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# Repositioning Engineering Profession and Practice for Technological Advancement and Sustainable Development in Nigeria.

**Christopher O. Ahiakwo and Grace N. Ahiakwo**
Department of Electrical Engineering, Rivers State University, Port Harcourt
ahiakwo.christopher@ust.edu.ng
shoutout2grace@gmail.com

**ABSTRACT**
*This paper explained the need to repositioning engineering profession and practice in Nigeria for sustainable development. It pointed out that some countries that had independence in the same period with Nigeria are far ahead of Nigeria in technological advancement. It considered the influence of politics and economy on Engineering profession and emphasised on the major causes of the slow pace of economic growth of the country as corruption, lack of political will, nepotism, and tribalism. The paper also provided antidotes for repositioning engineering profession and practice for sustainable development which include but not limited to running the nation's secondary and tertiary institutions on public private partnership (PPP) basis, dichotomization of technological and vocational institutions, introduction of innovation and creative studies in the school curricula, training and retraining teachers, optimization of entrepreneurship opportunities, adequate funding and proper utilization of funds.*

**KEYWORDS**: Engineering Profession, Practice, Repositioning, Technological Advancement and Sustainable Development.

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## 1. INTRODUCTION

The practice of Engineering is an all-comers event in Nigeria as many artisans parade themselves as Engineers. This purpose of this paper is therefore to explain the reasons why we need to reposition the Engineering profession and practice in Nigeria for technological advancement and sustainable development.

The paper considered the role of politics and economy on the practice of Engineering profession. It shown how political changes have defined and often frustrated the opportunities for engineers to develop the infrastructure and facilities that the country needs for successful economic growth. In this manner it defines the connections between the three and submits that development is a product of engineering. For better understanding of this topic, let us define some of the key terms used (Repositioning,

Engineering Profession, Engineering Practice, Technological Advancement and Sustainable Development) in relation to economic development of the nation.

i. **Repositioning** is the art of changing the way and manner in which engineering is practise in Nigeria and opening of new ways of overcoming the challenges confronting its development in the country.

ii. **Engineering Profession** is a field that is involved in a formal education and prolonged training by using mathematics, science and technology to solve problems. We can see engineering everywhere in the world, improving the ways we work, travel and communicate. In all, engineering is seen as a driver of development globally.

iii. **Engineering Practice** is the application of scientific principles and methods to proffer solutions to varieties of existing and potential problems. This practice has not been adequately carried out in Nigeria. This is as a result of how the training and practice of the profession is structured in the country. Hence the paper is very appropriate in this era of new normal.

iv. **Technological Advancement and Sustainable Development** is the steady growth and development of the application of scientific knowledge to continually enhance and improve the design and implementation of engineering solutions to meet the needs of humanity. Putting all together, Repositioning the Engineering Profession and Practice in Nigeria for Technological Advancement and Sustainable Development, simply means changing the way and manner in which the study, training and application of scientific principles, methods and knowledge are applied and utilized in Nigeria to obtain a steady growth and continuous development of creativity and innovative solutions that meet human needs.

National growth and development are determined by the availability of competent human resources. Among them are those with the ability to interpret mathematical equations and understand scientific concepts. These are just some of the skills that engineers need in developing concepts or products. Today, the field of engineering offers more career choices than any other discipline. In the past, there were four major engineering branches, namely Mechanical, Chemical, Civil and Electrical. Today, the number of available engineering degrees is vast. They include engineering fields such as Aerospace, Agricultural, Biomedical, Chemical, Civil, Computer, Electrical, Electronics, Environmental, Health & Safety, Industrial, Marine, Materials, Mechanical, Nuclear, Petroleum, Polymer, and Water Resources Engineering to mention only but a few.

Aerospace Engineering Engineers in the field of aerospace develop aircraft made to travel both within and outside of the atmosphere of the Earth.

Agricultural Engineers: Agricultural engineers look at the entire complex situations in farming which include food security and delivery. They have the ability of providing solution to the dilemma. They are involved in mechanizing farming, as well as processing and storage of farm products.

Biomedical Engineers: They are Engineers in the medical field. They are saddled with the responsibility of designing and implementing techniques that will improve the health care sector of the economy. They often introduce new

techniques and life-saving machineries that can enhance treatment of patients.

Chemical Engineers: They are Engineers with the skill of developing chemical products. They are mainly seen in the industries as design/ process engineers. They have the ability of mixing two or more chemical products to meet specific needs.

Civil Engineers: The responsibilities of civil engineers are tremendous. These responsibilities include structural design of buildings, roads as well as the actual construction. Civil engineer is also responsible for assessing water pathways, drainages, culverts and bridges.

Computer Engineers**:** This category of Engineers have combined knowledge of electronics and software. This combination is the skill behind the use of computers and the success of today's information communication technology (ICT).

Electrical Engineers: Electric lighting and supplies of power are just some of the areas that involve an electrical engineer. Engineers in this field also work with wiring, power control, and even automobiles. Oftentimes, Electrical Engineers work on voltages ranging from low to extra high voltages.

Electronics Engineers: The area of operation of an Electronic Engineer is restricted to domestic voltages. He focuses on electrical appliances of very low voltages especially those using direct current (Radios, Television sets, Telephone sets, etc.).

Environmental Engineer: Environmental Engineers combine engineering knowledge with science to provide the medium through which natural environment is transformed into cleaner, healthier and less polluted environment.

Health & Safety Engineers: Health & safety engineers organize various aspects of safety policies. They are predominantly seen in an industrial setting, especially in the Oil and Gas industry. At times, they may work with other agencies to implement these strategies.

Industrial Engineers: An industrial engineer is responsible for making sure that things are running as smoothly as possible. They go through production schedules, assess output levels and strategize means for improvements.

Marine Engineering: This aspect of engineering is connected with marine vessels. It involves Naval Architecture, Off-shore and Onshore Engineering and other marine related engineering activities**.** Knowledge of mathematics, design, and computing is essential for a Marine Engineer.

Materials Engineers: Materials engineers have many titles. They are also called test engineers, process engineers and research engineers. Their job responsibilities include brain storming ideas for materials needed for a particular process and the implementation of those ideas.

Mechanical Engineers: They are responsible for designing and testing mechanical equipment. They have the ability to read and interpret draws, fix malfunctioning equipment and coordinate production processes.

Nuclear Engineers: This job carries with it, the weight of handling nuclear elements in order to utilize energy. Researching, preparing and testing of nuclear reactors are some of the main tasks of a nuclear engineer.

Petroleum Engineers: They are the persons behind the scenes in the oil and gas drilling production. They take data in its raw form and analyse things such as cost, production output, and equipment operation. This information is vital for the multinational oil companies and the Federal Government.

## 2. DEVELOPMENT OF ENGINEERING IN NIGERIA:

Globally, there is a rapid growth in engineering development. This growth is very prominent in Europe and America but has not been significantly reflected in the developmental trend in the perceived poor nations of the world like

Nigeria. This is mainly due to the developmental strategy adopted by government. The developmental strategies adopted by different governments of Nigeria have all along projected the country as a consuming nation rather than a manufacturing nation. Hence, the need to re-strategize and restructure the practice of engineering in the country to produce a road map towards sustainable economic development. Development is a product of engineering. Many nations know that engineering is development. Nations that have realized this have transited from under-developed to developed nations in relatively short time. Those who have not are wallowing in poverty and misery (Adeola, 2017).

A Nation's growth and development is determined by her human resources. This is further buttressed by Maduewesi (2005). He asserted that National development is defined in terms of human development which is measured by the extent of poverty and deprivation of a given country.

## 3. TECHNOLOGICAL ADVANCEMENT AND SUSTAINABLE DEVELOPMENT:

Technology affects the way individuals communicate, learn, and think. It helps society and determines how people interact with each other on daily basis. Technology is dominating every aspect of human activity in the society of today. We are therefore living in an era where technological advances are common, especially in the manufacturing and commercial sectors. Technological advancements have improved the quality of life substantially. It has also brought about many ill effects such as cyber-crimes (internet frauds). Nevertheless, technology will continue to have stronger influence over society and will eventually become an inseparable part of the society as it is today.

Some Top Breakthrough Technologies in 2021

i. 5G Technology.
ii. Internet of Behaviours (IoB)
iii. DevSecOps.
iv. Intelligent Process Automation (IPA)
v. Tactile VR.
vi. Big Data Analytics.
vii. Human Augmentation.
viii. Everything-as-a-Service (XaaS)

Some Top Breakthrough Technologies in 2020

i. Uncheckable internet.
ii. Hyper-personalized medicine.
iii. Digital money.
iv. Anti-aging drugs.
v. AI-discovered molecules.
vi. Satellite mega-constellations.
vii. Quantum supremacy.
viii. Tiny AI.

Some Big Technological Advances Since 1844

i. Personal Computers — 1970s.
ii. Global Positioning System — 1970s.
iii. The Internet: ARPANET — 1973.
iv. GPS Navigation — 1990s.
v. The Digital Camera — 1990s.
vi. Web Browser — 1994.
vii. Social Media — 2004.
viii. The Modern Smartphone — 2007.

Here are some advantages of technology in our lives**:**

i. Ease of Access to Information. The World Wide Web, abbreviated as www has made the world a global/social village.
ii. Saves time.
iii. Ease of mobility.
iv. Better communication means.
v. Cost efficiency.
vi. Innovation in many fields.
vii. Improved banking.

viii. Better learning techniques.

## 4. REPOSITIONING ENGINEERING PROFESSION AND PRACTICE FOR TECHNOLOGICAL ADVANCEMENT AND SUSTAINABLE DEVELOPMENT:

As more Nigerians are becoming apprehensive about the poor quality of our product from schools (Graduates without the requisite skills, competence and performance), it has become imperative to propose the following as the way forward on this all-important aspect of repositioning our engineering profession and practice for technological advancement and stability.

### 4.1 Public Private Partnership (PPP):

Training in the private sector by private employers and in private training institutions can be the most effective and efficient way to develop the skills of the work force. This arrangement will not only provide direct links between institutions and the industries but will also enable students acquire relevant skills. This will restore confidence of the employers on the graduates. For instance, Centre of Excellence Marine Offshore and Onshore Engineering, Rivers State University has partnered with the multinational companies, to provide direct access and laudable avenue for knowledge advancement and training opportunity for both lecturers and students.

### 4.2 Dichotomization of Technological/ Vocational Institutions:

Technological and vocational education should have clear out dichotomy with the conventional institutions. They should have their curricula tailored to meet the employability skills demand of relevant specialties. For sustainability, graduates of such institutions should have enhanced salary scale. According to Eke (2014) adequate attention would be paid to technology and vocational schools if they exist independently and run vocationally. Studies have described this approach as one of the key secrets of many countries that have excelled technologically. For instance, Australia has over 20 vocational (trades) schools that specialized in training (Vocational Training Education) VTE and 4 technical colleges otherwise known as trade colleges where students after completing a modified 12-year certificate programme, commence a School-based apprenticeship in trades of their choice. In Ontario, Canada, secondary schools are split into three: Technical, Commercial/Business and College. In Central and Eastern Europe as well as Japan, vocational schools are separated from general education with great emphases on acquisition of practical skills and problem-solving techniques. United States, China and France, in addition to running their vocational schools independently, employed other approaches to fund and support their engineering programmes. This is one of the factors that have led to their sustainable economy. The major advantage of this approach is that it makes students to be focused and fosters effective supervision and mentoring for quality assurance (Moller, 2006).

### 4.3 Innovation:

Innovation is the driving force behind economic growth and the key to solving future global challenges. The key challenge facing every nation is balancing incentives for innovation without diffusing the benefits of innovation as largely as possible (Kent 2013). Hence, the need to reposition the engineering profession and programmes alongside the global trends in technological breakthroughs. The focus now is in Information Communication Technology (ICT) and digitalised approaches in engineering instructional contents. In line with the foregoing, Vest (2013) maintained that the US, Britain and

other developed nations realized the goals and objectives of the engineering profession by not only integrating ICT into their schemes but also observed strictly every terms as pertains to policy implementation and best practices. This practice has gone a long way in enriching the instructional contents and teacher quality of these countries. It has in turn led to the production of knowledgeable and skilful graduates. It is imperative that the objectives and techniques embedded in engineering should be in consonance with the dynamism of socio-economic trends and global market paradigm shift in order to develop rapidly.

### 4.4 Appreciation of Creative Works:

Restructuring the educational curriculum by giving preference to creative/practical projects, that is, assigning more credit load to creative works. Creative works can also be encouraged by sponsoring their production and exhibition as well as giving of gratification to students with outstanding performances in their various fields of study. In consonance with this, Rufai (2012) asserts that learners' creative ingenuity can only be enhanced and maximized if greater emphases are placed on competence-related activities. This will challenge students to master creative thinking skills and also develop self confidence in executing their tasks with little or no assistance (Duposhim, 2013). Duposhim(2013) further maintained that the US, China, Japan and many other developed nations adopted this approach, ensuring that adequate fund was voted and utilized on engineering programmes.

Attempts by government in this direction, would definitely provide ample grounds and enabling environment for acquisition of knowledge and development of psychomotor skills for self-development, economic empowerment as well as improved the public image of engineering practice.

### 4.5 Availability of State of Art Tools and Equipment:

Available statistics revealed that our workshops and laboratories not only suffer inadequacy of facilities but fraught with obsolete and dysfunctional equipment. Sometimes, even when fund is committed for the purchase of these facilities, sub-standard and moribund equipment are purchased with the aim of enriching individuals' pockets at the expense of the future of entire Nigerians. Provision and training of students with modern tools would enrich the quality of engineering programmes as well as transform the educational sector technologically (UNESCO, 2002).

### 4.6 Retraining of Teachers and Optimization of Entrepreneurship:

Training and retraining of engineering teachers in various aspects of lifelong learning is quite imperative in rebuilding engineering practice in order to realize its goals and objectives. According to UNESCO (2002) the increasing changes in socio-economic and technological advances demand an urgent response which makes it imperative that engineering teachers should be encouraged to undertake some in-service training in the areas of technologies and entrepreneurship. Thus, entrepreneurship is an integral aspect of engineering profession, (Okoye, 2013). Retraining teachers will enhance their propensity in content, mastery and instructional delivery in order to meet the yeaning needs for successful enterprising and industrial standards. To buttress this, UNESCO (2001) Revised Recommendation for Engineering Education states that the lifelong learning should include:

i. Continuous review and updating of knowledge, competencies and skills.

ii. Continuous updating of specialized professional skills and knowledge.
iii. Periodic work experience in relevant occupational sector.

According to Wanacott (2001) engineering teachers should update their occupational ICT skills through workshops, seminars, conferences, summer works, business partnership, networking with other teachers, reading professional literature among others. Hence, when teachers are trained entrepreneurially and otherwise with modern tools and methods, their confidence will rise and the quality of their instruction and method of delivery will improve. Ultimately competent and employable graduates who can be hired (employable) or can hire (self-employed) will be turned out

### 4.7 Provision and Effective Utilization of Funds:

Fund is one of the major requirements for execution of programmes, especially in engineering. Studies have shown that inadequacy and misappropriation of fund have been a serious challenge to Nigerian educational sector (Bamiro, 2012). However, this has resulted in non-availability of facilities, dearth cum poor quality of teachers leading to low quality of instruction as well as poor academic performance of the students. Conversely, the US, Britain, China, Singapore and Japan nurtured and sustained their engineering education by allocating substantial amount of their national budget to engineering programmes (Taylor, 2014; World Bank, 2010). For instance, South-African government has created a National Students' Financial Aid Scheme (NSFAS) that provides financial aid to academically deserving students from poor households as well as National Artisan Development Support Centre (NADSC), a three-year project funded by the national skills fund to provide students with specialized skills for the artisan sector of their economy.

Similarly, Bamiro (2012) cited in Akinseinde (2014) affirmed that Tertiary Education Trust Fund (TETFund) is the major source of funding public tertiary institutions in Nigeria, while blaming lack of fund for implementation of programmes on inconsistence and nonchalant attitude on the government and its agencies. Bamiro further maintained that TETFund earmarked about ₦42 billion to develop six (6) universities, three (3) polytechnics and three (3) colleges of education into world class institutions in April 2009; while the Federal Government in 2012 allocated N25 billion to tertiary institutions for special High Impact projects directed at improving the teaching and learning environment of the institutions (Rufai, 2012). The million-dollar question is therefore, what extent has this fund has been accessed and utilized in meeting our educational needs. In view of the foregoing indices, it is imperative that Government at all levels must be pressured to devote the recommended 26% of her budgets to education and religiously checkmate its utilization. Out of this percentage at least about 50% should be allocated to engineering education representing roughly 10% of the total budgets to facilitate effective implementation of engineering programmes in order to produce competent and qualified teachers, who will produce employable graduates needed to overcome the challenges of manpower so as to meet the competitiveness of the rapidly changing global economy.

## 5. CONCLUSION

This paper affirms the capability of engineering in reducing poverty if properly repositioned and applied. Hence, the urgent need for total overhauling of the engineering profession, practice and educational system, especially the

industrial work-oriented-courses (Jubril, 2008 ;NPE, 2009). The lecture posits that repositioning engineering profession and practice should ensure that its syllabuses were innovative, re-engineered or re-designed to build and train the needed Engineers of today's intellectual battles of life that will apply creativity in utilizing local contents to turn the country from a consuming nation to a manufactory nation.

Conclusively, repositioning engineering profession and practice for technological advancement and stability is the most appropriate thing that would bring development and create employment opportunities in the country. This will in turn improve the economy, social life of the citizens and reduce youth restiveness. Presently, over seventy percent (70%) of the cause of youth restiveness in Nigeria is as a result of unemployment and harsh government policies.

**Recommendations**

Without prejudice, this lecture posits that repositioning engineering profession and practice in Nigeria for technological advancement and stability is achievable with the under listed recommendations.

(i) That government should ensure sustainable peace in every part of the country. No business can flourish in a harsh and violence pruned environment.

(ii) That the citizens should have uninterrupted electric power supply to allow small and medium scale industries to flourish.

(iii) That government should empower graduates of engineering of technical and vocational institutions to setup small and medium scale enterprises and diligently mentor and monitor their activities to ensure their sustenance and active contribution to nation building as well as poverty reduction.

(iv) That government and its relevant agencies, should operate a public private partnership (PPP) programme in engineering to provide/promote functional and affordable education capable of harnessing the resources of the nation for societal wellbeing.

(v) That government should separate Engineering Institutions (Technological/Vocational) from Regular/Conventional schools and bring in the industry to supervise, mentor and monitor the implementation of programmes without compromise.

(vi) The Stakeholders and the Policy makers in the educational sector should restructure engineering curriculum in such a manner that more credit hours and scores should be allotted to practical work exercises than theoretical studies.

(vii) That government should provide engineering teachers with effective re-training programmes in the use of modern tools and make sure that such tools are sufficiently available in the institutions. This will enhance quality of teaching and guarantee the production of employable graduates.

(viii) Polices and functional instruments for optimization of the nation's local resources to cater for the needs of the country and the creation of linkages for export of manufactured products. This is one of the major things that will enable the country migrate from being a consuming nation to an exporting nation.

(ix) Avoidance of multiple taxation: A system where the Federal taxes an enterprise. The State and Local governments, under the guides of revenue generation, compel the same enterprise to pay other taxes with coded names like sanitation fees, grand

rent, operational permit, etc, retards entrepreneur development of a nation.

(x) The use of thugs for revenue drive is primitive and should be abolished. No investor would like to invest in an environment where his goods/products would be destroyed under the guides of revenue generation.

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