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Topic: Reskilling Nigerian Engineers for Emerging Changes

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Abstract

Engineering skills continue to be in high demand as economies grow, but one of the most critical links in the chain is the ability of Engineers to cope with emerging changes. Re-skillingⁱ calls for Engineers to continually update the learning power needed to perform their professional roles competently and in a sustainable manner. This means that whenever changes occur, whether locally or globally, engineers will be equipped with the right competences and skills to provide lasting solutions to the challenges that have emerged. It is recognized that the emerging changes touch on the needs of society and its ability to survive in the present and future situations. The changes manifest in various forms - social, economic, political, safety, environmental, health, security, population growth, urbanization, housing cost, food and water supply cost, energy cost, climatic conditions, new technology, natural phenomena, culture and behaviour, etc. Whatever the change that is emerging, it requires the Nigerian Engineer in this case, to contribute to the process of controlling its impact, rather than be passive or caught unawares.

The objective of this paper is to encourage Nigerian Engineers to continually develop themselves and support economic growth, using skills and experiences that appropriately address new and future demands of the society.

Let us consider some basic concerns that Nigerian Engineers need to address real and potential changes as they emerge:

- **How are we able to ascertain that Nigerian Engineers have received the right level of educational training and exposure to address the present day demands of society?**

Apart from receiving formal education in their primary disciplines, Engineers are expected to continually update themselves with new learning as changes occur around them. This can be considered as 'continual improvement education' in engineering and the aspects of society it impacts.

- **Will the available technical skillⁱⁱ sets be able to address present and future energy needs of Nigeria (local consumption and export), in the midst of increasing population and growing energy cost?**

- where are we on the deployment of
 - conventional energy technology?
 - clean energy technologies such as hydro and onshore wind sources?
 - emerging technologies such as marine tidal and wave sources, etc?

- **How does the current governance structure for developing engineering professionals support economic growth?**

The Federal Government of Nigeria has established structures to support economic growth, including setting up research and development institutions or Agencies that focus on certain critical areas of the economy. Examples abound, but what is important in the context of this discourse is the ability of Nigerian Engineers (and the entire Engineering family) to utilize them as opportunities for professional development. For example, the Petroleum Technology Development Fund (PTDF) is Nigeria's agency for developing and enhancing the skills, capacities, competences and capabilities of Nigerians to operate and manage segments of the oil and gas industry. One of its objectives that should be of interest to Engineers in tertiary institutions is in "enhancing the teaching, learning and research skills of university lecturers, including trainings in Engineering Design Software Interpretation".ⁱⁱⁱ

- **As engineers, how are we equipped to participate in emergency response efforts during natural or man-made disasters (in terms of providing the right skills and behaviors that should add value)?**

Man-made incidents such as collapsed buildings, domestic fires, flooding, etc, appear to occur more frequently and when they occur, the recovery actions can only be carried out only within the limit of available resources. Often, the loss prevention infrastructure and technical skills are inadequate to cope with the changes on the ground. Certain changes and practices in the society escalate the risk, e.g. overcrowding, non/poor compliance to engineering codes and standards, and lack of the right technical skills in terms of quality and number. People responding to emergencies ought to be knowledgeable about the potential incident scenarios with the associated hazards and be able to apply the appropriate recovery control measures. The absence of the right resources will often lead to slow or wrong response, resulting to huge monetary and material losses. Investigation reports have revealed that most of the incidents are avoidable and their root causes traced to the combination of Engineering Design, Error Enforcing Conditions, Organization, Training and Attitude. In all of these, there is an engineering solution starting with acquiring and growing the right skills to solve the associated problems.

- **How have we appraised the reality of the current economic climate in Nigeria and the need to diversify the resource base in the midst of a dwindling oil market? For**

example, how well have Nigerian Engineers helped in harnessing the abundant energy resource in natural gas?

Industry experts agree that there is a huge market for Nigerian natural gas for local consumption, as well as by international markets. We can build from the ongoing Nigerian liquefied gas project initiatives, but it demands growing the relevant engineering skills to support the effort side-by-side. Reflecting on High Technology as a Strategic Tool for Development in Nigeria, Professor Turner T. Isoun opines that “Nigeria must acquire the necessary technology skills and infrastructure to enable it to exploit its huge oil and gas resources, as a matter of urgency – in order words, it must meet the challenges of the oil and gas sector and run before learning to walk”. (T.T. Isoun with M.J. Isoun^{iv}: Why run before learning to walk? pp 281). Suffice it to say that currently, Nigerians (and Nigerian Engineers) merely explore for new oil fields, produce and market crude oil while significant volumes of the associated gas are still being flared. Today, we can consider investing on Gas-to-Liquid Technology (GtL - the Qatar example), to complement the ongoing Domestic Gas Utilisation program in Nigeria. A key product from the GtL is aviation fuel and related products which will be of great benefit to the economy. That way, Nigerian Engineers will get to design/deploy alternative technology that is appropriate to the Nigerian situation. At present, the natural (non associated gas reserve is underdeveloped and a significant proportion of the associated gas being produced is flared. With the right investment strategy and technical skills to support its growth, it will potentially become another source of light hydrocarbon fuels as well as reduce the importation of liquid fuel.

- **How about our knowledge and understanding of global standards in the various engineering disciplines?** What is the place of Engineers in executing the changes that have arisen with the introduction of new legislation, e.g. carbon dioxide emission control versus climate change? The growth in carbon dioxide emissions, implicated as a prime contribution to global warming is a problem that cannot be ignored, even in Nigeria. For example, Carbon capture and sequestration as a way to reduce greenhouse gas emissions is being pursued as specific game-changer projects in some countries. In Nigeria, CO₂ emission is of significance in the Oil & Gas and Power industries as well as from other human activities, mainly from the combustion of carbon-based fuels (wood, coal, oil, and natural gas). It offers Nigerian engineers an opportunity to explore/deploy carbon sequestration technology thereby contributing to the overall climate change mitigation efforts.
- **As engineering professionals, how have we aligned ourselves with the new frontiers that Government has ventured into?**
Let us consider recent government pronouncements relating to investments, e.g. in coal energy (rejuvenation) for power generation, solid mineral extraction licenses

and other initiatives from the ongoing privatization reforms. There is no doubt that Nigerian Engineers feel challenged with the opportunities that such programmes offer them in contributing to wealth creation and economic growth of the nation. FIRO's experience on Solid Mineral Resources and Local Engineering Utilization indicate that an array of technologies and engineering based professionals is required to develop the vast natural resources in both metallic and non-metallic solid minerals in Nigeria (Irabor, Pratrck S.A^v: keynote lecture at 2014 Nigerian Content Workshop, brochure pp 9)

- **As Engineers, what can we learn from the Nigerian Content Act^{vi} and how have we responded in the implementation effort of Government and the people?** How have we grown the skills needed to run the policy as intended (being able to undertake certain critical activities ourselves with minimal expat influence, as it were). Although initially triggered by the need for active participation by Nigerian nationals (and their businesses) in petroleum industry activities, it is extending to other sectors of the economy, which is good. It calls for Nigerian Engineers to step up the quantum and quality of their professional practices by providing solutions that meet contemporary challenges, whether in the Private or public sector of the economy.

Other similar questions we should attempt answering are:

- How are Nigerian Engineers preparing themselves to remain relevant in a competitive world, especially as national aspirations continue to grow and focus on survival?
- How has new technology impacted the practice of Engineering in Nigeria generally; and how are Nigerian engineers expected to response? Specifically, how involved are we in developing and introducing new technologies that meet our peculiar needs?

Way forward

1. Anticipate changes, analyzing the associated risks and opportunities with a view to offer sustainable solutions according to your professional calling as an Engineer.
2. Reinvigorate the learning culture and undertake reskilling as part of the overall process of managing emerging changes, going forward. It is recognized that government policy or legislation can further enhance this effort. As the population the nation grows, the engineering services needed to support it are expected to grow in proportionate manner. The approach should be that of continual improvement in education, specifically in the acquisition of new skills that support the practice of Engineering in terms of adequacy, effectiveness and sustainability. Writing on the need to promote teacher training to support the nine-year schooling that was introduced in 1992, Gaines opines that there is "No future without Education" (Jeremy Gaines^{vii}: Nigeria at 50, pp 152). The same may be said of

Nigerian Engineers, “No meaningful development can be achieved if Engineers remain docile and fail to re-educate (reskill) themselves professionally”

3. Cross learn as much as possible without re-inventing the wheel, but comply with property patency and copy right rules as they apply to products and services. It may involve understudying from identified experts such as Original Equipment Manufacturers (OEMs) and Vendors of new technology applications. We can learn from existing practices in the western world and other developing countries. For example, the role that legislation and energy pricing play on the introduction of certain new technologies is worthy of note, e.g. on biomass electricity^{viii} (Brazil experience) – Brazil has an abundant, cheap fuel in the form of begasse, a waste product of sugar processing. The low operational costs of begasse incineration reduce the levelised costs and are incentivized with suitable policy and transparency. Similarly, the UK has seen significant biomass investment following government support schemes. Policy and financing is seen to play a vital role in the introduction of renewable new energy projects. For example, World Energy Council report indicates that Onshore wind new-rebuild in the US is incentivized by production tax credit (PTC).
4. Alternative energy investments on renewable and conventional power generating technologies: Apply appropriate technology taking into consideration Nigeria’s natural resources, cost of deployment and whether or not the choice can be sustained regionally or across the geographical spread of the nation.
 - a. Understand the project risks and associated costs. The process of valuing projects regardless of local risks and technology-specific risks may assume that an equity investor requires about 10% return on their investment. Thus, managing the Return on Actual Capital Expended (ROACE) is crucial both for private and public energy projects. The later presents more complex challenges because of social expectations and the political structure in place; yet, every project ought to break even at some point and grow.
5. Prioritize the investments and learning schemes, focusing on areas that will add the most value in terms of effort and available resources. Also optimize the existing built-capacity (industrial plants, power stations, petroleum refineries, etc) and grow the skills accordingly. For example, while attempting to develop the potential from oil and gas resources, what must be done is to link the industry to Nigerian universities, scientific and Research institutes. Note that we first need to establish a strong foundation on technology learning, starting from the primary and secondary school levels, in order to sensitize the young minds that would potentially choose engineering as a career. That way, we shall be able to build capacity in the relevant

skills and add value to products in Nigeria's entrepreneurship in the oil and gas sector as well as other critical aspects of the economy.

6. Build on the pedestal of the Nigerian Content Development (NCD). The Nigerian (local) Content policy challenges both Private and Public Sectors of the economy to utilize the services of Nigerians and locally produced available equipment and materials to deliver projects. Reskilling of Engineers will support the successful implementation of the NCD in various ways and should be given priority in both NSE and COREN agenda. Sharing the GCA Energy Limited Experience on NCD implementation at the 2014 Local Content Workshop, Adams A. Mamadu^{ix} acknowledged that "Driven by the aphorism that NCD cannot have happened without internally developing the capacity of staff, the training and retraining of staff is given a premium consideration".
7. Continue to partner with Government and contribute to legislative changes that support the economic growth of the nation. Recently, the Nigerian Society of Engineers created e-groups involving Fellows of the society to address burning issues in some identified sectors of the economy. Each group is expected to brainstorm and produce a professionally-articulated Position Paper on the state of the sector and the way forward. To achieve good results, we must continually update ourselves with the right underpinning knowledge and skills on each subject matter.

Expectation for growth in the new frontiers

In order to keep pace with emerging changes, Nigerian Engineers are expected to move from over relying on conventional energy sources and delve into new frontiers of energy development, e.g. clean and renewable energy technology. Experts are of the view that "Many of the other technologies are currently only deployed in specific regions, depending on the characteristics of the technology and local policy support. However, in line with the continued growth in clean energy investment, the geographic spread of the technologies is likely to increase in the future into countries such as Brazil, South Africa and South Korea" (WEC 2013 Cost of Energy Technologies, pp39). The national aspiration is for Nigeria to belong to this block of countries, having been identified one of the largest growing economies in Africa. Evidently, Nigerian Engineers are positioned to support new technology development in the energy sector.

Conclusion

As Nigerian Engineers have the challenging task of critically examining contemporary problems facing the nation and come up with feasible solutions^x the actual delivery can be enhanced by training, retraining and reskilling themselves. The reskilling^{xi} process involves supporting one another, learning from one another, learning from experiences and incidents in the public domain for the benefit of NSE and the growth of the nation. To become relevant in all of this, Nigerian Engineers need to embark on continual learning

improvements, individually and as a professional group. In their engineering practices, they must be seen neither as ‘consumer professionals’ nor passive members of the society. Instead, they encouraged to be productive and respond to emerging changes with an informed power of knowledge to support creativity and innovation – together, we can achieve it.

ⁱ Reskilling – “If you reskill, or if someone reskills you, you learn new skills, so you can do a different job or do your old job in a different way.’ (British, Business)

ⁱⁱ Skill – the ability to use one's knowledge effectively and readily in execution or performance b : dexterity or coordination especially in the execution of learned physical tasks. 3 : a learned power of doing something competently : a developed aptitude or ability (Merriam Webster's 11th Collegiate Dictionary)

ⁱⁱⁱ Petroleum Development Fund (Nigeria's catalyst for sustainable capacity building in the oil & gas industry) – What you need to know about PTDF., www.ptdf.gov.org

^{iv} Isoun, Turner T (Prof) with Isoun, Miriam J: Why run before learning to walk? Reflections on High Technology as a strategic Tool for development in Nigeria, BookBuilders * Editions Africa, Ibadan Nigeria, 2013; pp 281.

^v Irabor, Patrick S.A; Solid Mineral Resources and Local Engineering Capacity Utilization:- Federal Institute of Industrial Research, Oshodi (FIRO's) experience - a keynote lecture presentation at the 2014 Nigerian Content Workshop & Exhibition alongside the COREN Assembly, International Conference Centre, Abuja Aug 19-21, 2014, brochure pp 9.

^{vi} Nigerian Content Definition: “...the quantum of composite value added or created in the Nigerian Economy through the utilization of Nigerian human and material resources for the provision of goods and services to the petroleum industry. Such goods and services must be within acceptable quality, health, safety and environmental standards in order to stimulate the development of indigenous capabilities”

^{vii} Gaines, Jeremy: Nigeria 1960-2010, The Shell Petroleum Development Company (SPDC) of Nigeria Ltd, ISBN 978-3-00-033717-8, pp 152.

^{viii} World Energy Council: World Energy Perspective – cost of energy Perspectives (WEC_J1143_costoftechnologies_021013_web_final.pdf), worldenergy.org

LCOE – the USD/MWh price for an inflation-adjusted, fixed-price off-take agreement that, taking into account all project-specific costs, offers the sponsor and/or project developer the minimum equity return to undertake the project.

^{ix} Mamadu, Adams A: The GCA energy Limited Experience – Focus on Gasket Production; NSE/PTDF Local Content Workshop - Theme: Local Engineering Capabilities and Capacity Utilization, Abuja, 21st August 2014, brochure pp 15.

^x Gemade, B.A.I: an address by the Honourable Secretary of Works and Housing, Council for the Regulation of Engineering in Nigeria (COREN) Proceedings of the First National Engineering Assembly, Lagos, 26th March 1993; pp 10.

^{xi} Reskilling – the process of learning new skills so you can do a different job, or of training people to do a different job. Employees need to buy into their own reskilling rather than having it forced upon them. (Cambride Dictionaries online).