

**NIGERIA INFRASTRUCTURAL DEVELOPMENT: THE NEED FOR A TECHNOLOGICAL REJUVINATE**

**ASAJU KAYODE\***

Department of Public Administration, Faculty of Management Sciences,  
Federal University Wukari, P.M.B 1020, Wukari – Nigeria. +2348035992503

**ADAKO DAUDA**

Department of Public Administration, Faculty of Management Sciences,  
Taraba State University Jalingo, P.M.B 1167, Jalingo – Nigeria.

**DOJI CORDELIA ROMAN**

Department of Public Administration, Faculty of Management Sciences,  
Taraba State University Jalingo, P.M.B 1167, Jalingo – Nigeria.

**SADIQ SULEMAN**

Department of Public Administration, Faculty of Management Sciences,  
Taraba State University Jalingo, P.M.B 1167, Jalingo – Nigeria.

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**ABSTRACT**

At the global level, infrastructure has been enlisted as a salient indicator for ensuring sustainable development goals (SDGs). And a nation cannot be said to have effectively achieved meaningful growth and development without an adequate thrive in its technological infrastructural development. However, Nigeria as a nation on the contrary has high degree of non-technological innovation that inhibits her developmental stride. Hence, this study assesses the level of infrastructural technological development of a Nigeria state, and the government efforts that are directed toward meeting such infrastructural deficit in the country. By using the summative evaluation method in assessing relevant data from secondary sources reflecting the entire country, the data were analyzed using content analysis. It was revealed that Nigeria as a nation has high degree of non-technological innovation that inhibits her developmental stride. The multiplier effect caused the country's desire to become one of the top twenty (20) economies by 2020 to shipwreck. The study recommends, that Nigeria needs to consciously and genuinely invest in essential infrastructures such as steady electricity supply, good roads, and quality educational system that will support the country to navigate into its digital future. Creating a synergy between the country's physical and digital infrastructure that will enable it to work in a dynamic synergy not in mutual isolation

**Keywords:** Development; Infrastructure; Infrastructure Development; Infrastructural Technological Development; National development

**1.0 INTRODUCTION**

**1.1 Background to the Study**

Infrastructure and development are two inseparable terms that the absence of one can literally negate the actualization of the other, in that, the relevance and interwoven nature of the two terms are so crucial that at the global scale, infrastructure have been enlisted as one of the seventeen (17) goals for achieving sustainable development goals (SDGs). Wherefore, countries that desire genuine development whether politically, economically, socially, or technologically (PEST) must invest in its infrastructure. Hence, the relationship between infrastructural endowment and economic development of individuals, entities, and nations has been subjected to numerous researches since the end of 1980s. And even though the degree of direction or causal relationship between the terms are still debatable, but one thing is clear; there exist a symbiotic relationship between basic infrastructural amenities and economic performance whether at individual, entity, or national level. In that economic development or national growth seems to be high where there thriving technological infrastructures capable of supporting such noble efforts. Infrastructures therefore, are the basic, concrete, and essential facilities/ services that are needed to be in place in order to aid development. The presence of infrastructure, particularly technological infrastructures help in facilitating and accelerating economic development to the degree that, its absence will amount to distortion in the economic growth and development of the individual, entity, and nation concern. Hence Fatai, Omolara, and Taiwo, (2016), are of the view that development whether in terms of good healthy living or otherwise depend largely on such infrastructure as telecommunication, transport, energy, water, health, housing, and education to be invested on for it to thrive. Meaning development cannot be attain void of infrastructural presence, as infrastructure raises growth quality, reduces economic disparity and poverty level. And direct investment into its abundance is capable of promoting positive externalities in terms of making production facilities available and lowering cost associated with trade transactions as well as generate employment opportunities for the people. In the same vein, dearth of infrastructure, goes to constitute serious hindrance to sustainable growth and development capable of worsen poverty level of the citizenry. Hence, the only open window for explore to any country that desire meaningful and sustainable development is to commit resources for the provision of infrastructures in terms of good roads, railway networks, electricity, schools, housing, hospitals, water, etc.

Egbetokun (2018) is of the view that firm-level technological innovation not just infrastructure is widely accepted to be important for growth and development. And technology is seen to have gradually assume an important role in human and economic development beginning with fire discovery during the stone age, to invention of wheel, the internal combustion engine that enables navigation of the waterways, to the invention and the usage of electricity, telephone, and the internet, as well as the emerging field of artificial intelligence (AI), suggest that the sequence of technological application in meeting human needs is a constant and progressive innovation. This to Ndukwe (2021) is the possible reasons why nations that, or will lead development of new technology or thinking are the ones that often emerge as the world leaders. As such, developed nations he further stated were able to harness developments in science and technology, and deploy same in meeting the various socio-economic and environmental challenges that confront mankind. Technology which transforms science's ideas into reality for sure have continuous to change the way people interact, trade, entertain, and view the world around them.

Inspite of technology numerous impacts to infrastructural development, which different countries of the world are taking advantage of, in ensuring the advancement of their economic

and national development. Nigeria as a nation on the contrary has high degree of non-technological innovations that inhibits the developmental stride of the nation. This possibly explains why though four years after 2020, the country is yet to achieve its vision 20/2020, which goal is to position Nigeria among the twenty (20) top economic countries of the world by 2020. The painful thing is that the country recorded this failure in the face of available knowledge that reveals infrastructural development as a critical factor in driving national economic growth. However, in the case of Nigeria the missing link is largely in the area of insufficient technological application in infrastructural development that will bring about speedy meaningful development. This lacuna in literature is what this paper intend to bridge.

With this in mind, this paper tend to assess the trends and nature of infrastructural and technological development of Nigeria, the authority efforts geared toward ensuring the technological development of the country, and the problems militating against such developmental stride, as well as, the implications of such effort to national development of the country.

Generally, this article offers an insight to infrastructural development by assessing the trends and nature of infrastructural and technological development as well as the implications for infrastructural development to national development.

## 1.2 Methodology

This study used summative evaluation method in assessing relevance data from secondary sources derived from government official document, private/non-governmental agencies report, journals and books extracted both online and in hard copies to ascertain the country's infrastructural technological development effort.

## 2.0 CONCEPTUAL ISSUES

### 2.1 Meaning of Infrastructure

Infrastructure is a multidimensional concept which has no single universally accepted definition that covers all the aspect of the term. And to explain or define it from one perspective will be grossly insufficient in explaining infrastructural development of a nation such as Nigeria. Hence, different definitions of the term as proffer by different scholars shall be discuss, starting with Brixiova, Matambatsere, Ambert, and Etienne (2011) in their exploratory study of the constituent of infrastructure concluded that they are physical assets that are defined as fundamental facilities and systems serving a country, city, or an area such as transportation and communication systems, power plants, and schools. While to Jochimsen (1966), who in a bid to have a holistic and unify view of infrastructure opined that it is the sum total of material, institutional and personal facilities and data which are available to the economic agents and which contribute to realizing the equalization of the remuneration of comparable inputs in the case of a suitable allocation of resources that is complete integration and maximum level of economic activities. Meanwhile Boyle (2023), who approached the study from a business perspective define infrastructure as the basic physical systems of a business, region, or nation and that often involves the production of public goods or production processes. Investopedia and Burns (2023) further undertook the study from a historic perspective, by tracing the first appearance of the term to late 1880s, derived from the French word "infra" below and

“structure” building; on which they pinned the definition of infrastructure to mean the foundation upon which the structure of an economy is built. In the same vein Cambridge (1986), in a quest to understand the economy supporting system define infrastructure as the basic systems and services that are needed in order to support an economy, for example, transport and communication systems and electricity and water supplies. Collins (1979) in a community development supportive study infer that infrastructure is a substructure or underling foundation such as basic installations and facilities on which the continuance and growth of a community, state, etc. depends on, for example roads, schools, power plants, transportation and communication systems etc. MBN (2023), in an interrogatory study of what make a country function as it should opined that infrastructure as the basic systems and services that a country or organization needs in order to function properly. where infrastructure for a whole nation, is say to include all physical systems such as the road and railway networks, utilities, sewage, water, telephone lines, and cell towers, air control towers, bridges, etc, plus services including law enforcement agencies, emergency services, healthcare, education, etc. The uniqueness of the above definition is that it links infrastructure of a country to her developmental indicators/facilities. Wherefore, one can deduct from the foregoing that infrastructure encompasses all equipment, facilities and personnel who advances the course of development.

### **3.0 TYPES OF INFRASTRUCTURE**

#### **3.1 It is often categorized into two known as hard and soft infrastructure.**

Hard infrastructure refers to tangible, physical assembly or structures such as roads, bridges, tunnels, and railways that support the economic. They are the physical system needed to run a modern industrial nation. Torrisi (2009) in his study listed this category of infrastructure to include roads, highways, and bridges, as well as assets that are required for operation of facilities as mass transit buses, vehicles, and oil refineries cum technical systems such as networking equipment and cabling which provide critical support functions to smooth operation of business. Kumar (2005) in an effort to differentiate between hard soft infrastructure refers to the large physical networks necessary for the functioning of a modern industrial nation as hard infrastructure, whereas soft infrastructure refers to all the institutions required to maintain the economic, health, cultural and social standards of a country, talking about the finance, education, health, governance, and the judiciary system, and security architecture that enable the economy to thrive. On this account, Brookings Institute (2012), in an analytical study of the numbers of job created by infrastructure reported that about 14 million people have jobs in fields that are directly related to infrastructure; starting from locomotive engineers to electrical power line installers, to truck drivers, and construction labourers, which account to nearly 11% of nation’s workforce. Soft Infrastructure on the other hand is the services required to maintain the economic, health, and social needs of a population. It represents the human capital and institutions necessary to maintain the economy that delivers certain services to the population. It is believed that investment in soft infrastructure is a deliberate act aimed at ensuring that people thrive and participate in daily life. This is because human capital development is a great developmental stride for any country that aspires to have its place in the economy globally premise.

#### **3.2 Classification of Infrastructure**

In terms of classification, infrastructure has been classified into social and economic infrastructures.

Social infrastructure has to do with the combination of basic facilities which are not for immediate or direct reward but are necessary for human development such as healthcare facilities (hospitals), education (schools, colleges, university etc.), and housing while, economic infrastructure are the combination of basic facilities that are helpful and offer direct and immediate economy reward to individuals and businesses with a multiplying effect in the national development. This includes such facilities as telecommunication, electricity, transportation, and energy etc.

### 3.3 Technology

Technology to Ejiogu (2004), is the cumulative understanding of science and its application in the exploration of the environment through processes, instrumentation, and manipulation of the physical elements to manufacture a product. In a narrowest sense, technology consists of manufactured objects or tools such as axes, arrowheads, and their modern equivalents such as pots, water reservoirs, building etcetera whose purpose are either to enhance human capabilities or to enable them perform tasks which otherwise could have been impossible without such an aid (Grubler, 1996). Furthermore, Ndukwe (2021) in his paper the missing link of Nigeria's development describes technology as the application of scientific knowledge for practical purposes. In a similar definition Anthony et al (2023), opined that technology is the application of scientific knowledge to the practical aims of human life that brings about change and manipulation of the human environment. To Harcourt (2011), technology is the use of scientific knowledge to solve practical problems, especially in industry and commerce. Furthermore, it is the specific methods, materials, and devices used to solve practical problems. And as advance by the Federal Ministry of Science and Technology, the terms refer to the way of doing things through the application of knowledge derived from systematic investigations of natural forces and devices indispensable to the stable enhancement of the quality of life and human process. Simply put, technology is a means of harnessing and exploiting our understanding of nature and resources to improve the human condition, the natural environment or to carry out other socio-economic activities. Therefore, science and technology (S&T) intervention becomes even more relevant for building a successful economy, especially today when knowledge-based economies are emerging stronger (Ias, 2022). Science and technology therefore, are indispensable vehicles for transforming a society from backwardness to modernity; from being a liability to becoming an asset; as well as from being a non-industrialized nation to an industrialized one; from a dependent economy to a self-reliant economy; and from an import-oriented economy to an export-oriented one. For these reasons it is easier for countries to be categorized into first, second and third worlds on the bases of their level of application of science and technology in their developmental stride. In general, science and technology form the bases for distinguishing developed countries from developing or undeveloped ones; and from net-consumers to net-producers country. In other words, science and technology are the cardinal factors in determining the quality of life of the people and the overall status of a nation.

### 3.4 Classification of Technology

Grubler (1996) in an effort to classify technology opined that it consists of both hardware and software, which is the knowledge required to produce and use technological hard wares. Material or Hardware Technology- refer to knowledge that are converted into real life tools, equipment, agro-chemicals, improved plant varieties or hybrids, improved breeds of animals and vaccines.

Knowledge-Based or Software Technology- on the other hand are such technical knowledge, management skills and other processes which are needed to successfully produce products or grow crops. Thus, technology includes both what things are made and how things are made. Finally, knowledge, or technique, are required not only for producing objects or gargets, but for their usage as well. For instance, knowledge is essential to be able to manufacture and drive a car or use a bank account. Knowledge therefore, is essential both at the level of an individual, an entity, and the general society. Using computer as an example without a user, who knows how to operate it, let alone how to read and understand the computer language, may make the computer simply a useless piece of heavy equipment. Technology varies in size and complexity, whether hard or soft requiring both tangible and intangible settings in the form of spatial structures and social organizations to function.

### 3.5 Technological Development

Ias, (2022) postulated that science and technology have been central to the progress and development of virtually all the nations of the world, and that they contributed enormously to various sectors of the economy by sharing a symbiotic relationship with development. On his part Schumpeter (1942), focus on studying the stages of technological development and acceptance by advancing three stages or processes that new, higher technology go through. The first stage is the Invention, which constitutes the first development of a scientific or technical brand product or process. Then the Innovation which is the stage where the invented product or process is made available in the marketplace and the final stage is the Diffusion or spreading, which refers to the process that such successful innovation gradually comes to be widely available for use in relevant applications through adoption by firms and individuals. It could be inferred that the cumulative economic and environmental impacts of new technology results from all the three stages, which Jaffe et al (2002), refer collectively to as the process of technological change. In analysis of the definition of technological development by Schumpeter (1942), OECD Environment directorate and international energy agency (2003), believes that the definitions could wrongly suggest that technical change (technology development) is a linear process that simply goes from invention to innovation, and to diffusion. In contrast they view it to be more of a cyclical process; where feedback between market experience and further technical development become essentially important. The study by Grumbler (1996) backed up the assertion above, by revealing technological evolution to be neither simple nor linear. Rather, been characterize of four most important distinct features of uncertainty, dynamic, systemic, and cumulative

- **Uncertainty:** scholars refer to this uncertain change in technology as a “snake pit” problem which prevails at all stages of technological evolution, from initial design choices, through success or failure in the marketplace, to eventual environmental impacts and spin-off effects where constant alternatives are sprouting up.

- **Dynamic:** This talks about the fact that technology keeps changing all the time resulting in new varieties, or “species”, and the continual improvements and modifications; with the components experiencing changes much frequent than either its nonmaterial components or the society at large.
- **System:** Technology is not treated as a discrete, isolated event that concerns only one artifact. Rather, it requires a host of other technologies to function. This interdependence of technologies causes enormous difficulties and resources to adequately implement new ones that can meet the expected needs.
- **Cumulative:** Technology changes are built on previous experience and knowledge, which makes it extremely difficult to build a new technology from the scratch.

### 3.6 National Development

National development according to Ariyo (2023), who prefer the term Nation-building view it as the construction and structuring of the national identity using the power and resources of the state aimed at unifying the people within the state to be politically stable and viable in the long run. He further opined that growth in the GDP is not the real measure of national progress. Rather, the aspect that should matters most is the rate at which the economic wealth is translated or trickle down to the less privilege through more opportunities, and better health for all among other things. While Ias (2022), associate the term nation-building (national development) with state building, democratization, modernization, political-development, post-conflict reconstruction, and peace building.

## 4.0 THEORETICAL FRAMEWORK

Theory supporting this study is the system theory as advocated by Weihrich et.al (2008), The theory emphasizes the harmonious working or operation of different components to achieve a common goal. Hence, a System can be said to be made up of different independent components or parts that functions as a whole. With each of the component been independent of the other and each subsystem is vital to the effective running and wellbeing of the whole (Asaju, 2023). This implies that all the subsystems are important and none could be undermined for the other. In application, infrastructural technological development does not exist in isolation. As they both takes inputs from each other and the environment which is part of the main system. As a general norm, all organizations whether closed or open, receive inputs from the environment, transform them, and export the outputs back to the environment. Wherefore, infrastructural technological developments are vital integral parts of national development. Infrastructural development takes input in terms of modern sophisticated machineries, Artificial intelligence, well-trained workforce that will ginger change and sustainable national development in Nigeria.

### 4.1 Infrastructural Development and Technological Development in Nigeria

The world Economic Forum report of 2011-2012 ranked Nigeria at position 125 out of 142 in terms of overall quality infrastructure with a value of 3.0 that is 1.3 below the mean value. In comparison to countries like Cameron and Ghana that are ranked 122 and 90 respectively. In respect to road quality, Nigeria was ranked 120 with port infrastructure at 117, railway quality

at 104 and air transport quality at 104. Whereas in electricity supply, the country was ranked 139 at a valued of 1.5, that is 3.3 below the main value. These figures as of 2020 remain largely unchanged. On this premise Akinwale (2010) in his study reported that Nigeria's infrastructure is meager and efforts to improve it have not yielded the desired results. The situation that Olanipekun, Aje, and Awodele (2014) agreed with the earlier assertion by reporting that the country's infrastructural situation sharply contrasts the Economic Theory of Infrastructure and Commons Management" of 2005, which states that certain important resources should equitably be used for the benefits of all members of the society.

## 4.2 Trends and Nature of Infrastructural and Technological Development in Nigeria

Olufemi, Olatunbosun, Olasode, and Adeniran (2013) observed the obsolete nature of the Nigeria's infrastructures and reported that most of the country's infrastructural facilities were developed during the second national development plan between the periods of 1970 to 1974. A situation that makes Oyedele (2012) in his study to project the country's infrastructural development need to be far above the available resources used in its provision. Meanwhile Olanipeku, Aje and Awodele (2014) believes that Nigeria, with a very good share of Military government regime, has witness an era characterized by economic boom which could have advanced the country's infrastructural development but, only succeeded in widening the gap of the country's infrastructural demand and provision. Olufemi et al (2013) reported that rather than successive governments to focus on the provision of infrastructure after the second national development plan, they were instead beclouded by the social, economic and financial implication of the projects by considering factors such as high capital expenditure of the public infrastructure, high socio-environmental and technical risks of construction, direct and indirect external effects for operating the infrastructure. e.g Land use, spatial and regional development, social cohesion and environment. Difficulties of cost recovery from users/beneficiaries, making potential financial profitability, Strong local monopolistic situations of infrastructural operator, long financial payback periods even when projects are financially viable. However, due to the high volatility of the oil market and poor implementation of the national plan, the government then embarked on series of economic reforms, and it is the aftermath effect of these reforms that led to the neglect of all infrastructures in the country and under investment. Oyedele (2012) therefore believes the current situation of the country is such that most infrastructures are now decayed and needed repair or replacement. Indicating gross lack of correlation between the demand for infrastructural development which is higher and the resources for it provisions that are limited.

## 4.3 Efforts at Technological Development in Nigeria

Technology development and transfers according to Canuto (2018) have not only impacted on the rising local productivity levels in developed and developing economies, but has also enabled a partial alteration of the technology-innovation landscape. So much, so that some receiving countries are now significantly becoming new avenues of research and development, with the introduction of various technologies which has long changed the engine of development in developing nations and the nature of foreign trade. Building further on this background Akpan, Ogosu, Andem, and Zibigha (2022) in their study stated that globalization, exchange rate, Trade openness, foreign direct investment (FDI) has contributed to technology development in Nigeria. Furthermore, Oruma and Amah (2021) examined the impact of

globalization on technology in Nigeria by reviewing different positions of globalization as well as the technology types available by x-raying their implications within the context of Nigeria. And concluded that technological globalization leads to expeditious economic growth in Nigeria, with immense benefits to both the public and private sectors of the Nigeria's economy. The act, they believed has enabled the Nigeria government to stimulate dying sectors of the economy, executed via foreign investments and trade, whilst promoting raw materials exports that are generally in abundance in the country. Foreign direct investment (FDI) is one of the efforts by the government of Nigeria to improve technological development as reported by Yauri (2006) who investigated the vertical effects of FDI on Nigeria's manufacturing firms in an attempt to establish whether manufacturing firms in Nigeria that receive FDI, benefit from technology flows which comes along with foreign capital. He found that Nigerian firms that received FDI employed more technology than non FDI firms, practically due to the foreign capital influence. The study concluded that FDI is beneficial to manufacturing firms in Nigeria, since one of the critical constraints to Nigeria's manufacturing firm's productivity is lack of technology.

#### **4.4 Problem Militating against Technological Development in Nigeria**

In the words of Kolade et al. (2023), digital technology is the future, but the infrastructure to support it is poor. Essential infrastructures such as steady electricity supply, good roads, and quality educational system that will support the country to navigate into the digital future are inadequate. And the synergy between the country's physical and digital infrastructure is impeding its timely attainment to full developmental potential. The country's lack of access to affordable energy, straight forward logistic, and a deep skills pool, do not only limit how the digital technology will be deployed, but also make the country less competitive in deploying such technology, aside that, infrastructural investment in Nigeria comes with risks that very few investors have the appetite to invest in. Therefore, Udodi (2023) in his study the factors that affect government use of technology in Nigeria reported that inadequate infrastructure for technological development such as poor internet connectivity and limited access to electricity in some parts of the country are militating against the governments and public sector effort to implement and maintain technology systems in the country. The study further outlined lack of skilled personnel with the requisite technical skills to implement and maintain technology systems often lead to delays and inefficiencies in the implementation and use of technology in the country. Funding and budget allocation for technological development are also identified as major issues that are militating against the development of technology in the Nigeria's public sector. Particularly as the country's public sector organizations are consistently faced with budget constraints that limit their ability to invest in technology. Corruption and a lack of transparency in procurement equally hinder the use of technology in government and the public sector of the country. This negative practice often leads to the procurement of substandard technology, or the diversion of funds intended for technology implementation. Balogun (2015) list some of the problems militating against technological development in Nigeria to includes security, lack of database for infrastructures, lack of adequate ground breaking research in the field of technology in the country, political instability, low capital or poor budgetary allocation for technological development, poor government policy in the area of technology, poor maintenance culture or lack of sustainable policy, and lack of enough skill manpower. Implications for Infrastructural Development and National Development in Nigeria

The negative implication for neglecting or underinvesting in the country's infrastructural development according Olufemi et al (2013), has affected the economy by increasing the cost of raw materials which the multiplying effect led to reduction in productivity and competitiveness among the country's firms. This neglect is believed to have a share effect on the reasons why the nation's critical infrastructures as road networks, power supply, aviation, and railway services, are bad with numerous abandon projects in the education, health, housing and transportation sector of the economy; thereby affecting the inflow of Foreign Direct Investment (FDI) into the country, as most investors are leaving the country for others with supportive infrastructural facilities, resulting in increasing in the numbers of firms that are folding up on daily basis in the country.

## 5.0 CONCLUSION AND RECOMMENDATION

Firm-level technological innovation not just infrastructure is important for growth and development as human and economic development are hung on technology so much so that, individuals, entities, and countries that lead in the development or adoption of new technology in its developmental stride are the ones that will often emerge as the economy leaders. It is therefore unfortunate that Nigeria as a nation on the contrary in this edge is still having high degree of its infrastructure pinch in a non-technological innovation that is inhibiting her developmental stride. This missing link of insufficient technological application in infrastructural development of Nigeria has caused and is still causing the nation's desire of becoming one of the top twenty (20) economies by 2020 to shipwreck, as the country's economy is currently tilting down the ladder of development. And even though globalization, exchange rate, trade openness, and foreign direct investment (FDI) are impacting on the technological development of the country by stimulating the dying sectors of its economy, much is still needed to be done, as the country's lack of access to affordable energy, straight forward logistic, and a deep skills pool, do not only limit how digital technologies are to be deploy in moving the economy forward, but also makes the country less competitive in terms of modern infrastructural technology development. This is worrisome particularly with the country's faced with numerous cases of insecurity, lack of accurate infrastructural database, inadequate ground breaking research in the field of technology, political instability, low capital or poor budgetary allocation for technology development, poor government policy in the area of technology, poor maintenance culture or non-sustainable policy, as well as lack of enough skill manpower to retain and attract inflow of Foreign Direct Investment (FDI) into the country, as the few available ones are checking out of the country for others with abundant infrastructural facilities, further exacerbating the numbers of the firms that are folding up on a daily basis in the country.

### 5.1 Recommendation

Nigeria needs to consciously and genuinely invest in essential infrastructures such as steady electricity supply, good roads, and quality educational system that will support the country to navigate into its digital future. By creating a synergy between the country's physical and digital infrastructure that will enable it to work in a dynamic synergy not in mutual isolation. As well as bridge the digital divide at all level of the government, so as to enable the country attains its full potentials. On this note, there is a dare need to invest in the country's physical infrastructure to enable the citizens fully assess the benefits of digital technology by prioritizing allocation of

resources for technology implementation; as well as, increase transparency and accountability in its procurement processes; through prioritizing efforts in addressing the dearth of infrastructure and skilled manpower, alongside increase in funding technological policy implementation. It therefore entails that; the three key principles of access, adoption, and application guiding digital inclusion must be adhere to, such that disadvantage groups in the country can have access to, and use the information technology in developing themselves and the society at large.

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