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## ENGINEERING AND TECHNOLOGICAL EDUCATION IN NIGERIA: CHALLENGES AND PROSPECTS

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### ABSTRACT

Technological advancement serves as a major key to a nation's development. On the other hand, proper engineering knowledge plays a major role in the attainment of a higher level of technological advancement. Most developing countries find it difficult to impart adequate knowledge and training to Engineers at different levels of training. An overview of the problems militating against proper Engineering Education in Nigeria is taken in this paper. This paper discusses Admission into Engineering programmes, Engineering students, Engineering curriculum, Engineering Laboratories, Engineering Lecturers, Funding of Engineering Education as well as Discrimination within the profession of Engineering. The paper recommends that Government should regularly review the National policy on science and technology with a view to identifying new developments towards making the training of Engineers and Technologists relevant.

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### INTRODUCTION

The origin of engineering education can be traced from two different distinct roots. First is the trade apprenticeship education where the trainees of the local trade program studied to advance their practical and theoretical knowledge of their various trades. The second root can be traced through the college or university that recognizes natural sciences which serves as a key point for specialization to an application in engineering (Booth, 2004).

The problems of engineering/technological education in Nigerian Universities and Polytechnics have been articulated by many stakeholders. The problems include the dearth of suitable teaching and technical personnel, low funding levels, inadequacy of infrastructural facilities, poor remuneration and low staff morale. It is widely held in institutions of higher learning that if appropriate level of funding is established and maintained, many of the other problems will cease to exist. The relatively unattractive remuneration package in the Universities /polytechnics has been the main impediment to staff sufficiency in the institutions. Highly qualified personnel would rather go to the oil and financial sectors where acceptable rates of pay are maintained. Thus, the few that drift to the universities hold the jobs as stop-gaps while the search for a more rewarding employment is continued. This breeds very high staff turn-over and an attendant decline in the quality of instruction.

Teaching and research effort are frustrated by the obsolescence of laboratory and workshop equipment, paucity and lack of current textbooks, journals and periodicals and a flawed admission process which often does not properly reward merit. To this end, this paper ventures into a novel approach aimed at repositioning Nigerian Engineering and Technological Education using the concept of strategic management to advocate a new dimension which will not only walk the nation out of its current and perennial problems of low productivity, insecurity and poverty, but will also bring to light the prospect of a nation that is blessed with abundant human and natural resources.

### ADMISSION INTO ENGINEERING PROGRAMMES

Admission processing plays a major role in determining the quality of engineering students as well as the quality of engineers eventually produced. Admission into Nigerian engineering faculties may be gained through the joint matriculation examination process or the direct entry route. In both cases,

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the candidate needs a minimum of five credit passes at two sittings of the GCE ordinary level to qualify for registration. Unfortunately, secondary education standards have fallen so badly over the years that many school certificate holders cannot speak three correct English sentences or pass O/level subjects at a sitting. Acceptance of five subjects at two sittings thus provides an avenue for poor students to gain admission into the engineering programmes.

The requirements for the direct entry admission are even less stringent-when compare to A/level passes at two sittings without the prescription of a maximum time lag between the first pass and the second. Thus a candidate can pass two such subjects after four or five yearly attempt to get admitted. This type of student is naturally weak and will not be able to cope with the intellectual requirements of the programme. To make progress in the course, may be resort to sharp practices and other forms of examination malpractices. The matriculation examination is, itself, not free of blemish. It is widely believe that most of the results published by the Joint Admission and Matriculation Board (JAMB) do not represent the actual performance of the candidates. Students whose continuous assessments through school and the senior secondary examination results have shown to be poor students often score ridiculously high marks and are offered admission at the expense of good students with moderate JAMB scores and excellent school certificate results. This informed the recent resolution at the National Summit on Education that admission to universities should no longer be based solely on the JAMB scores but that universities should be free to apply other assessment criteria to make selection. The current requirements for registration in engineering degree programmes in Nigeria are credit passes in English Languages, Physics, Chemistry, and Elementary or General Mathematics. Further Mathematics and Technical Drawing are not compulsory. Students with good grasp of both General and Further Mathematics have a much greater capacity to benefit from the engineering degree courses. Also, a good background in Technical Drawing at secondary school level is known to aid the rate of assimilation of Engineering Drawing in the University. It would appear therefore, desirable to make subjects further requirements for registration in engineering programmes.

### **ENGINEERING STUDENTS**

Adedokun, (2011) lamented that, it is quite embarrassing to discover that there are some graduate of such professional fields who never experience how to handle or touched tools throughout their programme and maintained if all engineering awarding institutions in Nigeria were to be holistically audited in terms of equipment, many graduates will have their certificates rejected or recalled. Atsumbe and Saba (2008) postulated that students undergoing engineering education in Nigeria should be exposed to the current edge technology machines during their programs for them to be able to develop emotional stability and self confidence in their respective places of work, this opportunity should be given to them during their students' industrial work experience scheme (SIWES) by allowing them with free access to handle machines in the industries.

### **ENGINEERING CURRICULUM**

The effectiveness of a program start with effective and adequate curriculum design that will guide and equip the student's skills needed in their respective area of specialization. The curriculum of engineering education is described as obsolete and needs to be thoroughly revived from time to time by the body concerned in order to meet the world standard and allow Nigerian graduate to compete globally. The curriculum should be able to create space to accommodate certain aspect of engineering applications that are prevalent in our environment today. The high level of re-training of graduates of engineering education by the industries signals the evidence of the curriculum inadequacies. Therefore, for engineering education to fully support economic growth, there should be provisions for the change of tools that is used in solving the problem as the problem is equally changing from time to time. This implies that engineering education curriculum should be flexible in nature, examined frequently and modified in order to accommodate certain societal needs (Kofoworola, 2003; Onwuka, 2009).

## **ENGINEERING LABORATORIES**

Laboratories works are designed to inculcate in the engineering students the ability to experiment and learn to confirm theories by experimentation. It teaches students that situations are never ideal and that a result may be affected by a myriad of factors over which the experimentalist may or may not have control. A student who misses the opportunity to experiment, therefore, is deprived of a most important component of his engineering education.

This is the dilemma faced today by most engineering students in Nigeria particularly, those in the first generation universities of Ibadan, Ife, Nsukka, Lagos and Benin. Laboratory equipment in these universities are obsolete or unserviceable. The few that are available are shared by an inordinately large number of students because of population explosion. In the circumstance, 15 students or more may congregate on one machine for an experiment. Only two or three of them participate actively in the assignment. The others copy the results from them without experiencing or understanding how they were obtained or derived.

The situation in the engineering faculties of some of the newer universities, particularly state universities is even worse. These faculties have no laboratory facilities at all. Their students do no experimental work yet they have been graduating students in engineering. This is a very bad situation indeed. The products of the programmes will have considerable difficulty relating what they learnt in the university with the reality of industry. Such graduates will require some special practical training to cure the inadequacies of their undergraduate studies.

## **ENGINEERING LECTURERS**

Adedokun (2011) and Shu'ara (2010) reported that the academic staff of tertiary institutions is haunted with low number of senior lecturers with PhD qualification which is seriously affecting engineering education in the country. The current situation is quite unhealthy for Nigerian tertiary institutions where majority of the academic staff belong to the junior cadre of Assistant lecturers, lecturers I, lecturers II who happened to be learning the ropes, these group of lecturers usually have master's degree with no much experience in research and most of them belong to the engineering faculties. The majority numbers of professors are getting close to retirement age and the gap that was created between the lower lecturers and the higher ranks created a vacuum that is difficult to fill in, and there are also some professors in engineering that are based abroad for greener pastures and refused to come back because of the poor remunerations. Owolabi and Rafiu (2010) described the lopsided attitude among the member of engineering professions by showing lack of professional commitment due to the poor leadership of the professional bodies which do not take the welfare and the condition of service of its members so seriously. This has generated a lot of setbacks in the area of engineering education in Nigeria.

## **DISCRIMINATION WITHIN THE PROFESSION OF ENGINEERING**

This is a major factor and source of imbalance which has for a long time affected the so desired professional relationship among the various cadres in the engineering family. In realty, the assertion of Prof. Segun Adesina in Odiagbe (2001) should form the basis of engineering education in Nigeria that is 'basic technological Development cannot be achieved in the universities. At this stage of our history, where production and mechanization are our problems, Polytechnic Education would appear better placed to tackle technical and development problems than University education. The discrimination between HND holders and the B.Sc in terms of remuneration should therefore be played down to meet the objective of the programme.

## **FUNDING OF ENGINEERING EDUCATION**

The quality of output from the tertiary institutions depends solely on proper funding of the sector by the bodies concerned for the profession of teaching, learning and research facilities. The indication on how a country gives priority to its education at all levels depends on the overall budget to education in relation to the overall resources allocation. The expenditure on education involves the total spending on academic institutions and other supporting educational services.

Funding in Nigeria involves all the three tiers of government namely; Federal, State and Local government. This also includes capital and recurrent expenditure of education sector along with Educational Trust Fund (ETF) as well as scholarship award by the federal, state and local government.

### **INSTITUTION-INDUSTRY RELATION:**

The industrial sector is the major consumer of the products from the tertiary institutions. There is therefore a need for adequate collaboration to ensure that the institution's produce graduates are diplomats who will fit into the industrial system. Although most developed economic in the world depends on private sector initiatives for the successes they have recorded, the education system should be able to produce the right caliber that will fit into their aspirations. –a stage we are yet to accomplish. To this end, Government should, among others, give consideration to the following:- Establishment of standard procedure for evaluating contribution of industrialists to technological development by providing incentives e.g. tax relief for such activities based on :-

- Number of students employed for SIWES
- Donations to tertiary institutions
- Sponsorship.

### **CONCLUSION**

Engineering education is indeed one of the strongest pillars of economic growth and national development of any nation. The current trend in engineering education in Nigeria has created a disparity between the quality of training received by the graduates vis-a-vis the employers expectation in the businesses and industries in the country despite its enormous resources.

According to Uujamhan 2001, Engineering education and practice must aim at:

- Creating and providing job for the masses
- Provide a versatile labour force that can change with changing technology
- Arrest young people and encourage older ones to pursue further studies
- Create a new citizenry that thinks globally, technically, economically and politically.

This paper looked at the challenges of Engineering and technological education in terms of admission, students; curriculum, funding, facilities, industrial relation as well as the discrimination between the Engineering profession with a view of suggesting the way forward.

### **RECOMMENDATIONS**

In order to achieve a quality Engineering Education in Nigeria, the areas that need redress are as follows:

#### **FUNDING: -**

This will reduce the huge investment involve in training engineers by evolving other participants to support the public sector through:

- Private sector
- Non-governmental organization
- Endowment
- Privatization
- Involvement of the industry through adaptive research

#### **ACCREDITATION OF PROGRAMMES: -**

The three supervisory agencies for the three categories of tertiary institutions in Nigeria now have as one of their primary objectives the need to ensure that quality of the academic content of the curricula is not diluted below a predetermined standard. To this end, periodic inspection and evaluation of the input to the system is conducted to ensure that standard are not compromised. These agencies are statutorily empowered to stop or withdraw the approval or accreditation of programmes which fall below standard at the time of the visit. Hence, the accreditation exercise has as its main focus, quality improvement. The management of the various institutions are through the



accreditation advised on ways of revitalizing their institutions with adequate staff, updated curriculum, admission requirement, academic regulations and other facilities.

### **DISCONTINUATION OF SATELLITE CAMPUSES:-**

the restrictions placed on establishment of tertiary educations in the name of satellite campuses by some of the institutions and private individuals was a welcomed development –a form distant learning programme was embraced by many of the applicants especially those, who for socio-economic reasons, would not like to lose their jobs. However, this development presented a challenge to the educational system as quality was usually compromised as most of the campuses operated without enough academic staff, physical facilities, library facilities and those admitted were deficient in admission requirements. This concern of government about the quality of the education informed the decision of the federal executive council to close down the campuses and established a powerful committee to ensure the implementation of the policy.

### **ROLE OF GOVERNMENT:-**

A unique edge of any nation over its competitors is a well- developed, dedicated and motivated human capital. Efforts of Government should focus on ensuring that available manpower is strategically positioned to match new competencies especially in these days of globalized economy.

(v)Role of Professional Bodies:- the professional bodies /institutes can provide the required link with the industry thereby making the training relevant. This can be done by:

- Provision of necessary environment for the linkage through interactions with the programmes in the school
- Bringing the industry needs to the Engineering Departments
- Assistance with the placement of Engineering trainees for industrial attachment
- Provision of seasoned professionals to participate in accreditation visitation to institutions
- Provision of experts to participate in the development and review of curriculum.

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