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ENGINEERING LAW

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**ABSTRACT**

Nigeria is the most populous black nation on planet earth and sets a great vision to be among the top 20 economies in the world by 2020 with a minimum GDP of $900 billion and a per capita income of no less than $4000 per annum. This paper argues that infrastructural development is critical to achievement of the vision. Consequently, a discourse on theoretical framework and review of literature on the role of infrastructure in economic development was undertaken. The paper also places the country’s economy in a global context and assessed the state of infrastructural development in the country. Also, factors responsible for the current state of infrastructural development in the country were examined. The paper reveals that two years into the vision, the country’s economy is growing at a very low pace than envisaged. It also reveals that the quantity and quality of infrastructure needed to propel a rapid economic development are absent. The paper recommended adequate funding of infrastructure in critical sector, transparency and good governance, population control and physical planning of settlements among others for the realization of the vision. The paper concluded that the war of economic transformation through infrastructural development in the country would be lost or won in our settlements where productive economic activities are located; hence physical planning that will propel infrastructure development in major settlements and across the regions of the country is germane to the realization of the 2020 vision. Infrastructure problems are the bane of developing nations. Infrastructure is the medium, the tools and techniques of executing a project or Programme or strategy. Demand for infrastructural development is higher and resources used in provision of infrastructure are limited in developing nations. There is no doubt that infrastructure is the key component of the investment climate, leading to reduced costs of doing business and enabling people to access markets. Fundamentally, infrastructure promotes trade and integration into world markets, and is key to human development, including the delivery of social services such as health and education. Developing nation leaders’ lack of vision had widened the gap in infrastructure demand and provision. Maintenance culture is also lacking in developing nations. Most infrastructures are now decayed and need repair or replacement. Sustainable infrastructure development in developing nations involves identifying the right project, carrying out feasibility and viability studies and carrying out physical development of the project. The challenges are numerous and include finance, technology for development, maintenance and design. The challenges also include international requirements of project to be sustainably developed. Projects must meet the carbon emission standard set by international organizations, communities must be bio-diversified and emit as little greenhouse gases(GHGs) as possible through sustainable energy use, natural environment must be conserved and so on. Evaluation of the problems of infrastructure in developing nations is the purpose of this paper.

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**INTRODUCTION**

**Infrastructure** is the fundamental facilities and systems serving a country, city, or other area, including the service facilitates necessary for its economy function. Infrastructure is composed of public and private improvement such as roads, railways, bridges, tunnels, water supply, sewers, electrical grids, and telecommunication. In general, it has also been defined as the physical components of interrelated system providing commodities and service essential to enable, sustain, or enhance societal living conditions.

They are 2 types of infrastructure, **“Hard** and **Soft”** infrastructure. Hard refers to the physical network necessary for the functioning of modern industry. This include roads, bridges, railways, etc. Soft refers to all the institution that maintain economic, health and social, and cultural standard of the country. This includes educational programs, official statistics, parks and recreational facilities, law enforcement agencies, and emergency services.

**Engineering law** refers to the application of laws applying to the practice of professional [engineering](mhtml:file://C:\Users\BC\Desktop\New%20folder%20re\Engineering%20law%20-%20Wikipedia.mhtml!https://en.m.wikipedia.org/wiki/Engineering). Engineering law is the study of how ethics and legal frameworks should be adopted to ensure public safety surrounding the practice of engineering. The practice of engineering is largely separated from the practice of a natural scientist by engineering law. A semiconductor physicist and an electrical engineer, practising at a large company are mainly differentiated by the laws they are practising under and the license they carry. The laws and the license will affect the tasks that can be performed by the engineer compared with the tasks that can be performed by a natural scientist. Engineers are held to a specific legal standard for ethics and performance while a natural scientist is not. Engineers are subject to disciplinary measures such as fines or loss of license for professional misconduct and negligence.

**Managerial economics** deals with the application of the economic concepts, theories, tools, and methodologies to solve practical problems in a business. In other words, managerial economics is the combination of economics theory and managerial theory. It helps the manager in decision-making and acts as a link between practice and theory. It is sometimes referred to as [business economics](mhtml:file://C:\Users\BC\Desktop\New%20folder%20re\Managerial%20economics%20-%20Wikipedia.mhtml!https://en.m.wikipedia.org/wiki/Business_economics) and is a branch of [economics](mhtml:file://C:\Users\BC\Desktop\New%20folder%20re\Managerial%20economics%20-%20Wikipedia.mhtml!https://en.m.wikipedia.org/wiki/Economics) that applies [microeconomic](mhtml:file://C:\Users\BC\Desktop\New%20folder%20re\Managerial%20economics%20-%20Wikipedia.mhtml!https://en.m.wikipedia.org/wiki/Microeconomic) analysis to decision methods of businesses or other management units.

As such, it bridges economic theory and economics in practice. It draws heavily from quantitative techniques such as [regression analysis](mhtml:file://C:\Users\BC\Desktop\New%20folder%20re\Managerial%20economics%20-%20Wikipedia.mhtml!https://en.m.wikipedia.org/wiki/Regression_analysis), [correlation](mhtml:file://C:\Users\BC\Desktop\New%20folder%20re\Managerial%20economics%20-%20Wikipedia.mhtml!https://en.m.wikipedia.org/wiki/Correlation) and [calculus](mhtml:file://C:\Users\BC\Desktop\New%20folder%20re\Managerial%20economics%20-%20Wikipedia.mhtml!https://en.m.wikipedia.org/wiki/Calculus). If there is a unifying theme that runs through most of managerial economics, it is the attempt to [optimize](mhtml:file://C:\Users\BC\Desktop\New%20folder%20re\Managerial%20economics%20-%20Wikipedia.mhtml!https://en.m.wikipedia.org/wiki/Optimization_(mathematics)) business decisions given the firm's objectives and given constraints imposed by scarcity, for example through the use of [operations research](mhtml:file://C:\Users\BC\Desktop\New%20folder%20re\Managerial%20economics%20-%20Wikipedia.mhtml!https://en.m.wikipedia.org/wiki/Operations_research), [mathematical programming](mhtml:file://C:\Users\BC\Desktop\New%20folder%20re\Managerial%20economics%20-%20Wikipedia.mhtml!https://en.m.wikipedia.org/wiki/Mathematical_programming), [game theory](mhtml:file://C:\Users\BC\Desktop\New%20folder%20re\Managerial%20economics%20-%20Wikipedia.mhtml!https://en.m.wikipedia.org/wiki/Game_theory) for strategic decisions, and other [computational methods](mhtml:file://C:\Users\BC\Desktop\New%20folder%20re\Managerial%20economics%20-%20Wikipedia.mhtml!https://en.m.wikipedia.org/wiki/Computational_economics).

**CHALLENGES FACING INFRASTUCTURE IN MANAGERIAL ECONOMICS**

* **Corruption:** Corruption does not only raise the price of infrastructure, it can also reduce the quality of, and economic returns from, infrastructure investment. The corruption in Nigeria is very high and unbearable for effective infrastructural development. The Bureau of Public Procurement (BPP), the Independent Corrupt Practices Commission (ICPC) and Economic and Financial Crimes Commission (EFCC) have not been able to eradicate corruption in the country. The BPP has saved the country a whopping sum of N216.6 billion during the 2010 Appropriation year from its review of contract processes before the issuance of certificate of No Objection.
* **Demand and supply:** Due to poor performances of most past leaders in the area of infrastructure provision, the agitation for infrastructure development overwhelms the provision. With a land mass of 9,110,000 square kilometers of land and over 160,000 million people, Nigeria has a total road network of 193,200KM. This comprise of 34,123KM federal roads, 30,500KM state roads and 129,577 KM local government roads. Unfortunately, over70% of the federal roads are in bad state of repair. In the area of housing, Nigeria requires about 17 million housing units and 60 trillion naira in order to meet its housing needs. Food provision is inadequate.
* **Capital Flight, Capital Sink and Capital Stagnancy:** Infrastructure development projects in Nigeria suffer from capital flight, capital sink and capital stagnancy. A lot of materials and managerial services are procured outside the country. The contracts are full of loop-holes that allow leakages of funds. In some cases, there are over-design for the designers to earn more professional fees which are percentage of the contract sum. Capital stagnancy due to abandoned projects are also rampant.
* **PESTLES Analysis:** The challenges of infrastructural development in Nigeria can be discussed under PESTLES Analysis. Challenges of infrastructural development can be: political, economic, social, technology, legal, environmental and safety. Political environment has to do with the political stability, policy formulation and politics of the project environment both within and without. Economic environment deals with issues like interest rate, inflation, currency exchange rate, price fluctuation etc. Social environment has to do with workforce diversity including cultural difference, age difference etc. Technology environment deals with the machineries which are used for the execution of projects. Physical environmental issues like site topography, geology and climatology is also essential. Safety issues have to do with health and safety and security of resources on site, that is human, material and financial.

While some countries have been able to implement individual projects to alleviate those difficulties, Nigeria does not have common strategic targets for infrastructure development. Good governance is crucial for ensuring the effective and efficient provision of infrastructure. This is largely because, firstly, good governance means that resource allocations will reflect national developmental priorities and thus respond to societal demands.

* **PARETO Analysis:** Pareto analysis is a statistical method in decision making that is used for the identification of a specific number of tasks that produce major impact. It uses the Pareto Principle (which is also called the 80/20 rule). It originated the idea that by doing specific20% of the work, you can generate 80% of the benefits of doing the whole job. In terms of quality improvement, a large majority of defects (80%) are produced by a few key causes (20%). This is also known as the vital few and the trivial many. In project management, 80%of project delays are caused by 20% of tasks etc. It can also mean that 80% of the tasks are done by 20% of the workforce. The people in charge should strive to improve the number of workforce that are genuinely working.
* **Development Matrix:** The four requirements of any physical infrastructure projects are: design, finance, technology and management. The appropriate designs that will ensure value for money are not adopted. The finance is not adequate, is procured at high interest rates and financial management is lacked by most Nigerian contractors. The technology of construction is scarce and the management of infrastructure is lacking. The maintenance culture of Nigerians is poor thereby allowing most projects to decay.
* **Project Management:** Project management approach in project delivery evolved in the late fifties in the United States of America (USA) when it was first used by the American Army for military projects execution. The success recorded through project management approaching the Defense sector led to its establishment as a reliable method of project delivery in other sectors like construction, manufacturing, health Information Technology (IT), media, pharmaceutical, education and entertainment. The approach was introduced into United Kingdom (UK) in the early sixties. Countries like Hong Kong, Malaysia, Canada and Ireland have adopted this approach, but it is still unpopular in developing countries, especially in Nigeria. Risk management is necessary for all Nigerian projects.
* **Procurement Method:** The procurement methods being adopted are prone to criticisms. The Public Finance Initiatives, especially the Concession Method and Public/Private Partnership(PPP) are questionable and seems to mortgage others who are not part of the arrangement to the scheme’s future. The 105-kilometre Lagos-Ibadan Expressway which, under the PPP scheme, the federal government did concession to Bi-Courtney Consortium in 2009 forN89.53 billion for 25 years is not the best arrangement possible and has not change the situation of the road development. Projects are supposed to meet objectives, but in most cases, projects embarked upon are white elephant projects. Good governance will be the only antidote that can bridge the wide gap. Secondly, good governance promotes accountability, reduces corruption and therefore minimises resource wastage through inefficiency. And finally, good governance ensures stability (economic and political) and reduces the level of risk associated with large and lumpy infrastructure investment

**CHALLENGES FACING INFRASTRUCTURE IN ENGINEERING LAW**

Nigeria’s slow economic development is often attributed to its infrastructural deficit. While there is no consensus over where exactly to place the blame, the Nigerian Society of Engineers (NSE) has over the years maintained that thrusting the building of physical infrastructure on foreign expatriates is akin to ‘thinking global’ while neglecting ‘local’. The Society holds that for Nigeria to grow her economy, she must develop within her cultural intelligence and indigenous nuances. Nigeria does not have an economy that benefits all Nigerians.

It is high time we stopped ourselves in this country. We do not have an economy that benefits and sustains all Nigerians; Nigeria’s economy sustains only a few Nigerians, especially those in the corridors of power, in collaboration with foreign contractors. I say this because our economy is dependent on export of our national resources, and the prices and processes of extraction of these resources are not wholly determined by Nigerians.

The processes of appropriation in Nigeria is lopsided and tilts more towards supporting recurrent expenditure at the expense of funding for capital projects and development of common engineering infrastructure. This is not helping engineering and, by implication, it is not helping our nation. As Engineers, this unwholesome practice frustrates us. Just as many young Nigerians are getting frustrated and seeking to cross the deserts and the Mediterranean at all cost, thereby losing their lives. Accumulation of the neglectful governance, distasteful legislative practices and frustrations of citizens is an indication of self-imposed slavery in Nigeria.

The engineering profession sees the Presidential Order 5 for planning and execution of projects, promotion of Nigerian content in contracts and science, engineering and technology signed by President Muhammadu Buhari, on February 5, 2018 as a well-intentioned document that seeks a greater future for the Nigerian nation by opening the space and opportunities for home grown development.

We must all rally round ourselves and ensure that Nigerian Content gets priority consideration in all projects. We are not saying that foreign professionals are not welcome in our country, but they must demonstrate that they truly love Nigeria by investing in establishing of industries in Nigeria, in active partnership with indigenous Engineers as leads.”

The Society would not only be ensuring domestication of global codes and standards, but will be discouraging frittering Nigerians commonwealth in payment for government contracts which are awarded to foreign nationals, saying that is the only way to guarantee sustainability and growth for such industries.

On what transpired in the Lagos-Ibadan expressway which was concessioned to Bi-Courtney. The concession of the Lagos-Ibadan expressway was done in May 2009 and we proceeded to assemble a formidable team that involved the best of the relevant sectors that would deliver a world-class expressway.

The design put in place appreciated the peculiarities of the road especially the emergence of new towns that have been established on the road since it was built in 1977. These new towns include Ibafo, Isheri, Mowe, Ogere and Redeemed Church. The design provided for entry and exit to these towns without obstructing the flow on the expressway. The concession agreement was terminated three weeks after former President Goodluck Jonathan gave directive for the project to kick-start.

At the meeting of 1st July 2012, President Jonathan directed the Infrastructure Concession Regulatory Commission to negotiated and concluded the deal within two weeks in the presence of all our financiers and consultants who had flown from their various countries to meet the President. Against the run of play, less than three weeks after the reassuring meeting, it was announced on a national television that the project had been terminated. The partners were amazed and dazed that a project that the President gave an assurance could just be terminated irresponsibly. The present road is the resurfacing of the 1977 road. It is a road that is inadequate to accommodate the geographical developments that have taken place on the road since 1977. These include the emergence of towns like Ibafo, Isheri, Ogere, Mowe and the Redeemed Church camp.

Most of the busiest roads in Nigeria are built without things that should accompany highways. When working on the Lagos-Ibadan expressway, there were 54 petrol stations on it. This necessitates that the road must be built in a way that people should not just drive into the filling station directly. If petrol stations can be driven into straight from the road, then it is not an expressway road. There are so many things that are ought to be done on the road that are not done. This is a challenge to the Nigerian Society of Engineers. No country has enough money from government treasury to provide the needs of its people. So, it is better to allow private capital to do those projects that can be sustained as private investment so that limited government resources can be used for other areas that are not commercially viable.

The NSE must lead from the front in order to ensure that local Engineers play more than passive roles in the infrastructural development of Nigeria. They have to do whatever it takes to seize the momentum. I do not believe the large foreign firms have the emotional capital that is required to develop Nigeria infrastructure. Most of the things they seek to do here; they cannot suggest it in their home countries. But if Nigerian Engineers lead from the front, they will be able to insist on certain parameters and minimum quality of work. As foreign leaders troop to Nigeria in search of business partnerships, I urged government to act in the best interest of Nigeria as a country as they negotiate trade deals.

**SOLUTIONS TO INFRASTRUCTURE DEVELOPMENT IN MANAGERIAL ECONOMICS**

* **Unity:** If we must reclaim Nigeria, we must in the first instance see unity as the weapon with which we can dislodge this present crop of leaders. Our ethnic and religious difference is what our elites have used in manipulating us over the years, but if we can put aside our differences irrespective of the tribe and religion we represent, we will destroy that weapon they have always used against us. If those in the ruling class can unite to steal our wealth, why won’t we unite also to change policies and programmes of selfish government, and vote in worthy, qualitative and efficient people into positions of leadership? The bond that ties us together as a nation runs very deep, deeper than any individual cause or interest. Therefore, we must prove to the world that we are standard bearers of an independent country which we must stand to safeguard and secure for the generations yet unborn.
* **Development of both Private Sector and Small Businesses:** These initiatives create the condition for economic growth. The government need not be deceived on the right solutions to Nigeria’s economic recession. ‎ These solutions would be valuable in shaping his economic direction and also tackle the problems of unemployment in Nigeria,
* **Diversification of Nigeria economy:** We can recover from the current economic crisis if government diversifies the economy and repairs the refineries so that the impact of the drop in crude oil prices which is having a toll on the economy will be cushioned. It is up to the government to act and respond appropriately.
* **Improvement on housing and home ownership for Nigerians:** ‎ ‎This is quite important because many poor Nigerians have to go for many years without a mortgage plan and this is hurting the economy.
* **Provision of adequate security:** Security will put more confidence in the mind of investors and even tourist that want to invest in the country so therefore the government should increase security in the country and hire youth as security agents which will in turn reduce unemployment too.
* **Provision of employment opportunities for the youth:** The issue of absence of profitable job for our young people should likewise be tended to. An unmoving personality they say is the fallen angel’s workshop.

Unemployed young people are perilous species as they can be controlled by deceitful components and used to do accursed acts. On the off chance that the approaching government can give profitable work to our childhood, it will thusly help our economy to develop. On the economy, we should start to move far from our over-reliance on oil as our fundamental wellspring of income. We should start the procedure of encouraging so as expanding our income drive states and nearby governments to add to the assets inside of their space to create elective wellsprings of income. They should be given a time span inside of which to accomplish this and have appropriate checking component set up to guarantee consistence with the strategy on the way forward on Nigeria economy development. Joe city 2016

* **Implementation of the right monetary policy:** For the Nigeria budget to stimulate economic growth, it must be backed up with the right monetary policy and it is pertinent to point out that so long as Nigeria continues to depend on oil exports for the bulk of its revenue, the value of the naira will continue to affect the price of oil, so there is the obvious need to diversify the economy. One of the ways out is to create the enabling environment for the productive sector to thrive. The agricultural sector must be developed for us to be able to produce goods and have agro-based industry as well as have enough to feed and to export. There is also the need to harmonize the fiscal policy and the monetary policy before the value of the naira can be determined. It is crystal clear that Nigeria is in a deteriorating financial condition, so it needs fiscal and monetary policies to actually stabilize the situation for us to have a recovery.

**SOLUTIONS TO INFRASTRUCTURAL DEVELOPMENT IN ENGINEERING LAW**

**1.  Better project planning**

Robust and diligent project planning is usually perceived by project sponsors to be an expensive undertaking. However, the shortcuts sometimes taken by sponsors consistently result in very expensive project failures, as well as improperly structured or poorly executed capital projects. These have significant unfavorable implications for the sponsors, investors, and financiers of such projects, and the infrastructure sector track record in Nigeria as a whole.

In developing projects and ensuring that the right results are achieved, it is necessary that the project sponsor be more deliberate about the business case development and project appraisal process.  The sponsor should also ensure the necessary feasibility, traffic, environmental, legal/regulatory and other relevant studies are carried out to support the business case for investment. While ensuring that the objectives of infrastructure projects are clearly articulated and communicated among the key stakeholders, attention should be given to risk identification, allocation, and management. It is extremely important that relevant risks are allocated to the stakeholder that is best positioned to handle them, especially when dealing with Public Private Partnerships (PPPs). The importance of technical expertise cannot be overemphasized at this stage. Adequate project preparation goes a long way to build credibility and demonstrate bankability for a project, and enables the project attract the right “partners” and investors, many who continue to show interest in the Nigerian market but are unable to find properly developed / structured, i.e. bankable, projects to invest in.

**2. Stronger technical partnerships and commitment to knowledge transfer**

Infrastructure projects typically require a broad mix of diverse skills and competencies for successful delivery. The level of competence required for successful and timely execution of these projects is usually built over several years of successful project design, development, and delivery. Unfortunately, Nigeria is challenged on this front as there is a dearth of skilled manpower and only a limited number of infrastructure projects have been successfully delivered in the country over the last five decades.

Nigeria must therefore forge stronger relationships between local sponsors and foreign technical partners that have significant experience successfully delivering infrastructure projects in other countries. This is necessary for credible infrastructure development, and the subsequent management and maintenance of the infrastructure assets after delivery.  Sponsors must ensure that the interests of their technical partners are aligned with theirs, and the arrangement must deliberately create opportunities for local capacity building by pairing local talent with international expertise right from the start of the project for necessary skills and knowledge transfer.

**3. Mobilizing the “right” equity for infrastructure projects**

Many project sponsors sometimes underestimate the quantum of equity required for infrastructure projects and look for ways to seek short-term returns or save on project developments costs.  This usually ends up being detrimental to project viability, quality of delivered assets and project completion timeline. It is important for sponsors to understand the long-term nature of infrastructure projects and also seek to work with other co-investors with similar interests as it relates to risk, investment horizon and expected returns.

Private equity and infrastructure funds play an important role in providing financing for projects at different stages, and are always looking to partner with credible and experienced local sponsors to develop projects. The technical expertise and track record of the sponsors are extremely important factors for these financial investors, in addition to the sponsors’ deep understanding of the local environment. Other sources of equity that need to be tapped into include pension and insurance funds, subject to regulation by their respective regulatory bodies. For example, pension funds in Nigeria are allowed to invest in infrastructure projects through infrastructure bonds and infrastructure funds, and the project shall not be less than N5 billion in total with limits of 15% and 10% set for infrastructure bonds and infrastructure funds4 respectively.

**4. Innovative funding arrangements**

The Nigerian economy is dominated by short-term financing of three to five years terms, traditionally provided by domestic commercial banks. However, a limited number of deals in the market have been funded with seven to ten years’ loan tenors usually with participation from international banks and development finance institutions, and in some cases with risk guarantees from multilateral organisations like the World Bank.

One of the major issues faced by foreign investors and financiers include the exchange rate risk for dollar-denominated transactions, where revenues of the project / investee companies are in Naira, as well as the limited hedging options / instruments to mitigate this risk. With limited options for hedging against currency risks, investors tend to (1) focus on improving their expected return profile to make up for the potential loss should the Naira devalue, and (2) become more cautious: only investing when there is some comfort around the stability of the Naira, or where there is an opportunity to transfer the currency risk to the users / customers.

Project sponsors should actively explore development grants, project development funds (either loans or convertible instruments) and equity participation by technical partners. There is also a need to explore alternative business models where opportunities exist to collaborate with other stakeholders in the value chain, such as equipment or feedstock suppliers, and other vendors in order to reduce the initial cash outlay for projects. These should be explored in addition to other financing sources such as Sovereign Wealth Funds (SWFs), Development Finance Institutions (DFIs) and International Development Agencies (IDAs).

**CONCLUSION**

The development of Nigeria’s infrastructure and its positive impact on industrialization, economic empowerment, balance of payments and strength of the Naira cannot be over-emphasized. It is not too late to translate the much-talked-about economic potential of Nigeria into reality. It will definitely require political willpower to ensure the environment is investor ready, new ways of partnering with government agencies, private sponsors, companies and countries, and also a realistic medium to long term view on the lasting benefits of infrastructure investments to all key stakeholders.

For investors that are ready to get involved in Nigeria’s infrastructure space, and are ready to carefully identify, assess and mitigate risks while working closely with government and other key stakeholders to shape the investment landscape, there are significant opportunities to generate returns.

There is no better time to invest in Nigeria’s infrastructure and no better time to contribute to the diversification of the Nigerian economy.