

MAXIMIZING THE BENEFITS FROM WATER AND ENVIRONMENTAL SANITATION

**Responding to the HR needs of the WATSAN sector:
Faculty of Technology, Makerere University**

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The quality of human resources is a critical factor if benefits from water and environmental sanitation infrastructure are to be maximised. This paper describes how Faculty of Technology, Makerere University has continuously effected changes in its curricula in response to the changing needs in the industry, including the water sector. It explains the major structural changes in the curriculum since that time, the reasons for the changes, and the present structure. The paper also gives a picture of the enrolment trend in engineering and other disciplines, briefly looks at the support from the development partners who have greatly contributed to staff capacity building, the training of specialised engineers as demanded by the competitive market and changing technology particularly in areas of research and hands-on training. Finally the paper looks at the limitations and the way forward.

Introduction

Human Resource Development in the Water Sector, the theme of the conference session, best fits the objectives for which training institutions in Uganda and world over are run and in particular Faculty of Technology. However, as the world moves towards a more competitive market, training institutions have been strained with specialised demand for engineers not to mention the water Sector so as to meet the demands of ever changing technology, increase in human population, and pressures of urbanisation. It is important at this point, that a series of events that have shaped and steered the Faculty of Technology to better standards since its inception in 1970 be discussed to give a clear picture of its responsiveness to social, economic and technological pressures, discuss how Civil and Mechanical Engineers are trained to suit the requirements of the employers amongst which is Water and Sanitation Sector, available support, limitations, and the way forward.

Changes in curriculum structure

The Faculty of technology fully opened its doors in July 1970 with 26 students in three traditional areas of Civil, Electrical and Mechanical Engineering. At the time, the Government of Uganda realised that industries needed more technical capacity than what was being produced, mainly from the University of Nairobi and abroad (Prospectus, 2003/04).

The programmes duration was four years, divided into three parts – the Preliminary and Part I, which was common to all the students and lasted two years. Part II where students specialised in the three disciplines for two years. Part II was to help students concentrate and attain skills in their areas of interest. It had been envisaged that students needed to concentrate on specific disciplines to develop skills useful to

their employers.

In July 1978, a major structural change took place and the common course was reduced to three terms, becoming the equivalent of the first year. Examinations were then held at the end of each academic year. The fourth term of each year was devoted to industrial training. This structure remained virtually unchanged until December 1985 when the second major change took place in the Engineering Courses. It was resolved that admissions were to be direct in the three disciplines of Civil, Electrical and Mechanical Engineering. Three years later, the Department of Architecture was started in 1989, followed by that of surveying in 1990 (Turyagyenda et al, 2005).

In 1990, the Faculty of Agriculture started Department of Agricultural Engineering, with an arrangement that students spend first two years in the Faculty of Technology, studying the same course with their Mechanical Engineering counterparts, an arrangement that still stands the test of time.

In 1998 the University introduced a semester system, which the Faculty of Engineering embraced. This was accompanied by diversification, redesign and introduction of a credit system.

In 2004, the Faculty amidst increased demand from the industry started a new Department of Construction Economics and Management, and new courses of Construction management, Land Economics and Quantity Surveying started so as to enhance quality and give choice to employers. The Faculty therefore is moving from traditional academic-oriented to an industry-oriented approach of training engineers. In 2005, there are nine (9) undergraduate, six (6) Masters, and PhD programmes as compared to three in 1970 as shown in Box 1.

Box 1. Programmes Offered by Faculty of Technology, Makerere University

Undergraduate Programmes

Undergraduate Programmes	Duration
Bachelor of Architecture	5 years
BSC Civil Engineering	4 years
BSC Electrical Engineering	4 years
BSC Mechanical Engineering	4 years
BSC Surveying	4 years
BSC Quantity Surveying	4 years
BSC Land Economics	4 years
BSC Construction Management	3 years
BSC Telecommunication Engineering	4 years

Graduate Programmes

Postgraduate Diploma in Urban Design and Construction Project Management.
Master of Engineering and Master of Science in Civil, Electrical and Mechanical Engineering.
Master of Physical Planning
Master of Architecture
PhD studies in all disciplines.

(Source: Dean, Faculty of Technology)

Training Engineers to Water and Sanitation sector needs is mainly handled by two departments of Mechanical and Civil engineering. Civil engineers are given theoretical skills in class in: Hydraulics, Hydrology, Environmental Chemistry, Water Resources and Public Health Engineering, while mechanical engineers are trained in Fluid Mechanics, Mechanical Installations, Pumps and Motors. These courses are adequate for students to develop the necessary skills in water sourcing, treatment, transmission, distribution and protection.

The second part is Hands-On Training where students and get a feel of the actual practical work. This is in form of laboratory work in the Faculty and Industrial Training. Organisations such as Directorate of Water Development (DWD), National Water and Sewerage Corporation (NWSC), WaterAid Uganda, and District Water Authorities have helped in this area. These organisations have contributed immensely to training students in this area. In fact the water sector is the most efficient and stable sector because of its approach to capacity development by getting involved in training of engineers to specific technical needs.

Table 1. Student statistics in the faculty of technology, Makerere University; Academic Year 2004/05

Program	Gender		Sponsorship		Total
	M	F	Govt	Self	
Architecture	70	34	68	36	104
Civil Eng	249	62	148	163	311
Electrical Eng	206	59	121	144	265
Mechanical Eng	177	17	130	64	194
Surveying	48	13	51	10	61
Const. Mgt	20	3	0	23	23
Tel-com. Eng	79	11	8	82	90
Land Economics	6	1	0	7	7
Quantity Surveying	31	8	1	38	39
TOTAL	886	208	527	567	1094

Engineering education and training

Two methods are employed in training Engineers. That is, Theory obtained in lecture theatres and Practice from laboratories and industrial training. This section analyses the curriculum and hands on training of Civil and Mechanical engineers to meet specifically the needs of Water and Sanitation Sector in Uganda.

Enrolment trend since 1970

Table 1 shows student enrolment categorized by sex and sponsorship to various programmes for the Academic Year 2004/05. A total of 1094 students were admitted to various programmes compared to 26 in 1970; 886 male, 208 female, 527 sponsored by Uganda Government and 567 privately sponsored. Civil Engineering programme has the highest number of female enrolment and over years have preferred joining the water and sanitation sector compared to other sectors. Figure 1 & 2 show enrolment by sponsorship and sex across programmes in the Academic Year 2004/05 respectively.

Figure 3 (a & b) shows the enrolment trend since 1970 with a total of 26 students; all male. A significant number of

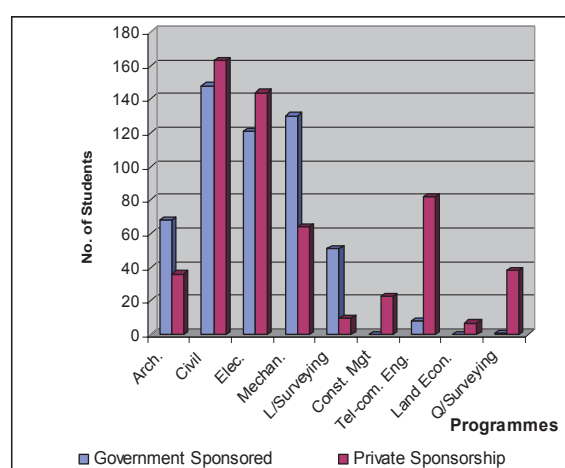


Figure 1. Student enrolment by sponsorship for academic year 2004/05

Source: (Faculty of Technology, Makerere University)

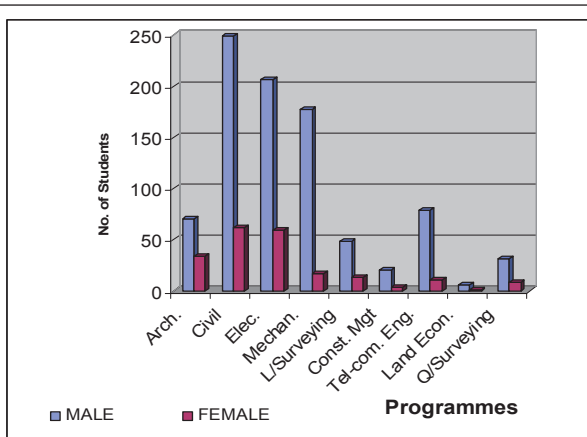


Figure 2. Student enrolment by sex to different programmes for academic year 2004/05
Source: Faculty of Technology, Makerere University

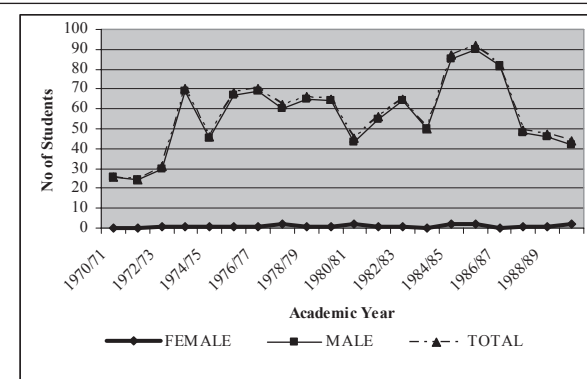


Fig. 3a

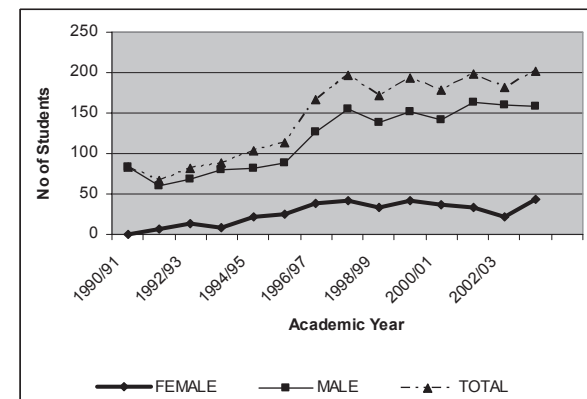


Fig 3b

Figure 3. Enrolment trend of students in faculty of technology since 1970
Source: Faculty of Technology, Makerere University

female students (seven) were enrolled in the academic year 1991/92. Enrolment grew steadily to 208 in the Academic Year 2004/05, which is a great achievement to the engineering profession.

The Faculty has produced a total of 2460 graduates to the

market since 1970, of which 420 are female. Compared to the national population of 25 millions, the figure is still too low to effectively tackle problems associated with rapidly growing population especially in the areas of shelter, provision of safe water, sanitation among other vital services. By 2010, it is projected that this figure will have more than doubled with increased enrolment, expanded curriculum, and also graduates from other institutions like Kyambogo, Nkozi, and Mukono Universities.

Support from development partners

The Faculty is currently involved in a number of projects with the following development partners that have helped in skills development of students to the benefit of the industry. The support is from undergraduate industrial training to graduate research/studies: -

Sida/SAREC

The project is about enhanced PhD supervision capacity of local professors with assistance of their counterparts from KTH (Royal institute of Technology – Stockholm) and LUT (Lulea University of Technology). This project also avails funds for young lecturers to carry out research, which will help in the necessary skills development in the water and sanitation sector among others.

NUFU

Under this project there has been provision of professors to this Faculty from the Norwegian University of Science and Technology and the Oslo School of Architecture to enhance human capacity, and sponsorship of PhD candidates. Other support has included funds for research, infrastructure assistance in the form of computers, testing equipment and two vehicles.

Italian Co-operation

The main objective of this co-operation is capacity building in Human Resource and Research. The Project includes exchange of Professors from the Universities of Rome, Milan, Sardinia, etc and their counterparts from this Faculty. A lot of research activities have been supported by this programme and has enabled five Faculty staff to obtain PhD degrees. The co-operation also covers infrastructure support such as computers and testing equipment.

I@Mak.com Program

This project supports the decentralization programme in Uganda and so far the Faculty has done quite a commendable job in training of district engineers with the funds from the project. It has also availed funds to support industrial training of students and their supervision by the Faculty staff members and the local district engineers.

USAID/UGS Alliance

This Project has provided Advanced Software to the Department of Mechanical Engineering for the training of our

students mainly at the undergraduate level but also at the postgraduate level. The Initiative is aimed at developing high-tech skills for the private sector. It is anticipated that this partnership will spread in the region with Makerere University providing the launching pad, and enable design of water mechanical fittings.

Limitations

Despite the fact that the Faculty has moved towards a more specialised type of training, it's not yet to the level of the industrial and market requirements. The following are some of the problems hindering adequate specialised training:

1. Lack of Training Strategy between the industry and the Faculty. Those that receive the training in second and third years of practice; end up in other fields of engineering.
2. Limited Financial Resources to encourage students move to other parts of the country during training. I@Mak.com has tried to help send students upcountry for three years now. However the program is ending this academic year, and therefore its future uncertain
3. Limited Capacity at Departmental Level. Specialised training dictates that Public Health Engineering and Water Resources become independent sub-department.
4. Lacks of a Training Programme in most organisations where students go for practice. It is DWD that has developed the programme to train our students, and this has helped increase its human capacity.
5. Lack of formal linkages between the Faculty and the industry in areas of research and training. It's important that these organisations participated in training of engineers to suit their needs at early stages.

Way forward

A lot of investments have been sunk into water and sanitation infrastructure. In order to maximise the benefits therefrom, is it important that the quality of the human resources be raised. It is the desire of the Faculty to provide employers with specialised engineers trained to specific needs of the industry. However, to achieve the above objective the Faculty together with the industry must work together in the following areas:

1. Strategic Co-operation in the areas of research and Training. The industry must identify problematic areas for our research at both undergraduate and Masters' programmes.

2. Technical and Financial support in the area of research. This will help improve performance, and enhance capacity.
3. Development of a Training programme for the students so as to enhance skills development as demanded by the industry.
4. Improvement of industrial linkages with the Faculty. Currently DWD has such a link with the Faculty and has continued to train students even after graduation.

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