



The Roles of Engineering in Overcoming Nigeria Emerging Issues and Challenges

A.B. Hassan^{1*} and A. Bitrus²

¹Department of Mechanical Engineering, Federal University of Technology, P.M.B.65, Minna, Niger State, Nigeria.

²Department of Mechanical Engineering, Niger State Polytechnic, Zungeru, Niger State, Nigeria.

E-mail address: ^{1*} abhassan@futminna.edu.ng, ² rockrich4u@yahoo.com

*corresponding author (Phone Number: +234-803-452-9014)

Article Info

Keywords:

Engineering, Engineer, Infrastructures and Sustainable development.

Received 27 January 2020

Revised 13 January 2020

Accepted 13 February 2020

Available online 02 March 2020

ISSN-2682-5821/© 2020 NIPES Pub.
All rights reserved.

Abstract

Engineering roles are not laymen affairs, they are responsible for effective infrastructures and economy development of any nation, thereby improving living standard of the people and ensuring sustainable national development of nations. Engineering plays a significant role in ensuring the achievement of any nation vision and further ensure that sustainable solutions are available, considered and implemented for sustainable development. Thus, engineering as a profession in Nigeria is bedeviled by manpower development, good governance and innovations challenges. This paper examines the engineering responsibilities in solving the Nigeria emerging issues and challenges, and suggests ways engineering profession could be empowered to do more in the task ahead for Nigeria sustainable development.

1. Introduction

Engineering is the field or discipline, practice, profession and art that relates to the development, acquisition and application of technical, scientific and mathematical knowledge about the understanding, design, development, invention, innovation and use of materials, machines, structures, systems and processes for specific purposes. The term 'engineering' derived from the Latin word "*ingenium*", which means ingenuity (or cleverness) and invention. The terms 'art' and 'technical' are important because engineering also arranges elements in a way that may, or may not, appeal to human senses or emotions [1, 2].

Saman [3], defines an engineer as persons who is/are trained (and may be licensed) in the design, construction, manufacturing, and use of engines or machines and consultant, in any of various branches of engineering. Prior to the development of engineering, our ancestors developed and designed tools such as axe, hammer, lever, wedge, pulley, wheel etc that were essential for their survival. Indeed, human beings are defined by their tool-making, designing and engineering skills, and the socialization and communication that facilitated the invention, innovation and transfer of these technologies [4, 5, 6]. Although based on trial and error, our ancestors designing skill is similar to the modern idea of engineering, where trial and error is still an important part of innovations. Today, almost every area of human interest, activity and endeavor has a branch of engineering associated with it. Mankind lives in engineered economies, societies and techno-cultures [7].

2. Emerging National Issues and Challenges

Nigeria is dominated by agriculture (subsistence agriculture accounts for 70% employment) and public accounts for 70% of paid employment and consumes about 75% of its revenues on recurrent expenditures (personnel cost, overheads etc.), general administration. Nigeria has slow developing private sector, due to lack of adequate security of investments & energy, low local demands for Nigeria made products and services, tax duplication issues. It is also bedeviled by insecurity; lack of diversification of its economy, due to unfavorable business environment, funds, high cost of doing business, unstable fiscal policies and bad governance. Also, obvious is inadequacy and continue deterioration of infrastructure (schools, housing and general town planning, potable water, sewage and waste disposal, roads and other transport facilities, public facilities e.g. health facilities, sporting facilities, recreational facilities, post offices and courier services etc.); corruption; wrong attitudes toward government funds such as not insisting on value for money spend etc; and low level of investment. The nation is not also immune to global issues such as climate change.

The challenges above have contributed significantly to the low standard of living and underdevelopment of the nation. Hence, this paper discusses the roles engineering should play in solving these challenges, in order to enhance national economy and maximizing the exploitation of the various potentials of the nation (in agriculture; solid minerals; energy; education; transportation; health; tourism & culture; water & sanitation; information, communication & technology; environment and sustainable development; housing; youth and sport development; science, technology & innovation; media & communication; business environment & competitiveness) to create wealth, nurture private sector and improve the welfare of Nigerians. Thus, as Nigeria is aiming to be among top Africa and world economy, the demand for engineering skills is higher than ever before, in order to deliver sustainable engineering systems; robust physical infrastructure to support private sector development and protect against geophysical hazards such as extreme meteorological events, job creation and promote low-carbon/renewable energy technologies.

3. The Responsibilities of Engineering

The chief responsibility of engineering in Nigeria project is management of engineering infrastructures that support the development of all sectors of the economy. This management involves the conception and analysis of engineering projects viability, project planning, implementation and control, equipment planning and utilization, manpower planning, materials management, plant locations, works layout and materials handling, maintenance management, quality control, information management and cost engineering. These infrastructures to be managed from the Nigeria emerging issues and challenges (as defined by World Development Report, 1994 within the context of economy) include:

- i. Better provision of roads networks, highways, waterways/ports (e.g. dredging of Baro inland port) and railways (e.g. Minna-Baro, Minna-Jebba, Minna-Zungeru, Minna-Abuja, Minna-Kaduna, and Minna-Ilorin, Abuja-Lagos rail lines) for transportation/tourist shuttle.
- ii. Airports development and management.
- iii. Improvement of water and sewage systems management, that ensures an adequate supply of clean water, as well as disposal of solid waste collection and disposals.
- iv. Development of oil and gas industries with local contents and participation.
- v. Enhancement of electricity generation, transmission, and distribution, in order to meet the needs of all (may be commercial, residential, or/and industrial).

- vi. Erosion control plans, irrigation and drainage systems, rehabilitation/construction of dams.
- vii. Agricultural food production, preservation and storage facilities management.
- viii. Infrastructures necessary for safe exploitation of solid minerals resources.
- ix. ICT infrastructures expansions and management, especially in media (e.g. television/radio), and security of life and properties.
- x. Building development (industrial/commercial/government/residential) and services, of either new buildings or addition on to old infrastructure within the nation.

Furthermore, it is the role of engineers to interpreting the technological possibilities of the Nigeria technological vision to the society, investors and government; ensuring reliable and safe functioning of all materials, components, sub-systems and technologies used; their integration to form a complete, sustainable and self-consistent system; and all interactions between the technical system and the context within which it functions.

Total infrastructural development and sustainability (because of their interdependence e.g. failure in science and technology will have great impact on energy, transport, communication, solid minerals sector, water supply, education, agriculture, administrative issue, security, trade and industry etc.) is the cornerstone to the actualization of the nations respective visions. It is the prerequisite requirement for better service delivery, that support quality of life such as healthcare, science, education, insurance, recreation etc. It failure underpin many aspects of economy and social activity and, as a consequence, can have a wide spread impacts across nations [4].

4. The way forward

The task of achieving Nigeria of our dreams and sustaining development may be challenging. However, the following suggestions could further enhance engineering profession to do more in this project:

a. Human resources development

All the cadres of the engineering family must be properly educated and trained to be immediately productive and provide service. The authors have claimed that our basic engineering education is theoretical. However, I believe the authors should make suggestion on improving industry-university collaboration as a way to strengthen our system. The general consensus as revealed in a survey carried out by Aderoba [8] is that an engineer in a developing country should be able to use his hands as well as his brain.

b. Nation of emergency

There is need to declare a nation of emergency on the engineering educating institutions and infrastructures. This will enable the government to address the problem holistically. The nation's poor engineering educating institutions and infrastructures has imposed huge socio-economic burden on the populace.

c. Innovations

The Nigerian populace already adopted various coping mechanism in response to poor services from public utilities. As such averting expenditures are incurred for example on standby generator, fuel, boreholes, and table water etc. It is not surprising that several studies [9], [10] and [11] etc reported that the citizenry are willing to pay for improved services. Thus, the nation government innovative efforts in public private partnership (PPP) is highly commendable, it should be improved and sustained. It is imperative to involve private sector in infrastructure development and service delivery to exploit those willingly-to-pay [12].

The PPP offers one of the greatest potentials of resolving infrastructural inadequacies in many societies and meeting internationally accepted development goals [13].

d. Good governance

Lack of good governance principles had a devastating effect on infrastructures. Good governance is participatory, consensus-oriented, accountable, transparent, responsive, effective and efficient, equitable and inclusive and follows the rule of law [14]. The provision of basic services from infrastructure is a “people affair”. It requires peoples of all sphere of life interaction. Such interactions are basically governed by politics, for instance the politics of resource control, revenue allocation and establishment of priorities, interaction between institutions and the involvement of those directly affected. It is therefore politically naive according to [15], to avoid the politicization of service provision. What is important is to raise the political profile of the infrastructure issue and increase pressure on politicians to be accountable for good governance. Engineers should also contest political offices.

e. Corruption

The endemic of corruption is known though the empirical evidence is lacking to generalize the magnitude of the problem. Experts around the world have been suggesting various ways to battle the endemic of corruption. These include viewing corruption within the context of governance, information and transparency, creation of incentives and rewards, public disclosure, law enforcement among others (source). The Federal government has intensified battle against corruption through the establishment of independent corrupt practices and other related offences commission (ICPC) and economic and financial crimes commission (EFCC). The two organs have since been investigating and trying high profile corrupt cases. The nation government should support these commissions to function well within their established laws.

f. Incentives

Incentives such as sponsorships, and well pay job opportunities should be ensured, in order to change the low interest and enrolment of young people (especially the female gender) in engineering courses. This appears to be based on perception that engineering courses are hard and boring, and that jobs in engineering are not well paid give their responsibilities. Thus, incentives could strengthen the profession and ensure its sustainability.

The government should recruit professional engineers as engineering advisers, commissioners, and ministers where appropriate. The COREN and NSE leadership may be key here. They should annually release a report card on nation’s infrastructure. This “report card” will raise awareness on the nation’s infrastructure.

5. Conclusion

Nigeria has significant power potentials untapped; abundant resources (mineral, agricultural and forestry); its territorial waters are highly productive with abundant and diverse marine resources and need active engineering profession participation to move the nation forward. For the objectives of Nigeria of our dreams to be achieved, there must be high quality development and investment (from public and private) in education, agriculture, manufacturing, tourism, energy, health, water and sanitation (effective wastes collection and recycling, conversion of waste to energy etc.), networks of roadways, railways, waterways etc. These quality developments are not possible without engineering inputs in conception, analysis, planning, implementation, control and maintenance of engineering infrastructures. These engineering roles are not a layman affair that can be handled by

general management specialist. It requires training in management as applied to engineering systems and sustainability.

The development of engineering processes, resources, products, improved (and efficient use of) finances and environment should be at the front burner to ensure effective take-off and growth of the economy.[9], of Federal University of Technology Akure, said in his paper “Strategies for engineering development in Nigeria” and I quote “Without proper development of engineering, Nigeria cannot expect to effectively develop its economy, infrastructures or improve the standard of living of its people”

The political-will must be strong to provide enabling environment (policies and actions) for engineering to provide the leading role in planning, designing, and building facilities for transforming the nation from its present economy backwardness to be among the top world developed nation economies soon.

Reference

- [1] Tony Marjoram and Yixin Zhong, (2010), “What engineering is, what engineers do” UNESCO’s first report on Engineering: Issues, Challenges and Opportunities. Available at: www.onlineethics.org/cms/25719.aspx (Accessed: 21/3/2013)
- [2] Niger Nation vision 3:2020, available at: www.nigernation.gov.ng/epubl/vision3-2020.pdf (Accessed: 21/3/2013)
- [3] Saman Abd Kader, (2011), “Professional Engineer’s Roles and Responsibility”, available at: eprints.utm.my/598/1/A_saman_prof_eng.pdf (Accessed: 22/4/2013)
- [4] World Development Report, (1994), “Infrastructure for development”, The World Bank, U.S.A “World Bank. 1994. World Development Report: Infrastructure for Development. New York: Oxford University Press. © World Bank. <https://openknowledge.worldbank.org/handle/10986/5977> License: CC BY 3.0 IGO.”
- [5] Clough, P., Duncan, I., Doug, S., Smith, J., and Layton, I., (2004), “Sustainable infrastructure: A policy framework”, report to the Ministry of Economic Development, New Zealand, Peerenboom.
- [6] Faluyi A.O. (1993), “The Engineering Family: Relative Roles and Responsibilities”, Proceedings of the First National Engineering Assembly by COREN at the National Theatre, Iganmu, Lagos. p. 12-26.
- [7] Alhassan A. A. (2010), “An over view of road construction and maintenance in Nigeria: Niger nation as a case study”, published in a quarterly publication magazine of NSE Minna branch, The Minna Engineer, December 2010.
- [8] Aderoba A (2000), “Self-Employment: A Challenge to engineering Graduates in Nigeria”, Nigerian Journal of Engineering Management (NJEM), Vol. 1. No 3. p.1-8.
- [9] Sule, B. F. and Okeola, O.G. (2010), “Measuring willingness to pay for improved urban water supply in Offa city, Kwara nation, Nigeria”, Water Science and Technology: Water Supply. Vol. 10 No. 2, pp. 933-941.
- [10] Madhoo, N. Y. (2007), “Estimating the budgetary impact of higher willingness to pay for residential water using CVM: A case study of Mauritius”, Asian Journal of Water, Environment, and Pollution, Vol. 4 No. 2, pp. 57-64
- [11] World Bank, (2002), “Water resources sector strategy: Strategic directions for World Bank engagement Draft”, available at <http://inweb18.worldbank.org/ESSD/essdext.nsf/18DocByunid/> (Accessed: 20/2/2013)
- [12] Ibrahim, D.O and Musa-Haddary, Y.G. (2010), “Concept of value for money in public infrastructure development”, Presentation at The Nigerian Institute of Quantity Surveyors, A 3-Day international workshop on public private partnership approach to infrastructure development in Nigeria, Abuja.
- [13] Omagbitse, B. C. (2010), “Project finance issues for infrastructure provision”, A presentation at The Nigerian Institute of Quantity Surveyors, 3-Day international workshop on public private partnership approach to infrastructure development in Nigeria. Abuja.
- [14] Alexandria, Va. Hukka, J. J., and Katko, T. S. (2003), “Water privatisation revisited: Panacea or pancake?” IRC International Water and Sanitation Centre, Delft, Netherlands.

- [15] Abrams, L. (2001), "Water for basic needs", WHO commissioned input to the first world water development report, available at <http://www.thewaterpage.com/documents/basicneed.pdf> (Accessed: 7/12/2012)
- [16] Aderobe, A. A. (2000), "Strategies for engineering development in Nigeria", available at: www.nuc.edu.ng/nucsite/File/Inugural%20Lecture/ILS-24.pdf (Accessed: 22/4/2013)