivery of

the SDGs. For example, telecommunications investment has the potential to spur economic growth and create employment while substantial expansion in quantity, quality and access to infrastructure services, especially electricity is fundamental to rapid and sustained economic growth and poverty reduction. The transport sector can accelerate and intensify trade and development. Rail transport in particular, as a result of its efficiency, reduced greenhouse gas emission and lower cost per kilometer, plays an increasingly important role in the conveyance of freight over long distances. In comparison to other means of transportation, railways are particularly useful in mass transit systems for both inter-city and urban settings. The importance of the blue economy, particularly the maritime transport is critical for trade, economic growth and poverty reduction. This is as modern and well-functioning ports and gateways serve major economic corridors.

### Concluding Remarks

Basic infrastructure like roads, water, and sanitation and electricity power remain inadequate in Nigeria. Economic growth, social development and climate action are heavily dependent on investment in infrastructure, sustainable industrial development and technological progress. In the face of a rapidly changing global economic landscape and increasing inequalities, sustained growth must include industrialization that first of all, makes opportunities accessible to all people, and two, is supported by innovation and resilient infrastructure.

Infrastructure development plays a key role in the SDGs Agenda. The 17 Goals aim at tackling a wide range of global issues, including those related to poverty, health, education, water and sanitation, energy inequality,

climate environmental degradation, prosperity and peace and justice. They include three goals directly related to infrastructure: water, sanitation and hygiene (SDG 6), energy (SDG 7) and infrastructure and industrialization (SDG 9). Moreover, infrastructure developments will positive spillover on most other SDGs because every economic and social sector requires good infrastructure for development. Infrastructure is also an important driver of economic growth, which is essential in enlarging a country's revenue base to meet spending needs. Since the investment needs to achieve infrastructure SDGs are sizeable, successful implementation of the SDGs agenda requires strong national ownership to mainstream the SDGs strategy into national development plan, investment prioritization, and budget processes. This in turn requires carefully planning the financing options, galvanizing private sector involvement, and managing the associated risks, as well as improving public investment governance and efficiency. On the average, Nigeria faces an annual investment need of 2.7 per cent of GDP for infrastructure (roads, electricity and water and sanitation) until 2030 and 2063.

In view of the large investment needs of infrastructure, Nigerian policymakers need to strengthen financing and improve public investment governance and efficiency of infrastructure. Efforts should focus on careful planning of financing options, strengthening private sector involvement and managing the associated risks, as well as tapping into foreign aid. Public investment governance and efficiency will help to reduce financing needs of infrastructure in Nigeria for economic growth and poverty reduction.

### Reference

- Abdullali, B. & Mutiu, A. (2019). Infrastructural expenditure, economic growth and poverty reduction: What is the synergy in Nigeria. *Dutre Journal of Economics and Development Studies (DUJEDS)*, 8 (1): 195-203.
- African Development Bank (2016) *Annual Report*. Abidjan: AfDB
- Akinsete, E., Ogundare, O. & Akinbiyi, A. (2016). PPP's: The Antidote to Nigeria's Healthcare Infrastructure Deficit. PWC Advisory Outlook.
- Aremu, K. (2016) Leveraging Nigeria pension assets to bridge infrastructure gap. *Zenith Economic Quarterly*, 12(4): 35-42
- Ariyo, A. & Afiekhna, J. (2004) Utility privatization and the poor: Nigeria in focus. Global Issue Papers No.12. The Heinrich Boll Foundation, [http://www.boell.de/downloads/global/Gip%2012%20Nigeria\\_Engl.pdf](http://www.boell.de/downloads/global/Gip%2012%20Nigeria_Engl.pdf)
- Babanyara, Y.Y. & Saleh, U.F. (2010). Urbanization and the choice of fuel wood as a source of Energy in Nigeria, *Journal of Human Ecology*, 31(1): 19-26.

- Bakare, B.I., Ekanem, I.A. & Allen, I.O. (2017). Appraisal of Global System for Mobile Communication (GSM) in Nigeria *American Journal of Engineering Research (AJER)*, 6(6): 97-102.
- Banerjee, A., Duflo, E. & Qian, N. (2012). On the Road: Access to transportation infrastructure and economic growth in China, *NBER Working Paper* No. W17897.
- Baskakova, I.V & Malafeev, S.N (2017) The concept of infrastructure: Definition, classification and methodology for empirical evaluation. *Journal of the Ural State University of Economics*, 3(71): 29-41
- CBN (2015). *Analysis of Energy Market Conditions in Nigeria*. Central Bank of Nigeria Publications.
- Cellini, R & Torrasi, G. (2009) The regional public spending for tourism in Italy: an empirical analysis, *MPRA Paper* No. 16131
- Chotia, V. & Rao, N.V.M. (2020). An Empirical Investigation of the link between infrastructure development and poverty reduction: The case of India. *International Journal of Social Economics* 44(2): 26-34 Doi:10.1108/IJTSE-06-2016-0154.
- Deloitte (2015). *Digital inclusion and the role of mobile in Nigeria*. Deloitte Publications.
- Ebuh, G.U., Ezike, I.B., Shitile, T.S., Smith, S.E. & Haruna, M.T. (2019). The infrastructure-growth nexus in Nigeria: A Reassessment. *Journal of Infrastructural Development*, 11 (1-2). 41-58.
- Enimola, S.S. (2011). Infrastructure and economic growth: The Nigeria experience, 1980-2006. *Journal of Infrastructural Development* 2(2): 121-133.
- Energy Information Administration (2012) *Annual Energy Review 2011* DOE/EIA-0384(2011).www.eia.gov/aer
- Federal Government of Nigeria (2017) *Economic Recovery and Growth Plan, 2017-2020*. Ministry of Budget & National Planning
- Garza-Rodriguez, J. (2019). Tourism and poverty reduction in Mexico: An ARDL Cointegration. *Sustainability* 11 (3): 845; <http://doi.org/10.3390/su11030845>.
- Hirschman, A. (1958) *The strategy of economic development*. West view Press Inc., Boulder
- Ibrahim, M (2009) *Why infrastructure development in Africa matters*. NEPAD Publications.
- Mckinsey Global Institute (2017) Bridging infrastructure gaps: Has the world made progress? www. Mckinsey.com/mgi
- NBS (2021) *Rail Transportation Data Report*. National Bureau of Statistics, Nigeria
- NRC (2021) *Nigerian Railway Corporation Report on rail system development in Nigeria*. Federal Government of Nigeria Publications
- Odusola, A. F. (2017) Achieving the Sustainable Development Goals in Africa in the context of complex global development cooperation. *CESDEV Issue Paper* No. 2017/2
- Ogun, T.P. (2010). Infrastructure and poverty reduction: Implications for urban development in Nigeria. United Nations University. *UNU-WIDER Working Paper* No. 2010/43.
- Onakoya, A.B., Onakoya, A.O., Jimi-Salami, O.A. & Odedairo, B.O. (2013). Energy consumption and Nigeria economic growth: An empirical analysis. *European Scientific Journal* 9 (4): 25-40.
- Onwuegbuchunam, D.E. (2020) Port deregulation and productivity in Nigeria: Some implications for economic regulators. *Journal of Sustainable Development of Transport and Logistics*, 5(1): 133-140
- Osundina, C.K. & Osundina, O.A.C. (2014). Disaggregated government spending on infrastructure and poverty reduction in Nigeria. *Global Journal of Human-Social Science: Economics*, 14(5): 1-7.
- Sahoo, S. (2000). Infrastructure and economic growth: An empirical examination. *Reserve Bank of India Occasional Paper*. No. 21.
- Sambo, A.S. (2008). Matching electricity supply with demand in Nigeria. Paper presented at the National Workshop on the Participation of States Governments in the Power Sector, 29 July 2008, Ladi Kwali Hall, Sheraton Hotel and Towers, Abuja.
- Sojoodi, S., Zonuzi, F.M. & Nasim, M.A. (2012). The role of infrastructure in promoting economic growth in Iran. *Iran Economic Review*. 16 (32): 111-132.
- Strauss, A. (2012) Performance assessment of existing structures using monitoring based Markov decision process. *Fib symposium Stockholm*:237-240
- Taeffe, E.J., Morril, R.L & Gould, P.R (1963) Transport expansion in underdeveloped countries: A

- comparative analysis. *Geographical Review*, 53(4): 503-529, <http://doi.org/10.2307/212383>
- UNDP (undated) Financing solution for Sustainable Development, Goal 7 :Affordable and Clean Energy. <https://www.undp.org/content/sdfinance/en/home/sgd/goal7-affordable-and-clean-energy.html>
- United Nations Department of Economic and Social Affairs(UNDESA) (2014) *World Urbanization Project*. UN Publications
- World Bank (2015) *The cost of meeting the 2030 Sustainable Development Goal Targets on Drinking Water, Sanitation and Hygiene: Summary Report*, <https://openknowledge.worldbank.org/bitstream/handle/10986/2368/K8632.pdf?sequence=4>
- World Bank (2017) *Why We Need to Close the Infrastructure gap in sub-Saharan Africa*, April 2017, <https://www.worldbank.org/en/region/afr/publication/why-we-need-to-close-the-infrastructure-gap-in-sub-saharan-africa>
- World Bank (2018) *Infrastructure investment demands in emerging markets and developing economies*,<https://documents.worldbank.org/curated/en/141021468190774181/pdf/WPS7414.pdf>
- World Bank (2020). World Development Indicators. World Bank Database
- World Economic Forum (2014) *Infrastructure and urban development*. WEF Publications.
- World Development Report (1994) *Infrastructure for development*. New York: Oxford University Press/World Bank. <https://openknowledge.worldbank.org/handle/10986/5977>