**ENGINEERING LAW AND MANAGERIAL ECONOMICS FOR INFARSTRUCTURAL DEVELOPMENT IN NIGERIA**

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**ENGINEERING LAW (ENG384)**

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 ABSRTACT

 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 tells us more about managerial economics and engineering law and how it can aid infrastructural development. 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

 Engineers play a critical role in planning, developing,building and maintaining our public infrastructure stock.Whether it is water treatment facilities, bridges and roads,utilities and the electricity grid, engineers play a part in all aspects of public infrastructure. Engineers also have an added responsibility and that is to include economics in their calculation and decisions to solve real life problem. The purpose of managerial economics is to provide a systematic framework for problem analysis and solution.The pluses and minuses of various decision alternatives must be carefully measured and weighed.

 **INTRODUCTION**

WHO IS AN ENGINEER?

 Engineers perform services or creative work as consultation, testimony, investigation, evaluation, planning, analysis, design and design coordination of engineering works and systems, planning the use of land and water, performing engineering surveys and studies, and the review of construction or other design products for the purpose of monitoring compliances with drawing with drawing and specification.

 WHAT IS LAW?

*Law* is a system of rules that govern a society with the intention of maintaining social order, upholding justice and preventing harm to individuals and property. A body of rules of conduct of binding legal force and effect, prescribed, recognized, and enforced by controlling authority.

Law is the system of rules which a particular country or community recognizes as regulating the actions of its members and which it may enforce by the imposition of penalties.

 Another resource that can help us understand our responsibilities is the law. As we’ve already noted, the law is an imperfect guide to our moral obligations, but the law does often reflect our considered moral judgment and thus can be of some use.

WHAT IS ENGINEERING LAW?

 Engineering Law provides soon-to-be engineers with an introductory understanding of the legal framework under which they will work.Engineering law can be seen as those rules and regulations backed by sanctions when flouted, which guide the conduct and behaviour of members of engineering family in a community or society, and which they accept and consider as binding for their professional practice.

 The knowledge of engineering law is important to every engineer as we are involved in construction, contracts, consultancy services on capital projects, design, analysis, fabrications, adjudication of tender, bill of engineering measurements and evaluation. It does not mean that the legal profession plays a part in every contract; the majority of contracts are executed with both parties satisfied with their involvement and these never come to the court. However, when there is a dispute, provided that the courts are satisfied that a valid contract existed, they will enforce the details of the agreement.

WHAT IS MANAGERIAL ECONOMICS

 Managerial economics has been generally defined as the study of economic theories, logic and tools of economic analysis, used in the process of business decision making. It involves the understanding and use of economic theories and techniques of economic analysis in analyzing and solving business problems. It is a general knowledge that there exists a gap between theory and practice in the world of economic thinking and behaviour. By implication, a theory which appears logically sound might not be directly applicable in practice. Managerial economics can bridge the gap between economic theory and real world business decision.

ROLE OF MANAGERIAL ECONOMIST

1. A managerial economist helps the management by using his analytical skills and highly developed techniques in solving complex issues of successful decision-making and future advanced planning. 2. Accurately values all operations (support and production) of an entity (i.e. the supply and consumption of resources) in monetary terms.

3. Provides information that aids in immediate and future economic decision making for optimization, growth, and/or attainment of enterprise strategic objectives.

4. Provides information to evaluate performance and learn from results.

5. Provides the basis and baseline factors for exploratory and predictive managerial activities.

 6. He studies the economic patterns at macrolevel and analysis it’s significance to the specific firm he is working in.

7. He also carries cost-benefit analysis.

 Management can be defined as the organ or body of an organization specifically charged with planning, organizing, directing and controlling the use of the organization’s resources effectively and economically to attain the organization’s objectives. Managerial economics for engineers is concern with the systematic evaluation of the costs and benefits of proposed technical and business projects. It involves technical-economic analysis with a decision assisting objectives; mathematical modeling with emphasis on the economic effects is the primary analytical technique used to select between defined feasible alternatives.

INFRASTRUCTURAL DEVELOPMENT

Infrastructure is an umbrella term for many activities and basic structure and facilities necessary for a country to operate effectively and efficeiently.It refers to the total basic physical facilities upon which all other economic activities in a system depend.Infrastructure comprise the assets required to provide people with access to economic and social facilities and services such as roads, bridges, water.They are two main types of infrastructure

1.Social Infrastructure

2.Economic Infrastructure

 Social infrastructure are foundation services and structures that support the quality of life of a nation, region, city or neighbourhood.For Example: hospitals, schools and universities etc

 Economic infrastructure refers to the facilities, activities and services which support operation and development of other sectors of the economy. These facilities, activities and services help in increasing the overall productivity of the economy. For example: Irrigation, power, transport and communication are examples of economic infrastructure.

 Development can be seen as the process of creating something new or more advanced.It can also be seen as the process that creates growth, progress, positive change.

 Therefore infrastructural development can be seen as the construction and improvement of foundational services with the goal of sparking economic growth.

 **LITERATURE REVIEW**

 IMPORTANCE OF MANAGERIAL ECONOMICS IN INFRASTRUCTURAL DEVELOPMENT

1. Building of analytical models that help to recognize the structure of managerial problems, eliminate the minor details that can obstruct decision making, and help to concentrate on the main problem area.

2. Making available a set of analytical methods for business analyses thereby, enhancing the analytical capabilities of the business analyst. 3. Clarification of the various concepts used in business analysis, enabling the managers avoid conceptual pitfalls.

 The main role managerial economic plays in infrastructural development is that it aids decision making.

 How Can Managerial Economics Assist Decision-Making?

1. Adopt a general perspective, not a sample of one.

2. Simple models provide stepping stone to more complexity and realism.

3. Thinking logically has value itself and can expose sloppy thinking.

IMORTANCE OF ENGINEERING LAW IN INFRASTRUCTURAL DEVELOPMENT

Engineering Law provides engineers with an introductory understanding of the legal framework under which they will work.  That is, all engineering is performed under the constraints imposed by our society’s laws and must take those laws into account. These are the following importance of engineering law:

 1) Give engineers a greater understanding of their and their company’s position relative to the law so that they can act and talk more intelligently on the subject and be a better asset for their company.

2) Highlight a few areas that often trip up people in industry so that students can avoid the pitfalls or raise a concern if their company seems like it might have some exposure.

3) Help students know when their company has a potential or actual legal problem and should call a lawyer.

4) Aids engineers to be able interpret contracts in order to know if the contract has the required agreements.

5)It gives engineers an insight on how the legal system of the country works.

IMPORTANCE OF INFRASTRUCTURAL DEVELOPMENT

1) It is the basic requirement for economic growth

2) Employment generation

3) It brings about rural development

4) Contribution to national income



Figure above shows some benefits we could enjoy if infrastructural development is taking seriously.

 **METHODOLOGY**

CHALLENGES FACED IN INFRASTUCTURAL DEVELOPMENT

Case Studies:

A) Economic Infrastructure

1) Power Power supply: in Nigeria is an exclusive responsibility of the Federal government. After independence, the National Electric Power Authority (NEPA) managed the power sector for about 45 years and due to poor performance, the government decided to deregulate the sector and NEPA was transformed into a company- Power Holding Company of Nigeria (PHCN) through the Electric Power Sector Act of 2005. The company was to manage the power sector for 18 months after which the sector will be fully deregulated with several private companies emerging to handle different aspect such as generation, transmission and distribution. Due to poor implementation, the privatization of PHCN is delayed till date. However, it is expected that the process will be completed by the end of first quarter in 2012. At the moment, Nigeria faces a serious energy crisis due to declining electricity generation from domestic power plants. Power outages are frequent and the power sector operates well below its estimated capacity. The current power generation in the country is about 4000MW. Nigeria electricity consumption per capita is 111 kWh, which is one of the lowest in sub-Saharan Africa. This low level of consumption is a result of suppressed demand caused by deteriorated electricity supply infrastructure. Nigeria has 5,900 MW of generation capacity (three hydro-based and five thermal plants) and plans to expand its generation, transmission and distribution systems. Uwejamamore (2011) observed that power is currently provided in Nigeria at the cost of N23 billion and sells for only N9 billion, hence, full deregulation of the sector is planned by government for Nigerians to pay correct tariff and make the sector investment friendly. Inability of government to meet the 6000mw target earlier promised by December 2009 was due to dearth of gas supply. At present, 40% of energy produced is lost to system leakages. Government is now working towards diversification of sources – hydro, clean coal, wind and solar, through the Independent Power Projects (IPPs). Energy Commission of Nigeria (ECN) studies on energy demand to meet the Millennium Development Goals (MDGs) and the Vision 20:2020 identifies that a shortfall of between 9,000 – 17,000 MW will be recorded between 2010 and 2015 based on current energy usage and the projected growth rate in industrial development and the population. Also, the projected peak national energy demand is put at between 28,000 – 31,000 MW by 2015 while the revised demand projections by ECN have indicated that at the growth rate of 10% required to meet the MDGs, Nigeria’s peak demand will be in the range 175,000 – 192,000 MW by 2030. The poor state of power and other infrastructure in the country has unduly increases the cost of doing business; consequently, many industries have relocated and are still relocating to other West African countries. These imply loss of job and revenue to the government. At the moment, the situation of power in the country does not suggest that the sector can adequately support the attainment of the 20:2020 vision .

2) Transport: As noted earlier, responsibilities for infrastructure development cuts across the three tiers of governments in the country. Assessment of transport sector in many modes shows that the country has fallen well behind international benchmarks. The condition of much of her infrastructure has suffered from many years of under-investment and lack of maintenance. For instance, the Lagos-Ibadan expressway (a federal road) was opened to the public in 1981 and 30 years after, it is just being prepared for the first major maintenance works. This is the situation of many national highways across the country. Nigeria has a total road length of 193,200 kilometers, comprising 34,123 km Federal roads, 30,500 km State roads, and 129,577 km Local Government roads. At 2005 prices, this road network is estimated to have a replacement value of N4.567 trillion. It has been estimated that over the next 10 years, N300 billion will be required to bring national roads into a satisfactory condition. Current neglect of these roads implies a loss of network value of N80 billion per year and additional operating costs of N35 billion per year (FGN, 2009b). This situation is economically unhealthy and cannot support the country’s drive for economic transformation. The public transport infrastructure in the country has lacked investment and adequate maintenance for many years. Indeed, there has been a failure of planning to integrate different transport modes. For instance, there are currently no rail connections to the country’s ports. The railway system has almost ceased to function, although efforts are on to revive the railway system in the country. The railway now accounts for less than 1% of land transport in the country. The neglect of the railway has led to over-dependence on road transport with 98% of goods being transported by road. Air transport infrastructure in Nigeria is largely located within the 21 international and domestic airports and 62 private airstrips across the country. The airports are still in Federal Government ownership and are managed by the Federal Airports Authority of Nigeria (FAAN). Government also has the responsibility for aircraft regulation, traffic control and navigational aids through the Nigerian Airspace Management Agency, although much of the equipment is obsolete. Only three of the airports (Lagos, Abuja and Kano) cover their operating costs (FGN, 2009b).

3) Oil and Gas:is a major income earner for Nigeria and currently account for about 75% of her annual revenue. In the last 50 years, the sector has been managed by a federal government parastatal- Nigerian National Petroleum Corporation (NNPC). Due to limited gas distribution infrastructure, Nigeria today flares about 2.6 bcf/d of gas, representing 12.5% of all globally flared gas, which is 68% of the associated gas produced or 51% of the total gas production. Nigeria extended the zero gas flaring deadlines to 2008 from 2004 after operators argued that the earlier deadline was not feasible. Nigeria has four oil refineries (2 in Port-Harcourt and 1 each in Warri and Kaduna). When the refineries were newly built, they worked well and in stable condition, even though none worked at full capacity. Till date, the highest capacity production drags between 25 and 35 per cent of the installed capacity. In spite of the low capacity, they are usually subjected to 'turn around' maintenance (TAM); that is, a general and comprehensive overhauling of the refineries. It costs over $200 million to carry out turn-around maintenance for each of the refineries and yet it is difficult to produce between 25 and 30 per cent of daily fuel consumption in the country. Because the refineries are not working, the country has always sold crude oil to foreign buyers as export; and in return buy back the processed products at a very high cost compared to if the oil were refined within the country. At present, the Nigerian government claims that the price of petroleum products in the country is highly subsidized to the tune of N1.3 trillion per annum and prepares to remove the subsidy to reduce the burden on the country’s economy. Domestic gas demand is about 400 million cubic feet a day (MMcf/d), which is very low compared to the size of Nigeria’s population and its gas resources. Again, the domestic market is limited by the low level of industrialization and the inadequacy of the gas transmission and distribution infrastructure.

B) Social Infrastructure

1) Education and Health: An assessment of education and health sectors in the country shows that a lot needs to be done if Nigeria would be ranked among the top 20 economies by 2020. As at 2011, there are 117 universities in Nigeria (36 federal, 36 state and 45 private). The federal universities fare well than the state owned while the private universities are working hard to meet the gap in university education in Nigeria. Many of the private universities are well funded because their students pay economic fee unlike the federal and state universities. Since 2010, not less than 1.2m candidates seek admission into vaious universities in the country with placent given to only 200,000 candidates. The balance of one million seek higher education in other tertiary educations. This suggests that the universities in the county are insufficient to meet admission demands. Oyeyinka (2011) observed that university education in Nigeria has experienced considerable decline in quality over the last two decade or so, owing to a confluence of factors acting in tandem. They include episodic and uncertain political-policy environments that led to declining support from governments.With declining investment in teaching and research facilities resulted poor products in graduates and evident employment opportunities and diminishing value of earned income. The declining quality of education is largely a result of continuous budget cuts (since 1980) together with rapid increases in enrolment rates. This made the financing of education recurrent costs more difficult. Public expenditure on education, generally, declined from 6 per cent in 1980 to 0.65 per cent in 1995. The outlook for primary and secondary education is also not encouraging. Oyeyinka (2011) observed that Nigeria’s net primary and gross secondary enrolment rates are among the 10 worst in the world, while gross tertiary enrolment is low, placing Nigeria 83rd in the Legatum Prosperity Index (LPI). Only 60% of children of primary school age are enrolled in education with a clear under representation of girls in both primary and secondary education. Also, there are 46 pupils for every one primary school teacher placing Nigeria among the 10 lowest countries in the world. The Nigerian workforce has, on average, less than a year of secondary education, and several months of tertiary education, placing the country 97th and 85th on the Index, respectively. These are reflections of the poor state of education infrastructure in the country. A cursory look at the health sector in Nigeria shows that health care provision is a concurrent responsibility of the three tiers of government in the country. However, because Nigeria operates a mixed economy, private providers have a visible role to play in health care delivery. The federal government’s role is mostly limited to coordinating the affairs of the university teaching hospitals, federal medical centres (tertiary health care) while the state government manages the various general hospitals (secondary health care) and the local governments focus on dispensaries (primary health care), which are regulated by the federal government through National Primary Health Care Development Agency (NPHCDA). The total expenditure on health care is 4.6% of GDP, while the percentage of federal government expenditure on health care is about 1.5%. In 2007 when the population of the country was a little above 140 million, there were 13,703 public primary health care centres in the country. Also, there were 845 and 59 public secondary and tertiary health care facilities respectively and there were only three hospital beds for every 10,000 people Indeed, only 45.9% have access to medical facilities in the country in 2006 (National Bureau of Statistics (NBS), 2008). The inadequacy of health facilities in the country is a reflection of government’s commitment to health care delivery on one hand and on the other a reflection of mismanagement of the country’s economy given the fact that the country is blessed with abundance of human and natural resources.

2) Water and Sanitation: Water and sanitation are also critical to economic growth and well being of Nigerians. A study of the provision of improved drinking water, households connected with water and improved access to sanitation in Nigeria compared to other nations in the league of 60 top economies shows that access to improved drinking water is generally high in all the top 20 countries (FGN, 2009a). Nigeria’s figure is amongst the lowest. In a study of households’ access to improved safe drinking water (Alaci & Alehegn, 2009) observed that average households in Kogi state of Nigeria have no access based on the WHO standards. The study showed that a household spends an average of 65 minutes per day, 455 minutes (8 hours) per week, 1820minutes (30 hours and 33 minutes) per month and 21840 minutes (364 hours) yearly to fetch water. By implication this is what is actually lost due to the present water situation. NBS general households survey shows that in 2007, 10.4% of Nigerians obtain water supply from pipe borne water, 26.8% from bore hole, 33.3% from well, 24.4% from streams/ponds and 4.1% from trucks/van, i.e. water vendors (NBS, 2008). Also, between 1990 and 2008, access to improved sanitation in urban areas declined from 39% to 36%. This suggests that water and sanitation infrastructure in the country is grossly inadequate and has implications for wealth creation and economic development. These scenarios show that Nigeria has a long way to go in achieving the 20:2020 vision.

CHALLENGES FACED

1) Lack of Maintenance Culture:

 An obvious problem militating against infrastructural development in governments across Nigeria is the lack of maintenance culture. Government often construct new projects with little fund given to them rather than taking good care of the existing ones. These new projects, often times are used by the politician to boost their image and that of their political party to enable them get necessary support from their people. Looking at this from another perspective, embarking on a new project makes diversion of public fund to private use easier than the maintenance of the existing one.

2) Inadequate Funding:

 Funding has become a major challenge to infrastructural development in Nigeria for decades. As the country’s population soars, demand for additional infrastructure in all sectors also increases. Unfortunately, the government resources can hardly meet the increasing demand. Consequently, government has relied on foreign loans to complement budgetary allocations in the provision of infrastructure. This situation has led to the country’s indebtedness over the years. At the inception of the fourth republic in 1999, Nigeria’s foreign debt profile was over $40bn. Although, the country received debt pardon from her creditors and recorded a zero debt profile about five years ago, again, the country has been plunged into debt largely because of need to develop infrastructure in critical sectors of the economy.

3) Population Explosion:

 Nigeria’s population is now 167million and growing at 3.2% per annum. The physical and social infrastructure required to support this huge population is enormous and requires huge funding. The huge population which is more than 50% urban has placed undue pressure on existing infrastructure and on governments’ budgets over the years. Thus, the infrastructure base is grossly inadequate and suffered from deferred maintenance. Besides, Nigerian government has failed over time to integrate population policy with overall development planning. The short-fall infrastructural provision affects the economy negatively and lowers productivity in every sector and aggravates the poverty profile of the country.

4) Poor Governance:

 Apart from poor funding, poor system of governance in the country is largely responsible for the poor state of infrastructure in all sectors. To realize the 2020 vision, the country’s economy was expected to grow at 14% per annum; but current data show that the economy is growing at 7%. The low GDP growth is largely due to inefficient allocation and poor management of the country’s human and natural resources (The Punch, 2011). Also, the current system of governance in Nigeria has truncated infrastructural development at the grassroots. Section 7 of the 1999 constitution empowers states House of Assemblies to make laws for the operations of the Local Government Councils. Consequently, this provision gave the state governments opportunities to control the finance of the local governments, therefore, many local governments across the country today lacks freedom and financial strength to embark on any infrastructural development project that can serve as catalyst for economic growth and propel economic empowerment among the people in the grassroots.

5) Corruption and Economic Sabotage:

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RECOMMEDATION

1) There is need for the encouragement of maintenance culture in Nigeria. There is need to promote culture of maintenance in Nigeria. Existing infrastructure needs maintenance as this will prolong its durability and efficiency.

2) Sadly, corruption has become a way of life in Nigeria; however, there is need to stop it. Corrupt practices must attract stiff penalties to serve as deterrence to others as this remains the only antidote to infrastructural problem in Nigeria.

3) Managerial Economics and Engineering Law should be taking seriously in tertiary institution

4) Population control: Rapid growth of population in a developing nation like Nigeria is inevitable. However, the growth can be planned and sustained to achieve economic growth. For instance, between 1960 and 2000, the share of the population living in urban areas rose from 20% to 36% in both Asia and Africa, the per capital income increased to 340% in Asia; and only 50% in Africa (Bloom, Canning and Fink, 2008). Africa in general and Nigeria in particular has not taken full advantage of the process of urbanization to promote economic growth while Asia cities have capitalized on it by providing industries and the required infrastructure to sustain the growth (Yinusa, 2011). To reduce governments’ financial burden on infrastructural development, there must be deliberate control of the country’s population as done in China. In Europe, North America and parts of South America, where family planning has been adopted for population control, the healthy balance between populations and resource stock is a major factor in their enviable standards of living and impressive economic performances. China, for its part, with a population growth rate of 0.493, has moved rapidly into healthier development trends than countries such as India and Nigeria, where little is done on population control. It is either Nigeria deliberately controls her population or nature does it. Already, about 55 per cent of the Nigerian population lives on less than $1 per day, this is one of the highest poverty rates in sub-Saharan Africa. At the level of government, its responsibilities centre on the provision of quality education to enhance quality human capital, quality health care and basic infrastructure.

 CONCLUSION

This paper has shown clearly that engineering law and managerial economics aid infrastructural development and also that infrastructure is critical to the economic growth and development of any nation. It has also demonstrated that in spite of the current position of Nigeria relative to other nations with the largest economy, the country can indeed make it to the top 20 if her vast human and economic resources are efficiently managed. Besides, the nation as a whole has to imbibe the culture of transparency and accountability with greater managerial skills, adequate funding and greater private sector participation. Rapid urbanization, poor governance, poor funding, corruption and poor management culture and lack of proper urban and regional planning are some of the major challenges facing the attainment of infrastructural development. But if all these challenges can be faced there will be a rapid growth in our economy.