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Engineering Education in Nigeria: The Challenges and Recommendations

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Abstract: *This paper examines Engineering Education in Nigeria as a catalyst for national economic and infrastructural development. The present near collapse of economy in form of recession in Nigeria, is the consequence arising from negligence of Engineering Education in Nigeria. Challenges facing Engineering Education in Nigeria were identified and discussed clearly. This was followed by few recommendations that will help curb the ugly monster crippling the effectiveness of Engineering Education in Nigeria. The aim of this work will be achieved, if the issues raised here are treated with all sense of urgency by the regulatory bodies set up by government to monitor and regulate Engineering activities and Engineer administrators such as deans of engineering faculties in our institutions. Nigeria will be launched back to path greatness if there is a deliberate effort to revive the processes involve in Engineering Education.*

Keywords: *Challenges, Engineering, Education, Nigeria*

INTRODUCTION

Engineering Education is the activity of teaching knowledge and principles related to the professional practice of Engineering. This profession have given us the world we live in. It is incredibly diverse activities covering many different areas and levels. UNESCO report (2010) defined Engineering as the field or discipline, practice, profession and act 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. Over the years, Engineering Education has been neglected by government in so many ways. The nation at large has taken the profession as a second class profession. This invariably has driven the nation into its economic recession. The bodies charged with regulating Engineering Education directly or indirectly in Nigeria are the National University Commission (NUC), National Board for Technical Education (NBTE), and Council for the Regulation of Engineering in Nigeria (COREN). These bodies involve in evaluation of Engineering Education program. Data required for the evaluation ranges from academic content information, philosophies and objectives of program, curriculum content, admission into program, academic regulations, evaluation of students work,

practils and project works, examination standard and staffing, physical facilities such as laboratory, classrooms, offices, safety and environmental sanitation, funding of the program by the universities, administration pattern in the faculty, library facilities, employer rating and so on. The outcome of above criteria determines the status of accreditation. Non imposition of uniform curricula is a clog on the wheel of progress of Engineering Education in Nigeria. It was worsened as it was reported in NUC bulletin volume II No 44 published online on 7th Nov. 2016. In the report, the NUC executive secretary Prof Rasheed reiterated that NUC will not impose uniform curricula in Nigeria Universities. He further explained that the commission prescribes a minimum academic standard as contained in the Benchmark Minimum Academic Standards (BMAS) document for each program beneath which universities must not go in offering degrees. He stressed that it was to allow for flexibility, creativity and different interpretations and adaptation to local conditions. (NUC Bulletin, 2016)

Ajimotokan e tal 2010 "the quest for the sustainable national development and growth as envisaged is dependent on the extent to which Engineering Education is revamped and transformed to compete globally. Engineering Education is so momentous and should be spiritedly pursued, to fully exploit the available possibilities for promoting sound Engineering Education and sustain development. It is one thing to have an enabling environment and it is another to maximize the opportunities.

The key driver to drive Nigeria out of it economic dark path is conscious positive regards for Engineering Education as this has an inherent potential to deliver sound minded Engineering personnel who will man various sectors of the economy to promote global competition involving locally designed and produced products in Nigeria. Engineering Education in Nigeria should not be time programmed activity rather it should be an activity that is round the clock based to give room for proper research and digestion of the knowledge acquired from class room with practical projects. Never will it be bad, if students are granted unhindered access to the studios, laboratories and workshops at odd hours to enable them have full time in projects. The idea of specialization at the termination of Engineering Education program is of great concern. How much specialized technical details can one acquire within an academic year as is been done in most institutions offering Engineering program in Nigeria.

Engineering is responsible for technological development that has created our modern society; they have built infrastructure, industrial production, mechanized agriculture, modern transportation systems, and technological innovations such as mass media, computers and communication systems. Technological development is continuing at an ever-increasing pace, especially in new areas such as information and communication technology, nanotechnology and biotechnology. These developments are exciting, require increased engineering capacity and deserve public acclaim. Technological innovations have created wealth, facilitated our life and provided comfort. (UNESCO, 2010)

The training of Engineers in Nigeria is based on the traditional model of theory and practice in the university followed by 4 years pupilage attachment in the field to acquire necessary Engineering experience. (Akintola, Aderounmu & Owolarafe, 2002)

Ojiako (1986) identified problems facing Engineering Education as low entry standards, non-uniformity in entry process for all engineering faculties, moderate academic quality of entrant for the profession. Kudos to the current team members in charge of setting requirement for admitting engineering students. Presently, a pass level in O'level English is not acceptable for admission into any branch of engineering in Nigeria. Engineering is a profession of highly talented and analytical few in any society. We are in technology dependent age and technology without Engineering will be a national technical disaster. It is of great concern the dwindling standard of Engineering Education in Nigeria. The condition get worse day by day and it reflects in our decaying infrastructures and facilities. Advancement of the society is directly proportional to the quality of Engineering Education. On average, it takes 5 years to train an Engineering graduate in Nigeria high institutions plus the 1 year compulsory national youth service corps, after which a minimum of 4 years post graduate experience is required by law before he/she will be qualify to be licensed and operate as a

certified Engineer. This makes the Engineers the only professionals in Nigeria with the longest training period of 10 years or more with a very poor remuneration. Engineering in Nigeria is made up of a family known as Engineering family which comprises of the Engineers, Engineering Technologist, Engineering Technicians and Engineering Craftsmen. The formal institution training routes for Engineering Personnel are summarized below in the table.

Table 1: Categories of Engineering Personnel's, Regulatory Bodies, Training Institutions, Qualifications and Their Associations

Engineering Personnel	Training Institutions Regulatory Bodies	Training Institution	Qualification	Association of the Engineering Personnel
Engineers	NUC and COREN	University	B.Eng or (HND +PGD)	The Nigerian Society of Engineers (NSE)
Engineering Technologist	NBTE and COREN	Polytechnic	HND	The Nigerian Association of Technologists in Engineering (NATE)
Engineering Technicians	NBTE and COREN	Polytechnic	ND, Advanced City and Guilds Cert.	The Nigerian Association of Engineering Technicians (NISET)
Engineering Craftsmen	NBTE and COREN	Technical Collage	NABTEB, WAEC, NECO, City and Guilds Cert. or it equivalents.	The Nigerian Association of Engineering Craftsmen (NAEC)

Engineering Education usually connects social needs with innovation and commercial applications as it cuts across a vast diversity. How will Nigeria develop, when the education of professionals who create wealth for the nation is considered less important? Companies now feel less concern about the research output of our Engineering Education. Nigeria need her own Engineering Education system designed with due considerations to her background and social limitations and in consonant with her national objectives.

Methodology

A careful observation was made during our days of training as young Engineering undergraduates, our post graduate Engineering works and 6 universities, 6 polytechnics and 6 technical colleges offering Engineering Education in the six geo-political zones in Nigeria. Furthermore, verbal interviews were conducted on students and lecturers within faculties of Engineering, with a brainstorming session involving the team.

Discussions

Challenges Facing Engineering Education in Nigeria

Below are various challenges facing Engineering Education in Nigeria Institutions?

Bribing of Lecturers by Students: Bribe is a cancer that usually alters the sense of judgment of the giver and receiver as well. A bribe taker sees white and calls it black purposely. This is never good for engineering profession as the profession activities deals with human life and health directly or indirectly. An Engineering student who gives bribe to enhance his\her course grade has no regard for standards and values of Engineering. Isolation of standards and code of ethics in Engineering will lead to chaos environment were anything goes. Bribe taking is now a common occurrence in our education system as it is not peculiar to Engineering faculties. Literally in Nigeria, "Bribe is valued more than Brain". It is either the students' gives or the lecturers request for it. This monster called bribe comes in various forms such as cash, kind, gifts and so on.

Short Duration of Project Design and Participation: Intense academic project work is always given a serious look at the last semester of the final year. This has led a kind of crashed project designs done by student.

There are situations where students start and realize an academic project within one month. It raises serious concern, if the academic projects are research based geared to solve perceived challenges or a grade based academic projects aimed at grading students. This explains the reason why students, institutions, factories and industries are having a disconnect.

NYSC Service Posting of Engineering Graduates to Secondary and Primary Schools: National Youth Service Corps is a Federal Government Organization in charge of organizing one year compulsory service to our nation by all graduates below the age of 30 years exception of those above that age. What gains in terms of practical experiences will Engineering graduates acquire from secondary and primary schools as classroom teachers? A nation desirous of industrialization now forcefully post it young engineering manpower to classrooms probably to teach Mathematics, Physics, Chemistry, Biology, Technical Drawing and so no. Will heaven be loosed if they are posted to industries, ministries, private engineering consultants? Personally I feel this one year of service in secondary or primary schools is one year of technical brain reduction and redundancy.

Use of Obsolete Scheme of Work and Equipment: Obsolete Scheme of work is a known issue in most of our institutions. Technical challenges that are outdated are still used to teach young engineering students. The world has advanced in use of modern software tool, analyzers and so on. However, most lecturers and laboratory instructors are not conversant with modern approach to engineering. Operating in isolation as a nation will launch Nigeria into economic and technical blindness.

Poor Remuneration of Engineer Lecturers in Nigeria Institutions: Lecturers of Engineering background are paid poorly when compared with other professionals. This weakens the moral of lecturers engage in teaching Engineering undergraduates. Knowing well that they are not paid well, students look down on them often. What usually dwell in the mind of most are negative alternatives to meet up with the payment of their bills and other responsibilities. An unsettled mind sees research as a time wasting ventures that yields nothing positive. Many Engineer lecturers are denied their allowances. A typical example is the November 2016 warning strike embarked by Academic Staff Union of Universities (ASUU), which was as a result of unpaid allowances, arrears and bridge of agreement between them and Federal Government of Nigeria.

Unstable Power Supply in our Institution: Epileptic power supply is a critical challenge nationwide and this have in so many ways paralyzed the activities in our Engineering faculties. There are regular cases of suspension of laboratory or workshop practical due to unannounced power outage or power surge. This scenario often promotes inconsistency of research results, time and material wastages, equipment deterioration, damped staff moral and many more. Unstable power voltage is another serious issue that affects most devices used in engineering training practical.

Under Staffing and Poor Office Environment: Quality of thought has to do with environment. Some Offices in our Engineering faculties are not well vented and designed for office purpose. There are cases three to four senior lecturers share an office space. In such cases, how will confidential documents be kept safely? Engineering training environ should be a serene one unlike what we see every day. The pattern of independent power source for different department within the faculty promotes heavy noise within the environment. Generating power plants are even kept very close to offices thereby making the entropy of office environment high and unconducieve for human beings. Staff/Student ratio is below acceptable limit in most institutions. Cases abound were a teaching staff handles 10 or more courses in a semester at different department and levels with a class not less than 250 students per level.

Non Flexibility of Training Periods and Patterns: By Nigeria public service rule, official work hour ranges from 8:00am-4:00pm daily. This does not suite well with practical research work that needs minute to minute observation over a long period without break. Situation abounds when laboratory attendants shut the laboratory doors and windows once it is 4:00pm. Weekends are written off for laboratory attendants as they see it as off their official responsibilities. There should be a degree of flexibility in training periods, patterns

so that engineering training could be carried on even at odd hours, and days for those engaged in crucial research activities.

Zero Access to Public Internet Facilities by Students and Instructors: Often times engineering students pay for their personal internet facilities while in school. This is never a healthy approach to making engineering education accessible to the poor and rich for the development of the society. Such public facilities will aid students in no small measure to link them to the global network of engineering innovations that is of great importance.

Diversion of Industrial Training Fund Allowance of Engineering Students on Industrial Training: ITF is a government arm that coordinates industrial training for students and equally oversees the payment of their allowances. The industrial Training could be for a period of two months, four months, six months or one year as the case may be. However, not all industrial training periods attract such allowances. Corruption has found its way into the payment of the allowance. Many students were not paid after such training periods, some were underpaid even when the money was budgeted for and capture in the annual budget of the nation. The presence of corruption dampens a willing mind and directly limits the engineering knowledge supposedly to be acquired during the industrial training period.

Pretence during Accreditation Exercises in Institutions: Accreditation exercise is an exercise that ought to expose the true status and quality of an Engineering program. There are three bodies specifically empowered by law to accredit and monitor Engineering programs in Nigeria namely the National University Commission (NUC), National Board for Technical Education (NBTE) and Council for the Regulation of Engineering in Nigeria (COREN). Often times Engineering departments pretend to have facilities needed to run engineering program. They go as far as hiring equipment, manpower and office space to give an impression that standards are kept. Names of the departments are engraved temporarily on the hired equipment to deceive an assessor. This ugly trend covers the actual need for such equipment.

Recommendations

These are some recommendations in this work that will aid in improving Engineering Education in Nigeria.

- ✓ Adequate Practical teaching aids and conducive environment should be in place.
- ✓ Academic Project Topics should be assign to students earlier, like in 300 level to be realized at their final year to avoid rush at the last hour.
- ✓ NYSC Corps Members of Engineering background should be posted to their core area of specialization to avert brain drain.
- ✓ There should be conscious effort to review equipment, tool and facilities state with a view of identifying obsolete ones for replacement.
- ✓ Admission of Engineering Students at all cadres should be based on ratio of engineering personnel needed in a project site.
- ✓ There should be centralized examination ones or twice for all Engineering Students to write. The Students in Universities will have a common examination according to their levels and students in Polytechnics and Technical Collages will have theirs as well.
- ✓ Pretence such as hiring of equipment, office space, laboratories, workshops and manpower during accreditations should be discouraged.
- ✓ Upward review of Funding in form of research grants, aids and scholarships for Faculties of Engineering and its departments. More funding is crucial for a better Engineering Education.
- ✓ Reorientation of Academic Personnel's and students on the importance of best global Engineering Practices.
- ✓ Proper Spelt out consequences of taking and giving bribes of any kind by any one engaged in Engineering Education.

- ✓ There should be regular workshops, conferences, seminar, symposium, talk show and exhibitions for academic personnel and students.
- ✓ Regular and stable Voltage Power supply with free internet facilities should be made available at all corner within the faculties of Engineering.
- ✓ Staff\Student ratio should be enhanced to guarantee optimum performance.
- ✓ Students under engineering faculties should have dedicated hostels for maximum concentration and cooperation.
- ✓ IT allowance for Engineering Students should be enhanced and paid to them as at when due to motivate them to engage in real IT instead of faking the IT.
- ✓ Engineering Education should be all round the clock activities and at least one or more technologist and technician should always be on duty at periods such as nights, weekends, public holidays to aid students in terms of practical's and experimental works.

Conclusion

Engineering Education is a slow deliberate activities geared towards having a sound technical professionals in various areas of specialization. It is not a profession for get rich quick minders. If the above challenges identified are seriously attended to by adopting the above recommendations. Within a short period of time, engineering as a profession will be positioned as a first and foremost critical profession needed as a catalyst to drive Nigeria out of it current economic recession. In engineering education lies the tool needed to activate and create wealth for the teaming population of above 160 million Nigerians.

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