

**INSTITUTE OF MINING RESEARCH
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**Research and Consultancy Services in the Mining Industry in Zimbabwe – A
Coordinated Approach Through the Mineral Resources Centre**

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ABSTRACT

Education in the engineering fields can be considerably enhanced if it is designed to address the immediate and long-term needs of society. In this context education not only comprises the provision of basic training, but also includes the careful planning and execution of applied and fundamental research. This paper focuses on education and research institutions that provide services to the mining sector in Zimbabwe and describes a new approach to meeting high-quality teaching, research and consultancy requirements against a background of diminishing government funding.

Key units within the University of Zimbabwe providing services to the mining industry include the Institute of Mining Research, The Departments of Geology and Physics in the Faculty of Science and Mining Engineering and Metallurgy in the Faculty of Engineering. Within government, services are provided principally by the Departments of Geological Survey, Metallurgy and Mining Engineering, and the Scientific and Industrial Research and Development Centre. The major source of funding for all of these institutions is Government.

There is a degree of overlap between these institutions, some of which were established more than 30 years ago with terms of reference appropriate for the time. With decreasing funding exacerbated by a harsh economic climate in Zimbabwe there is need to revisit the charters of these organizations and to review the provision of services to the mining sector.

Recognition of this situation has led the Department of Geology to spearhead a new initiative to establish an alternative structure through which consultancy and research in mining related topics can be coordinated at the University of Zimbabwe. The Mineral Resources Centre (MRC) was established to facilitate fund-raising activities through consultancy services, research, post-graduate training and capital investment. By representing a group of like-minded stakeholders, the MRC can address larger projects, and thus secure more funding than individual entities will be able to obtain. The MRC is designed to be a lightweight structure that will not replace any of the existing teaching and research departments.

The MRC is not bound to any particular faculty within the university, and may even include stakeholders from outside the university. Interested parties are invited to participate on a voluntary basis in accordance with the management and quality-control guidelines laid out by the MRC. Participation is on a contract basis and will be determined for each project.

Service providers that participate in the MRC agree to use their resources in the best possible way, so that services can be presented in unison. In combining forces between various departments with expertise in Earth Sciences, it is envisaged that a wider audience can be reached, a better service can be provided and a larger resource base can be tapped both within the private and the public sectors. The MRC may help coordinate capital investment, and human resource development in the various participating entities. Considering the limited availability of financial and human resources in Zimbabwe, coordination and prevention of unnecessary overlap is in itself a valuable exercise.

INTRODUCTION

Effective education in the engineering fields can be considerably enhanced if it is designed to address the immediate and long-term needs of society. In this context education not only comprises the provision of basic training at undergraduate level, but also includes postgraduate training through the careful planning and execution of applied and fundamental research. This paper focuses on education and research institutions that provide services to the mining sector in Zimbabwe and describes a new approach to meeting high-quality teaching, research and consultancy requirements against a background of diminishing government funding.

The model we describe is driven by research and consultancy services. Although there may be some concerns about the model for the quality of tuition or the lack of attention to teaching, we believe that teaching and research are not mutually exclusive. In

fact they are complimentary and our model seeks to nurture the symbiosis between the two to the benefit of both staff and students. By strengthening the research capability and the financial base, teaching is enhanced at all levels.

Public good function

Whereas the economic climate may have resulted in a diminishing funding for educational institutions, it should be recognised that our University is a national asset and Government has an obligation to fund the institution at levels where its sustainability is guaranteed. This is the view held by the University of Zimbabwe which has defined its mission as "To provide high quality education, training and advisory services on a needs oriented basis" (1). Although the University recognizes the need to generate additional funding and to optimize management of its resources, it is our opinion that the leading institution of higher learning in the country should not be made fully

responsible for its finances and at the same time maintain its public good function.

It should be stressed that the initiative presented in this paper is designed to supplement university funding and streamline management. It should not be interpreted as an alternative means of financing basic university functions.

The role of new structures is not simply to provide supplementary funding but also to ensure that the interest of society is addressed in the best possible way. New management structures are essentially created to optimize the public good function.

BACKGROUND

The immediate need of society with respect to technical education is basic training. This need has been met by the core business of the Faculty of Science at the University of Zimbabwe for more than four decades. From a modest start of 68 students in 1957 the student numbers at the university grew steadily to 2240 in 1980. Rapid growth after independence in 1980 resulted in an impressive expansion of the infrastructure with student numbers increasing to 9300 by 1990. Up to this point "The University got literally all the funds it requested from Government for both the recurrent and capital budgets" (1).

In the 1990's the University was beset by a number of problems including one of inadequate funding. There was a perception that "The University is unfocussed and lacks a clear vision of its function in relation to industry"(2), a view based on the apparent "book knowledge" of graduates who were seen as having inadequate practical skills.

The quality of graduates and their preparedness to meet the immediate needs of industry is a matter of concern in Zimbabwe. Some views are that fresh graduates are ill prepared, especially in the fields of engineering, science and technology. Others consider that the basic skills should be imparted in the undergraduate years and the applied skills are developed during experience in industry and in postgraduate training programmes. The enhancement of practical skills in the engineering and scientific sectors is particularly important because of the need for hands-on training frequently requiring the use of specialized facilities and advanced and expensive instrumentation.

Institutions that afford postgraduate training include not only universities and polytechnics but research organizations that are actively engaged in the broad discipline of engineering and may therefore afford opportunities for higher education. Human resource development and capacity building occurs at all levels and can range from short and long term hands-on training all the way through to full-time postgraduate training.

EXISTING EDUCATIONAL AND SERVICE INSTITUTIONS

Key departments within the University of Zimbabwe providing services in the fields of mineral exploration and mining include the Institute of Mining Research, the Departments of Geology and Physics (Geophysics) in the Faculty of Science and the Departments of Mining Engineering and Metallurgy in the Faculty of Engineering. The multi-disciplinary requirements of mining, especially in its relation to the environment, health and the economy, may require input from other university departments as well (e.g. the Department of Soil Science and Agricultural Engineering in the Faculty of Agriculture).

Within government, services in the mining industry are provided principally by the Departments of Geological Survey, Metallurgy and Mining Engineering, and the Scientific and Industrial Research and Development Centre (SIRDC). The major source of funding for all of these institutions is Government.

There is a degree of overlap between the above institutions, some of which were established more than 30 years ago with terms of reference appropriate for that time. With decreasing funding exacerbated by a harsh economic climate in Zimbabwe there is need to revisit the charters of these organizations and to review the income generating capacity through the provision of services to the mining sector.

The Faculty of Science, University of Zimbabwe

The Faculty of Science is well established within the University and has highly qualified and experienced staff, good basic research facilities and an international reputation. Within the Faculty there is capacity for income generation but the full potential has not been realised.

The fundamental problems afflicting the Faculty and the University in general are the lack of sufficient finance from Government and poor management. This has resulted in such problems as an inability to attract and retain professional staff, low morale and inadequate funding for maintenance and replacement of infrastructure (3). These developments come at a time when the University is trying to enroll increasing numbers of students.

Very little direct income is generated in the Faculty as few departments have a proactive approach or a structure that facilitates consultancies at departmental level. There is little financial benefit to the department from individuals engaged in private consulting.

TOWARDS A SOLUTION

Recognition of these difficulties has led the Department of Geology at the University of Zimbabwe to spearhead a new initiative to establish an alternative

structure through which consultancy and research in the field of mineral resource studies can be coordinated. The idea is to create the Mineral Resources Centre (MRC) that will act as a representative body through which training and research in the fields of earth sciences will be coordinated. The MRC is designed to act as a facilitator for academic staff from different departments and faculties to tender for large-scale, multi-disciplinary projects. Participants initially include departments within the University of Zimbabwe, but could be expanded to include other interested organisations.

Previous attempts

The concept is not entirely new and has been attempted before without success. A previous attempt to establish a campus-wide consultancy service was initiated in the mid-80's within a stable economic environment when the need for such a service was not immediately apparent. The approach was top-down and not demand driven. At that time the university did not have a published strategic plan that the university community could "buy into", and the initiative failed to establish a viable unit.

In the late 80's departments with a common interest in earth sciences explored the possibility of establishing a separate faculty to streamline university services. The approach was bottom-up and did not originate as part of a long-term strategy of the University. As a result the initiative failed because of irreconcilable differences between potential participants due to a lack of central guidance.

THE CURRENT INITIATIVE

The current initiative had its origins in the evaluation report of a co-operation programme between the University of Zimbabwe and the Vrije Universiteit of Amsterdam for Mineralogy Research Training, MINREST II (4). The programme proposed the establishment of a "Research School" comprised of existing departments in the University. The MINREST concept benefited from the formulation of a five-year strategic plan by the University in 1998 which allowed the Vice Chancellor to call for income generating activities to be initiated at faculty and departmental levels. The Vice Chancellor noted that "the University needs to expand its resource base substantially if it is to maintain quality in its core-business" (5). Realizing the potential among the University staff, all faculties were invited to formulate a formal institutional approach so that collectively the University could tender for, and engage in consultancies and advisory services just like any commercial company. The anticipated result was an additional income to the institution, the departments and the staff members themselves. Departments in the Faculty of Science had mixed views on the proposal. In its concluding remarks, the Faculty acknowledged the need to establish and manage consultancies in view of

dwindling financial support from Government (3). However, in the present environment of low staff morale there is little meaningful income generating activity to departments in the Faculty of Science.

An alternative to the top-down approach is the bottom-up approach, which is more gradual. In its typical format a 'change task force' consults with managers at all levels in the organisation. Then, over time, it develops a detailed plan for change, with a timetable of events and stages that the organisation will go through (6). However, in practice this approach may result in the build up of organizational structures without a master plan in place. A group may simply start doing things to prove a capability in certain niches or areas of specialization and deal with the problems as they arise.

Dual approach

The two approaches are not mutually exclusive. The dual approach we believe is the reason for the success and the progress that the MRC has made to date. The top-down approach should provide a strategic plan devised by a higher authority. The long-term goal should be set even though it may be one that cannot be implemented immediately because of risk of failure. However, when putting long-term strategies in place, the Vice-Chancellor has to make sure that he has grass roots support for the program. With an awareness of the strategic plan a bottom-up approach can begin activities in areas of strength to demonstrate a capability. Actions speak louder than words and success will soon attract the attention of the non-believers. This we believe has been and will continue to be the case with the MRC.

The advantage of the top-down approach is that one is assured of institutional support for capacity building. The Dutch Government provided seed funding for the MRC through the MINREST programme. Subsequently the Vice-Chancellor has pledged his support for the Centre.

The advantage of the bottom-up approach is that it involves a relatively large number of people at departmental level, and that it demonstrates in the fairly early stages of formation, the ability of a new system to deliver the desired results.

To be able to push programmes in a piecemeal fashion is a characteristic of a successful strategic manager. There may be objections to parts of the programme, but if the master plan can be followed, the goal is likely to be achieved. The first step should be to understand the requirements and to try to accommodate them in the new plan. The incorporation of elements from both models is likely to enhance the probability of success. The requirements of the different groups and the existing management structures of the various participating entities should be recognised and respected. No single plan can be lifted from one environment and planted in another without suitable modification.

STRUCTURE OF THE MINERAL RESOURCES CENTRE

The MRC is designed to be a lightweight structure that will not replace any of the existing teaching and research departments at the University of Zimbabwe. Its aim is to act as a facilitator through which fund raising activities, consultancy services, research, post-graduate training and capital investment in the field of earth sciences can be coordinated. By representing a group of like-minded stakeholders, the MRC can address larger projects and thus secure more funding than individual entities will be able to obtain. An increased fund raising capacity will act as an incentive to participants.

MANAGEMENT OF THE MRC

The management structure of the MRC will consist of a Director, a Board of Management and a Board of Advisors. The Board of Advisors will be constituted from a group of high level experts with interest in earth sciences including senior representatives from industry, government and academia. They will assist in the formulation of policies and will be involved in the strategic planning of the Centre.

The Board of Management consists of senior representatives of all major stakeholders involved in the MRC. It assists in the administration and strategic management of the centre and is expected to form a network with industry to ensure that the activities of the MRC are in line with the needs of society. The Board of Management meets on a regular basis to perform the work of planning, organizing, setting goals, leading and controlling. Two requirements of management are that the decisions should be transparent and the decision and implementation process be rapid.

The Director is responsible for the day-to-day running of the centre within a network of multiple stakeholders. An important skill in dealing with multiple stakeholders is the ability to coordinate of interests that coincide and to resolve conflict among interests that do not coincide.

Mode of operation

The MRC is intended to have a small management structure with a strong leadership. The need for strong leadership is particularly important when dealing with multiple stakeholders as the organization has to operate in a world as visible as a fishbowl, and therefore has to develop skills that are essentially political to transcend interdepartmental politics. The decision making process has to be neutral and therefore there is a need to separate decision-makers from service providers.

The MRC should not be bound to any particular faculty within the university, and may include stakeholders from outside the university. Its role is primarily a coordinating one, by identifying the most appropriate facility for services of the highest quality. Interested

parties are invited to participate on a voluntary basis in accordance with the management and quality-control guidelines laid out by the MRC. Participation is on a contract basis, to be determined for each project.

Service providers that participate in the MRC should agree to utilise their resources in the best possible way, so that a greater range of facilities is available jointly. In combining forces between various departments with expertise in earth sciences, it is envisaged that a wider audience can be reached, a better service can be provided and a larger resource base can be tapped both within the private and the public sectors. The MRC may help coordinate capital investment and human resource development in the various participating entities. Considering the limited availability of financial and human resources in Zimbabwe, coordination and prevention of unnecessary overlap is in itself a valuable exercise.

Quality control and customer satisfaction

Of fundamental importance to the establishment of the MRC is that its participants must guarantee unquestionable quality control for all services offered. Only when quality is guaranteed, will the MRC be able to sustainably secure financial support. This may be achieved most expediently within a management structure that permits rapid and transparent decision-making. Such a structure requires a strong executive that can be held responsible and accountable for its actions.

How do we ensure a guaranteed quality service or alternatively what can we do to facilitate it? Two approaches are being considered. The first is to encourage competitive performance amongst existing university facilities such as laboratories. For example, if contracts are given to the best performing laboratory, it is hoped that less well performing laboratories will be encouraged to review their operations and procedures. This approach assumes that the groups or facilities in question have the capacity for self-evaluation and development. A second approach is to assist university groups or facilities in the methodologies of running efficient operations. Guidelines for management and operating procedures will be prescribed for routine tasks. Eventually these procedures could be used towards ISO certification to enhance customer confidence and satisfaction. The guidelines will also assist in a second customer requirement, that of timeous delivery of results, by identifying the elements of a task or operation and determining the time taken for each step of the process.

Another means of quality control is by tapping into expertise and resources via links with external organisations. Having access to expertise, techniques and equipment not available locally will broaden the scope of the research capability and service delivery of the MRC. It will also provide a check on services provided by the University.

SOURCES OF FUNDING

An initial grant of NLG50 000 (approximately ZW\$750 000) was provided as seed money for the establishment of the MRC, at the beginning of 1999, by the Dutch Government through the third stage of the MINREST programme. This included a replacement salary to the Department of Geology to allow a coordinator from that department to be committed fulltime to the MRC during its initial phase. It was envisaged that the MRC would become a fully operating commercial unit by December 2000, and income generated by the MRC could contribute to the future financial sustainability of the Department of Geology.

The MRC is engaged in a number of income generating activities with a gross turn-over of over ZW\$6 000 000 (approximately US\$150 000) in less than a year; the time period that the MRC has been operational as a financial entity. A substantial part of this income has been from consulting. These and other income generating activities are described below.

It should be stressed that time-spans involved in tendering for, and obtaining consulting contracts from local industries are significantly shorter than the time it takes to obtain funding for the establishment of a research project that involves post-graduate students. Therefore, income-generation during the initial stages of operation has focused on consulting services. This does not necessarily reflect a long-term strategy.

Consulting

A major income generating activity has been large multidisciplinary consulting contracts for industry. The MRC has been awarded six contracts since the start of its operations. One major contract has been an environmental impact assessment of chromite mining activity in the northern part of the Great Dyke. The successful completion of this contract may lead to a further contract for a similar project on the southern part of the Great Dyke. Two projects are concerned with the construction of geological exploration models for gold mines. The analysis and interpretation of petrographic thin sections is being done on a routine basis for a gold mining company.

In each case the consultants are selected by the MRC and are paid a daily fee, with a fixed rate of 12.5 percent of the fee being payable to the MRC. Consultancies in geology have brought in substantial salary supplements to participating staff. The MRC makes additional charges for analytical services and overheads. A cooperating laboratory, the Analytical Services Laboratory in the Department of Soil Science and Agricultural Engineering, has demonstrated its income generation ability through consultancies. Additional income from projects sourced through the MRC has enabled the laboratory to meet its operating costs and to purchase items of scientific equipment such as a UV spectrophotometer, reflux apparatus and

distillation equipment to the value of ZW\$ 185 000 (approximately US\$4600).

Research Activities

The MRC has established a number of research activities that will effectively generate income and enhance teaching in selected disciplines. The research is centred on two themes.

The first is a pilot project on a GIS compilation and a geochemical monitoring exercise of mine dumps in Zimbabwe. There has been considerable interest from industry and despite a sharp decline in the economy and a volatile political climate, the project has attracted one full-time PhD scholarship from industry and one MPhil student sponsored by the MINREST programme. A further DPhil programme by a candidate from the Institute of Mining Research and a current MPhil project, both funded by the Swedish Agency for Research Cooperation (SAREC) are being incorporated into the study. The strength of the project has attracted one student from Sweden and one more from Curtin University in Western Australia is expected to participate, possibly with a scholarship from AUSAID. In addition the link with Curtin University has brought an expert from Australia to the University of Zimbabwe for short periods and has provided access to advanced scientific instrumentation at Curtin University. The equipment includes Laser ablation ICP-MS, Time-of-flight ICP-MS and Gradient High Performance ion chromatography; techniques important in environmental analysis.

The second theme focuses on the tectonic and metallogenic evolution of the Zimbabwe Craton, a topical issue in which staff in the Department of Geology have considerable interest and expertise. The local mining industry has expressed interest in supporting selected parts of the project. Contact has been made with the Free University Amsterdam, the University of Utrecht, Curtin University, Mainz University, the University of Göttingen, the University of Cape Town and Witwatersrand University to explore the potential for cooperative projects. A workshop on the Archean is planned for 2001.

Links with industry

Links with industry have proven to be a valuable means of supplementing teaching in two ways. Firstly, industry has funded part-time lecturers for specific courses. Secondly, staff in industry have been invited to give lectures at the University thus supplementing the work of the teaching staff and exposing the students to the current interests of industry. Further exposure is provided through student placements during the course of training. By these means, industry is able to share its know-how with students and demonstrate what industry expects of the graduates. Honours year students are sufficiently well respected to be hired by industry to do their projects which are designed to address particular research topics of interest to the company.

MSc in Exploration Geology

The MRC has provided logistical support for the establishment of a new MSc course in Exploration Geology. It has been restructured into a series of independent course units, some of which are taught by invited lecturers from leading institutions in other parts of the world. The establishment of short courses held in co-operation with external institutions not only supplements income, but also leads to technology transfer by exposing local professionals and students to external experts.

The present short course format of the MSc programme in Exploration Geology was conceived within this context. Such a format also encourages company people to attend, and allows successful component parts of the program to continue, even if a full MSc course could not be maintained.

There were three full-time candidates for Module 1 and six for Module 2. In addition the various course units of the first two modules attracted a total of 59 participants from organisations in Zimbabwe, South Africa and Zambia. The fees paid by the MSc students and the other participants covered two thirds of the total cost of mounting the programme including the field trips in Zimbabwe and South Africa.

Short courses

In addition to short courses designed to be a part of the MSc programme, the MRC holds workshops in particular disciplines of topical interest. A recent short course on "Environmental Geochemistry of mine site pollution" held by Dr Watkins of Curtin University, Perth Australia over three days attracted 22 participants. Fourteen of these participants were from industry paying a full registration fee.

Alliance with other institutions

The links with Curtin University have been formalised by signing a Memorandum of Understanding between the two universities. The main benefit has been access to expertise in environmental geology through the Environmental Inorganic Geochemistry Group (EIGG) in the School of Applied Geology at Curtin University. Through this link, the mining industry will benefit from the provision of trained manpower and through collaboration in high-quality research studies in mining pollution, its remediation and mine site rehabilitation. The link also provides access to a range of equipment at Curtin University. In addition Curtin University has provided a project vehicle.

Joint Courses

The possibility of offering a joint MSc course with the International Institute for Aerospace Survey and Earth Science (ITC) in Delft is under consideration by the MRC. The Department of Geology is recognised as a high quality institution capable of offering courses comparable to those at ITC. Furthermore the geology of Zimbabwe offers an unrivalled natural laboratory

that is supported by an active and diversified mining industry, an ideal situation for practical training especially for overseas students. An added advantage is that costs of mounting a course in Zimbabwe are considerably less than those in Europe because of our weak currency. Thus by offering a more cost-effective joint MSc course in Africa, a larger number of students can benefit for a given amount of money.

Alumni

A novel way of seeking support is being launched through Alumni of the Department of Geology. A list of graduates has been prepared and promotional material is being compiled to urge former graduates to support the department through contracts, donations, publicity or in any other way that is likely to benefit the department.

RESOURCE MANAGEMENT

The assets of an organisation include its human, financial and physical resources. A common statement in annual reports is "Our people are our greatest resource." This recognition highlights the need for strategic human-resource management and development in addition to the careful use and administration of the other resources.

Human resources

The MRC can act effectively as a facilitator in human resource management and development. In terms of management, the MRC has the ability to draw together experts from the bank of University skills across many disciplines through networking. Thus networking effectively achieves critical mass by pooling the resources of cooperating units and it allows the University to collectively tender for large multi-disciplinary consultancies that individuals alone would not be able to undertake. Recent examples include the project on the Great Dyke being done by the Department of Geology, the Analytical Services Laboratory and a consulting firm external to the University, and another by the Institute of Mining Research and the Scientific and Industrial Research and Development Centre on the smelting of chromite. The resuscitation of an electric arc furnace and an induction furnace enabled a large project to be done for industry. The recommissioning of these facilities paved the way for an MSc project and a final year project for two students in the Department of Metallurgy. Now that the capability has been established, plans are underway to seek industry funding for future student projects.

One should consider the strengths of existing facilities and how these may be utilized, bearing in mind their own mandates, sources of funding and ability to expand. The MRC plans to contribute to the development of human resources by facilitating tertiary education at PhD level through scholarships from industry. There are advantages in turning consultancies into research projects in order to receive

funding through research grants. The feedback from industry has been positive and may also include equipment in future grants.

Equally important in the development of human resources is the need to facilitate the acquisition of skills in laboratory, business and financial management. Although there is already an indication that the core business of the MRC should be to facilitate research through experts rather than consultancy, there will still be a need for the provision and management of ancillary services. Some of the ancillary services provided by technical staff at the University are currently underutilised and if coordinated through the MRC, they could be used to generate additional income for the departments.

Finances

The financial management of the MRC is organized through a trust fund with a bank and an asset management company. In addition, the MRC has assisted the Department of Geology in establishing and managing trust funds that have been placed under the care of the Chamber of Mines. In each case the purpose of the fund, the beneficiaries and the trustees are clearly stipulated. MRC investments, which to date have earned high interest and are tax-free, have greatly improved the financial sustainability of the centre. The aim of the MRC is to build up sufficient reserves in trust funds to enable operating costs, such as salaries for support staff and running costs, to be met from the interest alone. Similar objectives are set for trust funds operated in the Department of Geology. It is proposed to coordinate capital investment through the MRC. A potential difficulty may arise if too many trust funds are set up as the management and accounting of these funds may become wearisome and time consuming.

Other aspects of financial management have already been described. These include a means of rewarding research staff and service providers adequately for work successfully completed. Part of financial management is in the application of the funds, be it for development of human resources or the physical infrastructure and equipment within an organisation. This aspect of resource management is discussed in the next section.

Physical resources (Laboratories and Equipment)

Shortage of finances and equipment are often quoted as constraints. In fact these resources are not in short supply at the University, but the management of them has not been optimized. The University has expensive pieces of advanced instruments that are not being fully utilized. For example there are three X-ray diffraction units on campus. One unit is about 30 years old and is limited in its capabilities. The second unit, a younger generation instrument has been out of commission for a number of years now. The third unit consists of two independent instruments that have yet to be commissioned more than two years after they had been

acquired. There are other similar examples of duplication and underutilization.

On a more positive note, the IMR has entered into an agreement whereby an atomic absorption spectrophotometer acquired by the Faculty of Engineering is being operated and maintained by the IMR. For the last nine years all the analytical requirements of the students in that department have been met by the IMR. The arrangement suits the Faculty of Engineering as they are relieved of the burden of accommodating the instrument, the day to day running and the preparation of calibration standards on a routine basis. Overall the arrangement has effectively resulted in a cost saving for the two departments and a reduction in the financial requirements for the University.

Another area of potential cooperation currently under consideration is the transfer of an XRD unit from the Department of Soil Science and Agricultural Engineering to the IMR. The former proposes to convert its current mineralogy laboratory into a pesticide laboratory, an area in which they have expertise. The IMR would be pleased to acquire a newer-generation XRD unit capable of being upgraded to acquire digital data, a facility that would greatly enhance the interpretation of XRD spectra.

The question of underutilization and duplication should be considered in the context of the demand for a service or facility. In the days of the mainframe computer all the computing requirements of the University were met by one central facility. As demands for computing grew and technology advanced to the point where desktop computers outstripped the performance of the old main frames, the personal computer became just that - one for each researcher. The hydride generator, an AAS accessory that improves the detection limit for certain elements, may be an expensive accessory to be shared today, but future demands for this service may justify the acquisition of several units within one organisation.

It is evident that there is a need for control or rather coordination of the acquisition of equipment. This may be achieved through some sort of clearing house or higher authority, a role that could be delegated to the MRC for both the management and acquisition of facilities that are sourced through public or donor funds. SAREC, the Swedish Agency for Research Cooperation, is in some ways already trying to implement such a policy through an "oversight" committee which was established after about ten years of funding research projects at UZ. In the current environment, any initiative to manage existing resources should take due cognizance of the strong desire for preservation of present identity, integrity and independence of each organisation. The overall aim of the University should be to move from a situation of independence of departments to one of interdependence to increase the levels of trust and

cooperation between departments in order to achieve a synergistic win/win level of communication.

There is a need to coordinate the acquisition of facilities and equipment according to a master plan. Such a plan presupposes that there is an overall research policy for the country. Although a draft document for Zimbabwe had been produced in 1985/86, the first Science & Technology Dialogue Forum held in 1998 noted that there is no official policy document on science and technology in Zimbabwe.

CONSTRAINTS TO BE OVERCOME

Communication

One of the main constraints has been the level of communication between departments and across Faculties. The degree of trust and cooperation within the University is not yet sufficiently high to fully exploit the synergistic win/win experience. For example projects on the management of mine dumps are being undertaken by seven departments within the University (Geology, IMR, Soil Science and Agricultural Engineering, Chemistry, Engineering, IES, and Biological Sciences). Each may be looking at the problem from a slightly different point of view. Valuing the differences is the essence of the synergy that will enable the problem to be dealt with more completely.

Communication at departmental level, and particularly between individuals, at an early stage is essential to avoid distrust and suspicions in a proposed change or new project. It is inevitable that there will be some that resist change and may actively try to sabotage plans for change. Communication on a personal level is therefore extremely important to try to get everyone on board right from the beginning.

Coordinator

The success of a venture frequently depends on the drive of an individual. An element of risk is therefore associated with the availability of the individual, which can be manifested in two ways. Firstly, the absence of the key player could have devastating consequences on the programme. The risk is reduced if there is a master plan and a degree of progress, which will encourage others to buy into the programme and support it. Secondly, a department, in this case Geology, may be adversely affected because the coordinator, who originated from that department, is no longer available to perform his normal teaching function. This problem has been recognised and has been addressed by the hiring of part time lecturers funded by the original grant for the formation of the MRC. A long-term solution is currently under consideration.

Impact on teaching

One of the requirements of the new strategic plan of the University states "To maintain its relevance to/in

society, UZ must clearly satisfy the needs of its clients and customers" (1). Although teaching has long been recognised as the core business of the university, it is now clear that high quality undergraduate and post graduate education as well as research, consultancy and advisory services and short courses are the major needs of society. The example of the MSc in Exploration Geology demonstrates that postgraduate courses can generate significant income and fulfill a need in higher education.

Considering the relatively poor condition of service of staff members at the University of Zimbabwe, a big concern may be the impact of consultancy on teaching. Any consultancy performed must be coordinated so that teaching is not adversely affected. The same is true for teaching equipment used in the execution of consulting work. This will require careful agreements between the MRC, participating departments and individuals concerned. Teaching is less likely to suffer if consultancies are part of research programmes that can be integrated into the teaching curriculum.

CONCLUSIONS

Initiatives to exploit synergies and integrate services to increase income-generating activities, enhance teaching and progress along the path of greater financial independence are essential if the University of Zimbabwe is to maintain its excellent record. The initiative to establish a Mineral Resources Centre focuses on a combined marketing policy for education and research institutions that provide services to the mining sector in Zimbabwe. The project is still evolving and success hinges upon proper guidance at top level in combination with genuine grass-roots support and understanding of the problems. A number of key success factors that are essential in making the MRC work can be identified.

Dual approach

The MRC has made a good start and has achieved remarkable progress in a relatively short time. The success can be attributed to the dual approach. There is a master plan, albeit only formulated in the broadest terms at present, which is receiving strong support from the highest authorities, as the MRC could be a role model for the University. In practice, progress at grass roots level is being made in incremental steps. Thus, the MRC follows the Japanese *kaizen* concept of incremental *versus* radical change, but being guided by an overall master plan.

Seed funding

Initial seed funding plays an important role as a catalyst at the beginning of a programme. The MRC had a small grant from the Dutch Government to start the project. The Institute of Environmental Studies is a very successful institute at the University which received a substantial grant from the Kapnek Charitable Trust as seed money.

Highly motivated driver

The success of the programme depends on the availability of a highly motivated individual to drive the project. It is essential that the person nominated for the task be able to devote a large proportion of his time to achieving the goals of the project. In this respect, the funding from the Dutch government provided for part-time staff to take over some of the teaching responsibilities of the current coordinator.

Wide consultations with stakeholders

The probability of success of an initiative is enhanced if it takes into account the stakeholders, which are the groups or individuals that can affect or are affected by the achievements of an organization's purpose. The wide consultations made at the start of the programme resulted in an awareness of industry needs and ensured an approach that was focused on these needs.

Establishment of Trust Funds

The authority to operate trust funds and to invest income provides a means for the MRC to build up financial reserves for specific purposes. This facility contributes towards the long-term goal of accumulating sufficient funds through the various activities to enable recurrent expenditure to be met.

Mode of operation

An important factor in the success of the MRC has been the management structure that promotes innovative and mutually beneficial partnerships between various departments in the University, government, the private sector and international organisations. Through a proactive approach the MRC can facilitate and coordinate the wide range of resources available throughout the University. The team approach enables the University to tender for and engage in larger multidisciplinary projects.

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