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Engineering innovation and industrial development

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Abstract

Nigeria remains underdeveloped fifty two years after colonial rule exporting primary raw materials and depending on imports of everything including even the debasing second hand goods. This paper examines the capacity of engineering innovation to transform the economy. Approach of successive governments was analysed. A linkage was traced between engineering innovation industrialisation and the nation's wellbeing. We conclude that power and the attitude of the people affect engineering innovation and industrial development.

1. Introduction

The primary purpose of engineering innovation is to provide product design and engineering to manufacturers of consumer goods. During the past one hundred years society has been transformed by the efforts and magnificent accomplishments of engineers. We presently celebrate feats like the locomotive, the automobile, the aeroplane, electricity, refrigeration and air-conditioning, radio and television, supercomputers and internet to mention a few. Topping the list is electricity which is perhaps the greatest invention without which other innovations would have been impossible. Abundant and available electric power helped the developed economies to achieve the great economic feats.

Refrigeration and air-conditioning have greatly improved the quality of life and have helped us to preserve and distribute food that would have perished. Radio and television and lately, cable television have reduced the world to a small village readily accessed with the touch of a button. We have witnessed a tremendous achievement in satellite technology making telephony common place and further reducing the world to an electronic village. It is taken for granted as viewers all over the world watched the American elections in real time. Where in Nigeria is the present march to innovation revolution? Nigerians are conspicuous consumers unperturbed by the fact that the country has not contributed in anyway to transform the lives of people positively. Today, Nigeria exports only primary raw materials – an index of underdevelopment. How can Nigeria defend her unusually cold response to a world that is in a hurry? My Russian teacher once said

“Nigeria, plenty talk no do”. Forty years after, this has remained terribly true. Whither Nigeria?

Engineering is the profession in which a knowledge of the mathematical and natural sciences, gained by study, experience, and practice, is applied with judgment to develop ways to economically utilize, the materials and forces of nature for the benefit of mankind (ABET, 1993). Dahlman (1980) defined technology as the inherent or acquired capability possessed by people and/or institutions which enables them to convert available inputs into desired outputs at maximum efficiency level. We therefore articulate that engineering technology has three components – skills, knowledge and tools. In the Nigerian context, we ask if these three components are present. If we are in the affirmative, where did things go wrong that the entire system is suffering serious decay? The objective of this paper is to outline the issues that took us to the present level and to proffer solutions

Human development requires expanding people's capabilities for living decent lives and enhancing their opportunities for economic, social and political empowerment. Human capabilities are enhanced through education, skills development, and socio-cultural changes to innovate products that are required for health and other human needs to improve their quality of life.

In the words of the Lagos Plan of Action (LPA 1980), industrialisation constitutes “a fundamental option in the total range of activities aimed at freeing Africa from underdevelopment and economic dependency”. The industrial development policy pursued in most African countries after their decolonisation was billed as catch-up industrialisation. By that they did not



mean catching up on the industrialised nation's route to development, but rather emulating their level of development. The long and laborious path that had led to this level was to be leapfrogged at one bound. This strategy has failed.

With minimal capital and maximum labour input, limited and mostly handed-down commercial and technical knowledge, using easily procurable tools and locally available raw materials, local innovators produced goods and provided services for the local people. Local experiences existed in Awka, Bida and some parts of Yoruba land where blacksmiths provided for the needs of local farmers. However, most of the new governments did not recognise and promote these activities as the starting point for development. Instead, they saw them as being backward and crude and subjected them to discrimination and marginalisation.

The governments, their advisors and financiers pursued a different strategy. In the expectation that leapfrogging development by introducing state-of-the-art technology would have greater impacts than replicating the European path to it, they ensured that the most up-to-date production technologies were transferred to Africa from the industrialised nations. At the same time, the African governments created rules and regulations and promotion instruments which favoured and subsidised the import of everything while discriminating, criminalising, and persecuting the local efforts which they claim are illicit. The protagonists of this model of modernisation strategy, however, were disappointed. Importing state-of-the-art production plants merely created islands of modernity in a sea of handed-down imperfection.

Modern installations depend on the reliable provision of power, communications and other infrastructural services, and in the Nigerian environment there were too many supply bottlenecks. Their technology is so sensitive that it required only raw materials, fuels, spare parts, maintenance and repair services that meet the highest technical demands, which were not available in-country.

2. Local content

The Federal Government's aspiration to achieve 70 per cent local content in the oil and gas sector by 2010 was not feasible, due to poor compliance with the guidelines governing the Local Content policy by most International Oil Companies (IOCs) operating in the country. The Nigerian Content policy was initiated in 2006 by the Olusegun Obasanjo administration to help develop local capacity building in the Nigerian oil and gas sector, with a view to ensuring that Nigerians participated actively in the operations in the sector.

The government had directed oil companies operating in the country to commence in-country fabrication of equipment as well as other major components used in oil exploration. The government had reasoned that the implementation of the content policy would serve as a means of dissuading capital flight - and thus aspired that 45 per cent of total contractual jobs in the industry had to be done in Nigeria and 70 per cent of the jobs done in-country by 2010.

However, we are all witnesses to the serious hiccups resulting from lack of local content in the sector. To date, most of the contractual works involving engineering services, such as Front End Engineering Design, Detailed Engineering works, as well as materials procurement are still being done outside the country, contrary to the domiciliation guidelines issued by the Local Content Department (LCD) of the NNPC (Thisday on-line).

The government had hoped that local content development would ensure that the quantum or percentage of locally produced materials, personnel, goods and services rendered to the industry are increased, thereby generating more employment and economic empowerment. But this was not to be, as these multi-nationals preferred establishing Nigerian offices, which they used as cover-up, when the real services were rendered by foreign companies in Nigeria or off the shores of the country.

3. Power

Over 75% of the country still experiences constant power failure, which ranges from 4 to 5 days weekly. Reliable Electric Power supply continues to be one of the most essential factors in keeping an advantageous economy; especially for the small businesses all around the country to survive. Most of the economy problems in Nigeria rest on the inadequacy of the power sector. The attainment of a reliable Electric Power Supply in Nigeria



could immediately disentangle 60% of our poor economy issues. It is clear and simple that Nigeria as a nation will forever continue to struggle at very low standard unless something drastic was done right away to correct this deficiency. One of the possible solutions could be renewable energy instead of the continuous heavy investment on thermal generators.

4. Handling of waste

Accompanying population growth and the expansion of socio-economic activities, around the globe the demand for resources has increased, resulting in increases in the volume of waste as well as increasing diversity in the types of waste. Recycling is becoming a national habit, practiced by millions of people every day. However, recycling alone cannot end our dependency on landfills and incinerators, nor reverse the rapid depletion of our natural resources. As world population and consumption continue to rise, it is clear that our one-way system of extracting virgin resources to make packaging and products that will later be buried or burned is not sustainable. Zero Waste is a new way of looking at our waste stream. Instead of seeing used materials as garbage in need of disposal, discards are seen as valuable resources. A pile of "trash" represents jobs, financial opportunity, and raw material for new products. There is need to redesign products and manufacturing processes to meet the Zero Waste standards adopted by various countries.

"Each recycling step a community takes locally means more jobs, more business expenditures on supplies and services, and more money circulating in the local economy through spending and tax payments." In addition Zero Waste puts the responsibility for materials entering the waste stream on the front-end with the manufacturer, not on the consumer at the back-end of the product's life. The end result is that manufacturers redesign products to reduce material consumption and facilitate reuse, recycling and recovery.

5. Technology development

India has made commendable progress in terms of the growth of scientific and technological culture. Today, India has a vast pool of S&T infrastructure with over 800

technical institutions including around 200 universities. In addition, it already has a critical mass of cutting edge research through 400 national laboratories, over 1,300 in house R&D units in the corporate and other sectors. However, the environment and support system are not congenial for the faster commercialization of R&D outputs. There exists lot of delay in commercialization of R&D outputs and in majority of cases the R&D outputs do not get commercialized for want of initial investment, the needed environment and the networking. In the recent past, the Ministry of Science and Technology, Government of India has been focusing its attention towards this and initiated a number of programmes in order to plug the gaps cited above.

By training engineers and technologists and encouraging them to innovate by rewarding them generously with both real and psychic income, India has been able to compete in the world economy and thrive by trading high quality, high-tech products over international boundaries.

6. Entrepreneurial initiatives

The Science Park and similar initiatives in the developed countries are the latest in the evolutionary line to create an atmosphere for innovation and entrepreneurship; for active interaction between academics and industries; for sharing ideas, knowledge, experience and facilities for the development of new technologies and their rapid transfer to the end user.

The objectives of the initiative:

- To forge a close linkage between universities, academic and R&D institutions on the one hand and industry on the other
- To promote entrepreneurship among science and technology persons, many of whom were otherwise seeking jobs soon after their graduation
- To provide R&D support to the small-scale industry mostly through interaction with research institutions
- To promote innovation based enterprises

Facilities and services provided by the initiative:



- Offers facilities such as nursery sheds, testing and calibration facilities, precision tool room/central workshop, prototype development, business facilitation, computing, data bank, library and documentation, communication, seminar hall/conference room, common facilities such as phone, telex, fax, photocopying;
 - Offers services like testing and calibration, consultancy; training, research, prototype development/process development, human resource development (short-term courses), technical support services, business facilitation services, database and documentation services, quality assurance services and common utility services.
 - At present, there are around 3,000 incubators of various types operational in the world. In the United States, there are over 800 incubators including about 200 Internet incubators. Europe has about 1,000 incubators including 300 incubators in Germany. Among the developing countries, China leads with about 100 incubators.
- Among the industrializing countries, Republic of Korea is reported to have about 300 incubators. Currently, infrastructure for Prototype Development and business incubation services in Nigeria is weak. The concept of Business incubation is just picking up.
- Engineers and technologists should be adequately compensated. The Nigerian Society of Engineers has some job to do in this regard.
 - Universities and polytechnics should be centres of excellence and adequate linkage should be maintained with government and industries.
 - Engineering and technology students should be made to solve live national problems in their class assignments and projects.
 - Economic crimes that enslave Nigerians should be seriously tackled.
 - The country should adopt appropriate mechanisms for technology business incubation in order to nurture new enterprises and provide technical advisory services to SMEs.
 - Some external assistance from agencies like UNDP, UNIDO, should be sought under a broad framework.
 - Efforts should be made to initiate country exchange programmes with other developing countries to understand and complement mutual efforts in carrying out studies, assessment surveys, training and setting up of incubation mechanisms.

We conclude that lack of infrastructure and the attitude of the populace are necessary for engineering innovation and possible linkage to industrialization through technology business incubation.

7. Conclusions

- Industries should be cited in rural communities to halt the rural-urban drift.
- More emphasis should be placed on engineering design and fabrication
- Present day engineering should be geared towards solving current problems. While India is replacing two wheelers with affordable four wheelers, Nigerians should be saved from the harrowing experience of carrying four or even five passengers on motorcycles with the attendant carnage.

This kind of conference should take the bull by the horn. It should not be a talk shop. Meaningful and workable solutions to our problems must emerge. Covenant University should blaze the trail as the Nigerian foremost private engineering university. A situation where everything from toys to air conditioners and passenger cars and trucks are imported from Asia is disturbing not to even talk of the dehumanizing “Tokunbo” and “Belgium” products. Pardon me for being so passionate and emotional but we have no choice if we are to refocus our national innovative ingenuity.

Thank you for giving me this opportunity to scrape the tip of the iceberg. I rest my case by saying that our problem though enormous is not insurmountable.

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