

DEVELOPMENT IN ZIMBABWE



'Education is the hammer of skill'

The Role of the University

A Lecture Series at the University of Oslo
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F O R E W O R D

This is a compilation of a series of lectures given at the University of Oslo in June 1983 by staff members of the University of Zimbabwe. They participated in a delegation to the University of Oslo to explore the opportunities for building academic contacts between individuals and departments at the two Universities. Their visit constituted one important step in a long process of developing the content and format of a collaborative program between the University of Oslo and the University of Zimbabwe, the first "case" in the general efforts of the University of Oslo to establish new forms of academic cooperation with the third world.

It was felt natural at the time of this first extended visit from Zimbabwe that the 9 members of the delegation should provide information about the current activities and plans of their respective departments/faculties. The lectures were given over five consecutive days and were open to anyone interested. All contributors agreed to the proposal of having the lectures distributed afterwards, first and foremost at the University of Oslo as a contribution to the mutual exchange of information among staff and students.

Due to logistic and administrative reasons it took much longer than intended to get the various papers ready for presentation. In the period that has passed, many developments have taken place at the rapidly expanding University of Zimbabwe. The papers should therefore not be taken as reflecting the situation today in all aspects. Nevertheless, the broad lines of the basic philosophy of and challenges to the University of Zimbabwe are well reflected in the papers even if certain specific informations may be somewhat outdated.

Science and Development

Prof. M.J.Swift, Faculty of Science

Introduction

In this paper I shall attempt to explain the role that I believe a University Faculty of Science has to play in the development of a sub-tropical country such as Zimbabwe. My brief covers the whole of science but perhaps I may be forgiven if I display a certain bias towards the biological sciences, because that is the ground on which I feel most comfortable. I shall illustrate my thesis by reference to the mode of operation of the Faculty of Science at the University of Zimbabwe.

It should be noted that the responsibilities of the Faculty of Science exclude other science-based subjects which are housed within the Faculties of Medicine, Agriculture, Engineering and Veterinary Science. This separation is in many aspects an unfortunate feature of university structure and much might have been gained by a closer integration. The role of the Faculty of Science may to some degree appear to be limited by being distinguished from these three faculties; their purpose has a clearly-established vocational role to train practitioners of medicine, agriculture engineering and veterinary medicine. Within this context what is the role of the Faculty of Science?

Broadly speaking it is two-fold; firstly the Faculty is concerned to produce the science-trained school teachers on which the educational future of the country depends; secondly to produce researchers, both at the professional and the technical levels who can tackle the fundamental scientific problems exposed by the activities, among others, of the practitioners of the other science-based professions. It would not therefore be correct to conclude that the Faculty of Science is concerned with "Pure" Science whilst the other faculties are concerned with "Applied" Science. This indeed is a distinction which, although perhaps thought to have meaning within the educational institutions of the industrial world, has little value in Zimbabwe, a point I shall return to later.

In common with similar faculties elsewhere the main duties of the academic staff members are firstly to educate scientists through the undergraduate (BSc) and postgraduate (MSc and DPh) degree programmes and secondly to themselves conduct research. There is however a third role which is perhaps more significant in a country like Zimbabwe that it is in the high technology societies of the North - that of consultant to government and industry.

These activities give a first definition of the role of the University scientist in the development of the country.

The Science Degrees at the University of Zimbabwe

The composition of the Faculty of Science is much the same as that in any other University (Table 1). In addition to the teaching departments there are two research departments. The Institute of Mining Research is an institution set up with funds from the mining industry in Zimbabwe, and which is concerned specifically with research related to the development of this important component of the Zimbabwean economy. The Lake Kariba Research Station was established not long after the filling of that enormous man-made impoundment

TABLE 1

The Departments of the Faculty of Science, University of Zimbabwe. All the teaching Departments contribute to the BSc (General) and BSc (Honours) degrees. In addition some of the Departments contribute service courses to other Faculties; these contributions are also indicated in the Table.

<u>DEPARTMENT</u>	<u>TEACHING SPECTRUM</u>
Biochemistry	BSc, MB (Medicine)
Biological Sciences	BSc
Chemistry	BSc, BSc (Agric)
Computing Science	BSc, BSc (Eng), BSc (Psych), BSc (Econ)
Geology	BSc
Mathematics	BSc, BSc (Eng), BSc (Econ), BA
Physics	BSc, BSc (Eng)
Institute of Mining Research	Research only
Lake Kariba Research Station	Research only

and has a brief for multidisciplinary study of the region around Kariba in all its respects, including the physical and the biological resources of the lake and the medical, sociological and agricultural facies of the region. Nonetheless biological research has been its major focus of interest as I shall have occasion to refer to later.

Let me now return to the major function of the Faculty of Science; its teaching role. The entry requirement for science is to normally have passed three science subjects at Advanced Level at a sufficient standard. A most important feature of our current stage of development, as Professor Chavunduka has described elsewhere, is the rate at which student numbers are increasing. This expansion has not been as rapid in any of the science-based faculties as in Arts, Social Studies or Commerce and Law. The reason for this is partly due to an inevitable lag in the schools, because of a lack first of all of science-trained teachers at the secondary school level, and secondly because deficiencies in equipping schools for the teaching of science. Students coming into science are therefore often less well prepared in the practical skills of science than they should be although in the theoretical aspects of science they are generally well trained. This has implications for our curriculum, and our first year (Part I, Table 2) is structured to take account of this. Students take three more subjects in the first year and after this may enter two streams; the General stream in which they study two subjects or the Honours stream (which may be completed in three or four years according to subject) in which they eventually will specialise in a single subject. I have illustrated this for combinations of Geology, Chemistry, Biological Sciences and Mathematics but comparable combinations of other subjects are of course possible.

These two types of degree, General and Honours, are designed to produce two types of graduate. The General Degree is aimed at the Secondary school teacher. School teaching is regarded by us as an absolute prime target for our graduates at the present, for the reasons that I have already given, - the very

TABLE 2 Undergraduate degree programmes in Science. Examples are given of programmes leading to either BSc (General) or BSc (Honours) degrees. Note that students may leave with a degree after three years or four years of study.

	<u>Scheme 1</u>	<u>Scheme 2</u>	<u>Scheme 3</u>
PART I	Chemistry Biological Sciences*	Chemistry Geology Biological Sciences	Chemistry Physics Mathematics
PART II	Biological Sciences	Chemistry Geology	Mathematics
PART III	Biological Sciences (General)	Chemistry Geology (General)	Mathematics (Honours)
PART IV	Biological Sciences (Honours)	Geology (Honours)	

* In this scheme Biological Sciences is taken as a double-subject.

high demand for science-trained teachers. We believe that it is in our interest as well as in the country's to concentrate on this at least in the short term.

One interesting feature of discussion is the best way to produce such school teachers. The scientists tend to feel that the best way to produce a good secondary school teacher is to put him or her right through the BSc programme up to the General level and then to add an educational component afterwards. Many educationists prefer a system in which education is taught in parallel with the science during the first degree. What we feel is that this merely dilutes the science and that graduates taught this way are less well prepared in the practical aspects of science than those with post-graduate Certificate of Education following a three-year BSc General. This represents an area of some debate in internal University politics and it is one in which the discussion has hardly begun. The argument against the Science Faculty view is that it takes four years to produce a school teacher and that this is uneconomic. The educationists' view would be that a three-year production is all that is needed or indeed, all the country can afford. We do recognize the very urgent need for new teachers, but we feel in a sense that the quality is more important than the quantity in this respect.

The second type of career is of a more specialised kind which the Honours degrees are designed to meet. This is for those graduates who will go into research or industry. Very little has been said so far in these seminars about Zimbabwean industry, but you should know that there is a very wide range of well-established industry in Zimbabwe. At present this sector suffers in common with the rest of the world from the economic recession, but with the injection of necessary capital it is capable of taking off in a very substantial way. The Science Faculty is producing graduates capable of entering industry in a variety of jobs; from chemistry into the pharmaceutical industry, the paper industry, the pigment industry and the

whole range of other chemical based industries; from physics into all the aspects of instrumentation technology required throughout industry, a very important product of our University because we do not have in the country a very well developed, second level technical education system at present, so graduates from physics and engineering are important in respect of the general technological base of our industry; from biological sciences, we are putting now a considerable effort into the development of microbiology, with the view that there is considerable potential for the transfer of the bio-technology being developed in Europe, the USA and Japan. We have a good food production industry in Zimbabwe, which already has fermentation technology as part of its base, and we see no reason why the use of micro-organisms in industry should not increase. In the near future we are hoping to mount an MSc course in Industrial Microbiology.

In addition to careers in industry, there is the supply of graduates to the very good umbrella of research institutes within the country. Many of these are associated with agriculture and medicine, but the biological sciences, biochemistry and chemistry departments all produce graduates able to enter into this type of research career.

Following the undergraduate (Bachelor's) degree and before or after job-experience suitably qualified graduates may enter one of the MSc Programmes. These are usually specialised in content and vocational in nature. For instance in Biological Sciences we have such courses in Tropical Phytopathology, Tropical Entomology, Animal or Plant Physiology and Resource Ecology. In other departments there are subjects like Analytical Chemistry in the Chemistry Department, Food Science in Biochemistry and Exploration Geophysics in the Physics Department.

This whole area of the post-graduate study is however one which is under considerable discussion. We have had a very long debate in the Faculty on the curriculum at the undergraduate

level and we are now switching our attention to the MSc programme. The essence of this debate is the appropriate nature of our curriculum for the new Zimbabwe - this is our contribution to the national process of transformation. Our decisions are based on achieving the appropriate balance between the manpower requirements of the country as perceived from outside the University and the academic judgment of the members of the Faculty of Science as to how best to reach those targets. In doing so we firmly believe that the practical demands made on our graduates are best served by an academic training of high standard in the method of scientific enquiry, i.e. that what we must teach our students above all is how to frame and solve problems. This contrasts with a technical or vocational approach to education, but we maintain that whilst this has an important place, it results in narrow specialists suited only to single limited tasks.

The essential role of a University Science Faculty is to produce the graduate who is flexible enough to adapt to changing circumstances and not to be daunted by unfamiliar challenges. We believe also that development in the third world often demands solutions to scientific and technical problems for which the so-called developed nations have no models.

This brings us to the question of the research role of the Faculty of Science.

Scientific Research at the University of Zimbabwe

The spectrum of research in the Faculty of Science is varied depending as it always does on the predelections of the individual but I would say that on the whole it probably has a rather practical or applied bias in comparison with a similar faculty in the Northern hemisphere - there is possibly less investment in what is termed "pure research". I am going to illustrate this in relation to Biological Sciences.

Table 3 gives some idea of the main areas of research which are conducted in biological sciences. Also indicated are the links between University research and research within government agencies. Often there is direct collaborative research between our researchers and those in government. Occasionally it is even a type of contractual arrangement whereby we are asked to involve ourselves in particular problems, sometimes it is purely a person to person link or an overlapping area of interest. But it is rare that such contact would be lacking. In many instances junior researchers in Government funded Institutes are registered for Higher Degree at the University and their work is thus subject to the scrutiny of a University supervisor. Thus scientific research at the University is deeply embedded in the priorities of research set for the country; the choice of research is influenced by these priorities and in turn the priorities may be modified on the basis of the findings of University scientists.

Let us now consider some specific fields of research. First of all, limnology. This, the study of biological resources and the physical and chemical features of the water bodies and streams of Zimbabwe is of prime importance. Water is the most critical of our natural resources in the sense of its scarcity and unpredictability. The study of water management is crucial to the country's development and is undertaken in the Biological Science Department, the University Lake Kariba Research Station and the Engineering Faculty. On the biological side there are links with the Department of National Parks and Wildlife Management (Aquatic Sciences Division) and with those parts of the Ministry of Agriculture concerned with aquatic production.

I should point out that the Department of National Parks and Wildlife Management is part of the Ministry of Natural Resources and Tourism and has responsibility to maintain a number of national parks, particularly in the western part of the country, which in themselves are a substantial resource: they are not only what they are seen as, that is a tourist

TABLE 3 Major research areas in the Department of Biological Sciences. Also shown are the major government agencies with which co-operation or collaboration is in operation.

<u>Department of Biological Sciences, University of Zimbabwe</u>	<u>Government Agency</u>
Limnology (with University Lake Kariba Research Station)	Department of National Parks and Wildlife
Environmental Physiology (Animal & Plant)	Research and Specialist Services
Entomology	Crop Protection Research Institute Tsetse Control Programme Cotton Growers Research Institute
Parasitology	Blair Laboratory (Ministry of Health)
Plant Pathology* (Virus Bacteria Fungi)	Forestry Research Institute Crop Protection Research Institute
Soil Biology	Forestry Research Institute Soil Productivity Research Laboratory Agricultural Technical & Extension Services
Plant Tissue Culture	Research & Specialist Services Horticultural Research Institute
Terrestrial Ecology	Department of National Parks & Wildlife Natural Resources Board Agricultural Technical & Extension Services

attraction to look at wild animals, but they are also a resource of natural vegetation and soils in a relatively undistributed state, a genetic and chemical pool on which we can draw in the future. Another product of the time of expansion we are now in, is the developing conflict between this premise of conservation and the needs of the expanding population with their concomittant land-hunger. Somehow we have to resolve that problem in Zimbabwe as well as elsewhere. The Department of Biological Sciences has extensive research connections with National Parks in the terrestrial as well as the aquatic fields - most particularly in wild mammal ecology and behaviour.

The Environmental Physiology both of animals and plants is an area of research that has profound implications for a climate such as that found in Zimbabwe, where great extremes are common. For instance on a day in winter you may go from frost in the early morning to a temperature of over 30^o at mid-day. Animals and plants are adapted to an extraordinary extent to withstand these extremes and this is both fundamentally and practically an interesting area.

In Entomology we are concerned with both detailed studies of various insects, and with practical problems of pests or vectors of disease - cotton-boll worm and tsetse fly for instance. Parasitology has a programme which uncludes research into Bilharzia, a very extensive health hazard in Zimbabwe, and in plant pathology research on both viral, bacterial and fungal diseases are being conducted. Ecology is my own particular field of interest, and here we are interested particularly in the management of the biological resources of soil, in farming systems which have only a low input, or no input at all, of fertilizer. We also have a group involved in terrestrial ecology, who have specific interest in the mapping of the vegetation of the country, as well as the wildlife ecologists studying the behaviour- reproductive behaviour particularly - of large mammals.

An interesting recent development has been a number of requests from government and international agencies for the Department to carry out environmental impact work. This is related not so much to industrial pollution but to the effect of increasing rural population pressure on the natural resource reservoir of the country. One example of this type of contact is a project funded by the United Nations Environment Programme to study aspects of the relationship between environment and the rural economy in the Sabi Valley system in the south-eastern part of the country, where environmental degradation is proceeding at a very high rate, including silting up of one of Zimbabwe's major river systems.

From this brief survey of research activities in biology I would wish to highlight again the point made in my introduction; the conduct of research in a country such as Zimbabwe is perforce breaking into new ground - simply because of the absence of a long research tradition and because biological research has been notoriously temperate-zone biased. But at the same time the nature of that research, resulting from the choices made by our scientists is such as to make the results of immediate importance to the country's development. Hence my scepticism concerning the distinction between "pure" and "applied" science - most applied science in the tropics is fundamental by necessity.

Conclusion

That really completes the round of facts and figures that I wish to cover. I should like to finish by discussing briefly the role of science in development.

Perhaps, as a scientist, I have slightly less philosophical doubt about the substance of "development" than some of my colleagues at this symposium. Indeed I should like to borrow my definition from that of Mr. Makamure who defined development as "the acquisition of the capacity to utilize resources" : I should wish however to add two words viz. "the acquisition of the capacity to utilize and conserve resources". At the risk

of introducing an element of conservatism into our debate, it is the belief of many biologists that this conservation function, which implies a necessity for deep study of natural resources over a long period of time, must occupy prime attention alongside the development of appropriate methods for their utilisation.

For scientists the 'acquisition of the capacity to utilize resources' essentially means 'development of the method of utilizing resources'. That is the transfer of the appropriate scientific techniques to our students and to scientists in Zimbabwe. As such, it places the scientist in a somewhat different context to many other subjects where the separation of method and product, or means and end, is less easy to define. We can say, for instance, that there is no such thing as Colonial science, or Marxist science, or Zimbabwean science, or British science, or even Feminist science, but, if you say that, what you are talking about is the method that you are employing; it is clearly fundamental to the practice of science that the method is an objective one. We are all aware of the limitations to the objective application of method and of the danger of assuming objectivity. But it is nonetheless imperative that this remain a prime component of the scientific credo. On the other hand it is not enough simply to say that the scientific method has not got an ideological content and assume that all social responsibility is thus assuaged.

If we take up the point made by Mrs. Muchena, that every education system has some value judgement built into it, of course a scientific education is no way divorced from this. There are choices that can be made, with regard to the curriculum, and with regard to the research topics. These choices are perhaps not ideological in content, but certainly have strong social implications. For instance, if we take the question of the choice of curriculum we would start of course, as anybody else would, with academic perceptions as to what we should teach, to convey the core of essential knowledge of modern science and to convey the method of science to our students. But having done that, clearly, in no discipline

can you teach the whole subject so a choice must be made between the parts of the subject which will be taught and which will be omitted. In the current context of Zimbabwean development one of the features which determines (and I would propose, should determine) that choice is that of relevance to the country. What is relevant, in terms of our choice, to the present stage of development in Zimbabwe, and what is not.

This may be illustrated by the structure of the current biological sciences curriculum, where cell biology and molecular biology are currently not strong disciplines whereas, within the United States and north-western Europe they have come to dominate biology. How can we justify playing down one of the most outstanding intellectual and practical developments of the century, one which has revolutionized our whole view of the world and our place in it? Molecular biology is an area of science which is both dependent on a very highly developed and sophisticated equipment system, and currently (though only temporarily) does not have an obvious spin-off into an industrial base of the kind we have in Zimbabwe. Thus faced with a choice between this and topics such as entomology or ecology we choose the latter which do have an immediate application. But in doing so we must be aware of what we are doing and why we are doing it; and be prepared to modify our choice when changing circumstances dictate. Thus in a few year's time Zimbabwean industry may well be able to embrace the bio-technological revolution and we must be prepared to meet that challenge by producing graduates in molecular biology to man it.

Another feature which influences choice of curriculum - and I suggest one which is subordinate to those mentioned above - is that of manpower requirements. We are quite often told that we should plan our courses in relation to manpower needs. I tend to modify that to an idea of the subject itself, rather than the actual product, because manpower requirements notoriously change very rapid indeed, and by the time you have

geared yourself up to produce twenty plant pathologists, then the situation has changed, and it is twenty ecologists that are needed. So our approach to this is the one described earlier, that is whilst we do take note of the manpower requirements of the country with regard to the choice of curriculum we nevertheless would primarily see curriculum design in terms of preparing students to solve scientific problems; to recognize the dimensions of a problem and cope with it by a process of general solution; rather than by a specific training to fit narrowly defined roles.

The same sort of choice influences research, but here it becomes even more critical because there has been - I think - a general disillusionment in the western world over the relationship between the investment in scientific research and the effect on the GNP of a country. As such, I think there has been a withdrawal (certainly in my own country of origin, Britain) from funding a great deal of scientific research with the idea that it is actually going to result in a significant advance in the quality of life. But nevertheless, I retain my belief that there is a link between the rate of development of a country, and the quality of its research base. But this also comes down to the question of priorities in research. Once again I believe that the choice is not of mutual exclusivity between what is seen as 'applied' or 'pure', it is the right mix of both which is essential. For a country such as Zimbabwe this can perhaps better be expressed as the distinction between solving an immediate problem in the short term and providing a scientific framework for solving a range of problems in the future (tactical versus strategic research).

With the University scientist I believe lies the onus for the latter alongside his colleagues in Government funded research agencies who must cope with the former. But the University must not disdain the requirement for relevance and practicality even whilst postulating that a straight line is not necessarily the quickest path between the two points of problem and solution.

Whilst I worked in London this question of choice and emphasis would have seemed in itself an academic argument. In a country like Zimbabwe it is a very real debate which must never be allowed to settle but be present in every scientist's mind from day to day. The most limited of all our resources is trained manpower and this must be deployed most wisely for all. But nonetheless it should never be accepted that politicians and administrators have clearer vision of technical problems and priorities than do farmers or scientists.

I should like therefore to close this discussion with a quotation from a recent editorial in the journal Nature which defines for me the role above all of the University scientist - but which is only acceptable to the society which foots the bill for science if it is harnessed to an awareness of the social role of the University:

"both in teaching and research the indispensable social function of Universities is the level-headed iconoclasm of which they are the only continuing source".



Mineworkers at Kamativi Tin Mines



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