

# ENSURING EFFECTIVE ENGINEERING AND TECHNOLOGICAL EDUCATION IN NIGERIA: THE ROLE OF STATISTICS

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## ABSTRACT

Effective and proficient practice of any art or craft starts with appropriate training of the practitioner. Engineers and technologists can only be as good as their training background and the level of experience they have acquired. The level of information available to the trainer in the engineering and technological systems can significantly affect the output (human resource and products). It is therefore important to establish reliable and quantitative information on:

- the quality and quantity of trainees
- the quality and quantity of the trainers
- the quality and quantity of the facilities of training, and
- the expected utilization of the products (opportunities) or market demand of such products.

This paper takes a look at the difficulties in the training of engineers and technologists in some disciplines in Nigeria. Attention is given to the essence of training, which is the improvement in productivity and standard of living of the trainee. Issues dealing with the qualification and number of the trainers in any given discipline will be explored.

Counselling and its impact on successful career, as well as proper professional choice on the part of the trainee are also discussed. It is concluded that training requires the availability of reliable statistics on population and national socio-economic data to promote job satisfaction.

## 1. INTRODUCTION

It can be said without contradiction that availability of trained and skilled personnel will always positively contribute to and ensure a smooth economic and industrial development of any nation or people. Formal education is the primary contributor to any meaningful training of skilled personnel for industrialization. The 6-3-3-4 system of education was adopted in Nigeria to provide the formal training of her citizens. The system provides six years of primary education, three years of junior secondary education, three years of senior secondary education and four years of university or tertiary education. In the United States

of America, where the system was originated and is continuously used, there is evidence of particle skill acquisition for sustenance, maintenance, and expansion of her economic and industrial activities commensurate with the national security and social security policy objectives. Efficient production and managerial skills abound in the public and private sectors of the economy, thus generating employment, products' availability and reduction in the inflation rate and consumer price index.

In Nigeria, the dearth of qualified engineers and skilled technologists is the bane of her industrial growth and economic advancement. Critical shortage of highly skilled engineers and technologists was realized prior to Nigeria's Independence. United African Company (UAC) opened the first training school at Burutu in 1954. In 1958 the Shell-BP Petroleum Development Company established a trade school at Port Harcourt while Union Trading Company (UTC) opened a school for 30 motor mechanics in 1959 at Enugu (1). After independence and in the 70's, engineering was offered at Ahmadu Bello University, University of Lagos, and University of Nigeria Nsukka. These efforts were to provide the manpower requirement for the industrial modernization and expansion brought about by the oil boom. Skill training envisioned by public and private sectors encompassed formal education system, on-the-job training and non-formal systems. The mix provides the theoretical know-how, specialized/practical experience and updating of knowledge to remain current in the art. The goals of the training should include the following:

- creating an informed or knowledgeable population in the desired profession
- controlling factors of production (finance, raw materials, human resource and technology) for effective productivity and profit.
- Improving the standard of living of the people.

These objectives have not been achieved in Nigeria. Less than 50 per cent of the skilled manpower needed was available in 1977 (2). The situation has not improved according to the figures presented by the Central Bank of Nigeria (1996) for Registered Unemployment and vacancies declared and filled. The Report shows that on the average, there were 9 registered applicants per declared vacancy at the professional cadre, and only 0.2 per cent of the applicants were given placement between 1992 and 1996. The need for more trained professionals is even more acute today than it was in the 90s. Such training calls for availability of sufficient and qualified trainers and facilities.

## 2. ENGINEERING EDUCATION

The purpose of training an engineer is to enable him/her understand the basic and detailed requirements in the selection and use of engineering systems, machines and materials. The training will create confidence in the engineer or technologist in applying optimal use of available resources for production. There is therefore a strong need to have enough qualified trainers to give the required knowledge.

### 2.1 Availability of Trainers

Traditionally, engineering has been perceived as a profession for the highly intelligent groups, which must be proficient in Mathematics and the Sciences. Hence very few dared to train as engineers or as technologists, with male dominating. This gave rise to low turnover

of engineers compared to other professions such as law, medicine and the arts. The expansion of the economy and the eventual move from agrarian to industrial society created a wide gap between supply and demand of engineers. Graduates were given immediate placement with good conditions of service and incentives. Most engineers were therefore employed in the public and private sectors of the economy and being a lecturer was a distant consideration for most engineers. The lack of continuous entry into the teaching profession by engineers has been a strong limitation to programmes expansion within the engineering disciplines.

Most engineering disciplines are grossly understaffed for example, Chemical, Petroleum, Electrical/Electronics and Civil Engineering Departments in most Universities and Polytechnics are affected. Attractive conditions in the private sector lures the graduates from these disciplines away from the teaching career. In recognition of the fact that the trainee is as good as his trainer and the facilities used for the training, the National Universities Commission (NUC) adopted adequacy of academic staffing as one of the major criteria for the accreditation of academic programmes in Universities (4). Other considerations included physical facilities, and equipment and library books and journals.

There is limited data available on the staffing strength of engineering faculties. Okebukola (4) noted that there are currently 20,214 teachers in all Nigerian universities. The teacher/student ratio is given as 1:26 on the average. There are 299290 students enrolled in The sciences (Medicine, Engineering, Pharmacy, Zoology and Botany). The distribution of the students to specific disciplines would have provided a more useful tool for the determination and control of admission into the programmes. Failure to have such detailed Statistics beclouds the true staff strength in some disciplines in engineering. Musa (5) presented the situation in Chemical Engineering at Obafemi Awolowo University, University of Lagos, Lagos State University and Ladoke Akintola University of Technology which showed that the existing teacher/student ratios are 1:38, 1:49, 1:55 and 1:53 respectively. At the University of Uyo (Uniuyo), the situation is different in Chemical Engineering where the ratio stands at 1:12. For Petroleum Engineering it is 1: 14 while Mechanical Engineering is at 1:15. This optimal ratio can only be explained by the necessity to control the initial intake of students since the engineering programme is barely six years old at Uniuyo.

It is generally observed that Electrical/Electronics engineering, in most universities in Nigeria attract quite a large number of student enrollment but suffers from acute staff shortages. The staff/student ratio for this discipline could be expected to be worse than what is obtained in Chemical Engineering. The specialized training in most engineering disciplines minimizes the entry of quacks into the teaching profession. The quality of staff in the disciplines is expected to be high. With respect to formal trainers (teachers) in engineering, there is significant inadequacy in quantity with a dependable quality.

#### **Quantity and Quality of Facilities**

The facilities available in most universities are inadequate. It is difficult to see a university That has adequate classroom for lectures, laboratory equipment for practical, functional Machines in the workshops and a well-stocked library. This area requires urgent

intervention by both Government and the private sector since the cost implications are enormous and fall within capital expenditure. The cost implication for upgrading libraries and physical facilities in the individual universities in Nigeria was estimated by NUC during its recent accreditation exercise (4). The range is between N0.24 - N3.76 billion approximately. The cost is a function of age, programmes and population of staff and students in the Institutions. Science based programmes are more expensive in terms of the facilities needed to provide effective learning environment

The lack of adequate facilities in the institutions can not be compensated for by Students Industrial Work Experience Scheme (SIWES), in which the engineering student is exposed to the industry for 40 weeks during his undergraduate programme. The lack of facilities also affects postgraduate training as the student will not be able to do research at minimum cost and time. The effect on the staff (teacher) is not encouraging as staff research will be restricted by what is available or affordable. Hence, the quality of products manufactured (graduates) and manpower, will be deficient in the needed practical content. Organizations such as Mobil Producing Nigeria Unlimited - a subsidiary of Exxon Mobil as well as other multinationals have set up private learning centres to give their staff the needed orientation in the practical skills. The number of beneficiaries from such skill development centres could be enlarged if the facilities were available in the university. Kuye (6) advocates university-industry linkages in order to expand the skills of the graduates as well as improve staff research quality where the capacity to provide the facilities does not exist in the university.

### **2.3 Quality of Students in Engineering**

Engineering profession places a clout and premium on its practitioners. The reward comes through attractive remuneration or compensation while the fee is paid through faithful compliance with the ethics of the profession. Such a profession must have a dependable method of selecting its members and a continuous monitoring to ensure compliance with standard. Admission into any engineering discipline follows a rigid requirement of excellence in the basic sciences and Mathematics. These subjects (Mathematics, Chemistry, Physics) are seldom a favourite of most secondary school (high school) students. One must have credit passes in these subjects to be considered for admission. In addition, the candidate must meet the high cut-off score (point) in the Joint Admission and Matriculation Board examination (JAMB) in Nigeria. Candidates with strong potential to succeed can be selected if the admissions guidelines are strictly followed. The number of applicants for admission into engineering in the Nation's universities is increasing yearly. It is therefore possible to place candidates with high potential to succeed.

### **3.0 EMPLOYMENT OPPORTUNITIES FOR ENGINEERING GRADUATES**

The trained engineer is equipped with skills and knowledge to create wealth and comfort. Training therefore implies opportunity for employing the skills, utilization of the available manpower. Planned engineering education will consider the available job market for the trainee on graduation. It is also important not to create excess supply which will bring the price (wages) down. Organizations with vacancies for trained engineers in Nigeria can not be easily identified and the available vacancies quantified. Statistics of unemployed

engineering graduate is not widely available or circulated. Government has in the recent past called for the registration of unemployed persons in Nigeria. The true figures of the unemployed and the skills acquired may not be known. However, Government created the National Directorate of Employment (NDE) with the mandate to create jobs and develop the skills needed for placement of the unemployed in existing vacancies or encourage entrepreneurship or self employment. Many laudable programmes of Government, such as Better Life for the Rural Women, Family Support Programme and Poverty Alleviation Programmes, were created to provide employment to the youths and graduates of the nation's universities. Most of these programmes could not achieve their set objectives because distinct statistics on skills and corresponding jobs available or to be created are not known. The commonly accepted fact is that there is a significant short fall in available engineering and technical manpower available in Nigeria.

Table 1 is adopted from the (CBN) Central Bank of Nigeria Annual Report 1996 (3) to portray the employment situation for skilled manpower in Nigeria from 1992 to 1996. The total number of unemployed persons (professionals and executives) are given for the period. It will be assumed here that the professionals and executives have acquired the minimum skills needed for their performance on the job. The number of registered persons is seen to be decreasing and the reason given is "disenchantment of job seekers about the ability of employment exchanges in getting them suitable employment" (3). Within the same period, declared vacancies could not be filled by the job seekers given an average of 10 job seekers to a declared vacancy. The percentage placement indicates that an average of 0.02 placement was made each year out of 10 applications for the job (0.2 persons placed) This would simply mean that the applicants did not qualify for the job. Then one would ask if it could be due to lack of skills. But these are professionals and executives. Could the vacancies be filled by internal candidates, therefore excluding the external applicants (registered unemployed)? There is a gradual increase in the declared vacancy each succeeding year. Finally it could be asked if the vacancies declared were backed up with the necessary budgetary provisions to enable placement, i.e., do these vacancies actually exist? The report indicates that in 1996, the annual unemployment rate was 3.8 per cent while under employment was 11.2 and 20.6 per cent for the urban and rural areas respectively. The trained and skilled job seeker is engaged in work activities irrelevant to his training. One would like to believe that engineers and technologist are among the underemployed thus exaggerating the shortage of manpower in engineering. Without specific statistics on available job opportunities for engineers or any other profession, the number of manpower to be trained would be at best arbitrary. This will have adverse effect on admission (enrolment) and the quality of training.

#### 4. CONCLUSION

Engineering education requires quality control in the enrolment of students to ensure their eventual success in the profession. The quality of training must also guarantee acceptability in the job market. Unemployment and under-employment adversely affect the engineering profession if available job statistics are not adopted in the planning of engineering training.

Presently available data is not in readily useable form and will require re-organization into specific disciplines to make it relevant to engineering education.

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**Table 1**  
Registered Unemployment and Vacancies Declared (Professionals and Executives)

S/No CATEGORY	1992(1)	1993(2)	1994(3)	1995(4)	1996(5)
*1. Total Registration	34,185	34,074	34,012	33,927	30,467
*2. Vacancies Declared	3,347	3,401	3,731	3,839	3,694
*3. Placements	141	79	78	61	72
*4. No. Registered/Vacancy	10	10	9	9	8
*5. % Placement	4.2	2.3	2.1	1.6	2.0
*6. % Reduction in Unemployment	0.4	0.2	0.2	0.2	0.2

\*SOURCE: CBN Annual Report 1996, p. 126