

**“THE NIGERIAN INFRASTRUCTURES CONUNDRUM –
THE MISSING LINKS”**

being

**PRESIDENTIAL LECTURE OF
THE NIGERIAN ACADEMY OF ENGINEERING**

Delivered by

Engr Dr Edet J. Amana PhD, DIC, FNSE, FAEng, DSc (Honoris Causa), OON
Chairman, Amana Consortium Ltd, Lagos
President Nigerian Academy of Engineering 2010 - 2012

Date

Wednesday November 25, 2020

Venue

Afe Babalola Auditorium
University of Lagos, Akoka
Lagos, Nigeria

1. PREAMBLE

I thank Almighty God for the privilege to serve my country and the engineering community as President of the Nigerian Academy of Engineering for the period 2010 to 2012. I thank the President of the Academy, Engr Alexander Ogedegbe FAEng and the Immediate Past President Engr Prof Fola Lasisi FAEng for inviting me to deliver this Presidential Lecture. Please permit me to stand on existing protocol.

This lecture derives its title from the several decades of Nigeria's failed attempts to come to grips with the development of her infrastructures. We shall take snapshots of various attempts made by respective governments over the years to give Nigeria befitting infrastructures. We shall see where and why some limited successes were attained and why, overall, the failure has been abysmal.

As a result of her failed infrastructures, the economic development of our country has suffered major setbacks and what is potentially a rich and great country has failed to develop her enormous potential over the years. Nigeria was appropriately described as the Giant of Africa in the early 1960s following her political independence from British colonial rule. In 2017, Borgen Magazine from Seattle Washington described Nigeria as the poverty capital of the world. The World Economic Forum's 2016-17 Global Competitiveness Index ranked Nigeria's Infrastructure at the bottom - 132 out of 138 countries - and according to that organization's 2016 Executive Opinion Survey, the poor infrastructure is the largest constraint on doing business in the country.

Why should poverty and poor infrastructures bedevil a nation so richly endowed by God with enormous human and natural resources? What are the parameters that drive the delivery and development of infrastructures and why have we over the years failed to get them right? To answer these questions we shall take a close look at some typical infrastructures— railways, roads, and power generation, and quickly scan the national development planning process to note our successes and failures.

2. DEFINITIONS

It is important to define some words, phrases and ideas that are germane to our subject matter. These are infrastructures, science, engineering, technology, research and development, innovation and national innovation systems, data, corruption, leadership, politics and political engagement.

INFRASTRUCTURES are the facilities, and systems that are essential to the development and growth of society, enterprises, and economies. At the national and subnational levels, infrastructures may be classified into four broad categories:

- **Physical infrastructures** include roads, housing and public buildings, water supply, sanitation and sewage, power supply, transportation, pipelines, telephone, and internet

etc. Engineers are familiar with this group of infrastructures; indeed, they play key roles in their creation and maintenance.

- **Social infrastructures** are those facilities which help sustain the development and growth of society such as educational institutions and systems (schools/universities etc.), healthcare institutions (hospitals etc.), law enforcement institutions (police force), religious bodies etc.
- **Organizational infrastructures** are those organs and systems required for government and the economy to function. These include political system, judicial system, legislature, financial system, revenue generation system, the defence system etc.
- **Knowledge infrastructures** are those systems that enable us leverage technology to enhance performance in all areas of human endeavour. They comprise the network of people, artifacts and institutions that generate, share, and maintain specific knowledge about the human and natural worlds. Shared reliable knowledge is one of human societies most precious resource. Key elements which drive this resource have changed very rapidly in recent times. These **disruptive technologies** include Artificial Intelligence (AI), Internet of Things (IoT), Cloud Computing (CC), Robotics (R) etc. The application of these technologies has resulted in new ecologies and changed embedded social norms, relationships, ways of thinking and working with resultant redistribution of power and authority. For instance, data-driven decision making (DDDM) which involves decision making backed up by hard data is replacing decision making based on observation, intuition, or experience in many areas of human endeavour. We saw this play out during the Covid-19 pandemic when, in the highly organized economies, the vast amount of data generated from GSM usage was used to predict the spread and therefore management of the Covid-19 disease. GSM activity was also used in some states in Nigeria to determine those to access the Covid-19 palliatives thus transferring power from the local chiefs and community leaders to technology.

National, human, and economic development require extensive interplay of the nation's physical, social, organizational and knowledge infrastructures. The quantum and quality of development depend on the effectiveness of that interplay. For example, an effective educational system will produce people who effectively man the political system, the knowledge generation and application systems, the systems responsible for the provision of water, roads, etc. Similarly, a failed political system cannot provide the organizational framework necessary for the development of power supply, education, healthcare delivery or knowledge generation and application systems.

- **SCIENCE** is the reasoned investigation or study of phenomena aimed at discovering enduring principles among the elements of the phenomena. The scientific method involves

the identification of such phenomena, gathering relevant data, using the data to formulate hypothesis, and the testing of the hypothesis empirically.

- **ENGINEERING** is the goal-oriented process of designing and making tools and systems to exploit natural phenomena for the convenience of man often using the techniques of science.
- **TECHNOLOGY** is the knowledge, making, modification, and usage of tools, machines, techniques, crafts, systems, methods of organization to solve problems, improve on pre-existing solution to a problem, achieve a goal or perform a specific function. It can also refer to a collection of such tools, machinery, modifications, arrangements, and procedures. Technology is the consequence of science and engineering. For instance, science might study the flow of electrons in conductors and the knowledge gained, used by engineers to produce tools such as semiconductors, computers, and other forms of advanced technology. The development of technology may draw from many fields of knowledge including scientific, engineering, mathematics, linguistic, and historical knowledge to achieve some practical results. In other words, there is no area of human endeavour which cannot be managed through appropriate technology.
- **INNOVATION AND NATIONAL INNOVATION SYSTEM (NIS)**. Innovation is the process of making an idea or invention into a good or service that creates value and brings about positive change. The innovation process may involve improving existing methods, practices, and technology, or starting from scratch. The National Innovation System is the flow of technology and information among people, enterprises, and institutions in a nation. This is key to the innovative process at the national and sub-national levels. Put simply NIS includes all the economic, political, and social factors which sustain the national development process. These include the financial system, organization of private firms, the elementary, secondary and university education systems, labour markets, culture, regulatory policies, and the strength of the innovation institutions.

So, NIS is *“the network of institutions in the public and private sectors whose activities and interactions initiate, import, modify and diffuse new technologies.”* Because of the large variety of factors involved in NIS, no nation’s innovation system is the same as others. Each system is unique and needs to be developed and implemented by local expertise.

The Nigerian NIS policy is captured in the Science, Technology and Innovation policy (2011) which reflects the renewed commitment of the Nigerian government *“to deploy S&T as the fulcrum of all activities, geared towards realizing the nations potential as a global economic power.”*

- **RESEARCH AND DEVELOPMENT (R&D)** refers to innovative activities undertaken by corporations, institutions, or government agencies for the developing new products or improving existing ones. National Economic development results from R&D ecosystem

which comprises universities, research institutes, technical businesses, entrepreneurs, start up, venture capital etc.

- **DATA** are characteristics, or information that are generated in devices or collected through observation and are stored for reference and analysis. **Hard data** are data generated from devices and applications such as phones, computers, sensors, smart meters, bank transaction records etc. Such information is called hard data and can be measured, traced, and validated. Users have confidence in information from hard data. **Soft data** are based on qualitative observations such as ratings, surveys, polls etc. We also have **Big data** which is a combination of structured, semi-structured and unstructured data collected by organizations that can be mined for information and used for predictive modelling and other analytical applications. Companies use big data to provide better customer services and making faster and more informed business decisions. Hard, soft, or big data can be used nationally as a tool to make more informed economic decisions that greatly impact national economic development.
- **CORRUPTION** is defined as a form of dishonesty or criminal offense undertaken by a person or organization entrusted with a position of authority, to acquire illicit benefit. Forms of corruption include bribery, extortion, cronyism (improper appointment of friends and associates to positions of authority), nepotism (favoring of relatives or friends, especially by giving them jobs), parochialism, patronage, graft, and embezzlement.

There are different scales of corruption. **Petty corruption** are small favours between a small number of people. **Grand corruption** affects the government on a large scale. When corruption is so prevalent that it is part of everyday structure of society, it is called **Systemic Corruption**. Nigeria suffers from a high degree of systemic corruption. The National Bureau of Statistics publication of August 21, 2017 revealed that ***“on average, about one bribe is paid by every adult citizen of Nigeria to a public official and that the average amount paid in cash for a bribe is equivalent to a fourth of the average monthly salary.”*** The other forms of corruption, which may be called non-financial corruption, abound in Nigeria. Cronyism, nepotism, parochialism, and patronage destroy confidence in the system and dull the competitive edge. The damage to the national ethos caused by non-financial corruption is as bad if not worse than that caused by financial corruption because of the absence of the legal framework to apprehend and punish those guilty of those forms of corruption. Corruption is a hydra-headed monster which consumes everything in its path. The way to curb corruption is not just finding and punishing corrupt people. Tackling corruption requires educating our people, from kindergarten to adulthood to eschew corruption in all its forms, acquire the right attitude to life, and respect/obey rules and regulations set up to regulate orderly management of society. Corruption can be curbed by extensive deployment of technology in all areas of our activities.

- **POLITICS AND POLITICAL ENGAGEMENT.** Wikipedia defines politics as a set of activities that are associated with making decisions in groups or other forms of power

relations between individuals such as the distribution of resources or status. The Concise Oxford Dictionary has two definitions for politician. (1) A person who is professionally involved in politics, especially as a holder of an elected office. (2) In certain climes politicians act in manipulative and devious ways typically to gain advantage. While we must reprehend politicians, who act in manipulative and devious ways, it must be stated that politics provides the framework for making decisions which involve distribution of resources. The importance of politics in the delivery of infrastructures is underscored by the fact that, the which, why, where, what, when and how of infrastructures are all political decisions. We note that Political System is a component of the Organizational Infrastructures which we defined earlier. Absence of an enlightened, healthy political system spells doom to the delivery of infrastructures.

In addition to having a political system and players that are enlightened and committed, for sustainability, there must be political engagement between the political elite and the people to get their buy-in and ownership.

3. HOW INFRASTRUCTURES ARE DELIVERED

Delivery of infrastructures is the primary purpose of the national development planning process which government carries out from time to time. It is this planning process that determines the **What, Why, Where, When, and How** of the infrastructure. Such delivery is successful only to the extent that the organs of government, the regulatory framework provided within the organizational infrastructures, are robust and supportive of both short term and long term national strategic plans.

The interplay of organizational infrastructures with physical infrastructures is seen in the way British commercial and administrative interests shaped the development of Nigeria's infrastructures. The ripple effects of what happened in the dying decade of the 19th century is still with us today in all categories of Nigeria's infrastructures.

A quick look at the development of transportation infrastructures (railways and roads), and electricity generation infrastructure over similar timeframes (1896 – 2019), will give us some indication of what determines the success or failure of attempts to deliver infrastructures.

4. NIGERIA'S RAILWAY INFRASTRUCTURE

The narrow gauge (1,067mm) railway system which covered about 3,505km, most of which was built between 1898 and 1930 (over a 30-year period), was the greatest physical infrastructure achievement of Nigeria's colonial administration. The system linked up the whole country. With its western terminus in Lagos, it went through the following towns and regions:

- Lagos, Ibadan, Osogbo (Western Region)
- Kaduna, Zaria, Kano (North Central)
- Nguru, Maiduguri (North East)

- Zaria, Kaura Namoda (North West)
- Makurdi, Jos (Middle Belt)
- Enugu, Umuahia (East Central)
- Port Harcourt (South South)

This was a huge achievement because there were very few local skilled labour in those days and there were many adverse labour practices. Also, the construction stopped for about 4 years during the period of the First World War (1914 – 1918).

The British administration was determined to achieve this project because of the strategic importance the colonial administration attached to it.

- (a) To transport raw materials harvested from all parts of the country to the seaports of Lagos and Port Harcourt for shipment to Britain to feed British industrial production.
- (b) To speedily move military personnel from one part of the country to another as may be necessary for security.

But the success of this project was short-lived. From 1964 the Nigerian Railway Corporation (NRC) entered a long period of decline due to loss in patronage, change in government focus, inept management, and poor maintenance arrangements. The NRC filed for bankruptcy in 1988. It is noted that many countries including Japan, India, Indonesia, Taiwan, New Zealand, South Africa among others, still use the narrow gauge rail system. Nigeria abandoned the narrow gauge and in 1991 the standard gauge rail system (1435mm) was introduced to link the iron ore to the steel plant in Ajaokuta with extension to the flat steel mill at Aladja and the port of Warri (327Km). Standard gauge rail links have recently been provided between Lagos and Ibadan (181Km), and between Abuja and Kaduna (186Km) bringing the total length of standard gauge rail lines to 694km. Table 1 gives the development of Nigeria's railway infrastructure for the period 1896 – 2019. Fig 1 paints the picture of the neglect of this mode of transportation which is ideal for speedy movement of goods and passengers at high speed over long distances such as we have in Nigeria. An efficient railway system would provide much needed relieve for the road system and greatly reduce the wear and tear on the road due to heavy truck axle loads.

Comment: The failure of the railway system in Nigeria's transportation infrastructure mix has highlighted the need for the following:

1. Ensure coordinated strategic planning of the country's infrastructures.
2. Ensure that the people, the beneficiaries of the infrastructure have ownership through their involvement in the planning execution and management of infrastructure.
3. Ensure appropriate technology for local production of the components for further development and maintenance.

5. NIGERIA'S ROAD NETWORK

Although Nigeria's road development started before 1946, it is only when Nigeria began to operate the Federal constitution (in 1954) that road development data was captured and classified into 3 categories: Trunk A (Central government), Trunk B (Regional government) and Trunk C (Local administration). Available data show that in the colonial era, the total road network in the country was 13,240km in 1946 and went up to 45,993km in 1952. Post independent road development was anchored on the national development plans and may be discussed in five phases spanning the period 1960 to 1990 and post 1990.

Phase 1 (1960 – 1969): Road development was central to the 1962 – 1968 national development plan. There was road construction across the various regions of the country; for example, Lagos-Benin road (314km) was built between 1962 – 1963. But the civil war (1966-1969) disrupted road construction activities all over the country. This period lasted effectively about 3 years, during which the Nigerian road network grew by about 23,000 km to about 88,480 km.

Phase 2 (1970 – 1974): The end of the civil war in 1970 was the era of oil boom and tremendous energy, focused on reconstruction of infrastructures damaged during the war. Several roads were built by the states and the federal government and upgraded to dual carriageway (including Lagos - Badagry Expressway, among others). In 1974, the federal government took over 16,000km of roads from state governments, upgraded and reclassified them as Trunk A roads due to their national importance. By 1974, the total road network in the country was 95,375 km.

Phase 3 (1975 – 1980) was the golden era of Nigerian road construction. Continuing from the Phase 2 period, funding was available through the oil boom and the federal government was focused on opening up the country. Quoting Engr Oseni, retired director, FMW Planning Department, ***“The quality and extent of the national road network at this period received world acclaim and recognition in 1982”*** when Engr Osili, then Director of Federal Highways, was honoured as ***“Man of the Year”*** by the international Road Federation (IRF). This was also the period in which local consulting firms were patronized bringing a lot of value addition to the economy. During this period, seven dual-carriageways and other road infrastructures such as Lagos – Ibadan, Onitsha – Enugu, Port Harcourt – Enugu, Gusau – Sokoto Expressways, Lagos Inner Ring Road – 3rd Mainland Bridge were built. By 1980, the total road network in the country was 114,540 km.

Phase 4 (1981 – 1990): This period witnessed the construction of several dual carriageways which include Kano – Kaduna, Kaduna – Abuja, Enugu – Onitsha – Port Harcourt, among others, bringing Nigeria's total road network to about 193,000km. But many of the country's road assets fell into disrepair probably due to overload and poor

maintenance arrangements. It is noteworthy that about 95% of all passenger and freight movement was and is still by road, as other modes such as railway and waterways are absent. This highlights the absence of a transportation masterplan which would coordinate the development of all available transportation modes.

Post 1990: Minimal development of road infrastructure took place between 1993 and 1999. From 1999 to 2019, there have been some major road projects including the redesign and expansion of Lagos – Abeokuta Expressway and the East – West Road from Warri to Oron, among others. In about 30 years, there was only 7,000 km of new construction bringing the national road network to about 200,000 km.

(Ref. Road Network – Classification and Ownership Structure. FMW Statistics Dept. 2020)

Comment: The issues that have been highlighted by the poor development of Nigeria’s road network are similar to what were responsible for the failure of the development of Nigeria’s railway infrastructures.

In addition, it must be noted that in over 70 years since the development of road networks started in Nigeria (in 1950), this country of vibrant entrepreneurs has not produced a single major indigenous civil engineering contractor. The reason for this is Nigeria’s penchant for imported goods and services; the use of so-called “**experts**”. Government would rather use foreign contractors, who with the support of their home governments, compel Nigerian governments at national and sub-national levels, to honour contractual obligations which overwhelm their indigenous counterparts. The twin evils of corruption and absence of support for local contractors has made the unit cost for road construction and maintenance in Nigeria the highest in West Africa. Table 2 gives the development of Nigeria’s Road Infrastructure from 1946 to 2019 and Fig. 2 gives a graphical presentation.

6. NIGERIA’S ELECTRICITY GENERATION INFRASTRUCTURE

Nigeria’s electric power delivery system consists of generation, transmission, and distribution. For the purpose of establishing the missing links in the development of this industry which has served the Nigerian people so poorly, we shall take a snapshot of the development of electricity generation which started in Nigeria in 1896, 15 years after it started in England.

In 1896, generators were used to provide 60 kilowatts in Lagos. In 1923, a 2MW hydro plant was built on the Kwali River and in 1929, a private firm, Nigerian Electric Supply Company (NESCO) was established to manage a hydroelectric plant for the mining industry near Jos. The Electricity Corporation of Nigeria (ECN) was established in 1950. In 1951, total power generation by ECN was 46 MW. Post-independence in 1962, the Niger Dams Authority (NDA) was formed to build and maintain dams along River Niger and Kaduna River. NDA commissioned an 800MW hydro power plant in Kanji in 1968/69. In 1972, ECN and NDA merged to form National Electric Power Authority (NEPA), a

wholly owned Federal Government monopoly for the generation, transmission, and distribution of power throughout the federation. In 2005, NEPA transformed into the Power Holding Company of Nigeria (PHCN) which was deregulated and privatized into the current situation with 6 GENCOs for power generation, 11 DISCOs for distribution and 1 TRANSCO for transmission.

Electricity in Nigeria is generated through thermal and hydro power sources. Fossil fuels account for about 86% and hydro power for about 14%. In recent times, the industry has witnessed power generation from renewable sources – wind and solar, but contribution from these sources is not significant.

Table 3 presents a historical perspective of the development of Nigeria's power generation infrastructure 1896 – 2019. Whereas the current total installed capacity is about 12,000 MW, what is available varies between 4,679 MW and 3,399 MW (which is grossly inadequate to meet the needs of the populace). Total on-grid Electricity demand estimate for 2020 by Energy Commission of Nigeria (ECN) is 51GW which is over 4 times the current installed capacity.

Fig.3 which presents the plot of power generation against the period of development shows the inconsistency of focus of the national planning process on this most important driver and indicator of national development. Compared with peers. Nigeria's per-capita power consumption, which is about 144kWh is about 50% that of Ghana, 10% that of Tunisia and 3% that of South Africa.

Comment: That the installed capacity has not been achieved has been attributed to:

- Poor maintenance arrangements.
- Inadequate gas supply due to poor gas infrastructure and commercial arrangements. (Failure of Strategic Planning)
- Vandalism of equipment due to lack of ownership by the public.
- Low investment to build up generating capacity to meet population and industrial growth. (Failure of Strategic Planning)
- Inadequate transmission and distribution facilities to take up what is generated. (Failure of Strategic Planning)

7. FACTORS THAT DRIVE INFRASTRUCTURES DELIVERY

(1) **Need:** Need is easily established, but the degree of need will establish the priority given to the proposed infrastructure. In the case of the development of the narrow gauge railway system the need was for a fast reliable transportation system which would achieve the two cardinal objectives of the British administration:

Trade – Delivery of raw materials from the hinterland to the ports for shipment to the UK, and movement of imports from the UK to the hinterland.

Security – speedy movement of soldiers from one part of the country to the other should there be any breach of security.

(2) **Clearly Defined Objective:** As in everything in life a clear and unambiguous definition of proposed infrastructure sharpens focus and ensures success. We see this in the case of the Niger Dams Authority when Kainji, Jebba and Shiroro dams were planned (1962) to deliver about 1,910MW to the national grid.

(3) **Funding:** The successful infrastructure outcomes analyzed above were funded through government budgetary allocation and international loans. Private sector involvement in funding infrastructure needs very robust regulatory framework which only a responsive organizational infrastructures system (comprising judicial system, legislature, financial system, revenue generation system), can provide.

(4) **Political Engagement:** Infrastructure delivery is the essence of political activity. For sustainable infrastructure delivery outcomes, the political players must establish the need, give a clear definition of the objective/objectives, provide funding mechanisms, and ensure buy-in of the populace, the eventual users of the infrastructure. Prioritization in the face of competing needs and the choice of the infrastructure to deliver and where are political decisions.

(5) **Technology:** Has to do with the process and means of delivering and maintaining the infrastructure. Any infrastructure which is delivered without getting the people to acquire and internalize the technology used in its delivery lacks the peoples' ownership and is not sustainable. The narrow gauge railway system is an example of a well-delivered infrastructure which lacked the technology buy-in of the people. That resulted in lack of maintenance of the railway infrastructure and rolling stock. An Indian company was later invited to come and take over the management and operation of Nigerian Railway Corporation and they failed to bring it back to life. **For development of sustainable infrastructure, it is imperative that the technology be domesticated, and all aspects of technology ecosystems mobilized.**

8. NIGERIA'S INFRASTRUCTURES AND THE NATIONAL DEVELOPMENT PLANNING PROCESS

The purpose of the national development planning process which government carries out periodically is the delivery of physical and social infrastructures. A historical perspective is important to see the genesis of the challenges which have plagued Nigeria's infrastructures development process. The story of Nigeria as a political entity goes back to the Berlin conference of 1884 in which Africa was ceded to European powers and that part of Africa known as Nigeria was ceded to the British. Initial British interest in Nigeria was purely mercantile. That interest was realized through a trading company the United Africa Company (UAC), formed in 1879, by a soldier of fortune, named Sir George Taubman Goldie. Goldie's company was granted the Royal Charter by Queen Victoria in 1886 and renamed the Royal Niger Company. On December 31, 1899, Nigeria became a British administered territory (as opposed to a trading post) and the Royal Niger Company was paid £865,000 compensation in-lieu of its Charter. On January 1, 1900, the

Southern Nigeria and the Northern Nigeria Protectorates were created. These protectorates were amalgamated in 1914 to form the colony and protectorate of Nigeria. From that date to the mid-1950s when Nigeria won some level of self-governance, all the decisions affecting Nigerian infrastructures were made at the colonial office in London. Nigeria's first national development plan was formatted there. From 1955, following the 1954 federal constitution, Nigeria's infrastructure planning has been anchored in national development plans. We shall look at these development plans in the context of the five factors that drive infrastructures delivery – **Need, Clearly Defined Objective, Funding, Political Engagement, and Technology.**

8.1 The 10-year Development Plan (1945 – 1954). The strategic objective of Nigeria's first national development plan was the pursuit of British commercial interests. The needs were (a) security, and (b) trade promotion. It focused on the implementation of isolated projects in railways, inland waterways, ports. There was no involvement of the people, as all planned infrastructure were designed from the UK, built by foreign contractors. Its primary objectives were: (a) speedy movement of troops as may be necessary to maintain security, (b) bringing raw materials from the hinterland to the coastal ports of Lagos, Port Harcourt and Calabar and taking imported goods from the ports to the hinterland.

Comment: This plan was moderately successful within the context of its narrow objectives because of the clear definition of its needs and objectives and the political will and political continuity. Its success was however short-lived because the political arrangements did not include engagement of the populace and there was no component for the development of local talent and technology necessary for the sustainable management of the infrastructures. The 3,000 km railway system which was built over a period of about 30 years collapsed within two decades of its completion and resulted in total write-off of one of Nigeria's most valuable physical infrastructural asset,

8.2 The 5-year National Development Plan (1955 – 1960) was the development plan that took Nigeria to independence. It was formatted in a way that empowered the three regions – North, East and West. Each of the regions and the Federal government prepared separate plans that focused on collection of projects in all infrastructure categories aimed at improving the quality of life of the Nigerian people.

Comment: This was a period of intense political activity and competition between the newly created federating units. The plan lacked a national vision, strategy, and coordination. Local talent, research and technology were not developed to support programs.

8.3 The First Post Independent National Development Plan (1962 – 1968).

This plan, which was formatted in a federal democratic setting emphasized agriculture, industrial development, and manpower development. Major infrastructural projects implemented included transportation projects, power generation (Kainji Dam, Ughelli

thermal plant) Oil refinery, a Development Bank, and the Mint/Security printing company. The plan did not run its course due to political crisis which resulted in the 30-month Nigerian civil war (1966 – 1969).

Comment: Each region's list of programmes was like the others. There was no attempt at the center to optimize the planning to have a national economy. The plan rested disproportionately on public sector contributions; it conceived the role of the private sector as marginal. Most of the infrastructures and systems required deep technical management and scientific and technological investments that were not developed and domesticated. Meanwhile, crude oil (petroleum) discovered in Oloibiri in 1958 and in other parts of the Niger Delta area in the early 1960s, exploited exclusively by foreign oil companies, was replacing agricultural products by indigenous farmers as the mainstay of the economy. The political instability evinced in the civil war and dependence on imported products and expertise were the bane of this plan.

8.4 The Second National Development Plan (1970 – 1974)

The civil war had just ended, and Nigeria was under military rule. The national development effort had as its focus reconstruction, rehabilitation, and reconciliation in addressing the physical and social infrastructures damaged in the war. Some of the ingredients necessary for effective implementation of the plan, namely clear definition of objectives and funding provided by the oil boom, were favourable in this plan. It is significant to note that the first effort to coordinate scientific research was made by the establishment of Nigerian Council for Science and Technology (NCST, 1970) with the mandate to develop national priorities in research and supervise the implementation of basic and applied research to support the national development effort. The Nigerian Steel Development Authority (NSDA) was established in 1971, with research and supervisory functions, and the mandate to establish a steel production facility. That effort failed due to inappropriate technology, poor management, and dependence on foreign expertise and manpower. Nigeria has over 3 billion tons of proven iron ore reserves, but major local steel production has remained a mirage adversely impacting Nigerians industrial development effort.

Comment: The challenges in this plan, which have remained the bane of Nigeria's economic development process, were financial indiscipline, mismanagement of resources, planning inadequacies and dependence on capitalist nations and their institutions.

8.5 The Third National Development Plan (1975 – 1980) was a continuation of the second national development plan. Massive investment in road development continued, funded through the national budget. As a result of perceived non-effectiveness of the NCST, (a national organ set up to coordinate research and technological inputs into the national development effort), it was segmented into 26 research institutes and replaced in 1977 by the National Science and Technology Development Agency (NSTDA). These research institutes have been criticized as ineffective by those who focus on the bottom

line. Oronsaye's report wrongly recommended the scrapping of some of them. But these are the organs that can drive our economic productivity if they are strengthened and given the teeth to bite and chew. Rather than just provide support services in the economic development plan process, these institutions and others under the Federal Ministry of Science and Technology, should be the home of all the technology and knowledge systems that service all national socio-economic planning and implementation.

Comment: The importance of science, engineering, technology, and innovation (SETI) in the national economic development process was not appreciated and so the development programs planned in this period failed to achieve their objectives. Most of the key projects such as the Ajaokuta Iron and Steel Complex, Aladja Direct Steel Reduction Plant, the Eleme Petrochemical Complex, Oku Iboku Newsprint Paper Mill, planned as foundation for self-sustaining and dynamic growth were either not completed or could not take off because the planning failed to domicile a sustainable SETI system to ensure success. Also, agriculture was relegated; the oil boom provided petrodollars for importation. Private sector involvement was minimal.

8.6 Fourth National Development Plan (1981 – 1985) was implemented in a period of global economic recession. This plan was drawn under the newly introduced presidential democratic system and elicited the participation of local governments, but halfway into it, there was a military coup-d'etat. The organs of government were not focused. Not having the right perception of the Federal Ministry of Science and Technology (FMST) which was created in 1980, it was merged with the Ministry of Education in 1984 and separated from it in 1985. These actions demonstrated a lack of appreciation of application of Science and Technology in the national governance process. Although focus of this plan was agriculture, education, manpower development, infrastructure, and health, and projected a GDP growth of 7.2%, the GDP actually dropped to 1.25%, (11). This plan ended the era of national development plans.

Comment: This plan was characterized by high debt servicing which resulted from various foreign loans obtained in previous years, increased import bills amidst drastic fall in crude oil export revenue. It has been stated that "**out of all the plans launched since independence, the Fourth plan which was the most ambitious in terms of size of the anticipated investment programmes turned out to be the least successful in terms of achievement**". Nigeria was to remain under military rule for 15 years, from 1984 to 1999.

8.7 The Structural Adjustment Programme (SAP) (1986-1989) replaced the national development plan process. The stated objectives of SAP were promotion of investment, stimulation of non-oil exports, promotion of Nigeria's industrial efficiency, support for private-sector-led development, encouragement of the development and use of local raw materials and development/utilization of Nigeria's domestic technology. SAP rested on the pillars: deregulation of the value of the Naira, deregulation of interest rate, and removal of subsidies on government provided goods and services. SAP resulted in a

regime of interest rates which rose from 10% at the inception of SAP to as high as 45% - 50%, and exchange rate which though in early 1986 was at a parity of one Naira to one US Dollar rose to ₦150 to the US Dollar in 2013.

Comment: SAP failed because the national productive base was not sufficiently galvanized through adoption and application of appropriate technology to leverage the gains of deregulation.

- The research institutes in NSTDA were operating independently without attention to mission and with duplication of efforts.
- the productive sector was isolated from R&D activities.
- the S&T sector was insufficiently funded.
- there was lack of data for the planning process.

8.8 The Rolling Plans (1990 – 1999) and Vision 2010

After SAP, Nigeria adopted ad-hoc short-term instruments for economic management. Nigeria Vision 2010 was articulated in 1996 in a bid to have a long-term national vision on which development could be anchored. The vision aimed **“to transform Nigeria into a united industrious, caring, and God-fearing democratic society committed to making the basic needs of life affordable to everyone and creating Africa’s leading economy by 2010”**. The vision was to be achieved by using multi-tier plan configuration as follows:

- A 15 - 20-year perspective plan with a clear vision of the terminal state of the economy and coverage of the required policies and actions.
- A 3-year national rolling plan.
- A 1-year annual budget.

In the planning process, the annual budget was linked to the rolling plan because the budget matches resources with possible achievements. The rolling plan, on a continuous basis, would take into account new information, improved data and analysis and incorporate periodic revision into the planning machinery. Each revision would take account of factual circumstances based on data.

This rolling plan and Vision 2010 called for a developmental paradigm shift and placed a duty on Nigerians attitudinally to realise its goals.

Comment: Vision 2010 failed for the following reasons

- The structures to communicate and ensure the attitudinal change necessary for the success of the plan were not put in place.
- The structures and systems to ensure capture of relevant data were lacking.
- The technology to manipulate the data to provide necessary development options and decisions and implement those decisions were lacking.
- Investment in R&D remained flat despite international competition on innovation which showed Nigeria’s Innovation Index Score to be one of the lowest globally.

8.9 The National Economic Empowerment and Development Strategy (NEEDS) (2004 – 2007) was a medium-term economic development strategy that focused on: wealth creation, employment generation, poverty reduction and values re-orientation. These objectives were to be achieved by creating an environment in which private sector would thrive, government redirected to providing basic services to support and empower people to take advantage of opportunities offered by the plan, and implementing a social character and value re-orientation strategy. The Federal Government encouraged the states and local governments to develop similar strategies with acronyms SEEDS and LEEDS at state and local government levels respectively. The Federal Government gave emphasis in her budgets to healthcare, education, agriculture, roads, water resources, power, and security. A National Orientation Agency was created at the federal level with offices in the states. The NEED strategy has been adjudged moderately successful at the federal level. The same cannot be said of SEEDS in the states and very few Local Governments, if any, did anything about LEEDS.

Comment: NEEDS went out with the administration that started it. The enormity of Nigeria's development challenges requires the sustenance of development programs and efforts for longer periods to address areas that are defective and enhance performance in areas that are promising without the ravages of political distractions. NEEDS failed to address the pitfalls in the Nigerian economic development process.

- Absence of structures and systems at national and sub-national levels to capture relevant data.
- The technology to manipulate data, present development/decision options and implement decisions.
- Investment in R&D remained extremely low.
- There was no system to ensure effective implementation of NEEDS at all levels of governance.
- Continuity and self-correcting mechanisms were not built into the NEEDS.

8.10 Vision 20: 2020 (2009 – 2020) aimed to grow the Nigerian economy from the 41st position in world ranking in 2009, to be one of the top 20 economies in the world by 2020. Its objectives were to guarantee the productivity and wellbeing of the people, optimize the key resources of economic growth and foster sustainable social and economic development. As we draw near to the end of the plan period, we see that the plan objectives have not been realised; the plan is an abysmal failure.

Comment: Vision 20: 2020 had the following deficiencies:

- It's objectives were stated in general terms with no coordinated project focus.
- No coordinated structures and systems to capture accurate data for effective planning purposes.
- No national system of innovation involving investment in technology and in the use of R&D to drive national competitiveness and development.
- Systemic corruption.

8.11 The Medium-Term Expenditure Framework (MTEF)

From 2009 to date, Nigeria has based her economic development planning on the Medium-Term Expenditure Framework (MTEF) which is an annual and 3-year rolling expenditure planning process. MTEF sets out the medium-term expenditure priorities and budget constraints against which sector plans are developed and refined. MTEF also contains outcome criteria for the purpose of performance monitoring.

Comment: For MTEF to be effective in delivering sustainable development, there is need to ensure that the pitfalls which have marred the successful implementation of past development plans are contained.

- Need to work on our data capture/storage/retrieval systems.
- Need to do more to tap the enormous talent available in research and development in our universities, public and private research institutions.
- Need to tap opportunities available for private sector and public/private partnerships
- Although fighting corruption is at the front burner, a lot still needs to be done to contain that hydra-headed monster.
- The role of technology as the driver of national development is yet to be realized with necessary investment and promotion of knowledge infrastructure systems.

We must face the fact that Nigeria's organizational infrastructures are as dilapidated as our physical and social infrastructures. We are yet to realize the need to grow our knowledge infrastructures and put them to work for us deliberately and systematically.

9 TECHNOLOGY AS DRIVER OF ECONOMIC DEVELOPMENT

It has been established and is widely accepted that technology is the key driver of economic growth of countries, regions, and cities. Technological progress allows for more efficient production of more and better goods and services which is what prosperity depends on. However, the mechanisms through which technology is developed, adopted, adapted, and used in production is complex. Their detailed analysis and application allow for new ways that impact areas of policy (science and industrial policy), and research and development at national and regional levels. In fact, the concept of technology itself as well as individual and social capabilities required for its development can now be studied at much more detailed levels leading to contributions that impact higher education, job creation, and economic growth. Clearly there are links between education, research and development, innovation, and economic activity.

Open innovation has resulted in increased flow of knowledge and new types of co-operation between educational institutions, research organizations and business. Top R&D corporate investors have been responsible for the enormous progress which has been made in the development of engines, automated driving systems, big data, artificial intelligence, 3-D printing etc.

The ingredients for the development and application of technology are codified knowledge in the form of theories, frameworks, scientific papers, patents, instruction manuals and tacit knowledge or know-how acquired through study and application. This know-how resides in the brain of individuals and is a product of a lifetime of study and application. That is why education is the most important investment of any nation or people. It is also the most expensive investment because it starts from the day a person is born and continues, in increasing cost, as the person goes through the stages of primary to tertiary and post tertiary levels. It is the height of folly to make that kind of investment in the lives of our young people and then fail to protect and utilize it. Nigeria's most high-value export at the moment is not crude oil. It is her highly trained manpower. But the country is getting zero proceeds from this export. Instead of getting value, Nigeria is in a state of double jeopardy because this hemorrhage has left her national innovation ecosystem weakened and very much in need of transfusion. The other aspect of the tragedy is that instead of enacting policies that aim to stop the exodus of our highly trained manpower and encourage the return of our sons and daughters from diaspora to the only country that they can truly call their own, the Nigerian government is pursuing quick-fixes, borrowing large amounts externally to acquire expensive finished products which have no positive impact on our NIS and further deplete our foreign exchange balance and aggravate our debt burden. It has been observed that Nigerians thrive and excel everywhere except in their country. Surely, a system that does not support, promote, and demand excellence needs to be changed for us to achieve better and best outcomes for our country.

10 NIGERIA'S TECHNOLOGY MANAGEMENT FRAMEWORK

Nigeria's technology management framework are the systems, organizations, resources, regulations, and enactments that enable the development and deployment of technology in Nigeria. ***“The Federal Ministry of Science and Technology is the Nigerian ministry whose mission is to facilitate the development and deployment of science and technology apparatus to enhance the pace of socio-economic development of the country through appropriate technological inputs into productive activities in the nation.”*** Above Vision and Mission are so stated on the Federal Ministry of Science and Technology's (FMST) website. That is the mandate of the FMST.

To facilitate delivery on its mandate, the FMST produced Nigeria's Science, Technology, and Innovation (NSTI) policy in 2011. It has also developed a National Science, Technology, and Innovation Roadmap 2017-2030 (NSTIR-2030). The overall aim of NSTIR-2030 is to use NSTI as the catalyst for Nigeria's long-term sustainable development. The coverage of the NSTI policy overlaps with policies that have been developed by various Ministries of the Federal Republic of Nigeria, thereby necessitating the need for FMST to play the coordinating role in all matters that deal with the acquisition and application of knowledge and knowledge tools for the sustainable development of Nigeria.

The NSTIR 2030 objectives are as follows:

1. To provide a long-term science and technology framework, and support mechanisms for industrial revolution in Nigeria.
2. To facilitate the creation and acquisition of knowledge for production, adaptation, replication, and utilization of technologies to support Nigeria's technological and sustainable development aspirations.
3. To support the establishment and strengthening of organizations, institutions, structures, and processes for the rationalization of decision-making and coordination and management of STI activities within an institutionalized national innovation system.
4. To encourage and promote the creation of innovative enterprises that can beneficially utilize Nigeria's indigenous knowledge and technologies to produce marketable goods and services that compete with others in the global market space.
5. To coordinate and support the development of science and technology infrastructures to enable significant research for production of methodologies, models, and data to support Nigeria's socio-economic development plans.
6. To catalyze the conversion of deliverables from development initiatives to commercialized products that particularly maximize the use of Nigeria's home-grown technologies and raw materials.
7. To facilitate and support the creation and up-to-date maintenance of reliable database on Nigeria's STI resources and activities.
8. To improve and implement effective STI communication systems for enlightenment of the public about the critical role of STI in livelihood and inculcate STI culture in Nigerians.
9. To devise and implement systems for identification and pruning of STI talent at all ages and educational levels in Nigeria through support and incentives to build a strong long-term workforce.
10. To enable the implementation of sectoral plans and development plans at the State and Community levels through injection of STI support.
11. To coordinate the planning and catalyze the implementation of strategic projects such as those of space exploration, advanced computing, telemedicine, robotics, advanced navigation systems, nano materials that can accelerate the emergence of Nigeria as a technologically developed country.
12. To create and sustain reliable mechanisms for adequate funding of STI activities in Nigeria.
13. To create a platform for cultural re-orientation of Nigerians to science and technology as a utility in life on a daily basis.
14. To provide the platform, technology, structures, processes for the rationalization of decision making and the coordination and management of the national planning process.

The NSTIR-2030 is an integration framework for various STI plans at the federal and lower jurisdictional levels. Its implementation should extend to all levels of governance to provide a system in which the flow of data, needs definition and other inputs and the diffusion and deployment of technology action plans and success indicators are managed in the most socially beneficial way. The effective implementation of NSTIR2030 will bring about the social, economic, and environmental revolution of Nigeria and ensure the effective mobilization of all her assets to achieve the sustainable development of her economy, people, and environment. Fig.12 shows the interplay of sustainable development pillars with the assets and operational actions necessary to achieve sustainable development which is the central objective of all government policies and actions.

11 THE INFRASTRUCTURES ORGANISM

It has been established that for a nation to have sustained development, it must put in place a national framework which provides the platform and methodology for the four infrastructure categories to work together. Such framework will enable all organs of government focus on clearly defined strategic national needs, goals and objectives and ensure available resources are applied in the most effective manner to achieve those objectives.

The Infrastructures System may be likened to a human body. It develops and grows, thrives, or dies depending on the nutrient which feeds it, and the health and effective cooperation of its component parts. Fig.4 shows the **Infrastructure Organism** which is comprised of a head, heart, stomach, and limbs.

The Head of the infrastructures organism is **Knowledge Infrastructures**. It is here that all the thinking, planning, and coordination necessary for the success of any part of the body is done. It is a fact of life that no matter how beautiful the rest of the body may look, if the head is defective, the functions of all the other parts of the body will lack coordination and over time, may result in the paralysis or death of the organism. Nigeria's infrastructures are so dilapidated because Nigeria's Knowledge Infrastructures have been ignored over the decades.

The Heart of the infrastructures organism is the **Organizational Infrastructures**. It sends the lifeblood to all parts of the organism. Just as a defective heart results in stunted growth because it cannot maintain adequate supply of nutrient to the parts of the body, defects in the political system, judicial system, legislature, financial system, revenue generation system, the defence system, etc. result in stunted national development.

The Stomach of the infrastructures organism is the **Social Infrastructures**. It produces the nutrients that feed all other infrastructures. The nutrients are the human beings who are the products of the educational institutions and systems, healthcare institutions, law enforcement, traditional and religious bodies etc.

The Limbs of the infrastructures organism is the **Physical Infrastructures**. It provides the structures which enable mobility and facilities for the convenience and well-being of the organism

Just as the object of human beings is the life-long pursuit of physical emotional and spiritual fulfilment, the object of the infrastructure organism is the pursuit of human development and prosperity on a sustainable basis.

12 **CONCLUSION**

The delivery of infrastructures on a sustainable basis depends on effective application of the following parameters:

- **Need** definition which is focused, time calibrated and given a hierarchy based on priority.
- **Objective** defined in a quantifiable and measurable manner.
- **Funding** which considers the strategic development of indigenous resources and achievement of balance between public and private funding and partnerships and local and foreign borrowing.
- **Political engagement** requires that the political players and political processes be such that the right decisions are made on the Need and Objective definition and Funding option. The involvement and buy-in of the populace depends on political engagement. This underscores the need for the intelligentsia – people who are well informed, highly motivated, selfless, patriotic, and visionary to get organised to make their impact felt in the political space. Surely that is not beyond their reach.
- **Technology** can provide the backbone to hold together all the activities, the memory to document and advise, the knowledge to direct and manage, and the skills to implement the delivery of all infrastructures on a sustainable basis. Technology can be used to guide decision making and ensure faithful decision implementation. For technology to work, there must be a robust technology acquisition and management framework.
- **The Federal Ministry of Science and Technology (FMST)** has the mandate for the development and deployment of science and technology apparatus for the development of Nigeria. Over the years, the role of this most important agency of government has not been fully appreciated. As the agency for technology development and deployment for all levels of governance, it should, like the nerves or blood vessels in the human body, be present in every part of the governance structure. That is the only way Nigeria can inspire, mobilize, coordinate, and focus its enormous human and natural resources for the sustainable development of her infrastructures. In other words, every department of government at the national, subnational, and local levels should have a technology deployment office which is an arm of the FMST such that there is continuous flow of data and information in the whole country.
- **The Infrastructure Organism analogy** which likens the national infrastructure system to the human body gives the model to guide our thinking and action. Without adequate knowledge of infrastructure (**the Head**) to guide, regulate, and coordinate the complex process of managing Nigeria's infrastructures development, it will

remain a conundrum. The need for change which harnesses the intellectual resources of our people is urgent.

- **The role of the intelligentsia** in bringing about positive change in our country cannot be over emphasized. By virtue of their God-given talent, the Nigeria intelligentsia are the only people who can clearly see the benefits of putting technology at the driving seat of Nigeria's development. We must take the initiatives, make the sacrifices, continue to strive with patience to see that technology is enthroned to drive the development of Nigeria. The example of such countries as the Emirates and Qatar are worthy of note. In only a few decades, these Gulf States have come from third world to be leaders in first world because of enthronement of technology as driver of their development. The Nigerian Academy of Engineering can provide leadership to the other national academies, the highest seat of Nigeria's intellectual endowments, to do all that may be required in this regard. The Academies must work out how to stop the hemorrhage of Nigeria's lifeblood, the loss of her most prized assets - her youthful highly trained manpower to the developed economies
- I end this lecture with a quote from late Emperor Haile Selassie, ***“Throughout history, it is the inaction of those who should have acted, the indifference of those who should have known better, the silence of the voice of justice when it mattered the most, that made it possible for evil to triumph.”***

There is nothing that an organised, passionate, dedicated, selfless, committed intelligentsia cannot do.

Thank you and God bless the Federal Republic of Nigeria.

TABLES AND FIGURES

TABLE 1. DEVELOPMENT OF NIGERIA'S RAILWAY INFRASTRUCTURE (1896 – 2019)

(A) NARROW GAUGE SYSTEM (1067mm)

S/N	RAIL LINE DETAILS	CONSTRUCTION PERIOD	NUMBER OF YEARS	LENGTH (KM)	CUMULATIVE LENGTH (KM)
1	Lagos – Abeokuta	1896 – 1898 (2yrs)	2	96	96
2	Abeokuta – Ibadan	1898 – 1901 (2yrs)	2	96	192
3	Ibadan – Ilorin – Kaduna – Zaria - Kaduna	1904 – 1912 (8yrs)	8	1,044	1,236
4	Zaria – Kaura Namoda	1925 – 1929 (4yrs)	4	245	1,481
5	Kano Nguru	1927 – 1930 (3yrs)	3	347	1,828
6	Kaduna – Kafanchang – Kuru – Jos	1924 – 1930 (6yrs)	6	400	2,228
7	Kafanchang – Makurdi – Enugu – Port Harcourt	1916 – 1930 (14yrs)	14	737	2,965
8	Kuru – Bauchi - Maiduguri	1958 – 1964 (6yrs)	6	540	3,505
	TOTAL LENGTH			3,505	

(B) STANDARD GAUGE SYSTEM (1435mm)

1	Itakpe – Ajaokuta - Warri	1991 – 2013 (22yrs)	22	327	327
2	Lagos - Ibadan	2012 – 2019 (7yrs)	7	181	508
3	Abuja - Kaduna	2014 – 2019 (2yrs)	2	186	694
	TOTAL LENGTH			694	

(Ref. A Short History of Nigerian Railways by
(Bisiriyu 2016))

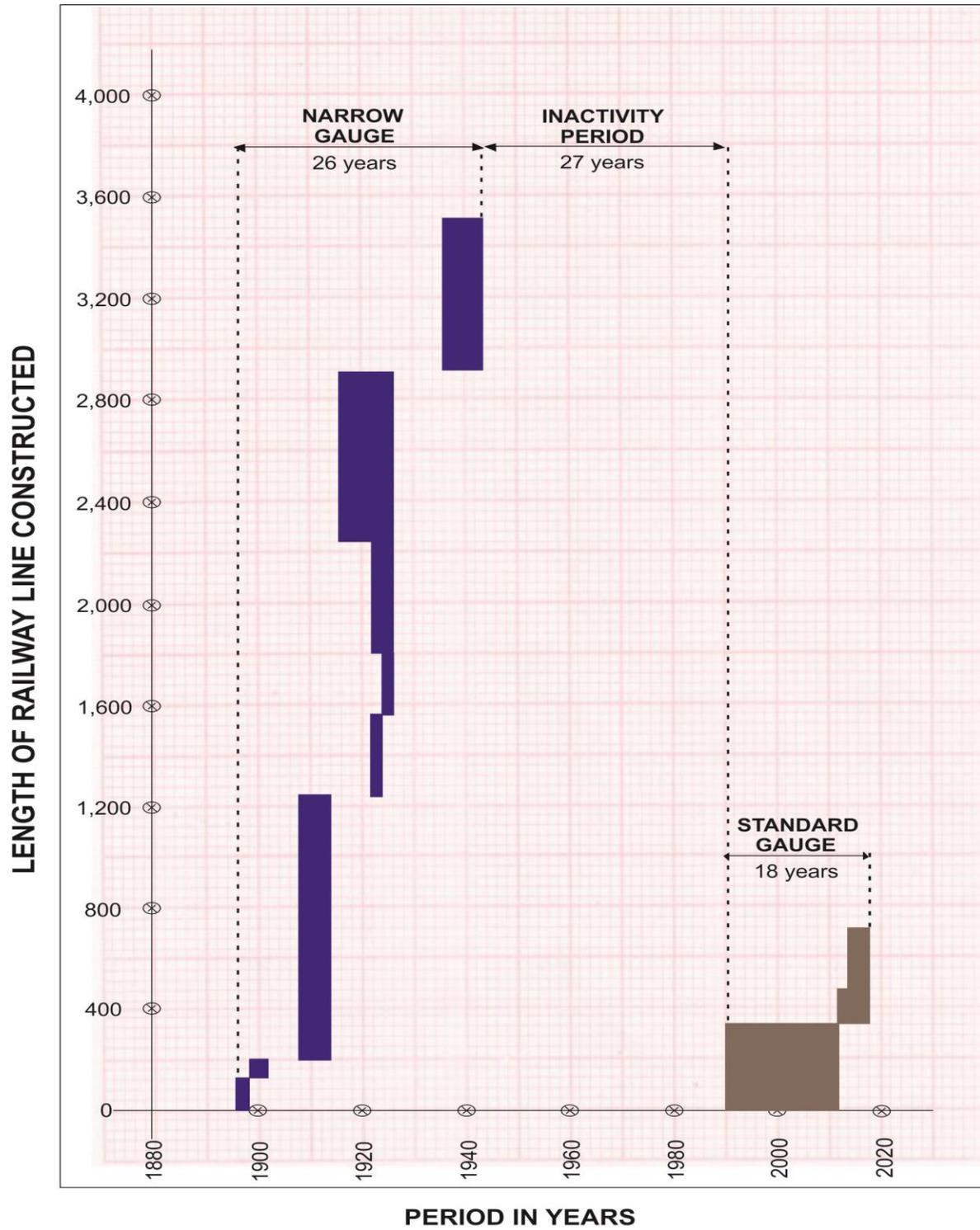


Fig. 1: DEVELOPMENT OF NIGERIA'S RAILWAY INFRASTRUCTURE (1896 - 2019)

TABLE 2. THE DEVELOPMENT OF NIGERIA'S ROAD NETWORK (1896 – 2019)

YEAR	FEDERAL ROADS (KM)	STATE ROADS (KM)	LOCAL & RURAL ROADS KM)	TOTAL (KM)
1896				
1946				13,200
1951	1,783		42,631	44,414
1960	8,694		57,010	65,704
1968	15,200		73,280	88,480
1975	18,109		77,266	95,375
1980	27,907		86,633	114,540
1990	35,000	31,000	127,000	193,000
2019	36,000	32,000	132,000	200,000

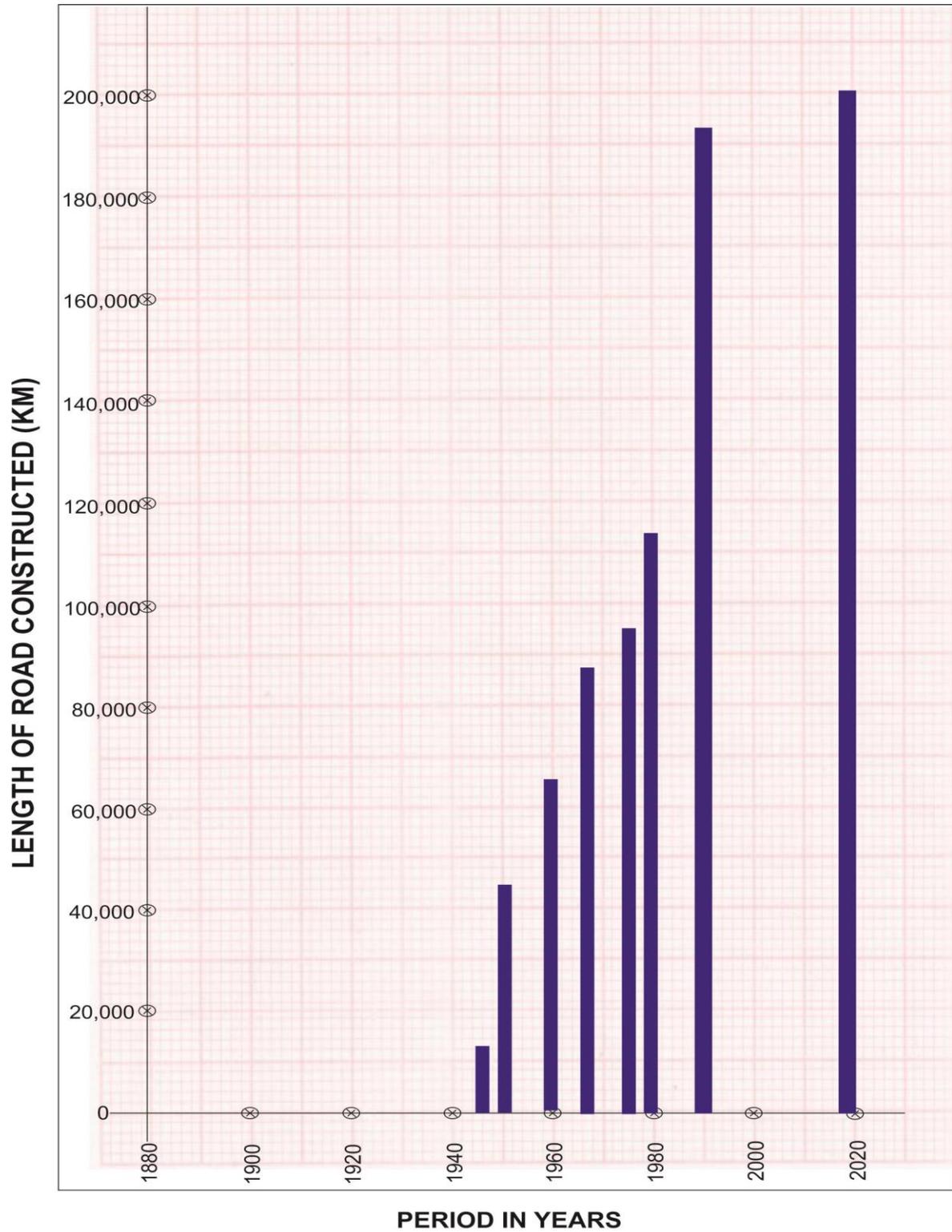


Fig. 2: DEVELOPMENT ON NIGERIA'S ROAD INFRASTRUCTURE (1896 - 2019)

TABLE 3. DEVELOPMENT OF NIGERIA'S POWER GENERATION INFRASTRUCTURE (1896 – 2019)

S/N	Power Station	Capacity (MW)	Year of Commission	Cumulative Per Period	Current Operational Capacity		
					Full (MW)	Partial (MW)	Non (MW)
1	Lagos Power Plant	0.06	1896				0.06
2	Jos Power Plant	2.00	1923				2.00
3	Orji River Thermal Power Plant	10.00	1960				10.00
4	Delta Power Station	900.00	1965	1965-68		465	435.00
5	Kainji Power Station	800.00	1968	1,700.00		760	40.00
6	Sapele Power Station	1,020.00	1981	1981-82		135	885.00
7	Afam IV Power Station (FGN)	726.00	1982	1,746.00			726.00
8	Jebba Power Station	540.00	1985		540		0.00
9	Egbin Thermal Power Station	1,320.00	1986	1985-90		1000	320.00
10	Shiroro Power Station	600.00	1990	2,460.00	600		0.00
11	Egbin Power Station (IPP)	270.00	2001				270.00
12	Afam V Power Station (FGN)	276.00	2002	2001-02			276.00
13	Eleme Power Plant	75.00	2001	621.00			75
14	Omoku Power Station (IPP)	150.00	2005		150		0.00
15	Omosho I Power Station	336.00	2005			304	32.00
16	Okpai Power Station (IPP)	480.00	2005		480		0.00
17	Olorunsogo Power Station	336.00	2007			304	32.00
18	Geregu I Power Station	414.00	2007			414	0.00
19	Trans Amadi Power Station	136.00	2009		136		
20	Afam VI Power Station (FGN)	624.00	2010	2005-10		624	0.00
21	Ibom Power Plant	190.00	2010	2,666.00	190		0.00
22	Aba Power Station (IPP)	140.00	2012				140.00
23	Geregu II Power Station (NIPP)	434.00	2012			434	0.00
24	Sapele Power Station (NIPP)	450.00	2012			450	0.00
25	Olorunsogo II Power Station (NIPP)	675.00	2012			675	0.00
26	Omosho II Power Station (NIPP)	450.00	2012			450	0.00
27	Zamfara Power Station	100.00	2012		100		0.00
28	Egbema Power Station (NIPP)	338.00	2013				338.00
29	Ihovbor Power Station (NIPP)	450.00	2013			450	0.00
30	Kano Power Plant	100.00	2015	2012-15	100		
31	Alaoji Power Station (NIPP)	1,074.00	2015	4,211.00		1074	0.00
32	F.C.T Usuma Solar Plant	1.20	2017		1.2		
33	Kaduna Power Station	215.00	2017		215		
34	Katsina Wind Farm	10.00	2018		10		
35	Azura Power Station (IPP)	450.00	2018		450		0.00
36	Gbarain Power Station (NIPP)	252.00	2018			225	27.00
37	Itobe Power Station	1,200.00	2018				1200
38	Zungeru Power Station	700.00	2019		700		
39	Okpai II Power Plant	450.00	2019		450		
40	Gurara Hydro plant	30.00	2019	2017-19	30		
41	Dandin kowa Hydro Power Plant	39.00	2019	3,347.20	39		
	Totals	16,763.26		16,751.20	4,191	7,764	4,808
	Installed Capacity				11,955		
Ref.	(a) List of Power Stations in Nigeria. Wikipedia						
	(b) Nigerian Power Sector : Opportunites and Challenges for Investment in 2016.						
	Latham & Watkins Africa Practice - Client Alert White Paper						

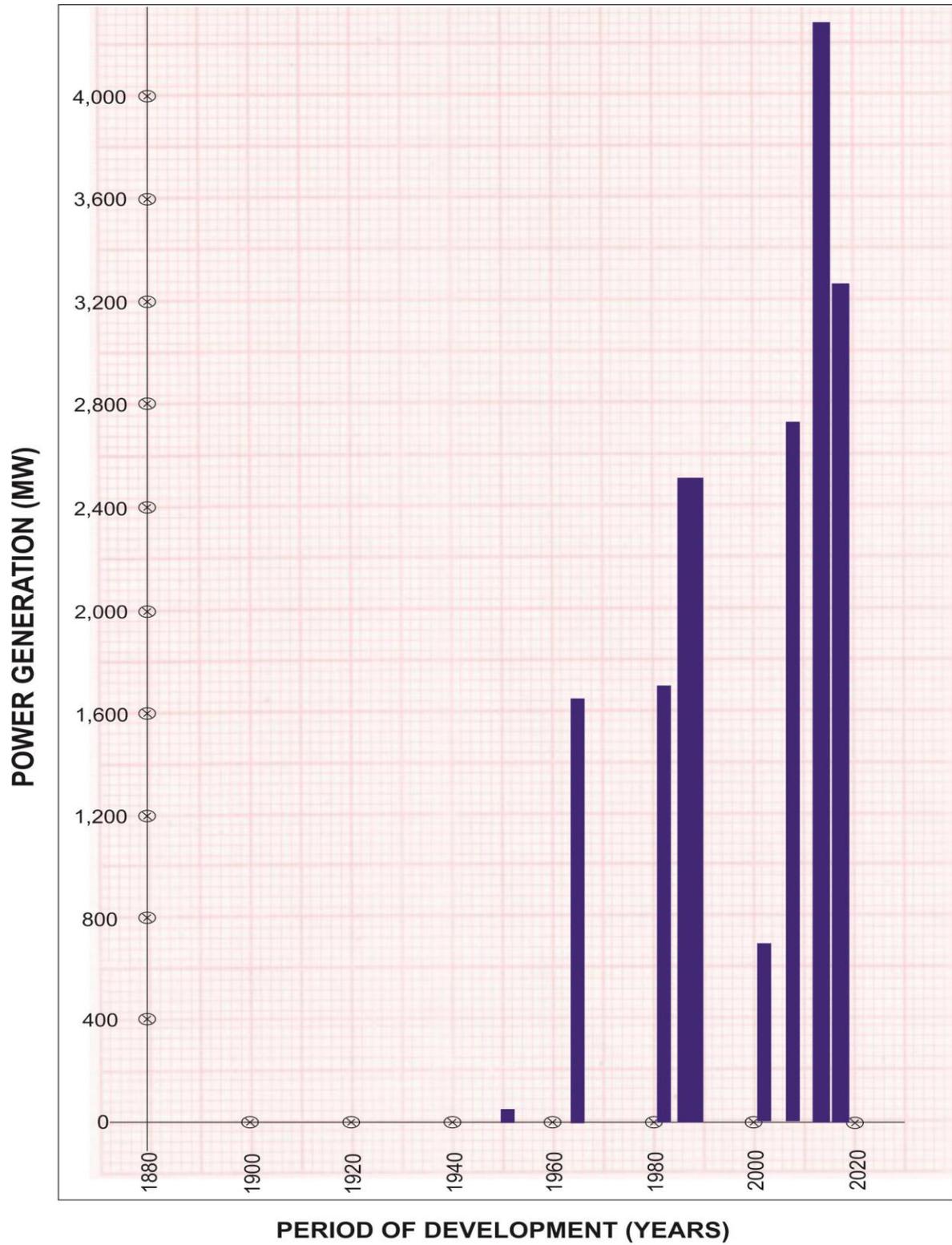


Fig. 3: DEVELOPMENT OF POWER GENERATION INFRASTRUCTURE IN NIGERIA