

# INDUSTRY-UNIVERSITY INTERDEPENDENCE AND SELF FINANCING ENGINEERING EDUCATION MODELS

Daniel M. Madyira<sup>1</sup>, and Edward Chikuni<sup>2</sup>

**Abstract**  $\frac{3}{4}$  The past few years have seen a radical dismantling of the traditional ways of doing things especially as a result of networking and Internet technologies. Complete systems have been made redundant. Sadly complete jobs have also been lost. However there is now a demand for a person with the right know-how. Retraining and updating rather than retrenchments is a better option for many organizations many of those that need the training are still young and eager to learn new things. For the Universities this presents a unique opportunity to offer their services while earning income. The authors report some short courses that are run in the Departments of Mechanical and Electrical Engineering at the University of Zimbabwe. These include those that are targeted towards the acquisition of specific skills and those that are designed for international examinations such as the Engineering Council (UK) and the City & Guilds International. They also discuss future prospects for similar courses in particular courses designed for credit at both undergraduate and postgraduate levels.

**Index Terms**  $\frac{3}{4}$  information technology, professional development, short courses,

## INTRODUCTION

The University of Zimbabwe started as the University College of Rhodesia and Nyasaland in 1955. It then became the University of Rhodesia in 1971. It was established initially with four faculties of Arts, Education, Science and Social Studies. The Faculty of Engineering was established in 1974 with only 11 students. The University has since expanded to 10 faculties which include Commerce, Law, Agriculture, Veterinary Science and Medicine. At independence from colonial rule in 1980, the university changed name to its current name of University of Zimbabwe.

Currently, the Faculty of Engineering has 6 teaching Departments of Geoinformatics & Surveying, Civil, Electrical, Mechanical, Metallurgical and Mining Engineering. The academic staff establishments and student numbers for these departments are given in Table I. As can be seen in Table I, the faculty has had a recent increase in student numbers (compare student numbers for year 1 and year 2). This has been mainly a result of a deliberate

relaxation of entry requirements to boost university revenue through increased academic fees.

**TABLE I**

ACADEMIC STAFF AND STUDENT NUMBERS IN ENGINEERING DEPARTMENTS

Dept.	Acad. Esta.	Acad. on Ground	Number of Students				Total
			Year 1	Year 2	Year 3	Year 4	
Civil	20	4	61	36	31	28	156
Elect.	19	7	60	50	45	35	190
Geofn.	11	7	31	17	7	9	64
Mech.	17	11	45	32	30	22	129
Met.	11	3	34	15	17	14	80
Mining	8	5	47	16	23	28	114

Of major interest also is the high vacancy rate for all departments listed in Table I. This is a result of low remuneration and rapidly deteriorating economic conditions in the country. As a result the university is losing a lot of academics to neighbouring and overseas countries.

Undergraduate degree programmes offered by the Faculty of Engineering are all four year honors degrees. Postgraduate programmes are also on offer in some departments such as MSc. In Renewable Energy and MSc. In Manufacturing Systems Engineering offered by Mechanical Engineering Dept., MSc. In Water offered by Civil Engineering Dept. and MSc. In Communications offered by Electrical Engineering Dept. These higher degree programmes are run by the same academic staff manning the undergraduate programmes with support from part-time staff mainly from industry and other universities. By university policy, all MSc. Programme are required to be self financing.

The university funding is through a block allocation by central government. This allocation has been dwindling over recent years forcing the University to look for alternative sources of finance. To put this into perspective, as of year 2000, the cost of training a university graduate was estimated at Z\$ 450 000.00 per annum but the financial support provided by central government was a mere Z\$ 150 000.00. This means the University had to source extra funds to offset the deficit. Traditionally, this balance has been met through donor funding agencies such as Sarec, Danida, Cida, Nufu, Ford Foundation etc. The last two years has seen a flight of donors from Zimbabwe for political reasons. This scenario is a major challenge to the University of Zimbabwe, one which can threaten its survival. As a result there is

<sup>1</sup> Daniel M. Madyira, University of Zimbabwe, Mechanical Engineering Dept, P.O. Box MP167, Mt Pleasant, Harare, madyira@eng.uz.ac.zw

<sup>2</sup> Edward Chikuni, University of Zimbabwe, Electrical Engineering Dept, P.O. Box MP167, Mt Pleasant, Harare, chikuni@eng.uz.ac.zw

significant pressure to come up with innovative ways of raising extra finance to support its operations in a very economically hostile environment. Some of the available options for raising more funding for the University are 1.) offering consultancy services and 2.) providing professional development courses for industry and commerce.

### SHORT COURSES IN MECHANICAL ENGINEERING

#### Motivation

The introduction of professional development courses (targetted at the local industry) in the Department of Mechanical Engineering was triggered mainly by dwindling financial support from central government as indicated above. The Department realised that it was getting more and more difficult to replace obsolete equipment (both teaching and laboratory equipment), computerise the department, finance other activities such as industrial visits for students, financing student projects and maintenance of laboratory equipment.

In the face of such problems, the Department developed solutions for raising extra funds. These were:

- i. Introduction of professional development courses for industry.
- ii. Offering consultancy services for all mechanical engineering disciplines.
- iii. Launching MSc. Programmes in Renewable Energy and Manufacturing Systems Engineering.

This discussion will focus mainly on the introduction of professional development courses.

#### Short Course Development Strategies

In order to develop successful short courses, extensive consultation with industry was first conducted mainly through the Department Advisory Committee. This committee was comprised of industrial corporate representatives, representatives from the Zimbabwe Institution of Engineering, The Standards Association of Zimbabwe and other stakeholder organisations. This forum provided information on the training requirements of the local industry particularly the key areas with highest demand for academic advancement for those in full time employment. In addition, the Department also developed courses which were perceived to be of future importance. These courses were offered mainly with the aim of stimulating interest in industry.

Having identified the key areas of short course development, the Department was faced with a number of problems. The first one was the issue of where the funds raised would end up. The idea was to avoid having to raise funds for the recurrent budget of the central administration of the

university. If funds are channelled through the central administration, then very little change would be realised at Department level. To avert this problem, the Department developed a project approach to the problem of raising funds.

This approach entailed the establishment of special projects such as the purchase of IT equipment. This would mean that all the funds raised would be channelled to that particular project. The following projects were developed:

- Purchase of computer for every academic staff office.
- Building an intra-department computer network to be connected to the university wide network.
- Purchasing computers for the undergraduate and post graduate computer laboratories.

When the short courses were launched in 1996, the department had only two pc's for use by academic staff. These were located in a central room. No academic had access to a pc in his or her office.

The targetted project approach has been a great success for the Department. It helped in overcoming resistance from the central administration which is naturally inclined to have all such funds directed into the central budget. It also helped in keeping the expenditure directed at the key development areas of the Department. Since all academics would benefit, in a way the strategy also helped to motivate all academic staff to participate in the programme.

The second problem was the motivation of staff. Although every academic staff would benefit for example through having computers in their offices, there was need for more personal motivation of staff. The Department therefore decided to allow the academics to take a percentage of the generated income. Thus for each course that an academic ran, 20% of the income generated, less expenses, went to the Department while the rest went to the individual convening and running the course. The course conveners were also encouraged to pay small gratuities to the non-academic support staff to motivate them and induce their active participation in the running of the courses.

This income sharing scheme had tremendous motivation on the course conveners. As long as there is direct financial benefit for the academic staff, they were prepared even to go into industry to market the courses. This leads us to the next problem.

The third problem was that of marketing the course. This was addressed by encouraging course conveners to visit selected companies in industry to market their courses. This was the most effective marketing tool at the beginning of the programme when there were no financial resources. With time, adverts were floated in the local press.

The fourth problem was the organisation of the programme. Since it was project oriented, there was need to have a structure to effectively coordinate these fund raising activities. A specific project director was appointed, from among the academics staff, to coordinate the fund raising activities. This involved the marketing of the courses, organising the actual running of the courses and allocations for the raised funds.

### Short Course Development

As indicated before, the courses which were targeted for development were identified through consultation with local industry as the main stakeholders. In this consultation, the key areas identified were those related to either new technologies, especially in the IT sector such as Computer Aided Design or those related to topical issues of the day such as Total Quality Management, Total Productive Maintenance etc.

Some of the courses which were developed are:

1. Introduction to Computer Aided Design with AutoCAD.
2. Advanced Computer Aided design with AutoCAD
3. Total Quality Management
4. Total Productive Maintenance
5. Preventive Maintenance
6. Project Management
7. Introductory Finite Element Analysis
8. Advanced Fracture Mechanics
9. Non-destructive Testing
10. Heat Treatment of Metals
11. Industrial Noise Awareness

The first two courses were a result of the advances in the computer aided drafting technology. Most draftsmen were therefore naturally under pressure to upgrade their skills in line with the changing technology. These were developed to run over five days mainly due to the practical nature of the courses. The 3<sup>d</sup>, 4<sup>th</sup> and 5<sup>th</sup> courses catered for the topical issues of the day. These were normally run over one to three days. The 6<sup>th</sup> course can be considered a more traditional course and it was run over four days. The last five courses were introduced in order to stimulate interest in these areas. Among these last five, only the ninth course has managed to attract participants over the last 5 years. These last five courses were all structured as one-day courses.

### Assessment of the Short Courses

The most popular course as measured by the number of participants and the consistency of participation over the last five years has been the computer aided design courses. These courses have been run consistently at least four times a year since launching in 1996, courtesy of the technological developments currently being enjoyed in the information technology sector.

The courses have managed to raise an average of Z\$ 200 000 per annum. This is about 25 % of the total recurrent expenditure of the department. These funds have enabled the department to computerise every academic office in the department, install a local area network allowing every academic member of staff access to the internet and in addition to purchase a few personal computers for the undergraduate computer laboratories.

Apart from the financial benefits to the department, the programme has also allowed academic members of staff to augment their low salaries. Besides the obvious financial benefits to the individual academics, this has also improved moral and contributed to the retention of staff in the department.

## SHORT COURSES IN ELECTRICAL ENGINEERING

### Introduction

The Department of Electrical Engineering is one of the most active departments in the Faculty of Engineering in terms of course offering. It offers two types of courses:

1. Courses for examinations of international bodies
2. Continuing education courses for persons in industry

The courses that are offered for international bodies and are targeted at those who, because of work and other commitments, are unable to attend a full time course. Two of these courses are described below.

### International Examination Targeted Courses

#### Engineering Council (UK) Examination

The department offers Certificate and Diploma courses in Electrical, Mechanical and Civil Engineering Disciplines. So far classes are only being given for certificate level courses which are:

The Engineering Council Examination structured as follows:

#### Compulsory Subjects

- C101 - Mathematics
- C102 - Engineering Materials
- C103 - Engineering Science
- C104 - Engineering Perspectives and Skills

#### Optional Subjects

- C105 - Mechanical and Structural Engineering
- C106 - Thermodynamic, Fluid and Process Engineering
- C107 - Electrical and Electronic Engineering

- C108 - Software and Information Systems Engineering

The courses are well attended with an average of 40 students attending the classes each year. The students are drawn from both private and public sector signifying general recognition of the programme. The Department of Electrical Engineering has given recognition to holders of the certificate by allowing them to pursue full time studies at the University, provided that they achieve a certain level of pass. Graduate Diploma level courses will be conducted subject to sufficient enrolment. In accordance with the new Engineering Council format, the Engineering Council Graduate Diploma is equivalent to a University Degree. To meet the requirements for entry into professional Engineering Institutions, candidates have to select a relevant combination of subjects from a comprehensive list of offerings. In addition, for most British Institutions, they have to achieve an average of "C" for the Graduate Diploma.

### City and Guilds International Courses

The department of electrical engineering also offers entry level and more advanced courses in Electronics and Microcomputer Applications (including basic Network Principles). These are targeted at school leavers and prepares them for their first job in the computer field. These too are very popular with class sizes also exceeding 40.

### Continuing Education Courses

The Department also conducts a number of courses for those that need to update their knowledge especially with the rapid changes in technology. For this group there are a number of short courses of up to two weeks duration in the following subject areas:

1. Data and Communications Networking
2. Computer Appreciation
3. Unix Systems Administration
4. Computer Systems Security

The course format not only allows interaction between the presenter and the attendees but also has practical emphasis. One interesting aspect of the above courses is that during and after the course the presenters and the department has been approached for advice on technical matters related to the firms from which they come, further enhancing the income of the department and that of the presenter.

### CONCLUSIONS & OBSERVATIONS

From the experiences of the Department of Mechanical and Electrical Engineering at the University of Zimbabwe, it can be concluded that:

1. Development of successful short courses for professional development requires input from the main stakeholders, particularly industrialists.
2. A target project approach helps to focus the financial resources gained from short courses and reduce the financial burden on the university budget.
3. Staff motivation can be enhanced by allowing income sharing with the course conveners and support staff.
4. New technologies particularly in IT offer opportunities for universities to offer professional development courses for industry and the private sector in general.
5. As few restrictions as possible from administration and more encouragement from administration are conducive to the success of such initiative.
6. In both the Mechanical Engineering and Electrical Departments, the income from these initiatives has contributed to at least 25% of the running costs of the departments.

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