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**ENGINEER EDUCATION: DISCIPLINARY PREFERENCES IN THE FACULTY OF  
ENGINEERING UNIVERSITY OF DAR ES SALAAM**

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**ABSTRACT**

Most practising engineers can hardly recall the days they had to make up their minds on whether engineering was their chosen career. This decision may have been approached with ignorance and very high expectations. Later after registering in a Faculty of Engineering the freshman was given a chance to choose a department; sometimes this had already been done for him by his sponsors so all he had to do was to walk into the preselected department.

A generation later, University entrants are faced with a similar predicament. This paper high-lights the procedures involved and proceeds to recommend the necessary fundamental changes in future.

**BACKGROUND**

Prior to the establishment of the Faculty of Engineering in Dar es Salaam, the majority of Tanzania's Engineers were trained in the University College, Nairobi. Normally the government and big employers such as Railways & Harbours would select eligible engineering candidates and sponsor them to study in Nairobi. This went on for about 10 years and then the Tanzania government decided that the quota of 10 - 20 annual output from the University of Nairobi would never satisfy the national requirement for engineers. Once the decision to establish a Faculty of Engineering in Dar es Salaam was reached, a Working Party was appointed in 1968 to evaluate the proposal. In 1970 three consultants were appointed to look into the details of setting up a new Faculty of Engineering.

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In July 1973 the first intake of 61 students was admitted into the Faculty. This batch completed their four years training and graduated in 1977. Most of these are by now responsible engineers in industry.

### NATIONAL MANPOWER REQUIREMENTS

The various estimates of Engineering manpower requirements can only serve as indicators since there is so far no scientific manpower planning program in operation in the country. The estimated demand of engineers for the period 1975-85 is summarized in Table 1 below.

Table 1. Estimated demand of engineers

Type of Engineer	Increase of Posts 75-85	Tanzanianization of Posts	Wastage	Requirement Total
Civil	310	223	67	730
Mechanical	508	196	91	990
Electrical	208	85	32	394

A rough estimate of the output of graduate engineers for the period 1975/85 was 1000 from Faculty of Engineering Dar es Salaam and 500 trained abroad. This left a deficit of more than 600 on the demand of 2100. Currently the deficit is put at 100 engineers annually i.e. whereas the demand by Ministry of Manpower Planning is 280 engineers, the Faculty of Engineering only manages to train 180. It will be noted that the ministry's demand does not include the private sector demand.

### STUDENT ADMISSION TO FOE

The Faculty of Engineering draws its intake from three main sources namely:

- (a) direct Form VI school leavers
- (b) Engineering FTC or its equivalent holders and
- (c) Mature Age Exam. candidates.

Admission into the B.Sc. (Eng.) course is always on a competitive basis due to over-subscription by eligible candidates. Presently the cut-off point is higher than in most other professional courses. Candidates in category (a) would be expected to have at least a B and C in relevant subjects i.e. 7 points to be considered for admission. The minimum entry requirement is 4 points or two Ds in relevant subjects.

## **ENGINEERING CURRICULUM**

The B.Sc.(Eng.) program is a 4 year course. The 1st. year of study is common to all students irrespective of the disciplines into which they will finally be subdivided in subsequent years. The academic years consist of three teaching terms of 10 weeks each or 30 weeks per academic year. At the end of the 1st., 2nd and 3rd year of study, each student is allocated to suitable industry/site for 8 weeks to receive practical training in industry.

### **THE FRESHMAN YEAR**

All new students in engineering have common courses for two terms. Out of the 30 weekly contact hours, 14 hours are devoted to workshop training. The rest of the time they attend lectures in Fundamentals of Engineering, Engineering Drawing, Development studies, Mathematics, Mechanics, Chemistry and Fundamentals of Electrical technology.

In the 3rd. teaching term, the students start to branch out. Teaching of subjects like Engineering Drawing is done in two groups: civil engineering drawing and electromechanical engineering drawing. However, workshop training continue to be a common course occupying half of the total instruction time.

The teaching of common subjects for at least two terms has been found necessary due to the freshmen's poor background in engineering subjects.

Most students have their first lecture in engineering drawing at the faculty. The idea of allocating students to the various disciplines in the 1st or 2nd term of study can only be considered after the reinforcement of the engineering curriculum in secondary schools.

### **DEPARTMENTAL ALLOCATION**

The exercise of assigning students to the various faculty departments is normally conducted at the end of the 2nd term of the freshman year.

All the students are normally asked to indicate the department they would like to join on successful completion of their 1st. year of study. It is at this point hoped, that after staying at the Faculty of Engineering 20 weeks even those freshmen who did not know the difference between the various disciplines would by then have made up their minds.

In the allocation procedure the next step is to match the student preference numbers with those the departmental capacities.

The latter were supplied by the Higher level manpower planning Department on the inception of the faculty. The ratio of students to be admitted into the various depts. was then (1970) given as 3:2:1 for civil: mechanical: electrical: chemical: process: agricultural. It is difficult to figure out what these ratios are based on especially as they have remained static for the past 15 years but I will not delve into that presently.

In this exercise if a department is over subscribed, the students who have prior commitment to the department such as a relevant FTC or an insisting sponsor are considered first. Then a ballot system is used to fill the rest of the department capacity. Those students who are left over, are given 2nd choice and if this is already full, they get their 3rd choice. The procedure has been used satisfactorily for a long time and the faculty would only welcome suggestions for a more equitable approach.

#### Student Preferences

The numbers of students who preferred various departments and their year of admission is given in Table 2 below. The figures in bracket indicate departmental capacity.

Table 2. Distribution of student into departments.

Year	Civil Eng.	Mech. Eng.	Chemical & Proc. Eng.	Elect. Eng.
1973	27 (30)	17 (20)	N/A	16 (10)
1974	27 (30)	19 (20)	N/A	13 (10)
1975				
1976	56 (60)	36 (40)		27 (20)
1977				
1978				
1979				
1980				
1981	106 (60)	20 (40)	22 (40)	12 (20)
1982	106 (60)	20 (40)	20 (40)	22 (20)
1983	88 (60)	30 (40)	9 (40)	17 (20)
1984	93 (60)	26 (40)	11 (40)	25 (20)

### DISCIPLINARY PREFERENCES

One cannot help noting that Electrical Engineering has always been in more demand than the department can cater for. Secondly it will be noted that the popularity of Civil Engineering has come with time. Contrary to the above two, Mechanical, Chemical & Process Engineering have always been undersubscribed. The author found out that it was easier to talk student into Mechanical Engineering than into Chemical or Process Engineering.

### REMARKS

The high demand for Civil Engineering can be attributed to popular opinion by students who gave their reasons of preference as Civil Engineering.

- easy to study
- does not demand a lot of maths
- does not demand a lot of chemistry
- does not demand engineering drawing
- more marketable

Most students fear Engineering drawing and design and therefore shun Mechanical Engineering. However, it was the second most popular in numbers. A lot of students who had CE as their first choice, had ME as a 2nd choice.

### Implications

The ideal allocation of students would be the one that pleases both parties i.e. the student and the department; continuous efforts should be made to maximize this function. The biggest set back is due to lack of information on the part of students. It will be noted that even after efforts have been made to introduce students to the various departments, the selection by majority of students is still of sentimental and subjective base. The number of students who prefer a given discipline due to parental and/or friends influence is amazing. Very often these parents and friends do not have the slightest clue as to the contents of an engineering curriculum. The author noted a single case in which a student, whose father was a practising electrical engineer, wanted to study civil engineering.

Rational selection can only be made in a situation where the students have enough information of what is offered in the various departments and know their relative capabilities in the various subjects. Fear of subjects like engineering drawing can only be dispelled by introducing the subject fairly early in the secondary school curriculum.

The newer disciplines such as Chemical and Process Engineering lack an image. The motivation derived from looking at successful engineers is very important to students. Publicity of these newer fields is necessary.

It could be argued that a capable engineer is not necessarily limited to one speciality. Quite possibly the students who will do well in mechanical engineering will one day find themselves involved in Chemical and Process Engineering activities. There are a good number of engineers who initially trained as mechanical engineers only to find themselves incharge of electrical installations; similarly some electrical engineers are currently incharge of electromechanical industries. Civil engineering seems to be slightly removed from the rest despite the fact that it is very dependent on their services.

An observation by the author and other people who have dealt with freshmen is that whereas there is reluctance to join a department that was indicated as 2nd choice, once the relevant student had 'agreed' to join he/she forgot their preference and went on to become good students. There are records of students who obtained 1st. class and Upper Second Honours degrees in departments which had not previously been their preferred selection. This does not justify forcing people into careers they would have otherwise not chosen. The main problem is that we are more often than not dealing with people who have not got enough information to make a rational choice.

In the final analysis we can only hope that there will come a time when secondary school education will be able to furnish pupils with enough information and preparation enable them to make up their minds before they apply for admission into University. Fear of the unknown has a terrible influence.

An applicant would therefore know from the outset which department would accept them and would then be able to accept or reject the offer for admission without a loss to either themselves or the nation. Once in the University all Engineering students would still have to undertake the common year program because of its acknowledged benefits.