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# **Training Agricultural Scientists for Southern Africa**

**Southern African Development Coordination Conference**

**Submitted to  
The Ministry of Agriculture  
Harare, Zimbabwe**

**July 1985**

**TRAINING AGRICULTURAL SCIENTISTS  
FOR SOUTHERN AFRICA**

**SOUTHERN AFRICAN DEVELOPMENT COORDINATION CONFERENCE**

**SUBMITTED TO  
THE MINISTRY OF AGRICULTURE  
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**- SADC -**

**SOUTHERN AFRICAN DEVELOPMENT COORDINATION CONFERENCE**

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## EXECUTIVE SUMMARY

The demand for more food coupled with restrictions on food imports in Southern Africa compels countries within the SADCC region to give more attention to the development of their agricultural sectors. Food production must increase by 3 percent a year just to keep even with the increase in population; however, stagnating total agricultural production and increased food imports are the norm.

The agricultural potential of the SADCC countries is greatly underexploited. Seventy percent of the population lives in the rural areas where labour productivity is low. In addition the available technology is not appropriate for many conditions in the region. Therefore, basic and applied research, more effective agricultural policies and greater investments in rural institutions and infrastructure are needed to stimulate increased agricultural production. These improvements demand trained people. The single most important constraint to rural development in Southern Africa today is the shortage of people who can better utilize and preserve the natural resources of the region.

These are the views of current leaders, administrators and educators in Southern African countries who know the agricultural potential in the region and recognize the constraints to achieving it. This report presents their views; it describes the problems facing the agricultural sectors, constructs a rationale for supporting the training of agricultural scientists and outlines a programme to improve training at local institutions.

The report is based on interviews conducted by a team of five agricultural specialists during visits to the nine SADCC countries. The visits took place during April, May and June of 1985, and were conducted on behalf of the Zimbabwe Ministry of Agriculture as part of its responsibility for food security in SADCC.

Although a large number of well-trained agricultural scientists are and will be needed in Southern Africa, quality is more important than numbers and the consistency of effort takes precedence over crash programmes. Investing in people takes a sustained commitment. A long term solution to providing training needs for countries in the SADCC region is to increase the capacity of local educational institutions to provide this training themselves.

Faculties of Agriculture at national universities in many SADCC countries are already playing a major role in training agriculture scientists. Malawi, Swaziland, Tanzania, Zambia and Zimbabwe have

current programmes at the B.Sc. level and above. Botswana and Lesotho are developing agricultural faculties to complement effective Diploma programmes at national agricultural colleges. Angola and Mozambique face critical manpower shortages, but are strengthening their agricultural schools.

However, to provide the trained manpower required for the agricultural sector, training programmes must be improved. They must be more appropriate and effective if local scientists expect to solve the agricultural problems of their countries and if SADCC countries hope to achieve a measure of independence in their quest for economic development. At the present time, all the agricultural faculties in the region lack sufficient support to improve their training and research programmes.

Some of the lessons in agricultural and economic development from other parts of the world, particularly other developing countries, can be applied to Southern Africa. Agricultural and economic development takes place in a complex environment and requires simultaneous changes in conventional resources, technology, human resources and institutions. To succeed, a national commitment to agricultural development and an investment in institutions that will aid in the process is required. Links between teaching and research are important, and some specialisation within universities in the region is necessary. The process is slow, spanning at least twenty years, but the payoff to developing a critical mass of scientific effort is substantial. Furthermore there is no apparent way to shortcut this process.

In contrast to recent manpower planning studies conducted in the SADCC region, FAO conservatively estimates that at least 500 scientists trained at the B.Sc., M.Sc. or Ph.D. level are required on an annual basis.

A program of support for training agricultural scientists will focus on the faculties of agriculture in the region. There are two reasons for this: First, faculties will educate the future generation of agricultural scientists. Second, the wealth of human resources already at the faculties is underutilized. While some training should take place abroad, more can be done within the region. Currently there is little exchange of students among faculties in SADCC and there is a lack of communication and collaboration between members of different faculties. Training in the region in agriculture is more relevant than training abroad and less expensive.

The report proposes the creation of a fund to be administered under SADCC auspices. The fund would support a programme for education in the agricultural sciences through two channels: individual scholarships and institutional grants.

- (1) Individual scholarships will be at the B.Sc., M.Sc. and Ph.D. levels. In the early years of the programme, some of the training will take place abroad but as local institutions and graduate programmes develop, more students will be able to receive training within the region. The scholarships will be awarded on a competitive basis to students who will join faculties, other agencies and organizations in SADCC countries.
- (2) Institutional grants will be made to enhance the educational programmes of the faculties. Curriculum development, textbooks and supplementary course materials, applied training, research, management of experimental stations and university farms are areas that need strengthening. Collaboration among the faculties in the region will make them more effective.

The fund would be managed by a small independent staff of agricultural professionals.

A creative program of individual and institutional grants to assist the countries in the SADCC region train more agricultural scientists and train them better is basic to the development of the agricultural sector.

## ACKNOWLEDGMENTS

This study was requested by the Ministry of Agriculture in Zimbabwe as part of their focus on food security issues for SADCC. The team is grateful to the Government of Zimbabwe for the opportunity to conduct the study. Team members met representatives of ministries, universities, and research institutions in each country they visited. In general, the SADCC liaison officer in the Ministry of Agriculture coordinated our visit. Discussions with staff members of these ministries were of great value. At the universities the Principal or Dean of the Faculty of Agriculture provided us with information on their faculties and gave us insights into the problems they face. They also arranged visits with faculty members and students. This report is an effort to summarize the many observations and suggestions that were made during these discussions.

The team visited eight of the nine SADCC countries during the period of 29 April to 12 June 1985. Due to a delay in obtaining a visa for Angola, information about agricultural education and current research activities in Angola was collected through telephone conversations, and data gathered during a previous visit by one of the team members is used in the report.

The project was administered by Winrock International and financed by USAID under contract number PDC 1406-I-00-4086-00. The support of these two organizations was greatly appreciated.

In spite of an effort to record and reflect accurately the needs and desires of agricultural scientists and administrators in the SADCC region, we realize that some of our interpretations may be in error. In addition we received helpful comments on earlier drafts of the report, not all of which could be incorporated in the final version, and we thank the reviewers. We accept full responsibility for the contents of the report and apologize for any errors or omissions.

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Chapter I. INTRODUCTION

Agricultural and rural development in Southern Africa faces a crisis. Total production of cereals has stagnated while cereal imports have increased by 500 percent. Per capita production has decreased by 30 percent over the past 10 years. Seventy percent of the region's 61 million people live in rural areas, and population is growing at more than three percent per annum. These statistics are alarming.

At the same time, agricultural and rural development in Southern Africa is at a crossroads. The focus of the Southern African Development Co-ordination Conference (SADCC) on development, and the tremendous agricultural potential in the region give reason to be optimistic. While governments in the SADCC region are committed to agricultural development, they now must choose which road to take to translate commitment into development. There is a critical lack of new agricultural technologies to help small-holder farmers in Southern Africa and little relevant research is currently underway. It is critical to exploit the area's local resources. People are the region's most important resource, and insufficient attention has been given to human resource development. These ideas summarize the views of people in the Southern African region who are interested and involved in agricultural development and who expressed their ideas to a SADCC mission on agriculture and training.

The relevance of these views is based on two facts. Africa has the lowest average level of investment in human capital of any continent and the SADCC region is low within Africa. Second, at such low levels

of investment in training people, the productivity of other investments, for example infrastructure development, is limited by the quality of trained people. Much of the lack of success of development programmes can be attributed to this scarcity.

Under its food security mandate, the Ministry of Agriculture in Zimbabwe invited a mission of five agricultural specialists to visit the nine SADCC countries from 29 April to 12 June 1985 to study the training of agricultural scientists for this region. During that time, the team members visited with officials in ministries of agriculture, planning, manpower development and education and with faculty members and students at universities in the various SADCC countries.

This report records what the team members heard from these planners, teachers, policymakers and administrators. It describes what the team learned in discussions with them and outlines a program to remedy what these people see as a major constraint to agricultural development in the region -- a shortage of agricultural scientists. This finding is not surprising. Indeed, virtually all SADCC documentation on agriculture stresses the urgency of developing better training programmes.

A massive effort is needed. The need is immediate and will persist; the challenge of meeting it is profound. More scientists must be trained, and they must be better trained if the SADCC countries are to achieve their agricultural potential and thus reduce their dependence on food imports for subsistence and on food aid for survival.

The shortage of qualified agricultural scientists is pervasive. Ministries of agriculture, other governmental units involved in rural development, parastatals, private sector enterprises and the universities in every country in the SADCC region lack sufficient

numbers of qualified personnel in most areas of agricultural production and rural development: in the plant, animal, physical, soil and rural social sciences.

The only economically viable, long-term solution to this problem is to increase the capacity of the faculties of agriculture in national universities in the region to train agricultural scientists. These universities will produce the vast majority of agriculturalists, teachers, researchers and administrators for the agricultural and rural sectors of the economy. In fact, in most SADCC countries they are already doing so. Although the numbers of people trained and the quality of the training in these universities is not yet fully adequate, there is no doubt of the potential. National universities could meet the both the quantitative and qualitative requirements of the SADCC agricultural sectors. To do this will involve a substantial programme of staff development and institutional support, which will enhance the intellectual environment and alleviate the constraints to improving the educational and research activities at these universities.

The faculties and colleges of agriculture recognize the strengths of their programmes and their capacity to supply competent personnel in agriculture. Every country in the SADCC region has established Diploma courses, and most have B.Sc. degree programmes. Established positions in faculties currently number more than 350 in the nine countries, 870 students are registered for B.Sc. degree programmes and over a thousand are in Diploma courses. This is a substantial base on which to build. Governments in the region are giving significantly more attention to their agricultural sectors, which results in more employment opportunities and better status for agricultural scientists. Every

faculty has an active staff development programme and is drawing its best students into academic positions.

There are problems, however--problems that are recognized by those concerned with training agricultural scientists:

- 1) Agricultural education in SADCC countries is primarily oriented to training future government employees. As a result, enrollments are limited, constraining faculty development and dampening growth in the agricultural sector.
- 2) Faculties of agriculture face severe and recurrent budgeting constraints and foreign exchange problems.
- 3) Faculties contribute little to the development process in spite of the fact that many of the best agricultural scientists in the region are at the universities.
- 4) Agricultural faculties have not yet participated in or benefited from SADCC activities.
- 5) The faculties still depend heavily on short-term expatriate staff (30 to 50 percent is common), imported texts and course materials, and short-term specific bilateral financial assistance.

To revitalize the agricultural sectors in Southern Africa, these problems must be overcome.

These major issues are discussed in the following chapters. The status of the faculties of agriculture, their similarities and differences are described in Chapter II. The basis of institution building with a view to improving these faculties is treated in Chapter III. Chapter IV points out the pitfalls of manpower planning and with reservations discusses minimum requirements for agricultural scientists in the region. Chapter V develops a rationale for a programme to strengthen faculties with a particular emphasis on training in the region. Chapter VI describes a training programme to meet the needs of

the region for more and better trained agricultural scientists. A conclusion and appendix complete the report.

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Chapter II. THE FACULTIES OF AGRICULTURE IN THE SADCC REGION

Agricultural education in Southern Africa has evolved since independence. Today every country in the SADCC region either has or will soon have its own faculty. These national institutions provide a base on which to build strong educational programmes. However, the institutions that train agricultural scientists are at very different levels of development, and consequently, there is a wide range in the type and quality of education that is offered. The region's variety offers a unique opportunity to strengthen the academic curriculum in the agricultural sciences by encouraging each university to develop areas of specialisation and build links with neighbouring institutions.

This chapter describes and compares the status of the various faculties and colleges in the SADCC region. It is a synthesis and summary of the more detailed descriptions of each institution found in Appendix A. This background information is a prerequisite to any attempt to understand the strengths and weaknesses of current training activities, to improve the training of agricultural scientists and to increase the effectiveness of these scientists in developing the agricultural resources in the region.

The existing agricultural training institutions in Southern Africa were established in the 1950s and '60s to train extension staff for ministries of agriculture. Training was generally confined to Certificate and Diploma courses in general agriculture. By and large the same objective holds for these institutions today, and every country has an adequate capacity to train at this level.

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From this base, many of the colleges were able to develop programmes at the B.Sc. level. In doing so, agricultural training became part of the national university and was usually transferred from the Ministry of Agriculture to the Ministry of Education. Initially, degrees were in general agriculture, but eventually specialized undergraduate degree programmes emerged. The development of the colleges, faculties and universities were affected by many factors. In countries with large populations (and large public sectors), universities developed more quickly and to a higher degree. For example, Tanzania today has a wide range of undergraduate specialisations and offers training at the M.Sc. and Ph.D levels as well.

In the Anglophone countries, post-secondary education in agriculture includes Certificate, Diploma and Bachelor's degree programmes. Students can take these courses sequentially, but depending on the level of secondary education steps along the way may be omitted.

The Certificate course is the most basic. It is intended for students who have not taken advanced level courses or basic science courses in secondary school. Certificate programs emphasize applied, hands-on training activities with a minimum amount of classroom instruction. These courses are one to two years in length. Certificate holders are candidates for positions as assistants in extension programmes in ministries of agriculture or for actual employment as agriculturalists.

Frequently, students enter Diploma courses directly from secondary schools. Requirements for admission are usually the completion of

`O' level courses. As in certificate programmes, emphasis is on applied aspects of agricultural production, although the classroom instruction is more rigorous. The Diploma takes two to three years to complete. Diploma holders may become extension agents or assume equivalent positions in ministries of agriculture. The better students go on to enter B.Sc. programmes.

Only a few secondary schools in Southern Africa offer `A' level courses. Passes at the `A' level with a focus on scientific subjects are usually required for admission directly into the B.Sc. programmes in agriculture. Since programmes at the diploma level are relatively well established in Anglophone countries, most students take diploma courses en route to B.Sc. programmes. Differences in the duration of these courses among SADCC countries are generally due to varied student backgrounds. For example, the B.Sc. programme takes five years in Zambia, but only three years in Zimbabwe. Zimbabwe has higher B.Sc. admission requirements than Zambia, specifying `A' level passes equivalent to two more years of study before admission.

Tables 1 and 2 provide information on diploma and undergraduate programmes in each country and departments in each institution. A B.Sc. degree is offered in every country in SADCC except Botswana and Lesotho, and these two countries are proposing to develop faculties soon. Specialized degrees at the B.Sc. level are offered in Swaziland and Tanzania (agricultural engineering and agricultural education) and are under consideration in other countries such as Zambia. Student enrollments are shown in Tables 3 and 4 on the following pages.

At the present time, only Sokoine University has a taught M.Sc. programme. Malawi, Zambia and Zimbabwe plan to offer taught graduate

**Table 1: Diploma Programmes Offered by Various  
SADCC Colleges/Universities**

<u>Country</u>	<u>Agriculture</u>	<u>Agric. Education</u>	<u>Animal Health</u>	<u>Forestry</u>	<u>Home Economics</u>
Angola	X				
Botswana	X		X	-	-
Lesotho	X		-	+	+
Malawi	X	-	-	-	-
Mozambique	X				
Swaziland	X	X	-	-	X
Tanzania	*	*	*	*	*
Zambia	*	-	*	*	*
Zimbabwe	*	-	*	-	*

\* Diplomas offered but not at the University.

+ Programmes scheduled to start with first intake in 1985/86 academic year.

Table 2: Undergraduate Programmes Offered by Various  
SADCC Colleges/Universities

<u>Country</u>	<u>Agriculture (General)</u>	<u>Agricultural Education</u>	<u>Agricultural Engineering</u>	<u>Food Science</u>	<u>Home Economics</u>	<u>Forestry</u>	<u>Veterinary Medicine</u>
Angola	x	-	-	-	-	-	-
Botswana	-	-	-	-	-	-	-
Lesotho	-	-	-	-	-	-	-
Malawi	x	-	-	-	-	-	-
Mozambique	-	x	-	-	-	-	x
Swaziland	x	x	-	-	-	-	-
Tanzania	x	-	x	+	+	x	x
Zambia	x	-	-	-	-	-	+
Zimbabwe	x	-	-	-	-	-	x

+ Programmes scheduled to start with first intake in 1985/86 academic year.

**Table 3: Number of Students Enrolled in Various  
Diploma Programmes in SADCC Colleges, 1985**

<u>Country</u>	<u>Agriculture</u>	<u>Agric. Education</u>	<u>Animal Health</u>	<u>Forestry</u>	<u>Home Economics</u>	<u>Other Special.</u>
Angola	NA					
Botswana	33	-	29	-	-	-
Lesotho	29	+	-	+	-	-
Malawi	308	-	-	-	-	-
Mozambique	NA					
Swaziland	56	60	-	-	42	-
Tanzania <sup>1/</sup>	393	229	-	35	-	41
Zambia <sup>1/</sup>	160	-	-	25	-	-
Zimbabwe <sup>1/</sup>	80	-	-	-	-	65
	<hr/>	<hr/>	<hr/>	<hr/>	<hr/>	<hr/>
	1,059	289	29	60	42	106

<sup>1/</sup> Diploma courses are offered in these countries but at separate institutions independent from the University. The student numbers in these institutions were taken from the Agricultural Research Resource Assessment in the SADCC countries.

+ Programme to start in January 1986.

Table 4: Number of Students Enrolled in Various Degree Programmes in SADCC Universities, 1985

<u>Country</u>	<u>Agric. (General)</u>	<u>Agric. Education</u>	<u>Agric. Engineer.</u>	<u>Food Science</u>	<u>Home Economics</u>	<u>Forestry</u>	<u>Vet. Medicine</u>
Angola	-	-	-	-	-	-	-
Botswana	-	-	-	-	-	-	-
Lesotho	-	-	-	-	-	-	-
Malawi	63	-	-	-	-	-	-
Mozambique	44	-	-	-	-	-	-
Swaziland	53	30	-	-	-	-	-
Tanzania	294	-	43	+	+	87	70
Zambia	264	-	-	-	-	-	17
Zimbabwe	196	-	-	*	-	-	51
	<hr/>	<hr/>	<hr/>	<hr/>	<hr/>	<hr/>	<hr/>
	914	30	43			87	138

+ Programme to start in January 1986.

\* Course shared with Faculty of Science.

degrees in the near future. Malawi, Zambia and Zimbabwe currently offer a M.Phil. Sokoine and Zimbabwe currently have students registered at the Ph.D. level, however, neither programme requires course work. Graduate programmes in the region are very small.

All the faculties have active staff development programmes. (Faculty numbers are given in Table 5.) These programmes aim to attract the best students at the conclusion of their B.Sc. degree. If scholarships are available after spending a short period on the faculty, they are sent abroad for graduate training. In some cases they return to the university for a year or two after their M.Sc. and then leave again for a Ph.D. They are usually bonded (have signed an agreement to return) by the faculty for a period of time and are often paid at least a portion of their salary in local currency while they are away. There are advantages to these programmes. This process helps select the best students, encourages long-range planning and helps raise scholarship support from the donor community. On the other hand, it can take up to eight years between the time a student is selected and returns to the faculty with a Ph.D. Furthermore, when an unplanned faculty vacancy occurs this lengthy process must begin again.

Agricultural education in the SADCC countries tends to fall into four general groups. Sokoine Agricultural University in Tanzania is in many ways unique and is the only university in the first group. It is an independent university focusing solely on agriculture. It has three faculties (agriculture, forestry and veterinary medicine), the largest staff (174) in the region and offers a wide variety of courses, specialisations and degrees. It has the potential to play a leading role in agricultural education in the SADCC region.

Table 5: Faculty Positions

<u>Country</u>	<u>Established Faculty Positions</u>	<u>Expatriate Staff</u>	<u>Local Staff 1/</u>	<u>Local Staff in Training</u>
Angola	N/A	-	-	-
Botswana	30	8	22	-
Lesotho	12	5	-	-
Malawi	45	8	30	14
Mozambique	24	17	7	-
Swaziland	31	15	9	11
Tanzania	174	21	153	51
Zambia	40	14	26	-
Zimbabwe	29	11	18	15
TOTAL	385	99	265	91

1/ With at least B.Sc. qualifications.

Due to its relative size, maturity and varied programme it would be an obvious place for undergraduate students from other SADCC countries to study. At the moment it is the only place in the region offering taught M.Sc. programmes. However, there are limits to the numbers that Sokoine can handle at the present time, due to tight budgets (particularly for foreign exchange), laboratory space and equipment, student accommodation, etc.

Currently, there are bilateral aid programs at Sokoine University that support the development of certain faculties or departments. Several departments have been left out of these programmes, and Sokoine would benefit from a general scholarship fund for its staff development programme. Staff development is given high priority by the university, but training opportunities abroad have decreased over the past few years.

The Universities of Malawi, Swaziland, Zimbabwe and Zambia form a second group. Each has a fully developed undergraduate programme, and with the exception of Swaziland, soon plans to offer courses at the graduate level. They have similar numbers of faculty and reasonably similar enrollments per class. Each of these institutions has development activities underway, however, and in three or four years will be quite different from what they are now. During this period the demand for placement of national students will be strong, and it will be difficult for foreign students to gain admittance. At a later date, more flexible and open enrollment may be possible.

Staff and faculty development programmes at each of these faculties has been very impressive. Malawi has a large number of local staff that were trained abroad and have now returned. The other three are still quite dependent on expatriates while local staff are in

training. Zambia and Zimbabwe have ambitious building programmes underway, while Malawi and Swaziland currently do not have any bilateral donor support beyond a few staff development scholarships.

Each faculty has the opportunity to develop an outstanding university farm, which will be of value to the students, faculty and the university. The task will not be easy: Zimbabwe has just recently (1984) acquired its farm, and its management skills are now being tested. The university farms in Malawi, Swaziland and Zambia are not run as effectively as possible and are under-exploited by the students and staff. There is a challenge to clarify the function of these farms and assure that they serve useful purposes.

These faculties and their staff have very little contact with other educational institutions in the region. The small number of academic positions in each faculty automatically imposes a degree of isolation on any single discipline, whether it is animal genetics, entomology or the economics of regional and international trade. Any specialist is almost certain to be the only one on campus. Thus, there is much potential benefit from the collegial exchange and peer review that would come from collaborative projects with staffs in other universities in the region.

Botswana and Lesotho comprise a third group in that they do not now have faculties of agriculture but plan to develop them. Like Swaziland, they have small populations. As such they have particularly difficult problems in manpower planning. Each country walks a fine line between too many and too few people trained in any one area. Too many persons in one discipline, some of whom will be unemployed, is as unfortunate as too few. Major questions about the long-term sustained demand for B.Sc. degrees must be answered in order to develop an

appropriate capacity. Swaziland, for example, had a Certificate program in animal science and after a few years dropped the programme because it had already overproduced.

During the existence of a combined university (The University of Botswana, Lesotho and Swaziland) from 1966 to 1975, the agricultural campus was located in Swaziland. Lesotho first withdrew from this union (1975), and then Botswana and Swaziland separated (1982). Swaziland automatically had its own faculty of agriculture. While some students from Botswana still study agriculture in Swaziland, many B.Sc. students from Botswana and Lesotho are now in the U.K. and U.S.A.

Developing an agricultural faculty is not a simple task, and scientists at the colleges and universities in both Botswana and Lesotho appreciate the effort that it will take. Other SADCC countries' experience with this very process is invaluable and should be made available to Botswana and Lesotho. Training of current and new staff will be required for each faculty. This training should begin as soon as possible. Delays in staff development will greatly increase the operating costs of the faculties in the first years, as expatriates will be required to fill vacant posts.

Angola and Mozambique form the fourth and final group. Their similar colonial heritage, recent independence and current civil disruptions raise severe problems for any kind of institutional development. Universities are no exception to this. Both countries have manpower shortages at every level, and support for undergraduate scholarships is urgently needed. There were few agricultural scientists from these two countries trained during the colonial period, and priority should be given to the development of the faculty. If some of these students were to study at a university in the SADCC

region, the receiving institution would need to make some provision to offer English language instruction and perhaps remedial work in scientific areas.

Differences among training programmes and institutions are significant, yet faculties also face a number of common problems. Those that were mentioned most frequently and are given the highest priorities by the faculties themselves tend to fall into four categories. The first is the constant and nagging problem of recurrent financing and foreign exchange which affects everything in the university system from faculty staff incentives to library acquisitions to laboratory chemical purchases and textbook availability. Faculties report that the budgetary situation is worsening and scholarship support and other bilateral assistance is becoming more difficult to find.

Ways to ease this continual constraint lie deep within the political and development processes, and solutions will not be easy. Nevertheless, universities need to begin a search for solutions. One avenue is to develop a broader base of support within the agricultural sector: partially by getting the university more involved in the economic development of the country and partially with more applied, practical research and teaching. A second avenue is to look for economies within the university itself: by making strategic choices to drop some course offerings, degrees and even departments, while developing other areas of specialisation. Higher education is almost universally free in Southern Africa. Rather than ministries of education paying for all students, they could determine the number of scholarships they will offer and let the university determine its enrollment. Some students would find other sources of financial support.

A second common problem is the limited amount of research that is being done at the faculties. This is true in spite of existing university farms, the close proximity of national research stations and the expressed interest on the part of faculty members in doing research. Part of the problem is again financial -- university research budgets are small. But there are other reasons as well. Teaching loads are high (15 contact hours per week are standard), facilities for research are poor and there are few incentives to conduct research. It is a tragedy that the best agricultural scientists in the region are not applying their skills.

A third problem is the low status of agriculture and, therefore, agricultural science. Most scientifically oriented students choose medicine, engineering and other subjects before agriculture, and as a result the standard of the students majoring in agriculture is low. Faculties need to give more attention to improving their image, assuring employment opportunities and appropriate training for their students. One option is to include in the curriculum (in addition to training for government service) training for the parastatals, banks, agri-business firms and even farming.

Finally, the growth in the faculties is uneven. Crop and animal departments tend to be quite strong across the region. However, agricultural economics, extension, food science and agricultural mechanization departments receive less support. For example, there is not a strong agricultural economics programme in any of the nine countries, yet the importance of socio-economic factors to rural development is unquestioned. It would be easier to build up some of these departments in the SADCC region if they had a regional focus.

Extension departments are generally weak, but Bunda College in Malawi is beginning to develop a strong programme in this area on its own and could have a regional as well as a national focus.

The wide differences in training agricultural scientists within the region and the large variation in institutions training these scientists provide an opportunity to build on this diversity, by creating programmes of cooperation and collaboration based on the exchange of students, faculty members, course materials, scientific ideas and research results. There are many advantages to doing so. The essential elements for building educational institutions are discussed in the next chapter.

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Chapter III. BUILDING EDUCATIONAL INSTITUTIONS FOR AGRICULTURE

Nation building is the preoccupation of Southern Africa. Increased productivity and development are necessary to achieve that goal. When half or more of the society's assets and population are embedded in agriculture as they are in the SADCC region, agriculture must develop if the productivity and welfare of the society are to improve.

A. Sources of Productivity in Development

Changes in productivity arise from four sources. Conventional resources can become more or less available as minerals, petroleum, etc., are discovered or exhausted, as population grows, or as new lands are cultivated. New technology can be invented or produced through research and development, and this increases the return to affected resources. Human resource capability can be improved and thus also productivity. New institutions can be developed to increase a society's productive capacity.

Frequently, technology is viewed as if it were the sole source of all new productivity, while scientific research and development is viewed as the source of all new technologies. Neither proposition is really true. New technologies are fashioned out of investments in people and institutions. Development involves investment in all four sources of productivity. They are prerequisites to any innovation, as well as complements to each other.

Even after new technologies are in use within the agricultural sector, they have a potential productivity that cannot usually be realized until combined with (a) some appropriate, complementary

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improvement in the people managing agricultural resources, (b) some adaptive modification of agricultural institutions; and (c) an adjustment in conventional resource combinations. Any major innovation in technology will require an adjustment in most, if not all, factor combinations before the full potential in productivity can be extracted. This applies not only to conventional resources (i.e. physical capital, labor, land, etc.) but also to human resources and institutions.

The proposition is even more general. Innovation leading to higher productivity can begin with a change in any of the fundamental elements of productivity: conventional resources, technology, human capability, or institutions. The four factors of productivity interact in development in a continuing process of innovative disturbance of any one of the factors, followed by the managed adaptation of the other factors to find a new, more productive and efficient combination of resource use.<sup>1</sup>

This proposal focuses on institution building and the development of new human capability in the faculties of agriculture in the SADCC region of Southern Africa. These are crucial social investments necessary to the development of any agrarian society. This chapter attempts to state the larger principles that have informed successful institution building and human capital development in agriculture.

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<sup>1</sup> For more details on these concepts and others discussed in this chapter, the reader is encouraged to refer to Bonnen, James T. "United States Agrarian Development: Transforming Human Capital and Institutions." United States-Mexico Relations: Agricultural and Rural Development. Stanford University Press, 1985.

### 3. A Developmental System of Institutions

Historically, successful examples of agricultural development are characterized by a complex web of diverse institutions supported by public policy and closely linked through the pursuit of a common goal: national agricultural development.

The central institutions involved in agricultural development usually include a number of functions and activities: science-based undergraduate and postgraduate education, agricultural research (ranging from basic science through various types of applied science), agricultural extension, farmers' organizations, and government programs to subsidize and/or provide credit, rural electrification, mail delivery, rural roads, soil conservation, land reclamation, irrigation development, animal health regulation, commodity and market regulation and stabilization. In addition, the public policymaking institutions for agriculture, along with markets and marketing firms, play critical roles in directing resources and coordinating any system of developmental institutions in agriculture. If all these separate institutions are to constitute a system with a common purpose, their behavior must be coordinated. They must communicate and cooperate to achieve a common goal.

To be successful, an institution's developmental system requires a strong national political commitment to agricultural development. Without sustained long-term political commitment at all levels of government, agricultural institutions will not develop adequately and will lack the necessary levels of institutional coordination.

Public and parastatal institutions frequently must develop a base of farmer support and find an acceptable way to express their interests and concerns in the policy process before they are mature and

effective. Farmers must have a means to express their views and concerns to the various institutions of agriculture about production problems, breakdowns in the marketing system or other local needs.

This reflects two characteristics of a successful system: two-way communication between the various participants in the system and a capacity for adapting the system to regional and local needs within the country. To do this requires a decentralized capacity for information retrieval and action.

Variation in climate, soils, topography, and natural biological populations create an almost endless number of uniquely different ecosystems within which any effort to improve the productivity of a specific plant, animal or farming system will encounter quite different problems of adaptation. Thus, for example, the creation of basic scientific knowledge is only the first step toward greater national agricultural productivity. Science creates a potential which cannot be fully realized until that knowledge is successfully adapted to a specific locality. This takes extensive adaptive research and technology development--i.e., applied research. Getting new technologies and knowledge into a form that can be used by farmers often requires extension strategies to deal with historical differences in farming experience as well as ethnic and other cultural differences. Feedback from farmers is a necessary part of effective technology transfer. All of this must be well-coordinated to be effective and efficient.

One of the clear lessons of successful agricultural development the world over is the necessity for a centralized national investment in agricultural research complemented by and coordinated with a decentralized capacity for adapting agricultural research to all the

highly varied local ecosystems. There is another: if postgraduate education is to be of high quality, it must be provided by a faculty involved at the "cutting-edge" of scientific research.

An additional characteristic of the developmental system of institutions in agriculture is that they combine and manage in a single system both society's problem solving and the pursuit of science for its own sake. The pragmatism and political expediency necessary to sustain effective problem solving involves organisation, values and expectations that are inconsistent and in perpetual tension with those found in the scientific pursuit of basic knowledge. Yet much of the productivity achieved in modern agriculture has arisen out of the sustained linking of these functions and the management of the resulting tensions to maintain a workable balance.

### C. Implications for the Countries in SADCC

There are issues in the SADCC region which some prior experience in institution building clarifies. It takes a long time, not 5, not even 15 years, but two decades or more, to develop a full, high quality faculty of agriculture. It took Sokoine University of Agriculture in Tanzania 20 years to develop its current capacity, yet substantial improvement is still needed; Institution building in agricultural education in India took 25 years even though the general base for higher education had been in place for a century. In Latin America, the colleges of agriculture remained isolated, contributing little to development, until national policy placed a high priority on agriculture research, government research grants were made to faculties and linkages were developed between the colleges of agriculture and government research institutes.

In the United States it took 25 to 30 years to create a viable science based curriculum and to establish research as a university function. It was 40 years before scientific research was producing a steady flow of useful knowledge and technologies, and over 50 years before the final institutional innovation--the extension service--was in place. Patience and sustained support is necessary. Clearly a nation must commit itself to long-term institution building and improving human resources if it is to have a highly productive agriculture.

A certain level of scientific expertise is necessary in every relevant area for the success of technological research and its application. Yet no single university in the SADCC region is likely to be able to afford that scale of investment. This shows how necessary it is for SADCC nations develop regional and international networks of scientists and to collaborate on research. Regional networks, of say, entomologists, are necessary to adapt scientific results developed elsewhere to SADCC agricultural environments and to produce basic research necessary for solving problems unique to Southern Africa. Some networks are already forming but are in their infancy. Professional associations and networks in Southern Africa are also necessary to human resources in science in both individual countries and the region. Here the Agricultural Development Council's experience of aiding human resource development in Asia is relevant. Although the Agricultural Development Council (A/D/C) focused only on the rural social sciences, after 30 years it helped produce not only a strong cadre of good social scientists in these countries, but also helped create regional networks linking the science professions and collaborative research, greatly strengthening individual and national

capabilities in teaching and research.

Too often in building faculties only numbers and manpower needs are emphasized. It is important to assure the quality of both the teaching faculty and the students it produces. During any nation's institution building period, the quality of its leadership in science, the institutions of agriculture and, indeed, in all its institutions is crucial. University graduates are expected to provide much of that leadership. For national faculties to be top quality they must have a major contributing role in the nation's research enterprise. Failure to play such a role reduces not only the quality of the faculty but also its contribution to the country's agricultural development. Internationally the experience in science also suggests that graduate education will not be of the best quality if it is done in isolation from ongoing quality scientific research in the field.

Finally, there is the question of the careers and roles for which recipients of university training and education are destined. In the early stages of development this is often mostly to staff ministries and other public institutions. However, as development occurs the absorptive capacity of the economy increases and the private sector will usually take an increasing percentage of the university's graduates. This shift should be anticipated. How rapidly it occurs and how far it proceeds depends on the speed and potential for development of a country's agricultural growth.

CHAPTER IV. MANPOWER PLANNING

Countries with developing economies have only recently recognized agriculture as an engine of economic growth. As a result, development planners in Africa did not pay sufficient attention to the crucial role of agriculture in economic development, and consequently many countries have ignored their agricultural sectors. They now face costly investments to revitalize agricultural sectors and recapture agricultural potential in their countries. Investing in people is one area where costs are high, but it is an area crucial to rural and agricultural development.

Qualified people are needed at various levels and in numerous disciplines to meet the requirements of the agricultural sector. People trained to the bachelor's level or above, are making or will make the major decisions on agricultural policy, on priorities for development efforts, on resource allocation within the agricultural sector, and ultimately on the future of people living in the rural areas of a country. Yet, in many developing countries, there are not many people trained at this professional level--far too few for the tasks at hand.

In Southern Africa, the effect of shortchanging agriculture in development plans has been damaging, and the shortage of well trained people is acute. Tanzania suffers from declining yields and unprofitable agricultural development schemes, yet has tremendous agricultural potential. Lesotho depends on foreign imports for 80-85 percent of its food. Zimbabwe's pre-independence

agricultural development policy was oriented toward large-scale commercial farms, while communal areas stagnated. Zambia has been dependent on non-renewable mineral exports, and until recently had invested only marginally in agriculture. The result of these strategies for all countries in the region is that there is a weak base on which to build and a lot of building that needs to be done--but a tremendous potential to capture and substantial returns to moving in that direction. The goals of having a secure source of food, an acceptable level of living for rural people and a source of growth for the non-rural sectors of the economy should capture the imagination of development planners and a major portion of development efforts.

However, it is more than a question of budget allocation. Recent experience with agricultural development programmes in Africa generally, and Southern Africa in particular, have shown that the transfer of technologies that were successful elsewhere have not been directly applicable to the SADCC region. Even knowledge developed abroad does not easily transfer. The lack of successful projects in the livestock sector is one example. Relevant new techniques are not sitting "on-the-shelf" waiting to be used in the region. It will take basic research to identify agricultural resources, determine appropriate ways to use but not destroy them and adapt outside knowledge and techniques to these local resources and conditions. It is a creative process that takes creative people collaborating over an extended period of time to make an impact. A community of agricultural scientists with specialized training at the bachelor's, master's or doctoral level is required.

However, it is very difficult to define that community and estimate the numbers of scientists needed, and at what levels and in which fields they are required. The development community's standard approach to this task is manpower planning.

A number of attempts have been made in the SADCC region to develop manpower plans at various levels. Unfortunately, the results are of little value. As a tool for development planning, it is probably overused, and certainly raise expectations unrealistically.

Manpower planning is either conducted by the Ministry of Planning or, in the case of agriculture, by a special office in the Ministry of Agriculture. Studies tend to concentrate heavily on the needs of the Ministry itself, in particular, its research, extension and planning departments with some attention to the parastatal sector. Most studies to estimate future requirements on the current vacancies in various ministry departments with some allowances for growth and attrition.

These requirements are then translated into training needs, and become the basis for enrollments in the local training institutions. Most diploma courses in agricultural colleges in the SADCC region, for example, were established solely to train extension workers for the Ministry of Agriculture, and this continues to be the policy. Therefore, an estimate of the annual requirement of the Extension Service determines the enrollment for the college. At the B.Sc. level, public sector demand is primarily in the research departments and in general administration. Training at the M.Sc. or Ph.D. levels is essentially for positions in universities or research posts.

However, the discussions the team had with administrators in these departments showed a strong demand for these skills and concern that they are losing their employees to banks, parastatals, private sector agri-business firms, regional organizations, other ministries and most importantly, to farming itself. The unfortunate result of a lack of foresight in manpower planning is that when vacancies occur, there are no candidates to fill them, and the process of training a particular person for a particular task must begin again. Vacant posts mean a loss of continuity and productivity. Therefore, the team concludes that there are inadequate projections of the numbers of agricultural scientists needed by each country in the SADCC region.

Manpower planning is very difficult to do correctly. The data requirements are substantial and are seldom available. Consequently the planner is forced to resort to unrealistic assumptions such as assuming fixed rates of attrition across or throughout ministries, a continued trend in attrition based on past experience or fixed ratios, e.g., one extension worker is required for each 1,000 farm families. Serving 1,000 families is far different in Tanzania than Swaziland due to differences in population and farm density.

Even though their impact may be difficult to measure, there are several important factors in determining manpower needs in the agricultural sector. They are essentially factors which look at the utilization of manpower rather than trying to quantify and predict manpower growth. The most important ones are:

- 1) The current performance of the agricultural sector;
- 2) The potential for intensive or extensive expansion of agricultural production and the agricultural diversity of the country;
- 3) The population growth rate (and, thus, future demand for food), the population density, the

- percentage of the labor force in agriculture, etc.;
- 4) The history of educational training in the country;
- 5) The stage of economic development and the nation's ability to absorb trained manpower into the economy.

The argument for increased support to training institutions in the SADCC region is based on the fact that in every country, most of these factors suggest that there is substantial potential for a sizable and continued demand for agricultural scientists. These five issues have been treated extensively in other SADCC documents and only the highlights are recounted in this report in an effort to establish the rationale for supporting higher education in agriculture.

#### 1) Performance

Agricultural production in the region has stagnated over the past 20 years, and in per capita terms has actually decreased. Table 6 and Figure I highlight the poor performance of the agricultural sector. For example, per capita production of cereals in 1984 was only 70 percent of the average for the 1966-70 period. Production indices show a decrease from 1972-73 to 1982-83 in every country except Swaziland.

#### 2) Potential

On the other hand, the region has tremendous potential to increase its agricultural output with intensive and extensive development programmes. Only Lesotho and Swaziland have limits in land availability. All the other countries, especially Angola and Zambia, have areas that could be used more productively: rangelands and forests and developing fisheries for example.

Table 6 Production Indices  
1974-76 = 100

	1972/73	1982/83
Angola	116	69
Botswana	77	50
Lesotho	83	65
Malawi	109	106
Mozambique	119	67
Swaziland	94	119
Tanzania	98	89
Zambia	91	62
Zimbabwe	90	76

Source: Various FAO Yearbooks

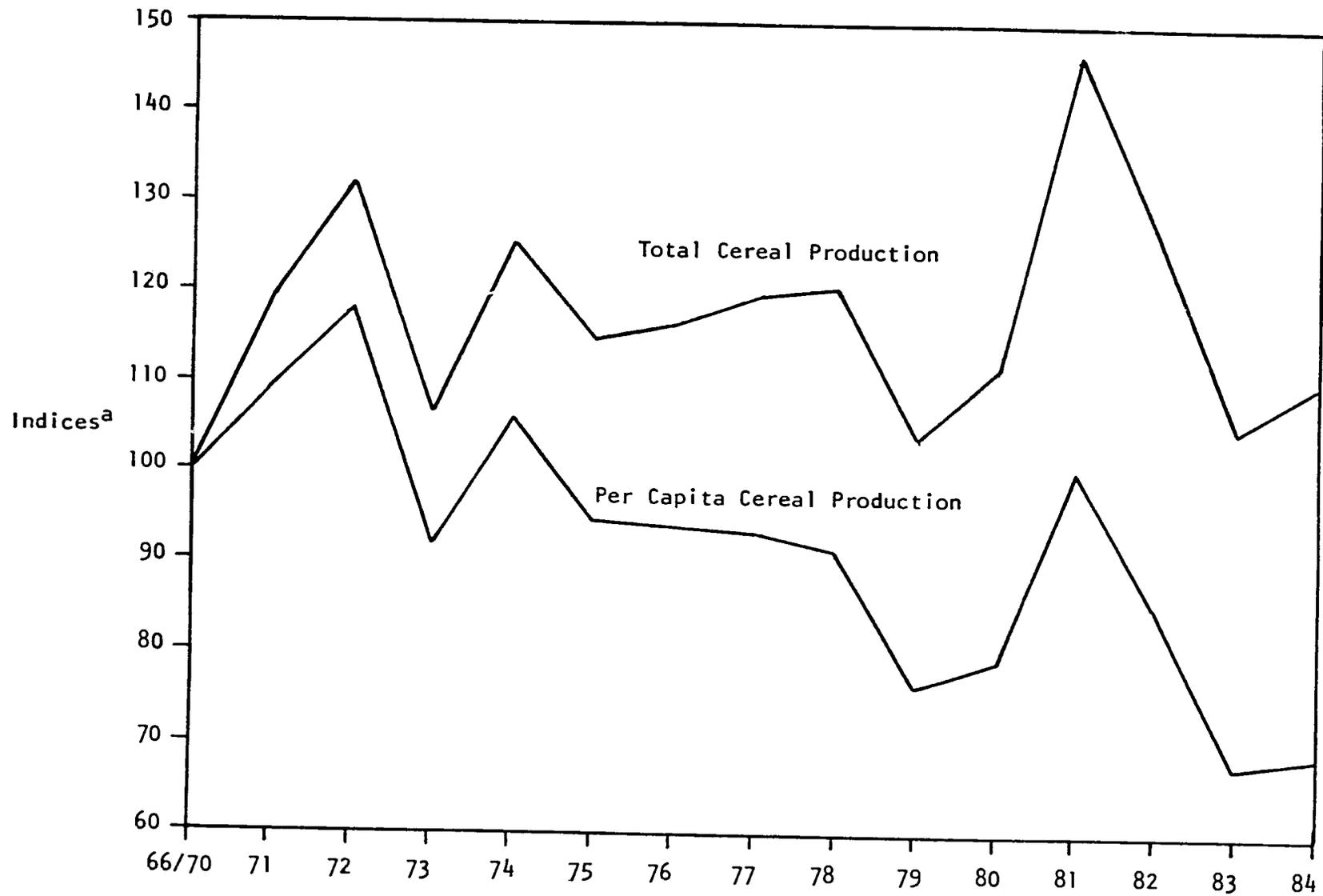


Figure 1: Total and Per Capita Cereal Production in SADCC Countries, 1966-1984

Source: SADCC Agricultural Research Resource Assessment

In addition, there is considerable diversity in most of the region's countries. This ranges from the agro-climatic diversity in Tanzania, for example, with tropical to high elevation systems, to socio-economic diversity in Zimbabwe, which has a dualistic agricultural structure. This diversity increases the demand for agricultural scientists to capture its potential.

### 3) Population

Population is expanding in the SADCC region at an average annual rate of 3 percent (see Table 7). Total population will be 107 million people by the year 2000, an increase of 75 percent. The implication of this is straightforward. If the region cannot increase agricultural production by at least 3 percent per year, either people will be worse off or food imports will have to increase. Probably a bit of both will happen.

There is a wide variation in population densities among the SADCC countries, as shown in Table 7, columns 6 and 7. Botswana, Angola and Zambia have a low people to land ratio which implies a higher per capita cost for infrastructure development. Malawi, Swaziland and Lesotho will have to stress agricultural intensification to attain adequate growth in total production.

Finally, all SADCC countries are basically rural. On average, 70 percent of the people live in rural areas and agriculture is the major employer (at 57 to 82 percent). Most of the human and physical resources of the region are embedded in a traditionally rural sector dominated by small-holders with low productivity. As long as small-holder agriculture is ignored, the great bulk of these

TABLE 7: Population and Land Use Statistics in SADCC Countries (1983)

<u>Country</u>	<u>Population Millions</u>	<u>Percent in Agricul- ture 1/</u>	<u>Total Land Area</u>	<u>Economically Productive Land 2/</u>		<u>Per Capita Economically Productive Land 4/</u>	<u>Per Capita Cultivated Land 5/</u>
				<u>Cultivated Land 3/</u>	<u>(Hectares)</u>		
Angola	8.339	55.8	124.67	86.00	7.50	10.31	0.90
Botswana	1.007	77.7	58.54	45.10	1.36	44.79	1.35
Lesotho	1.444	81.4	3.04	2.30	0.30	1.59	0.21
Malawi	6.568	81.7	9.41	8.32	2.34	1.27	0.36
Mozambique	13.311	61.4	78.41	62.18	3.08	4.67	0.23
Swaziland	.611	69.5	1.72	1.39	0.14	2.27	0.23
Tanzania	20.954	79.3	88.60	81.97	5.19	3.91	0.25
Zambia	6.232	64.6	74.07	60.31	5.16	9.68	0.83
Zimbabwe	8.168	57.0	38.67	31.35	2.68	3.84	0.33
Total Average	66.634	69.8	477.13	378.92	27.75	82.33	4.69

Source: FAO Production Yearbook, 1984

1/ Economically active population.

2/ Includes land under permanent and arable crops, permanent pastures, forests and woodlands.

3/ Land under arable and permanent crops.

4/ Column 4 divided by Column 1.

5/ Column 5 divided by Column 1.

nations' resources will continue to be underutilized, thereby limiting the economic development of the nation.

#### 4) History of Educational Institutions

While there are variations among SADCC countries with respect to the history of local institutional development, these are all rather recent. Tanzania began training its agricultural scientists shortly after it won its independence in 1965. The first graduates with Ph.D. degrees in agriculture did not return until the early 1970s. As discussed in the previous section, 15 years has been only a fraction of the time required to develop stable agricultural training institutions in other parts of the world, and there is no reason to believe that it will be shorter in Southern Africa.

These institutions will improve as they mature. The young age and short tenure of faculty members in universities in the SADCC region, their rapid rise to senior administrative positions, high percentages of expatriate staff, number of positions that are occupied by people that are undertrained and job mobility for staff members all demonstrate the youthfulness of these institutions. Many more scientists are required on a continuing basis to feed into these institutions as they mature.

#### 5) Stages in Development

This area is the most abstract, but perhaps the most important in the long run. Development strategies in many developing economies are derived from the public sector and aimed at getting agriculture moving. In the early stages, trained manpower needs are focused almost entirely on the government. However, as development

proceeds, the other sectors also need educated people, and job opportunities expand. The economy creates a demand for skilled people. For example, Malawi is sending 30 B.Sc. graduates in agriculture into the market each year (most of them will be employed by the Ministry of Agriculture), while Zimbabwe estimates that 100 agriculture graduates can be productively absorbed into its economy (only 40 to 60 of them are needed by governmental organizations). Both have about the same amount of per capita cultivated land. A partial explanation of this difference may be attributed to a more robust agro-industrial economy in Zimbabwe than Malawi.

As these examples illustrate, manpower planning is difficult to do well, and examples from the region are generally disappointing. However, the plans that do exist estimate large requirements for trained agricultural specialists. A FAO study covering the Southern African region illustrates the number and quality of agricultural scientists required. Perhaps citing the FAO projections in their "Training of Manpower for Agricultural and Rural Development in Africa" is useful. By their own admission, the report has shortcomings, but it does estimate the "minimum" requirements for countries in SADCC for the year 2000.

The FAO figures are reproduced in Table 8. Although these estimates are conservative (among other things, they tend to overlook the private sector) and are based on oversimplified assumptions, they still indicate that six countries have sizable requirements. Angola was not included in the projections, but surely falls into this category. Only Botswana and Swaziland have an adequate professional base at the present time. A slightly more realistic set of assumptions would indicate greater requirements in

Table 8 FAO Projection of Trained Professionals  
for the year 2000

	Current Status	Minimum Requirements	Annual Output Required
Angola	NA	909	NA
Botswana	180	93	1
Lesotho	162	190	11
Malawi	534	1,038	75
Mozambique	129	920	77
Swaziland	546	62	None
Tanzania	1,514	3,218	184
Zambia	511	795	55
Zimbabwe	467	677	42

Source: Trained Agricultural Manpower Assessment in Africa, FAO

these two countries as well.

The challenge to improve agriculture is obvious, the potential to do so is unquestioned, the need for more people is clear and the demand for better training is imperative. But how many?

Tables 9 to 11 show an estimate of the levels of professional staff (B.Sc., M.Sc. and Ph.D.) in most of the countries in the SADCC region. FAO estimates indicate about five hundred new agricultural scientists are need annually, and these estimates are conservative. In the agricultural faculties alone, over 100 scientists at the doctor's degree level are needed immediately to fill vacancies and replace expatriates. This figure jumps dramatically if one allows for growth in the faculty and normal attrition of faculty members. Scientists at the B.Sc. level and above are needed in research institutions and by the extension service.

Due to the numbers of people needed for sustained agricultural development in the SADCC countries, and the importance of appropriate training to them, the only long term solution is to train as many of them in the region as soon as possible. "Crash" educational programs abroad are a start, but they lack sustained effort. They tend to orient the program but not lead it; to indicate agricultural potential but not achieve it. Sustained effort, leadership and achievement will only come from within the SADCC region itself. Therefore, a program is needed to strengthen the SADCC universities' faculties of agriculture, which will, in turn, train the future generations of agricultural scientists on whose shoulders rest so much responsibility. While these faculties are very young, they have already indicated the contribution they can make. They deserve greater support and can make good use of it.

Table 9 Professional Staff in Research Institutions in SADCC Countries

<u>Country</u>	<u>Number of Govern- ment Institutions Conducting Research</u>	<u>Number of Private/ Parastatal Research Institutions</u>	<u>Number of Profes- sional Staff</u>
Angola	-	-	NA
Botswana	1	-	46
Lesotho	1	-	15
Malawi	3	3	177
Mozambique	10	-	79
Swaziland	2	1	24
Tanzania	1	6	353
Zambia	7	-	212
Zimbabwe	5	5	222
Total	<hr/> 30	<hr/> 18	<hr/> 1,128

Source: Agricultural Research Resource Assessment, p.9.

Table 10: Professional Staff in Extension Institutions in SADCC Countries

<u>Country</u>	<u>Number of Govern- ment Institutions Conducting Research</u>	<u>Number of Private/ Parastatal Research Institutions</u>	<u>Number of Profes- sional Staff</u>
Angola	-	-	NA
Botswana	1	-	37
Lesotho	1	-	49
Malawi	1	-	124
Mozambique	3	-	NA
Swaziland	1	-	29
Tanzania	3	-	202
Zambia	4	-	107
Zimbabwe	3	6	371
Total	<u>17</u>	<u>6</u>	<u>919</u>

Source: Agricultural Research Resource Assessment, p. 10.

Table 11: Faculty Positions, Qualifications and Training Needs, 1985

<u>Country</u>	<u>Established Faculty Positions</u>	<u>Local Staff in Training</u>	<u>Local Staff with Ph.D. Degrees</u>	<u>Approximate No. of Local Staff Requiring M.Sc./Ph.D.2/ Training</u>
Angola	N/A	-	-	N/A
Botswana	30	-	-	30
Lesotho	12	-	-	30
Malawi	45	14	12	26
Mozambique	109	8	N/A	50
Swaziland	31	11	1	33
Tanzania	174	51	47	54
Zambia	40	-	9	31
Zimbabwe	29	-	9	20
<b>Total</b>	<b>470</b>	<b>84</b>	<b>78</b>	<b>274</b>

1/ With at least B.Sc. qualifications.

2/ Assume that all local staff without Ph.D.s will have to go for Ph.D. training and expatriate staff currently employed will be replaced by local staff.

CHAPTER V. RATIONALE

A. The Role of Faculties of Agriculture in Development

University agricultural faculties can make two major contributions to economic development and the improvement of human welfare. They can:

- train future scientists, and
- apply their scientific skills to solving current problems in the agricultural sector.

Strong faculties of agriculture will accelerate the rate of agricultural development in a country or, if weak, limit the development process.

Training

Training in agriculture at the undergraduate level is of a general nature to prepare students in many areas of agricultural and economic development. Bachelor of Science graduates will become teachers in secondary schools or agricultural colleges in the country. They will work in ministries of agriculture, planning, rural development or parastatals and will directly affect the efficiency and productivity of the agricultural sector. Many will join the private sector, either as agriculturists or as members of the agri-business community. They will be responsible for efficient operation of input and product markets, etc. Others will go on to specialize in postgraduate educational programmes and eventually take positions in the universities or research establishments seeking to expand the agricultural potential of the country.

Training at the Bachelor's level should be done locally (if possible) or within the region if national programmes are not available. All nine SADC countries have or plan to have an undergraduate programme in agriculture. Eventually, all B.Sc. training will be the responsibility of the country itself. Lesotho and Botswana do not have undergraduate programmes, and Angola and Mozambique have small undergraduate programmes due to the failure to train agricultural scientists during the colonial period. However, quality undergraduate training is available in Malawi, Swaziland, Tanzania, Zambia and Zimbabwe. Institutions in each of these institutions could take students (in small numbers) from other SADC countries for undergraduate training conducted in English. (Where Portuguese is required, Brazil and Portugal are possibilities.)

Training at the graduate level in agriculture allows more specialization in disciplines or sub-disciplines. Master's level training is meant to supply people for research positions in governments, private firms, faculty posts or governmental policy appointments. Selective training at the Ph.D. level prepares candidates for faculty positions in universities or for leadership posts in research institutions, private and governmental.

Graduate training at a local level is quite valuable; however, only one university (Sokoine) now offers a taught M.Sc. degree. Malawi, Zambia and Zimbabwe have plans to begin such graduate programmes soon. As universities meet their development goals, capacity for more graduate programmes and more places for students will increase. High quality programmes depend on each university

developing a specialisation in a few areas while neighbouring universities specialise in complementary areas. The relatively small populations in the nine SADCC countries prohibit any one national university from developing special programmes in all areas. Even Tanzania with twice as many people as any other SADCC country cannot afford to train scientists in all areas needing attention.

There is no question that the region will need a substantial number of well-trained agricultural scientists at the graduate level. Furthermore, the need is for a continual flow of people with this advanced level of training. Many aid programmes make a major mistake by sponsoring large one-time foreign training efforts to staff a department or an agency with no thought to developing a "pipeline" to meet future needs, including replacements. Such programmes do not serve a country well.

### Research

The second major contribution of university faculty members to local economic development is the contribution of their own expertise to solving development problems. Without a doubt, the selection process for university staff in Southern Africa assures that some of the brightest students in the country are picked for faculty positions, and these students are given the best training available. Universities are a unique source of scientific knowledge and can contribute to understanding and seeking relevant solutions to development problems facing the country. Unfortunately, they are a resource too frequently left untapped.

Agricultural scientists in university posts can contribute by producing research results and by monitoring and evaluating agricultural development programmes -- both are important. While universities have little comparative advantage in "doing" development programmes, individual faculty members can contribute to development activities. Active participation will, in turn, enhance their teaching performance as they use their experiences to improve the curriculum and make it more relevant to the nation's problems.

#### B. Regional Training

The rationale for developing and strengthening the region's faculties of agriculture rests partially on the advantage of training as many young agricultural scientists locally as possible. There are at least six reasons for doing so. Local training:

- 1) is more relevant,
- 2) is less expensive,
- 3) takes advantage of economies of scale in education,
- 4) increases the retention of scholars in local institutions,
- 5) increases local staff numbers, which contribute to long-term institutional development, and
- 6) both enhances regional cooperation and promotes regional independence.

These are discussed in turn.

#### 1) Relevance

Agriculture is of major importance to every SADCC country. Rural population comprises 70 percent of the total population in the region. Similar percentages are actually involved in agricultural production. However, most of the agriculture is traditional with a low level of productivity. Furthermore, major areas of land are available, unused and yet apparently suitable for production. The potential for agricultural expansion is enormous.

Agriculture is location specific. Its potential is determined by the physical, climatic and human resources of a particular area. Since these vary from one area to another and are combined in differing magnitudes, the potential varies dramatically. Consequently, the most appropriate training of agricultural scientists is in the field, in the agro-climatic area of interest. At the present moment, of course, superior facilities, experienced scientists and secure financial support enables institutions in very different agro-climatic areas outside SADCC to offer the best agricultural training available. Students from the SADCC region who have trained in Western Europe or North America can attest to this.

Nevertheless, the objective of developing local institutions where training will be related to local problems is the only means of bringing sufficient resources to bear effectively on agricultural development problems in Southern Africa. A programme of support to faculties of agriculture is a major component in this transfer from foreign to local training. It will require increased faculty exposure and involvement in research to improve local agricultural production, solve development problems, provide improved and appropriate technologies, create more institutional materials, texts and case studies that focus on these problems, and introduce a more applied orientation with increased fieldwork in agricultural curricula.

Students from the SADCC region who have studied abroad point out the difficulty of applying much of what they learned to their own country's problems. Seldom are foreign curricula geared to Southern African agriculture and valuable time is often wasted on

inappropriate material. What is the value of knowing feeding strategies for beef cattle in snow-covered North America for a Zambian animal scientist when the student knows little of alternative feeds for animals in the dry season at home? Why should an economist from Malawi study sophisticated accounting techniques geared to modern farms in Western Europe when he or she will teach management principles of use to traditional small holder farmers? Why should a soil scientist from Lesotho learn how to control wind erosion in the Great Plains of the United States if the erosion in the highlands of his/her own country is caused by bare hills and rapid runoff of rainfall? Relevant local training will, over time, increase the return to investing in training agricultural scientists.

2) Expense

Training in North America or Western Europe is expensive. Annual costs vary from US\$12,000 to \$23,000. Compare these to tuition, accommodation, and other fees in national universities in the SADCC region, which vary from US\$1,000 to \$3,000. Current fees for local students at the University of Swaziland are US\$1,050; Zimbabwe, US\$1,300; and Sokoine, US\$2,300. Admittedly, these costs are subsidized and the real annual cost may rise to US\$5,000 in some areas, but regional education is still substantially cheaper. Training in foreign universities is four to ten times more costly than local training.

Furthermore, foreign education uses foreign exchange which is extremely short in every SADCC country. Particularly at the B.Sc.

level, there is little rationale for such expenditures.

### 3) Economies of Scale

At the current time, all countries face limits in the number of students their economies can absorb and enrollments are therefore kept at a low level. Students that train abroad are often the best students in a country. This decreases the numbers and level of local training and impinges on the productivity of the teachers and researchers who would benefit from the challenge of the most intelligent students. Thus, institutional development is hindered while students study abroad.

Many of the costs of running a university are fixed, and small increases in enrollment do not significantly increase budget requirements. If fees paid by local students from neighbouring countries would more than cover the increased costs to the university, the remainder could be used to improve curricula, laboratories, etc., in local institutions. Increased enrollments from students now training abroad should induce educational improvements at home. There are other advantages to increasing the quantity and quality of local training. Education is itself an industry -- a service industry -- and will generate local economic activity and create a multiplier effect within the local economy.

### 4) Retention

Employment opportunities for good, internationally trained scholars are always tempting. It is often difficult to get students who have studied in foreign countries to return to the home university, and even more difficult to get them to stay for an

extended period. Financial prospects, the prestige of employment in international institutions and political developments are some of the reasons that explain why it is difficult for local universities to compete, even though they desperately need these scientists. In the past it has been necessary to accept this risk since the training at home was not available. As local institutions become stronger, however, fewer foreign scholarships will be needed and the "brain drain" problem will be less severe.

#### 5) Localization

Young faculties in the SADCC region were originally staffed with expatriate scientists. Many still are heavily dependent on foreign staff, although localizing the faculties, i.e., replacing expatriates with nationals, is a high priority in every national program. Not only are expatriates expensive, they often lack specific knowledge of local agriculture, may not have particular loyalty to national institutions and are by definition employed for a limited term which is often too short. Therefore, faculties with a large expatriate staff find planning difficult, have programmes that lack consistency and see departments suffer from instability. Few institutions in the SADCC region have a goal of 100 percent localization. Most would like to have about 10 percent of their faculty from the outside, however, cases where 40 to 80 percent of the staff are still expatriates are problematic.

#### 6) Regional Cooperation and Independence

Relatively small populations and the natural resources and climatic conditions of SADCC countries impose severe constraints on

the ability of any one county to become entirely independent in food production. This is equally true with respect to agricultural education and research, although, as a region there is substantial flexibility and potential for independence. No single university should need to excel in every agricultural discipline if neighbours are willing to cooperate. Furthermore, in certain specialized areas, e.g., entomology, few universities in SADCC will be able to build the critical mass of talent to pursue an independent course. Rather, the critical mass will come from networks in research, communication, teaching, and curriculum development that bring together scientists from neighbouring universities to share, critique and support academic activities.

The development of the faculties of agriculture in the SADCC region is at a critical juncture. They have come a long way through their own initiative -- and with help from bilateral institutional grants. They are poised for a leap to a new plateau, one from which they will make a substantial contribution to agricultural development. However, they cannot do so if they operate in isolation and at the margin of the agricultural sector. More could and should be demanded of them. The next section describes a program that will help them respond.

CHAPTER VI. TRAINING AGRICULTURAL SCIENTISTS: A PROGRAMME

A programme of support for agricultural training in the SADCC region is based on the urgent need for more and better trained agricultural scientists. Although scientists are needed immediately, it is equally important to produce a steady supply. Furthermore, if they are to contribute to finding solutions to the complex problems in the region, these scientists must be well trained, knowledgeable in local agricultural systems and highly motivated. The only realistic way to meet these needs is to improve the quality and quantity of training institutions in the region. Faculties in most cases are already established but need support to become more effective.

The programme will focus on faculties of agriculture in universities. The time frame of the programme is long--twenty years--and the costs are substantial; yet the potential results are impressive and returns well worth the costs:

- 1) The programme will train scientists from SADCC countries to fill positions that are currently vacant or filled by short term expatriates in research departments, universities, and planning agencies.
- 2) It will enable institutions in the region to train future agricultural scientists for employment in a wide variety of positions in the economy in most disciplines at both the undergraduate and graduate levels. Local training will be both more appropriate to the needs of the rural sectors and available at a fraction of the cost of training abroad.
- 3) Furthermore, the programme will help the faculties of agriculture improve rural development and increase agricultural production and productivity through

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collaborative projects with development and research institutions at both the national and regional levels.

- 4) Finally, the programme will produce a critical mass of intellectual resources and take advantage of economies of scale in education through regional cooperation and communication with other faculties that would not be possible at the national level. While populations of the member countries vary from about one million to more than nineteen million people, no country can build the critical mass in the many agricultural disciplines required. Rather, this will come from specialisation within and collaboration among the faculties in national institutions.

The vast differences among the nine countries in the SADCC region--the educational and manpower needs for agricultural development, the potential for expansion in their agricultural sector, the mix of crop and livestock activities and the agro-climatic conditions--all lead to diverse requirements with respect to the skills and numbers of agricultural scientists that are needed. Angola and Tanzania have a tremendous potential to bring new land under production, Malawi will need to depend on more intensive land use to increase agricultural production, Zimbabwe has both modern and traditional agricultural sectors to serve, Botswana, Lesotho and Swaziland have small populations and narrow limits for their requirements of agricultural scientists; Zambia has depended in the past on mineral exports to finance economic growth, and agricultural development has lagged behind, Mozambique has major requirements for infrastructure development to lead growth in agricultural production.

In addition, the status of agricultural training in the nine SADCC countries is extremely uneven. Tanzania, which has its own university of agriculture, cannot be compared to Botswana or Lesotho, which do not yet have agricultural faculties. Agricultural training in the other countries falls somewhere in between these extremes. Angola and Mozambique have special problems due to current civil disruption and

the massive exodus of trained agricultural scientists at independence. This offers a unique opportunity for regional cooperation aimed at increasing the quality of all agricultural training programmes and developing national institutions efficiently at a minimum cost. Each country wants and needs to be able to train its own students up to and including a bachelor's degree in Agriculture. As training at the graduate level becomes more specialised, faculties will benefit from developing certain areas of emphasis and relying on institutions in other countries to provide training in other areas. Specialisation will be determined by the natural resources of a country, its potential for agricultural production, its agricultural needs as well as the current status of its agricultural training.

#### A. Goal and Objectives

The major goal of the programme is to provide the region with more and better trained agricultural scientists in the short run and to assist the faculties of agriculture in the SADCC region to increase the quality and quantity of the students they train in the long run. The specific objectives of the programme are to:

- 1) Upgrade the professional status of the agricultural scientists and increase the attention given to agricultural training in the SADCC region;
- 2) Strengthen the basic curriculum in national institutions at the undergraduate level to emphasize practical training on local agricultural problems;
- 3) Encourage the development of different and complementary areas of specialisation by the faculties for graduate studies;
- 4) Foster cooperation, coordination and communication among faculties within the region; and

- 5) Improve linkages between each faculty of agriculture and the public and private institutions concerned with agriculture.

These objectives will be achieved by three main tasks. The programme will:

- offer individual scholarships as many as possible to study at institutions in the region,
- make institutional grants to the faculties to improve local training, and
- monitor faculty development, evaluate the effectiveness of individual and institutional grants, and assist faculties in planning and developing new programs.

A regional fund initially supported by donor contributions would finance these activities. The programme will be administered by an independent organization operating under the auspices of SADCC.

A programme to support the training of agricultural scientists is consistent with a) the priorities in the SADCC region to exploit its agricultural potential; b) the agricultural development plans of national governments in SADCC; c) the goals of SADCC, the pronouncements of the special committees dealing with agriculture in the SADCC structure, and the recommendations of studies that have been conducted for SADCC with a view toward moving the economic development of the region forward; and d) the development plans of the faculties of agriculture in the universities themselves.

The Fund will finance grants that fall into two general categories:

- individual, and
- institutional.

Individual Scholarships will be awarded to exceptional students for academic studies in the agricultural sciences. Scholarships will include B.Sc., M.Sc. and Ph.D. programmes. The level of study will

depend on the needs of the country, the development plans for the faculty or college and the availability of highly qualified candidates. The administration of the scholarships will be flexible to meet the needs of the institutions in each SADCC country, needs that vary widely across the region.

To the extent that it is possible, the scholarships will support training within the region. At the B.Sc. level, much of the training will be done locally even in the first years of the programme. At the postgraduate level, initially much of the training will be done abroad. However, as faculties develop and improve their graduate programmes, more scholarships will be transferred to these institutions. Local M.Sc. training in the basic sciences, e.g., crop, animal and soil science, will be feasible early in the programme. Other specialisations at the M.Sc. level and much training at the Ph.D. level will take longer to localize. Figure 2 illustrates the approximate distribution of scholarships for university and non-university positions at the beginning of the program and shows how the distribution will change over time. Figure 3 illustrates the distribution for local versus training abroad at the B.Sc., M.Sc. and Ph.D. levels.

While important issues in administering the scholarships are discussed in Section C in this chapter, the principles that will guide a scholarship programme are:

- 1) The selection process should be competitive. There should be an open competition for scholarships both within countries and within the SADCC region. Although scholarships should be oriented toward strengthening faculties and supporting their development plans, they should not be limited to these goals.

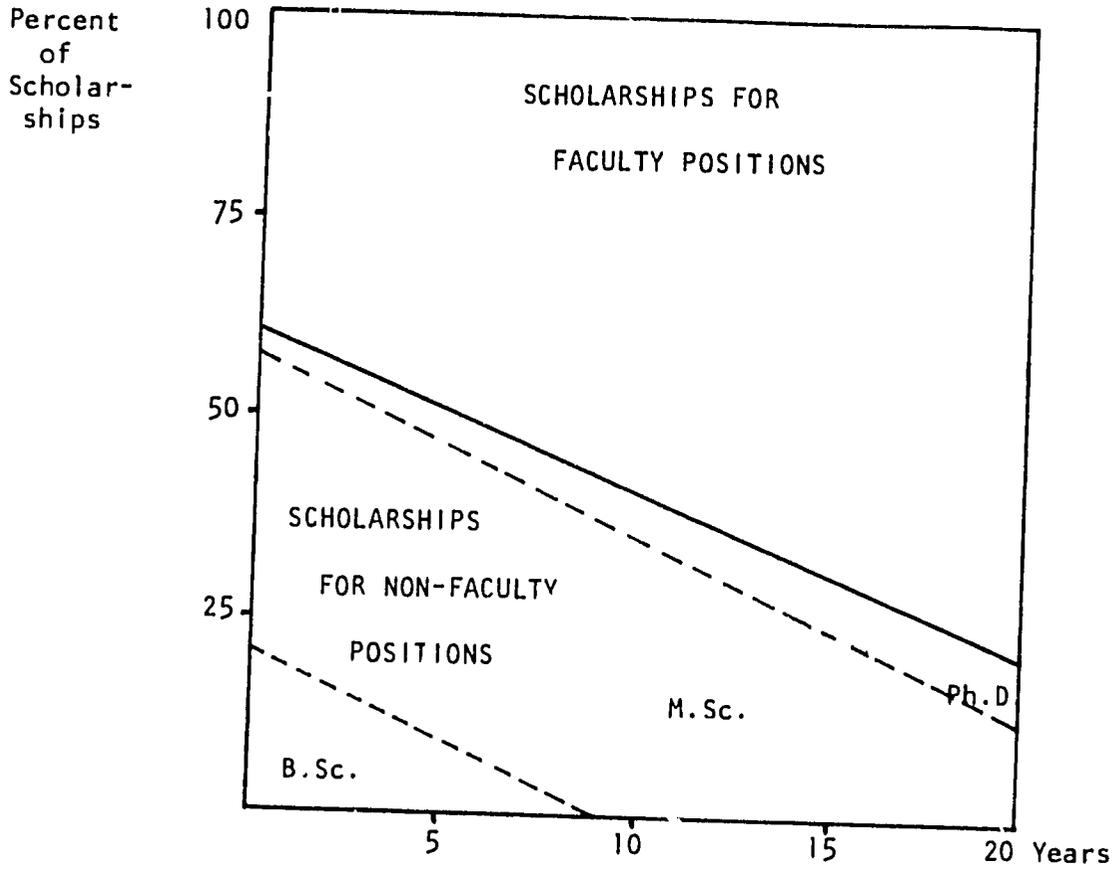


Figure 2: Distribution of Scholarships for Faculty & Non-Faculty Positions

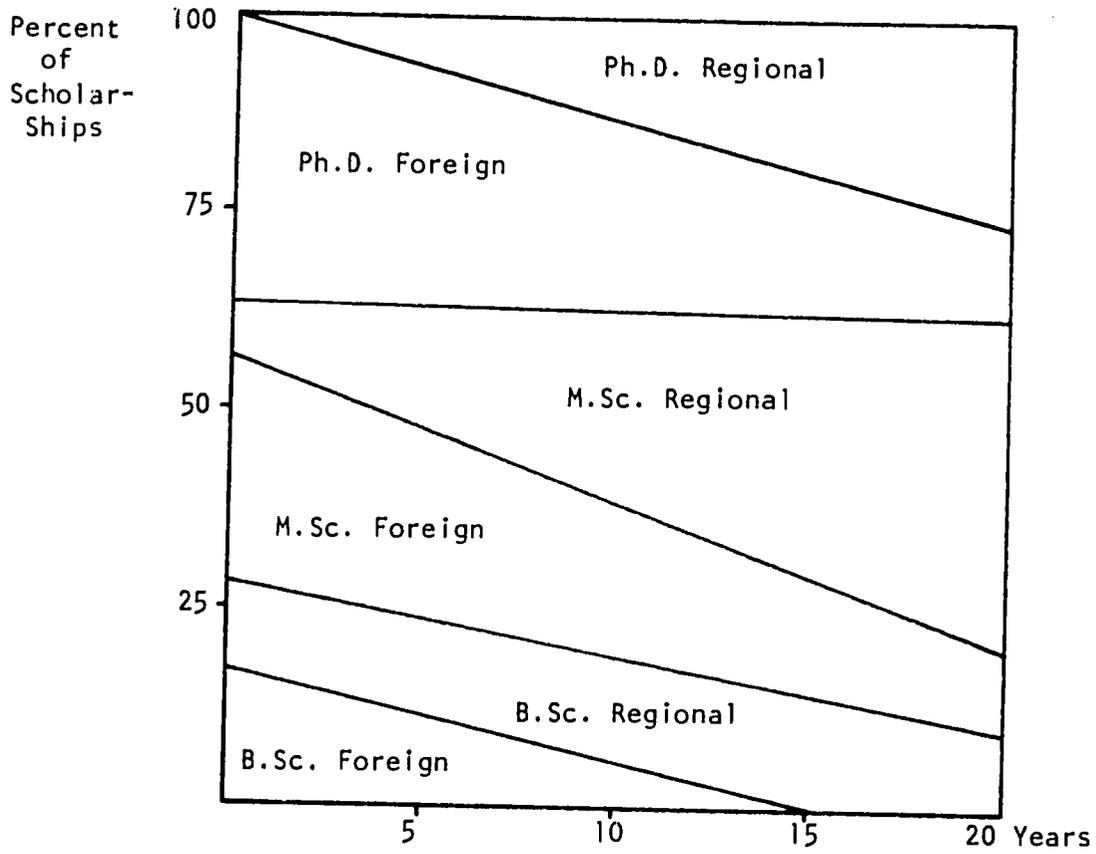


Figure 3: Distribution of Scholarships by Degree & Location Over 20 Years

2) The scholarships should promote careers in agriculture. The basis for improving the agricultural development of a country depends largely on attracting good young people into agricultural professions. Currently, agriculture has a low status among students; the best ones choose other fields. To compete, these scholarships should be prestigious and financially attractive.

3) There should be an intellectual involvement by the Fund in the scholarship programme. The administrative unit of the Fund should have an intellectual interest in the Fellows and continue to invest in their professional development after they have completed their formal studies. The Fund will administer the scholarship programme, e.g., coordinate the selection committee, assist admissions procedures and arrange for monthly stipend, but it also should do more than that. It should assure that the education of the students is both appropriate given students' backgrounds and suitable for their future employment opportunities.

Institutional Grants will be awarded to faculties to raise academic standards, improve the quality of teaching and sustain the existing investment in human capital. These awards could take many shapes and forms. They could be awarded to small teams within a department, to individual departments or to multidisciplinary groups within faculties.

Again, a number of principles will guide the Fund in awarding institutional grants:

- 1) The selection process should be competitive. (Proposals that will most likely lead to improving agricultural education in that discipline, department or faculty will receive financial support.)

- 2) Priority should be given to proposals that:
- improve the environment for learning in the faculty;
  - exploit the human resource potential in the faculty for quality applied projects;
  - encourage cooperation outside of the university (with ministries of agriculture, planning, parastatals or the private sector); and
  - enhance communication and cooperation with other faculties in the SADCC region.

The details of other issues impinging on the administration of these grants are given in this Chapter, Section D. Figure 4 shows a possible evolution of the financial allocations to each programme within the Fund.

The Fund's administration will be a small unit highly responsive to the development needs of faculties in the region. The proposal suggests there be three professional staff members: a director, a deputy responsible for individual fellowships and a deputy to administer the institutional grants. They will have an administrative staff of seven including an administrative assistant, a scholarship officer, a grants officer and three secretaries. The professional staff will need to be trained agricultural scientists, have experience in faculties of the region and be fully versed in agriculture in Southern Africa.

Fund activities are discussed in detail in the next three sections, beginning with a description of the unique and challenging task of the Fund to participate in the faculty development process from a regional

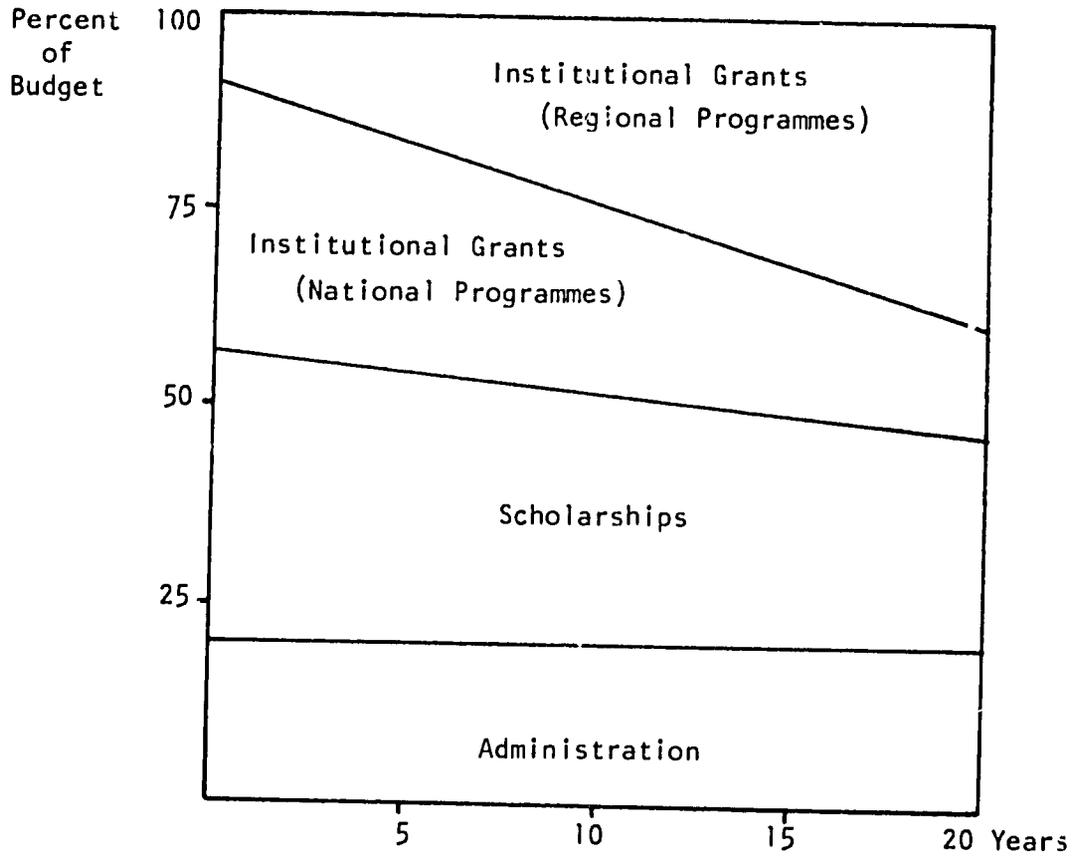


Figure 4: Distribution of Financial Resources of the Fund over 20 years.

perspective. This is essentially the responsibility of the director and the board of trustees.

#### B. PLANNING AND ASSISTING FACULTY DEVELOPMENT

A major function of the Fund is to give professional assistance to the faculties themselves. The value of the Fund to the region will be greatly enhanced if it can provide professional services to staff and faculty development planning, help faculties make contact with educators and other scientists who can contribute to their programmes, assist with activities related to the institutional grants and scholarships in order to improve their effectiveness and, with the board of trustees, coordinate regional activities for disciplines, departments and the whole faculty.

The success of the programme will be determined by how effectively the administrative unit follows through on the scholarships and grants that have been made. Well-conceived projects can and do go astray during the implementation phase, and often too little is learned from projects once they are completed. Knowing what worked, what failed--and why--can help those involved in similar efforts. An institutional memory of the development of agricultural faculties will be valuable not only to the SADCC region (e.g., to other faculties experimenting with similar ideas or programmes), but to the development community at large.

Similarly, attentiveness to the scholarship programme will be of benefit to the Fund. It is extremely important to refine the selection process, monitor student performance, improve the actual training and help students integrate into their respective institutions when they

complete their studies. The Fund should keep in touch with returned Fellows and assist them in maintaining their skills and credibility as agricultural scientists. Investing in people does not end with formal education. Too often the administrators of scholarships abroad see their task as being completed when the students get on the airplane, degree in hand, to return home. However, the degree is no assurance that the trainee will be effective on the job. Investing just a bit more time and energy in the student will give a higher return.

The quality of training Fellows receive would be continuously monitored. If a specific graduate department exhibits a consistently lower quality or a specific weakness, the Director should work to remedy the problem or, if nothing else can be done, redirect Fellows elsewhere. The Fund would maintain comparable quality in the programmes' products. If the director and the deputy director for scholarships conclude a Fellow lacks something in his/her preparation after completing a Ph.D., they would arrange further training or experience that could selectively strengthen that Fellow's capability for the faculty role into which he/she is going. Or if a Fellow had a unique talent in need of further development, the director would see that there was an opportunity to develop it.

The Director, with the help of the deputy director, could stay in touch with Fellows who have returned to their faculty (or the government), monitoring their intellectual and leadership growth and counseling them on career development. At the same time the Fund would help department chairpersons find ways to support young faculty, providing role models and mentors if possible. Intellectual development does not usually proceed well in isolation, but requires

stimulation and reinforcement, even challenge and a periodic change in direction and activity.

The Fund and its director also have a responsibility to assist in the decades of institution building that lie ahead in Southern Africa. This would involve working closely with the deans of the faculties of agriculture and the ministries of agriculture and education as well as private sector agricultural leadership to strengthen the basic institutions of agriculture. He/she would assist in finding appropriate leadership, in designing plans for institutional development, and in deciding when scholarships and grants from the Fund could best help achieve the priorities of the SADCC countries.

Institutional grants would help build strength into B.Sc. programmes, develop specialised M.Sc. programmes appropriate for Southern Africa agriculture, improve management skills in the faculties, encourage regional cooperation in the agricultural sciences, and assist the faculties in building links to other agricultural institutions within agriculture, to name a few examples. The director and the deputy director for institutional grants would follow up on these grants to evaluate their effectiveness, help implement them when problems arise and, consulting with faculty and university leaders as needed, help them achieve their institution-building goals.

In following up on the success and failures in the Fund's grant experience, the Director and the Deputy Director should be able to help faculties in the future as they continue institution-building efforts and faculty development planning. They could assist others in learning from the collective experience of the SADCC region in institution-building. They should be responsible, as best they can, to provide the

experience of the international development community in institution-building.

The relationship of the Fund's programmes to the SADCC Secretariat and other SADCC activities is also of crucial importance, and these relations will be the director's responsibility. This programme is a natural complement to SACCAR and the Consultative Technical Committee (CTC) for agricultural research, and the Director should see that the coordination and collaboration with SACCAR is given priority. Similar coordination is required with the manpower development activities under Swazi guidance, soil conservation led by Lesotho, other food security projects in Zimbabwe's portfolio, etc.

The location of the fund's headquarters is not discussed in detail in this report. Factors that will determine a suitable location include: (1) relation to the SADCC Secretariat, (2) its links to SACCAR, Swaziland's manpower development mandate, etc. and (3) a functional base with reliable communication and transportation. The team recommends that the location provide for a relatively independent administrative structure, one that is not associated with a university, faculty or educational institution.

The director would be aided in his duties by the board of trustees. It is recommended that the board be composed of the nine SADCC deans of the faculties of agriculture, two donors and two representatives of the ministries of agriculture. The board would constitute the only common forum for the deans of agriculture to give direction not only to the Fund but also to the agricultural science community in Southern Africa. This community is presently fragmented, isolated and lacking in a sense of common mission. It needs a forum

for developing coherence and direction. The board would help the director perform the Fund's assistance function as well as set policy guidelines for the administration of the Secretariat.

The Director is responsible for: 1) the overall development of the individual scholarships and institutional grants programmes, 2) an intellectual role in the follow-up on grants to agriculture faculty development activities, and 3) working with the Board to administer the Fund.

In short, the Fund not only provides scholarships and grants but follows through as a consulting firm to the faculties, locates the right people for specific roles in the development of faculties, and helps achieve the goals SADCC nations establish for developing the agricultural sciences in Southern Africa.

#### C. THE INDIVIDUAL SCHOLARSHIPS PROGRAMME

The individual scholarships programme is intended to be one of the main activities of the Fund. About 40 percent of the resources available to the Fund would be used to finance this programme in its initial phase. The following format and procedures are recommended.

##### Objectives

The main objectives of the individual scholarships programme should be:

- 1) To make available to young scientists in the SADCC region opportunities for further formal training (B.Sc. and above) in the agricultural and allied fields by provision of scholarships for training in universities in the region and overseas. The focus would be on agricultural scientists who are well-trained in their own discipline, who are sensitive to the wider technical, environmental, and socio-economic problems of the SADCC countries and who can, after the training, offer leadership in the articulation and execution of research and training programmes to solve these problems.

- 2) To assist faculties of agriculture and related fields in the SADCC countries in planning and implementing their staff development programmes.
- 3) To help those faculties in the SADCC countries concerned with training manpower for the agricultural and rural development sectors create practical, academically relevant and economically viable undergraduate and postgraduate degree programmes. This will be accomplished by training the staff and developing centres of excellence in postgraduate training that are equitably distributed in the region.
- 4) To assure that all faculties have well rounded undergraduate programmes. Departments in the various faculties are not all of equal strength. Thus, an early emphasis will be given to strengthening weaker departments. However, at the graduate level, the Fund should encourage the development of specialisation and attempt to help faculties train staff and gain stature in particular disciplines and sub-disciplines.
- 5) To encourage the exchange of students in undergraduate and postgraduate programmes between the faculties in the SADCC countries.
- 6) To cooperate with other SADCC institutions (e.g., SACCAR) in training programmes for agricultural scientists.

#### Administration

The administration of the scholarship programme should be vested in an independent scholarship committee which would:

- 1) Operate under broad policy guidelines established by the Board of Trustees.
- 2) Receive applications for individual scholarships from faculties/departments/individuals and award the scholarships on a competitive basis.
- 3) Approve procedures to be followed in selecting candidates to be awarded scholarships (e.g., the use of Graduate Record Examinations).
- 4) Decide on the number of scholarships to be awarded each year for undergraduate and postgraduate training both within the region and overseas. Decisions would depend on the relative emphasis on fields of training, based on SADCC and each country's priorities.

- 5) Determine the value of each scholarship (e.g., stipend, family allowance and book allowance).

#### Membership of Scholarship Committee

It is recommended that the committee have six members:

- 1) The Director.
- 2) The Deputy Director (ex-officio) for the scholarships programme.
- 3) Three eminent scholars, selected on individual merit from faculties in the region. They must have:
  - completed a Ph.D. in an agricultural discipline,
  - worked for a minimum of 5 years in a faculty of agriculture in the region, and
  - been responsible for a staff development programme in their departments.
- 4) One person, selected from a government department or public service (not from a university), who is a university graduate and has been in charge of staff development and management (preferably agricultural staff) at the director level.
- 5) Candidates for the scholarships committee should be recommended to the board of trustees by the director. The board will select the appropriately qualified candidates provided (1) two candidates do not come from the same country, (2) two candidates are not from the same discipline in the agricultural and allied sciences and (3) candidates must be physically working and/or residing in one of the SADCC countries.
- 6) Membership on the scholarships committee will be for a maximum period of three years. The board of trustees should ensure that all countries are represented in the scholarships committee on a rotational basis.

The deputy director for the scholarships programme should be responsible for implementing the decision of the committee under the director's supervision.

#### Procedure for Award of Scholarships

The scholarship committee will award scholarships for training nationals of the SADCC countries at three levels in the agricultural and allied sciences. The issues to be faced are indicated by the

following suggested procedures:

1) Bachelor of Science. For training in:

- Agriculture for those applicants from countries where a faculty of agriculture has not yet been established, e.g., Lesotho and Botswana, and where faculties cannot yet train adequate numbers of people, e.g., Angola and Mozambique.
- Specialised undergraduate programmes such as Bachelor of veterinary medicine, B.Sc. (forestry), or B.Sc. (agricultural engineering) which cannot be established in each country due to the high costs involved.
- B.Sc. training in agriculture and specialised fields overseas (preferably in other Third World countries, e.g., Brazil) for nationals of countries where English is not the official language (Mozambique and Angola). These students should, however, be given the alternative of training in a Portuguese speaking country, or taking a one-year English course in another SADCC university.

All the training should, to the extent possible, be done in one of the faculties in the SADCC countries. Before applying for an undergraduate scholarship, students who do not have adequate secondary training (i.e., no "A" level passes) should enroll in their local universities, (usually the faculties of science) to do the pre-entry science courses.

Awarding scholarships for B.Sc. training would probably be done only during the initial years of the programme. As each country builds up its own faculty of agriculture, this type of fellowship would gradually be phased out and the Fund eventually would concentrate on M.Sc. and Ph.D. fellowships.

2) Master of Science. Three categories of scholarships can be awarded for Master of Science training:

- Scholarships for M.Sc. training in faculties in the SADCC countries.

- Scholarships for M.Sc. training in institutions outside the SADCC countries, when such a programme is not available in the SADCC countries institutions.
- Partial support in facilitating exchange of M.Sc. students between two countries that have similar M.Sc. programmes. It is important to diversify the intellectual base of a faculty, and to make available to the students an opportunity to widen their experience and exposure to different intellectual environments.

Currently a taught M.Sc. is offered in Sokoine University of Agriculture. It awards Master's degrees in agriculture in the animal, crop and soil science departments, agricultural economics, agricultural engineering, and forestry and veterinary medicine. The faculties of agriculture at Bunda College; University of Zambia, and University of Zimbabwe are now planning to have taught M.Sc. programmes in various disciplines of agriculture. The faculties in the other countries do not yet offer M.Sc. training.

The institutions above, however, require strengthening in terms of staff development, equipment and other facilities before they can admit very large numbers of M.Sc. students and offer high quality education at this level. The Fund should, therefore, evaluate and monitor the M.Sc. programmes and the facilities in the SADCC institutions before awarding scholarships for training in SADCC faculties. In areas where M.Sc. programmes can be strengthened to admit more students through the institutional grants programme or other bilateral or local resources, such a department probably would be strengthened through the Fund to admit students from across the SADCC region.

Creative exchange programmes could also be developed with

universities abroad. For example, NORAD has been supporting the M.Sc. programmes in animal science and soil science at the Sokoine University of Agriculture in which the coursework portion is done at the Agricultural University of Norway. Norway has provided fellowships as well as equipment and other facilities at Sokoine. It is envisaged that the coursework portion will, within the next five to ten years, be offered at Sokoine University with NORAD support for infrastructure development. Zimbabwe has a similar programme of exchange with Michigan State and Pennsylvania State Universities. The Fund could therefore develop similar approaches and help the departments in certain areas of specialisation.

In the interim, until adequate M.Sc. training capability has been built up in the region, the Fund would award scholarships to qualified applicants to train in overseas institutions outside the SADCC region. In the long term, as M.Sc. training capacity is developed through the Fund's assistance and bilateral programmes, the Fund probably should gradually withdraw from awarding full M.Sc. scholarships and only cover external costs such as airfares to support student exchange programmes. The universities involved would gradually begin to meet the local costs (tuition and allowances) of M.Sc. students in their own countries or those in other SADCC countries on exchange programmes. The programme will then concentrate more on Ph.D. training.

3) Doctor of Philosophy. Three types of Ph.D.'s could be offered:

- entirely within the region (this would be mostly thesis research);

- partially in an institution in the developed countries (coursework or part of the research) or at the International Centres for Agricultural Research and partially at the local university (the student is usually registered and the degree granted by the local university); and
- entirely abroad.

Institutions in the SADCC region currently have limited numbers of staff to supervise Ph.D. work and consequently each case will have to be considered on its own merit. If one of the first two types is chosen, it should be up to the applicant and his department to assure the scholarship committee that the programme being proposed by the applicant and his/her department is relevant and the most effective in terms of quality and cost. Usually applicants for Ph.D. programmes will have some research experience. Therefore, they should, with assistance of their department chairman, dean of the faculty and deputy director for the scholarship programme, prepare a proposal for consideration and approval of the scholarship committee.

In awarding scholarships, the programme should be competitive and open to all eligible applicants from the SADCC countries at all levels of university training. As much as possible, the scholarship committee should ensure an equitable distribution of scholarships to all countries in SADCC. They will also have to assure a reasonable distribution between disciplines, especially within any one country. As a guideline, the committee should ensure that no country gets more than 20 percent or less than 5 percent of the total number of scholarships (at all levels) in any one year.

The most important criteria that will determine scholarship

distribution are an assessment of each country's needs for agricultural scientists (based on a country's agricultural potential, its previous human resources development and its ability to use trained agricultural scientists) and creative development plans at faculties, research institutions, or other public and private organizations. The distribution of scholarships based on such things as population or agricultural land areas are not effective criteria in helping achieve the programme objectives.

All fellows would be required to have institutional affiliations (although not necessarily at the university) to which they will return on completion of their studies and be bonded to serve in their respective faculties. Many of the scholarships will go to junior faculty, however, candidates in agricultural research and other institutions could also apply.

The director of the Fund and the deputy director for scholarships should ensure that the scholarships are advertised to reach as many candidates as is possible. They should work as closely as possible with chairmen of departments and deans of faculties in identifying candidates, from both within and outside the faculties so as to ensure that the programme is as competitive as possible and that the very best applicants apply. If the Fund can develop a prestigious scholarship programme with appropriate financial support of its fellows, these problems will solve themselves.

#### D. THE INSTITUTIONAL GRANTS PROGRAMME

Institutional grants are intended only as supplements to the

basic support faculties receive from their governments and from bilateral aid. The purpose of these grants is catalytic, to help faculties contend with limitations in the quality of education they provide students. Approximately 40 percent of the total budget of the Fund programme should be devoted to institutional grants during the first phase. This percentage will increase as the programme develops. (See Figure 4.)

Agro-climatic conditions and types of agriculture vary widely in the SADCC region. Faculties of agriculture are at different stages in their evolution. As a result, limitations on the quality and coverage of the education offered also vary greatly. While the proposals for grants can be targeted differently, all should define the problem, show how the proposed project would alleviate that problem, and what benefits would be derived. Proposals, whether from individuals, departments or faculties or some combination across countries, should also demonstrate how they fit into an existing faculty development plan or plans. The purpose is to facilitate the development of agricultural science faculties in the SADCC region to achieve the goals set by the individual countries and their faculties.

The following sections suggest some of the categories of grants and the diversity of purposes to which they might be addressed. A few examples are given, but they are only examples and are not intended to limit the specific purposes for which grants might be used. There undoubtedly should be some limitations on the grants. It is recommended that funds not be used to hire expatriate faculty, for example, nor should they be used to construct buildings or

purchase vehicles or the funds would not go far.

The guidelines for the institutional grants programme should be similar to the individual scholarships programme and have not been written down in detail in this document. They should include a clear statement of objectives, administrative tasks, establishment of a selection committee and selection procedures along the lines of those mentioned on pages 71 to 74.

Grants will need to be of a reasonable size (a maximum of U.S. \$250,000) to have an impact. In addition, the grants should sustain a particular development activity. Extensions for ongoing activities should be easy to arrange within the Fund itself.

1) Faculty Development

Grants can be made, for example, to faculties that are in the early stages of developing a B.Sc. programme, as are Lesotho and Botswana. The government and bilateral aid must provide the basic funding but this is a difficult task. A degree programme will often be authorized and budgeted to start on a specific date, but, due to resource limitations, it will start with inadequate provision for some aspect such as planning a curriculum, recruiting an initial faculty or developing accelerated programmes of education so locals can become permanent faculty. A proposal to the Fund might attempt to solve these problems. Indeed, with proper planning, faculty development could lead the development of a new B.Sc. curriculum by several years, and with adequate resources to back up that planning, one could eliminate much of the initial cost, that of hiring expatriates.

Often there is a need to bring B.Sc. students up to higher levels of proficiency before they can successfully be sent within the region or elsewhere for an M.Sc. Some students need additional preparation in the language of instruction, others in math, statistics and various sciences. An institutional grant could fund proposals based on a faculty development plan. This includes financing the creation of remedial capacity in the receiving institutions while also funding efforts of the faculty sending the student to improve the quality of its product so that remedial programmes are no longer needed.

Some universities in the SADCC region need greater specialisation within M.Sc. degrees. No single country can afford to produce all these specialisations, so proposals for cooperation across SADC to create and strengthen M.Sc. programmes would be appropriate. Over time, the region could develop at least one strong M.Sc., for example, in several of the special fields in crop science such as plant physiology, entomology, plant genetics, weed management, nematology, microbiology, or plant pathology. In selecting a specialised M.Sc. to develop, each country will undoubtedly focus on those with the greatest value to their own agriculture. Consideration should also be given to whether another faculty already has a strong M.Sc. in that specialisation. Cooperation of regional agricultural faculties could assure a broad range of specialised M.Sc.'s would be available somewhere within the region. Supportive materials, specific journals and books need to be collected for each specialisation. Many other areas for example, food science, nutrition and the social sciences, especially economics, need strengthening at the M.Sc. level.

CASE 1 ANGOLA AND MOZAMBIQUE: Angola and Mozambique have the most pressing staff development problems in the SADCC region. Consequently, financial support from the fund could make a substantial difference in the development of agricultural education in both of these countries. Part of this need will be met by the individual scholarship programme. However, a second and equally important impact would be a programme in each country to provide technical support in developing an educational programme in the field of agriculture. This would include other educators visiting Angola and Mozambique, but would also give administrators and scientists from each of these countries a chance to visit universities in Brazil, for example. The fund could enable these young countries to learn from and build on the experiences of others.

CASE 2 BOTSWANA AND LESOTHO: Recently the governments of Botswana and Lesotho each made a decision to create a faculty of agriculture at their national universities. The timing for beginning of these faculties is not set, but plans are underway. A substantial organizational effort is required before the programmes can begin, and effective planning now could avoid problems and save money. The Institutional Grants Programme would enable both countries to benefit from the experience their SADCC neighbours have had in building agricultural faculties. Developing curriculum, training staff, improving laboratory facilities, and treating applied programmes, are only a few issues that will need attention when upgrading the Botswana or Lesotho Agricultural College.

To begin a B.Sc. programme immediately in either country would require staffing many of the positions with expatriates. Perhaps the most important contribution the Fund could make would be to help each university formulate a staff development programme and immediately send Botswana and Lesotho scholars abroad for graduate training. The sooner this happens, the less dependent these new programmes will be on expensive, short-term instructors when they do begin.

CASE 3 TANZANIA: Currently less than 3 percent of the cultivated land is irrigated in most SADCC countries despite the apparent potential for more irrigated agriculture throughout the region. One of the main constraints in developing irrigated agriculture has been lack of trained manpower to plan and implement irrigation projects. To overcome this constraint, the Department of Agriculture Engineering and Land Planning of the Sokoine University of Agriculture (Tanzania) wishes to strengthen training in irrigation and drainage engineering by starting a M.Sc. programme.

Starting such a degree programme, however, would require financial support to purchase new equipment, build a small irrigated experimental and demonstration farm (5-10 ha) for practical training and student research work. Currently such support is not readily available. An institutional grant could assist such a project and, as a consequence, the department could admit students from within the region.

## 2) Faculty Renewal

Individual faculty members, no matter how highly trained, after a number of years of teaching will need to renew their disciplinary and intellectual capacities. This is especially the case with fields in which technological and intellectual progress has been rapid. Many advances have occurred, for example, in statistics, computer processing, electronic sensing and instrumentation, biological modeling, economic policy simulation, and molecular biology. These all hold substantial implications for the sciences in agriculture and for the academically trained who must face the problems of agriculture and its development.

Faculty sabbaticals abroad are the traditional means of intellectual renewal. In addition, it is helpful to sponsor visiting scientists and scholars who might spend anywhere from a few days to a full-term on campus offering lectures, faculty workshops and even teaching full term courses for faculty and advanced students in a specific area of science. Another approach that would help faculty would involve sponsoring periodic SADCC-wide workshops and conferences within disciplines and applied fields, which would be led by the outstanding scientists from within the region.

Proposals based on faculty goals and development plans that make a good case for some combination of the above--as well as other approaches--should be useful.

CASE 4 SADCC-WIDE: Almost any SADCC crop science faculty today would gain from a programme of 6-12 month faculty sabbaticals, combined with invited lecture programmes and workshops conducted by distinguished crop scientists from abroad or periodic workshops and conferences organized and conducted by crop scientists in the SADCC region. Scientists could share experience and to learn from each other. Some of this effort might focus on specific crops and problems of the region but in

all cases should bring into focus the most recent, relevant scientific knowledge. Most of the effort should be devoted to providing access to the most important advances in crop science and its specialized fields.

CASE 5 UNIVERSITY OF ZIMBABWE: As part of the ambitious development plan at the Faculty of Agriculture at University of Zimbabwe, an explicit emphasis has been given to improving training in statistical analysis. In few areas of agricultural research has there been such a rapid change in techniques of analysis as farm management. This is due in large part to the revolution in computer technology and advances in statistical theory.

The University of Zimbabwe could consider requesting an institutional grant to offer a series of two-week intensive courses in statistical analysis and computer applications for research and training applied to various disciplines. The grant would cover setting-up a computer laboratory, training consultants, as well as arranging travel and accommodation for participants from other SADCC universities.

### 3) Curriculum Development

Since curricula within the region are in different stages of development, as are faculties, there are many types of curriculum and course development needs that have not been met. For example, no fisheries curriculum exists, although fishery production has a substantial potential in many countries. Malawi has the SADCC responsibility for fisheries and has a freshwater fishing industry. Mozambique, Tanzania and Angola have ocean coastlines and might consider addressing the potential for saltwater fishery production, which differs from freshwater fishing production in many ways. Fisheries development is complex, involving many disciplinary needs, applied science fields and industrial problems varying from international and domestic law on fishing rights to health problems, conservation, processing technologies and marketing economics, to name a few. And this is just one example.

Other areas in which new curriculum might be developed are

resource management and conservation, wildlife management, and management for the university and public sector. In the latter case M.Sc.'s and Ph.D.'s, while highly trained in some scientific specialties, enter the universities or government ministries and often quickly assume administrative responsibilities with no preparation for administration as such. An appropriate curriculum might train M.Sc.'s in management while offering executive training courses of a few weeks to three months for new administrators in universities and in government. In many countries B.Sc. degree-holders also assume administrative roles early. Where this is the case, a faculty might wish to develop a proposal for creating undergraduate courses to provide a general base of skills in budgeting, personnel management, and general management.

CASE 6 ANGOLA AND MOZAMBIQUE: Textbooks and appropriate course materials in Portuguese are urgent requirements for both Angola and Mozambique. Some of these materials are available particularly in Brazil. If agricultural scientists from these two countries could develop communication links and establish networks to exchange information with Portuguese speaking scientists abroad, they could have access to adequate course material as well as intellectual stimulation. A second possible use of the Fund would be to translate into Portuguese texts from other SADCC countries.

CASE 7 UNIVERSITY OF LESOTHO: Lesotho was given the responsibility within SADCC to coordinate soil conservation and land utilization. Land management and resource economics is a relatively new area of study throughout the SADCC region, and the new Faculty of Agriculture at the University of Lesotho is a natural place for such an emphasis and specialisation to develop. The geography department on the Roma Campus already has established a comparative advantage in studying erosion control, and a resource economics focus in a rural economics department would be complementary.

A research programme within the Faculty of Agriculture linked to erosion control programmes in the Ministry of Agriculture could be funded by an institutional grant. The programme would examine the economics of erosion control and recommend viable strategies based on methodologies for analyzing resource

problems that could be used elsewhere in the region. By-products of the project would be a set of course materials on resource management in Southern Africa, a summary of resource problems in the region and the analytical capacity for evaluation of regional resource problems.

CASE 8 UNIVERSITY OF SWAZILAND: One characteristic of developing economics is the rapid promotion of well trained scientists. It is not uncommon for a new Ph.D. to be promoted within one to two years after his/her return to be department chairman or to another university administration post. Yet, training for administrative responsibility is seldom included in undergraduate or graduate programmes. This is one example of the need for creative curriculum development. A B.Sc. course in public administration could be designed to fill this important gap, and capacity to offer short courses for new administrators could be developed.

Swaziland has the SADCC mandate for manpower development and is involved in management training for mid-career professionals. The University could request an Institutional Grant to develop this curriculum including texts and other course material, in order to become a regional resource for this type of training.

At both B.Sc. and M.Sc. levels there is a great lack of supplementary course material for instruction in the agricultural disciplines, including texts in the appropriate language, microfilms or other reproductions of relevant research reports, and especially laboratory manuals and case materials adapted to traditional agriculture in Southern Africa. Proposals to develop such materials might focus on the needs of the SADCC region and be developed for use across the region in the various agricultural disciplines and subject matters. In addition, maintaining up-to-date inventories of M.Sc., and Ph.D. and faculty research in Southern Africa in various specialised areas might make a useful project.

CASE 9 UNIVERSITY OF ZIMBABWE: There are two very different types of production units in Zimbabwe: the commercial sector--- large, modern, highly mechanized farms established in colonial times by the Europeans - and farms in the communal areas---small, using traditional practices with common grazing land, a high population density, often located in hilly, low potential areas. Farm management texts tend to treat effectively the first, infrequently focus on the latter and almost never treat the integration of both in a dual agricultural economy.

Current research under way at the University in farming systems, research and food security could be developed into useful case studies for classroom instruction. A grant to the Department of Land Management would allow some staff to devote time to this activity -- gathering more information, writing cases, testing them in the classroom and expanding these topics. Editorial help and publishing expenses could also be covered. Zimbabwe is not the only country with a dualistic agricultural sector. Thus, cases from these countries could be included and the texts could be used in other universities.

In addition there are needs for unique applied or practical training materials specially adapted to the needs and problems of Southern Africa. Proposals could be submitted to the Fund for strengthening support of practical training, on and off campus, perhaps through local development of various types of visual aids ranging from charts and slides to visual overlays, films or video tapes. Three-dimensional sequential physical models of various processes might also be developed. Computerized simulation models for traditional agriculture might be developed in which students learn by actually making farm management decisions in an interactive problem context. There are many other possible examples of training materials needed to support practical training in Southern Africa. Frequently practical situations and problems cannot be brought into the classroom; often students cannot be taken to the appropriate field location. Often the only solution includes developing applied training materials on various aspects of animal health, soil erosion, or artificial insemination, to name but a few examples.

CASE 10 UNIVERSITY OF ZAMBIA: Animal husbandry practices by farmers in traditional systems in isolated areas of Zambia (and other SADCC countries) differ substantially from those in the modern sector that are treated in most textbooks. Yet, in many cases, Zambian students have not been exposed to these practices. For financial and logistical reasons, field trips cannot totally fill the gap. Therefore the animal science department would like to develop a set of video tapes on various

topics for classroom use. An example is a series on problems that arise in pregnancy and calving with large animals, which would include simple solutions to those problems as well as information on how farmers would respond. A grant for equipment, film, transport and technical assistance would finance this project. It would be ideal if it were done in collaboration with other animal science departments in the region. The tapes, of course, would be duplicated for use by other universities in the region.

#### 4) Improving Teaching Methods

Rarely does the path to an M.Sc. or Ph.D. in science include any systematic instruction in teaching techniques. Young faculty especially, but others as well, can improve their effectiveness as teachers with a little help to make them more conscious of the alternative techniques available to them in different kinds of classroom and laboratory situations.

Annual workshops for faculties could be directed by a local faculty members experienced in pedagogy or by experts brought in from other SADCC countries or elsewhere. It is often a good idea to develop and maintain this expertise as a continuing resource for consulting on the development of new courses and for help in evaluating teaching effectiveness. Another approach might bring in master teachers, renowned within a field, to lecture and consult in SADCC departments within that field. With resources as scarce as they are, faculties cannot afford to be ineffective in teaching the next generation of agriculturalists and scientists. Institutional grants to assure the effectiveness of teaching are an important part of this programme's purpose.

CASE 11 TANZANIA AND SWAZILAND: Many of the universities in the region have established committees or programmes to improve teaching and learning not only for the agricultural sciences but for a wide spectrum of programmes offered by these universities. Yet there are certain problems which are only specific to the

teaching of agricultural sciences. The Sokoine University of Agriculture has established a University Teaching and Improvement Learning Programme. The coordinator is currently in the process of developing ways in which teaching of agricultural science can be improved at university level. At the same time, the Faculty of Agriculture, University of Swaziland, has had considerable experience in training teachers of agriculture with B.Sc. degrees in agricultural education. These two institutions could develop proposals to study problems of teaching at the university level in the agricultural sciences, which should prove useful in the improvement of teaching in all the faculties of agriculture in the SADCC region.

##### 5) Management of University Farms

Because the purposes for which faculties of agriculture maintain farms are complex, management becomes equally complex. Some farms are run to provide food for students and to make a profit, i.e., as a commercial farm. This requires good management. Some farms or parts of a farm have the purpose of scientific research, i.e., an experiment station. This requires even more intensive resource inputs and high quality management, which cannot be judged against commercial farming criteria, since the purposes are different. The experimental plots can be used for teaching as well, which does not require different management but simply that the teaching uses be considered at the time the experiments are planned. Scheduling can be a complex problem. Model farms, another type of university farm, can be used for teaching farmers as well as university students. If planned and managed well, a model farm can be run as a commercial operation and still serve the purposes of instruction. Experiment stations and commercial farm management involve very different goals and are generally incompatible. However, both require well trained, high quality management or they will likely fail to achieve their objectives.

CASE 12 UNIVERSITY FARM MANAGEMENT: Bunda College, Sokoine University and University of Zambia have university farms that are supposed to be run for profit as commercial operations. However, they often do not make a profit, in part because of the dilemmas of running a university farm commercially while conducting research and teaching at the same time. Of necessity university farms tend to have large numbers of activities going on, such as growing many different kinds of crops while maintaining different types of livestock. However, managing a farm for a profit would require fewer activities, and students would be denied an opportunity of learning about other livestock and crops, and a broad research programme would not be possible. Farm managers need to be exposed to a training programme that would include budgeting, cost analysis, and time analysis for multiple purposes on a mixed farm. University farm managers might also hold meetings to exchange ideas on how to deal with some of the common factors contributing to the losses. Such courses and seminars could be funded from an Institutional Grant.

#### 6) Strengthening Communication and Institutional Cooperation

The institutions of agriculture in Southern Africa exist in substantial isolation one from another. This is true within countries and between countries. Faculty in one field in one country often have never met their colleagues in other SADCC countries. There is little or no sharing of knowledge or the intellectual stimulation necessary for progress in different disciplines and applied fields.

Research, teaching and extension within a country often have little communication or common linkage. As a consequence extension may lag well behind in scientifically tested practices and knowledge of agriculture, and the contributions that teaching and research make to each other are lost. This in turn means that some significant part of the potential productivity from the individual social investments made separately in agricultural research, academic teaching and extension is lost. The contribution these institutions make to agricultural development in the SADCC region is

thus less than it could be.

Grants to develop communication and institutional cooperation between the academic enterprise and the other institutions of agriculture would be appropriate for the Fund to consider. Networks of colleagues in the same field need to be developed for SADCC. As SADCC countries develop postgraduate teaching programmes, the universities must be linked into agricultural research in the region and the faculties have to maintain substantial scientific research activity of their own, or the quality of graduate education will suffer--to say nothing of agricultural productivity and development.

CASE 13 BOTSWANA, LESOTHO AND SWAZILAND: In these countries departments of agricultural research are physically very close to the colleges, so that research and teaching can be linked with a view to strengthening both. Time would be available for the teachers to do research because they would be relieved of some of the pressure of teaching. The library facilities in the research centres would be at the disposal of the faculty, and they could take advantage of the current journals available. Researchers would have the opportunity for the stimulation of teaching and the opportunity to expose their research ideas to faculty and students.

CASE 14 SADCC-WIDE: SACCAR, which has its headquarters in Botswana, is establishing a regional library and documentation centre for agricultural research in the SADCC region. Faculties could take advantage of this library by establishing communication and loan arrangements with it. Up-to-date research information would be available more easily, thereby strengthening the work of faculties. The grant could be used to meet some of the costs incurred in establishing this kind of linkage. Staff may wish to travel to this library to obtain research information. Material might be loaned or copies made and sent to them. One might even set up telex communication links. In return, the faculties should provide SACCAR with a complete set of M.Sc. and Ph.D. theses of staff and students and copies of research reports, discussion papers, and conference presentations.

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## Chapter VII. CONCLUSION

The proposed programme will assist the faculties of agriculture in the SADCC region by increasing the quality and quantity of the students they train. This involves strengthening the faculties themselves, facilitating their institutional development, fostering cooperation among faculties and improving the linkage between the faculties and public and private institutions concerned with agriculture.

Few regions of the world have started as recently and have as far to go in developing their base of scientific manpower in agriculture. The task is crucial to the nation-building goals of the SADCC countries. It is urgent, but will not be accomplished quickly. Building a nation, building the institutions of modern highly productive agriculture, is measured in decades not years. Long-term, continuing commitments by faculties, individual governments, agricultural scientists and donors are necessary.

The faculties of agriculture are conscious of the role they must play. They understand their potential and the potential of their nation's agriculture. They are not only ready to shoulder major responsibilities for producing the trained leaders and scientists but also to take up a direct intellectual role in the development of agriculture. Indeed, many have already begun these tasks.

Furthermore, SADCC member countries have attached a high priority to agricultural development and realize that effective institutions training agricultural scientists are an integral part

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of this process. A programme to transfer this training responsibility to the region and take advantage of the impressive human resources already existing in the faculties of agriculture in national universities would be consistent with the goals and objectives of SADCC and strongly supported by the faculties themselves. The Fund would greatly facilitate this process. This proposal was developed for consideration by SADCC through the food security program coordinated by Zimbabwe. It is based on the assumption that institution-building is a gradual process and a 20-year time period is necessary to achieve the goals and objectives described in this document. Phase I of the programme will be five years, at which point progress in faculty development would ensure a continuation. Therefore, an evaluation in five years should look for the following achievements:

- (1) The priority given to agricultural development by countries in the SADCC region will begin to show results due to the effective capacity that has been developed in the faculties of agriculture to train agricultural scientists. Several scholars sponsored by the Fund will have returned and will be occupying influential positions in the teaching and research activities of the faculty.
- (2) Improvements in academic staff and facilities will enable all training at the B.Sc. level to be conducted in the region, although undergraduates from some countries will still need to be sent to their SADCC neighbours.
- (3) Bachelor degree programmes will be developed in those countries which do not now have a faculty, and the quality of undergraduate programmes will be substantially improved in those that do. This requires a core of staff to cover the major subjects taught in a general agricultural degree. Some departments in every faculty will have been strengthened, and in some faculties new departments will have been created.

- (4) Some M.Sc. training currently done abroad will have been shifted to the region with quality curricula offered in crop, animal and soil sciences in several of the countries. In these faculties complementary specialisation within these three areas will be apparent. In the disciplines that are currently less well developed, e.g., agricultural economics, agricultural engineering, food science, etc., a few faculties will have chosen to increase their strength in one of these areas and develop a comparative advantage. These will be developing the capacity to train students from other SADCC countries. Much of the Ph.D. training will still be done abroad but most of the thesis work will be conducted locally.
- (5) Academic faculties and teaching materials will have improved to the point where some new curricula will be in use and supplementary textbooks specifically about agriculture in Southern Africa commissioned to local scientists. Laboratory manuals would be improved and solid programs of applied training and fieldwork underway.
- (6) Faculties of agriculture will be more involved in agricultural research and rural development and the contribution faculty members can make will be more likely recognized by ministries of agriculture, planning and education and by university administrators.

Nevertheless, despite these achievements the programme will only be gathering momentum in five years. Institutional development requires patience. Growth in the different faculties will be uneven, and developments within faculties will be uneven, yet progress will be measurable. One can look forward 20 years when academic excellence in SADCC is on a par with the international scientific community and a two-way flow of research results, publications, faculty and students between regional institutions and the foreign scientific community is of benefit to both sides.

## APPENDICES

FACULDADE DE CIENCIAS AGRARIAS

HUAMBO, ANGOLA

Angola received its independence relatively recently, and during the colonial period little training was done in any field including agriculture. Furthermore, political instability has prevented the development of the agricultural school at Huambo.

A general agriculture degree began at Huambo in 1983. Plans are to produce 8 to 10 graduates a year in agriculture and 4 to 5 in veterinary science. In the first year of the course, about 80 students were admitted but over 60 of these students dropped out that year. This was due mainly to the lack of supplies including food.

The Instituto de Investicao Agronomica is an agricultural research institute about 25 kilometres from Huambo. At independence, the institute had 60 professionals but they were all expatriates. At the moment they have no Angolans with M.Sc. or Ph.D degrees on the staff.

There are four secondary schools that specialise in agriculture: Escola de N'Gangassol, Escola de Mecanizacao de Sumbe, Escola de Mecanizacao de Huila and Escola Agrararia de Cafe da Gabela. These schools were set up to handle about 800 students. The current number of students is not known, but probably two of the schools are closed.

Manpower development is a major task confronting Angola.

BOTSWANA AGRICULTURAL COLLEGE

GABORONE, BOTSWANA

While Botswana does not have a faculty of agriculture at the moment, plans are underway to establish one. Meanwhile, two-year courses leading to a certificate in agriculture or animal health are offered at the Botswana Agricultural College (BAC). The College was established in 1967 to train students in agriculture at the certificate level. In 1969 a certificate-level course in animal health was introduced. A program in Social Work was added in 1972, but it has been transferred to the University of Botswana.

Previously students interested in a diploma went to Swaziland to specialise in either animal health and production or general agriculture. These courses were established in Botswana in 1980 after the University of Botswana and Swaziland was dissolved. On average, BAC has been producing 16 graduates in the diploma course every year since 1981. Currently there are 260 students attending the College, 198 in the certificate course and 62 in the diploma course. There are 15 students in the first year of the Diploma in Agriculture course, 18 in the second year. Twelve students are enrolled in the first year of the Diploma in Animal Health and Production, 17 in the second year.

Entry requirements for the diploma course are a pass at "O" level with at least three credits, (one of which would be in English and the other two in the sciences). Those holding certificates may be admitted to the program provided that they have had at least two years working experience after attaining the certificate.

Students are sponsored by the government of Botswana at an annual cost of 3,000 pula (about US \$1,860 at current official exchange rates). Costs for foreign students are higher at about 7,000 pula (about \$4,200). Of the 50 teaching members on the staff, 30 have B.Sc. or M.Sc. degrees (eight are expatriates). There are ten Staff Development Fellows abroad studying for a B.Sc. or above. Localisation of staff is feasible except in the field of veterinary medicine. The problem in this field is to find qualified candidates who can gain admission to a veterinary medicine program in the region or abroad.

The Department of Agricultural Research in the Ministry of Agriculture is in the same compound as BAC. It is divided into two units, one for animal production and the other for arable crops. The new offices of SACCAR are also next door. The Animal Production Research Unit has eight staff members with degrees, two of whom are expatriates. Of the local staff, there is one Ph.D., one M.Sc. and four with a B.Sc. qualifications. One local staff member is training for a Ph.D., one for a M.Sc. and two for a B.Sc.

The Arable Crops Research Unit has 22 staff members (four local staff, six expatriates and 12 advisor experts) and 19 Botswana in training; two for a Ph.D., five for a B.Sc. and seven for a Diploma. It is anticipated that in two to three years, there will be at least 21 local staff with a B.Sc. or above. The staff from the research department could teach at BAC on a part-time basis, say one course a year. At the moment there is little collaborative work between the two institutions, in spite of their close proximity, but discussions are underway to see if this could be improved.

Practically all local staff have been trained abroad, in the U.S., Canada, the U.K. and elsewhere in Africa. The cost to send students to other African universities is estimated to be less than one third of the cost in the U.S. Bilateral projects have funded much of the training, and the rest has been funded by the Botswana Government. The scholarships are for students who are current members of staff (in-service training) who have been identified for training after their second year at the university (pre-service training). Different ministries handle each type of scholarship.

With respect to the development of a faculty of agriculture at the University of Botswana the plan is to upgrade the College to a faculty of the university since the physical facilities of the College are quite adequate. There is a question of whether administratively the Faculty should be within the Ministry of Agriculture, where the College is currently located or in the Ministry of Education which is responsible for the University. A consultant's report written in early 1985 recommends an intermediate quasi-independent status for the faculty.

The B.Sc. degree will be a four-year program, the first year devoted to basic sciences and offered by the Faculty of Sciences on the main campus of the University in Gaborone. The last three years will be at the Agricultural Faculty in Sebele. The student intake will be 20 to 30 per year. The College realizes that to embark on a Faculty, the number of staff will have to increase, and existing Faculty will need Ph.D. training. In addition, curricula and syllabi will have to be developed. Assistance from experienced personnel in other SADCC countries would be of great help.

## LESOTHO AGRICULTURAL COLLEGE

MASERU, LESOTHO

The National University of Lesotho was established in 1975 after Lesotho withdrew from the University of Botswana, Lesotho and Swaziland. It is located at Roma about 30 minutes drive north of Maseru. At the moment, it does not have a Faculty of Agriculture, however, there are discussions between the University and the Ministry of Agriculture to establish one. The only post-secondary school training in the agricultural sciences is offered at the Lesotho Agricultural College (LAC), which was established in 1955 and is affiliated with the National University of Lesotho. The College is based in Maseru, with a branch campus at Leribe, and is administered as a division of the Ministry of Agriculture.

Currently, the LAC offers certificate-level training in agriculture, agricultural mechanization, domestic rural economy and forestry. Admission to these programmes is usually after Junior Secondary Examination. The duration of training is two years except for the forestry program, which is one year. The latter is being phased out and will be replaced by a two-year diploma programme in 1986. The College also offers two-year diploma programmes in agriculture, and one in agricultural education will start in 1986. Student enrollment is currently 140. The distribution of students in various programmes is given in Table 1.

There are seven departments in the college: agricultural engineering, agronomy, animal science, forestry, home economics, use and resource conservation, and social and quantitative studies.

There are 32 established professional staff positions for 1985; 25 of these are filled by nationals and seven by expatriates. Of the local professional staff three are trained to M.Sc. degree level, 11 have a B.Sc. and 11 a Diploma. The number and distribution of staff by departments is shown in Table 2.

Most of the training has been done through bilateral programmes in the U.K. and U.S.A.. Training at undergraduate and graduate levels is coordinated by the National Manpower Development Secretariat which is under the Ministry of Economic Planning. The Secretariat is also responsible for all training of Lesotho nationals abroad in disciplines that are not offered at the National University of Lesotho. Most of this training is supported by the bilateral cooperation programmes. Some students have studied in universities in other SADCC countries (e.g., veterinary medicine at Sokoine University of Agriculture or medicine at University of Zimbabwe). Lesotho is concerned that high admission requirements of some regional institutions make it difficult for Lesotho students to gain admission, even though there are scholarships available.

The Agricultural Research Department of the Ministry of Agriculture is adjacent to the college campus. It is staffed by 15 professionals: six Lesotho nationals and nine expatriates. Three of the local staff have M.Sc. and three have B.Sc. degrees. In addition, six other nationals are on training overseas (four for M.Sc.'s and two for B.Sc.'s). Most of the expatriate staff in the research station is part of a project funded by USAID.

If a faculty of agriculture is to be established in Lesotho soon, (either at the Agricultural College in Roma or at the University) then a concerted effort must begin immediately to train staff at M.Sc. and

Ph.D. levels. In addition, curricula and syllabi will have to be developed, and laboratory equipment, text books, journals and teaching aids, etc. must be acquired. Lesotho will benefit from the assistance of other national universities in the SADCC region in establishing its faculty.

Table 1. Student Numbers at the Lesotho Agricultural College, 1985

<u>Specialisation</u>	<u>Certificate Training</u>		<u>Diploma Training</u>	
	<u>1st Year</u>	<u>2nd Year</u>	<u>1st Year</u>	<u>2nd Year</u>
Agriculture	25	20	12	17
Mechanization	14	6	-	-
Domestic Rural Economy	14	15	-	-
Forestry	17	-	To start in 1986	
Agricultural Education	-	-	To start in 1986	
Total	<u>70</u>	<u>41</u>	12	17

Table 2. Professional Staff positions at the Lesotho Agricultural College, 1985

<u>Department</u>	<u>Total No.</u>	<u>Local</u>	<u>Expa- triate</u>	<u>Training of Local Staff</u>		
				<u>MSc</u>	<u>BSc</u>	<u>Diploma</u>
Agricultural Engineering	5	5	-	-	-	5
Agronomy	6	6	-	-	-	3
Animal Science	4	3	1	-	1	2
Domestic Rural Economy	5	5	-	-	3	2
Land Use & Resource Con.	4	2	2	-	1	1
Social & Quantative Stu.	4	4	-	1	2	1
Forestry	<u>4</u>	<u>2</u>	<u>2</u>	<u>1</u>	<u>1</u>	<u>-</u>
Total	<u>32</u>	<u>27</u>	<u>5</u>	<u>2</u>	<u>8</u>	<u>14</u>

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UNIVERSITY OF MALAWI, BUNDA COLLEGE OF AGRICULTURE

LILONGWE, MALAWI

There are ten faculties in the University of Malawi and they are divided among four campuses. The Bunda College of Agriculture is situated at Bunda, 30 kms south of Lilongwe, on its own campus, which covers about 1,800 hectares. It was established in 1966 to train students at diploma and degree levels primarily to work in the extension services of the Ministry of Agriculture and Rural Development. It admitted its first diploma students in 1966 and its first degree students in 1969.

The college currently offers two types of programmes:

1. A diploma in general agriculture. This is a three-year degree and students are admitted after successful completion of "O" level examinations in science subjects. Students with "A" level qualifications are exempted from taking the first year and hence do a diploma in 2 years.

2. A B.Sc. in general agriculture. Initially B.Sc. students did their first two to three years at Chancellor College, which is part of the University of Malawi, at Zomba. Since 1978, all instruction is done at Bunda. Admission requirements are a credit or distribution pass in the diploma programme. It is a two-year programme. The current curriculum is being revised to allow some specialisation in the final year of study.

Total enrollment is currently 371 students. Student numbers for both programmes for 1984/85 academic year are given in Table 3. The college is organized into five departments: agricultural engineering, crop production, home economics and human nutrition, livestock production, and rural development. The last department is subdivided into sections, agricultural economics and extension, English and communication.

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The staffing of the various departments is as shown in Table 4. Fifty percent of the local staff on campus have Ph.D. degrees, 13 of 30 have a M.Sc. and one has a B.Sc. The Department of Livestock Production is well developed; the department members are all from Malawi and seven have Ph.D. training. The Department of Crop Production will be well staffed when seven staff development Fellows return from their graduate studies abroad.

For the Diploma and B.Sc. programmes the library is well stocked (25,000 volumes), and the laboratories are adequate. At the moment, no taught postgraduate programs are offered by the college, although M.Phil. and D. Phil. degree programmes are available. Students are part-time and their research is carried out elsewhere, but under faculty supervision. The first Ph.D. degree awarded by the University of Malawi was to a student from Bunda College in 1971. Plans allow for taught M.Sc. courses in crop production, livestock production and agricultural extension. If the postgraduate programmes are to be expanded by the introduction of taught courses and an increase in students, Bunda College will need to invest in laboratories and equipment, library and staff training.

The college farm is part of the campus. One section (about 64 hectares) is allocated to undergraduate students for their practical training in crop and livestock production. Approximately 400 hectares is farmed commercially with the main livestock enterprises being beef and dairy cattle, pigs and poultry production. Tobacco, maize, beans and groundnuts are major crops. Like most university farms in the region it is difficult to manage, and it is the desire of the University administration to make it more profitable.

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Technical assistance over the past several years has come from USAID, ODA, UNDP/FAO and other organizations.

The college faces problems in three areas:

1. The budget for the current year is 1,310,000 kwacha (about US\$750,000). However, it has been almost constant for the past three years, and budgetary restrictions limit any expansion in programmes. This impinges on research as well.
2. The faculty is attempting to establish more formal links with the Ministry of Agriculture in order to improve its research programmes.
3. While the development of local staff is impressive, there is virtually no backup in any position and few new development Fellows are being appointed. Sudden vacancies would take a long time to fill and the nearly uniform age of the faculty could be a problem in the future.

Table 3. Student Distribution by year, 1983/84 to 1984/85

Year of Diploma Course	1983/84	1984/85
1	87	120
2	93	98
3	<u>118</u>	<u>90</u>
Total	298	308
Year of Bachelor's Course		
4	33	37
5	<u>29</u>	<u>26</u>
Total	62	63
Grand Total	360	371

Table 4. 1984/85 Academic Staff

<u>Department</u>	<u>Establishment</u>	<u>Local</u>	<u>Expatriate</u>	<u>In Training</u>
Agricultural Engineering	8	5	2	3
Crop Production	12	5	3	7
Home Economics/Human Nutrition	5	3	-	1
Livestock Production	10	10	2	-
Rural Development	<u>10</u>	<u>7</u>	<u>1</u>	<u>3</u>
Totals	45	30	8	14

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EDUARDO MONDLANE UNIVERSITY

MOZAMBIQUE

Eduardo Mondlane University has a Faculty of Agronomy and a Faculty of Veterinary Sciences. The Faculty of Agronomy includes departments of forestry, agronomy and social science although only forestry and agronomy offer four year degree programmes.

Enrollment in the Faculty of Agronomy grew slowly from its inception in 1970 until 1977 when 40 students were registered. By 1983 enrollment increased to 116 with 44 first year students. Further expansion is expected to reach 150 first year students by 1980.

The Faculty of Veterinary Medicine was established in 1983. Four year degree programmes are offered in animal production and veterinary medicine.

In both Faculties, considerable time is spent on practical training. In the Faculty of Agronomy about 30 percent of students' time is spent on practical work, whereas, students in the Faculty of Veterinary Medicine spend about equal time in theoretical and practical training. Practical training includes one month working on farms and in slaughterhouses.

Each semester is between 16 and 18 weeks in duration. The official language of instruction is Portuguese, although some expatriate instructors teach in Spanish. Most materials and text books used in the classroom are written in English.

There are several major constraints facing the University which must be overcome if more agricultural scientists are to be trained. First, there is a shortage of trained local teachers. Of the 24 instructors in the Faculty of Agronomy only seven are from Mozambique. The 17 expatriate instructors are from Holland (7), Italy (4), Cuba (3)

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and Chile (3). Many expatriate instructors have short or medium term contracts which result in high turnover of staff and consequently a loss of continuity in course work.

In the Faculty of Veterinary Medicine there is an urgent need for lecturers in physiology, animal production, animal nutrition, pharmacology, food hygiene and technology. The shortage of professional staff is shown in Table 5.

A shortage of laboratory technicians and administrative support staff put extra demands on the professional teaching staff and reduces the time given to teaching, research, and student advising.

Other constraints are a shortage of teaching materials including text books, scientific journals, audio-visual aids and veterinary instruments. Lack of student transport for field and clinical work also limits the effectiveness of training.

Fellowships are needed to enable students to obtain M.Sc. and Ph.D. degree training outside Mozambique. Numerous local staff are urgently required to fill current vacancies and positions held by expatriates. Only then will the University be able to adequately train the agricultural scientists needed to achieve the countries development goals.

Table 5. Teaching Staff For Agricultural Training, 1985

	<u>Professional</u>		<u>Technical</u>	
	<u>No.</u>	<u>%</u>	<u>No.</u>	<u>%</u>
Vacancies	50	46	10	4
Staff in Training	8	7	-	-
Nationals	12	11	151	65
Expatriates	<u>39</u>	<u>36</u>	<u>73</u>	<u>31</u>
Total Positions	109	100	234	100

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## THE UNIVERSITY OF SWAZILAND

### MANZINI, SWAZILAND

The history of the University dates back to 1945 when a Catholic University College was founded at Roma, Lesotho. It was renamed the University of Bechuanaland Protectorate, Basutoland and Swaziland (UBBS) in 1964. At independence in 1966, it became the University of Botswana, Lesotho and Swaziland (UBLS) and produced its first graduates in 1967. In the same year an agricultural campus was set up in Swaziland. The University of Botswana and Swaziland was formed after the withdrawal of Lesotho from UBLS in 1975. Finally, these two separated when the University of Botswana was formed in 1982, and the name was changed to the University of Swaziland.

The University has five faculties: agriculture, education, humanities, science, and social science. It has a student population of 1,206. The main campus is near Manzini and includes four of the faculties. The Faculty of Agriculture is located on a separate campus about 20 minutes drive from the main campus. It has its own farm (305 hectares) and is just across the road from the Ministry of Agriculture's main research station (the Malkerns Agricultural Research Station).

The Faculty of Agriculture consists of five departments: animal production and health, crop production, agricultural economics, extension and education, home economics, and land use and mechanization. There are 31 established academic staff positions in the faculty. Seventeen of the current faculty members are expatriates; two posts are vacant. The Department of Animal

Production and Health has five faculty positions (four expatriates and one vacant post, four in training); Crop Production, eight (four expatriates, one local and two posts vacant, four in training); Agricultural Economics, Extension and Education, eight (four expatriates and three locals, three in training); Home Economics, five (all local); and Land Use and Mechanization, four (three expatriates and one local, one in training). There are ten teaching assistants in the Faculty.

The Faculty offers two-year diploma courses in agriculture, agricultural education and home economics; and a four-year Bachelor's Degree in agriculture and agricultural education. All students begin with a six month pre-entry science course. Students registered for the B.Sc. degree take their first year courses in the Faculty of Science, then move to the Faculty of Agriculture to complete the remaining three years. In the final year, students do a paper in a specific area of study. Otherwise, they do not specialise.

The requirements for admission into the diploma course is at least a third class pass at the "O" level School Certificate Examination (SCE). For admission into the B.Sc. programme, a second class pass with credits in English and mathematics is required. Those with "A" levels can be admitted into the second year of the B.Sc. programme. The faculty accepts a number of students from Botswana under an arrangement made between the two countries.

The Ministry of Agriculture uses the facilities on the campus to offer a Certificate course in agriculture. However, the Faculty itself is not involved in this course.

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Current enrollment at the Faculty of Agriculture is 241 students. The distribution of students in various courses is shown in Table 5. There are 158 students in the Diploma programme and 83 in the B.Sc. program. Approximately one-third of the students are female; forty-four are from foreign countries (23 of these from Botswana), and 26 of the students are either privately funded or are funded by organizations other than the government.

Total costs for student enrollment per year are E2,050 for Swazi students and E4,050 for foreign students (approximately US \$1,050 and \$2,100 respectively at current official exchange rates). The total budget for the faculty is E1.2 million (US \$.62 million).

There are no postgraduate programmes in the University although the matter is being discussed and several departments in the Faculty of Agriculture are currently planning a post-graduate course.

Staffing is the major constraint facing the University at the moment. This is reflected in the high numbers of expatriate staff, the high turnover of faculty and the many faculty members' lack of experience. Furthermore, the teaching load is heavy, leaving little time for research by faculty members. There are some staff members abroad on advanced training. Financial support for scholarships or visiting professors has come from CIDA, EEC, ODA, NUFIC, IDRC, and USAID. However, these scholarships are awarded piecemeal, and at the present time there is no major bilateral development program. A tight local budget means that the faculty has few plans for expansion. For example, at the moment, home economics is taught at the Diploma level because all the academic staff in the department are scheduled to leave for further studies abroad, and staffing will become a major problem.

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A second major constraint has to do with the delicate balance in producing the right number of students. A small country like Swaziland does not have the flexibility to absorb too many graduates, but at the same time too little manpower in a particular field can severely constrain development. Therefore, the faculty and the university are very careful about student numbers.

Other constraints include student housing, inadequate laboratory facilities and equipment, and lack of qualified technical staff in certain areas.

TABLE 6. DIPLOMA AND DEGREE STUDENTS

Diploma Programmes

	<u>Agriculture</u>	<u>Education</u>	<u>Home Economics</u>
<u>Year</u>			
1	35	35	24
2	<u>21</u>	<u>30</u>	<u>18</u>
Totals	56	65	42

Degree Programmes

	<u>Agriculture</u>	<u>Agriculture Education</u>
2	19	7
3	12	14
4	<u>22</u>	<u>9</u>
Totals	53	30

## SOKOINE UNIVERSITY OF AGRICULTURE

MOROGORO, TANZANIA

Although Sokoine University of Agriculture was created in 1984, its origins go much farther back. Morogoro Agricultural College was founded in 1965, became the Faculty of Agriculture as part of the University College, Dar es Salaam in 1969 and subsequently the University of Dar es Salaam in 1970. The campus is on the edge of the town of Morogoro, 200 km west of Dar es Salaam. Sokoine University has 3350 hectares of land of which 2,300 hectares constitutes the University farm.

There are three faculties in the University: agriculture, forestry and veterinary medicine. The Faculty of Agriculture has seven departments (agricultural education and extension; agricultural engineering and land planning; animal science and production; crop science and production; food science and technology; rural economy; and soil science). The Faculty of Forestry has five departments (forest biology, forest engineering, forest mensuration and management, forest economics, and wood utilization). Finally, the Faculty of Veterinary Medicine has six departments (veterinary anatomy; veterinary physiology, biochemistry and pharmacology; veterinary surgery, obstetrics and reproduction).

The current (May, 1985) list of academic staff from professors to assistant tutors numbers 174. The Faculty of Agriculture is the largest with 120 staff members, the Faculty of Veterinary Medicine has 29 and the Faculty of Forestry has a staff of 25. Twenty-one of these faculty members are expatriates and almost a third of the Tanzanian

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staff are currently away from the university on study leave. By 1987, most departments will have an adequate number of academic staff trained to the Ph.D. and M.Sc. levels.

Within the Faculty of Agriculture, 43 staff members have Ph.D. degrees (34 Tanzanians and nine expatriates); 38 of the staff have an M.Sc. level degree or equivalent qualifications (34 Tanzanians and four expatriates); 39 staff members have only B.Sc. degree level qualifications. The Departments of Crop Science and Soil Science are the strongest with respect to staff, because they are larger and have more senior faculty members. These are followed by the departments of animal science, agricultural education and extension, agricultural engineering and land planning, rural economy, and food science and technology, all of which need some strengthening. The University is the only one in the SADCC region offering B.Sc. level specialized training in agricultural engineering (since 1983), which is offered jointly with the Faculty of Engineering, University of Dar es Salaam. As of January, 1986, it will be the only institution offering home economics undergraduate training and food science and technology at B.Sc. degree level.

Sokoine University is also the only faculty in SADCC to offer a B.Sc. degree in forestry. The Faculty of Forestry has ten staff with Ph.D. degrees (six Tanzanians, four expatriates); eight other staff have M.Sc. degrees (seven Tanzanians, one expatriate) and seven have B.Sc. degree qualifications. The university also has a well established Bachelor's degree in veterinary medicine which was started

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in 1976. (The University of Zimbabwe and the University of Zambia have recently developed veterinary medicine programs).

In the current academic year there are 494 undergraduate students only ten of whom are female. The Faculty of Agriculture has 337 students, forestry has 87 and veterinary medicine has 70. There are 98 postgraduate students, of whom 76 are Masters' and 22 Doctoral candidates. There are 21 foreign students in the undergraduate programs (12 from Zambia and 9 from Rwanda), and 10 foreign postgraduate students. All facilities offer Bachelor's, Master's and Ph.D. degrees.

The undergraduate program requires three years for the B.Sc. in agriculture, forestry and home economics. The B.Sc. in agricultural engineering, food science and technology and the Bachelor of veterinary science degree programmes all involve four years of undergraduate work.

Sokoine University has a substantial current staff development program. Staff members are upgrading their credentials by studying abroad as well as locally under financial arrangements with NORAD, DANIDA, USAID, ODA, etc., as well as SUA's own resources. These scholarships tend to be associated with support to particular departments. Consequently, financial support is lacking in some areas.

Over half the graduate students are financed by NORAD, through an arrangement between the Departments of soil science and animal science with the Agricultural University of Norway, AAS. DANIDA is financing all the graduate students in veterinary medicine through a similar arrangement with the Royal Veterinary and Agricultural University of Copenhagen. There are also postgraduate research links between the University and some of CGAIR centres (IITA, IIRI, and ILCA) in agricultural engineering, crop science, soil science and animal

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Science. A Memorandum of Understanding between the Sokoine University of Agriculture and IITA involving research collaboration, midcareer staff development, and conducting short courses for Eastern and Southern Africa was signed in 1984.

Annual costs of undergraduate programs vary from 42,000 to 55,000 shillings (US \$2,300 to \$3,100 at the current official exchange rate). Postgraduate programs cost about 53,000 shillings per annum (US \$3,100). For the next academic year these fees have been raised by about 25 percent. The university recurrent budget for fiscal year 1984/85 is 94,046,000 shillings (about US \$5.2 million).

As a result of the poor state of Tanzania's economy over the past five years, leading to various foreign currency shortages, the Sokoine University of Agriculture is facing a number of serious problems. This includes lack of foreign currency to purchase crucial journals, books, chemicals for training and research, spare parts for important equipment, and new equipment. In addition, due to government budgetary cuts, money for building new laboratories, lecture rooms, student hostels and staff housing has not been readily available. Scholarships for staff development have in recent years been difficult to obtain and are not affecting the university's programme. Although the Tanzanian government and donors have assisted the university by providing resources, more assistance is required if the university is to maintain the quality of its programmes as well as provide enough manpower. In addition, linkage between the university activities and those of the Ministry of Agriculture and Livestock Development and its main research organizations are not well defined.

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UNIVERSITY OF ZAMBIA

LUSAKA, ZAMBIA

The School of Agriculture is located on the main campus of the University of Zambia in Lusaka. The School offers a B.Sc. degree in general agriculture. The University Senate has approved a B.Sc. degree programme in agricultural economics and plans for a B.Sc. degree in agricultural engineering are under discussion. The B.Sc. (Agriculture) program began in 1971 as a five year course. This was shortened to a four year course in the mid-70's and changed back to a five year programme in 1982.

The school intends to offer an M.Sc. in agronomy (to be conducted jointly by the crop science and soil science department). The animal science department will also offer an M.Sc. course.

There are five departments in the school: agricultural engineering, animal science, crop science, rural economy and extension, and soil science. Currently there are 40 established faculty positions: agricultural engineering has eight, animal science eight, crop science nine, rural economy and extension eight and soil science seven. Almost fifty percent of the staff on campus are expatriate (14 of 30) while about 15 Zambian staff members are abroad for graduate studies. (See Table 6.) Ten of these Staff Development Fellows are studying for a Ph.D. degree while the remainder are in M.Sc. programs. Nine of the current Zambian staff have their Ph.D. (These numbers are constantly changing, as students return to Zambia and new students are sent abroad.)

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There are 264 students currently enrolled in the School of Agriculture. Table 7 summarizes the student enrollment. The entrance requirements include passes in five subjects at School Certificate 'O' level examinations. Some students are also admitted after they have completed a diploma at the Natural Resources Development College. The diploma is a three-year course and these students go directly to the second year of the B.Sc. program. Admission is quite competitive. In the past year only one student out of three was accepted for admission.

Students spend their first year in the School of Natural Sciences taking basic courses in biology, chemistry, physics and mathematics. The second to fifth years are spent solely in the School of Agriculture. There is no specialisation in the courses that are taken; however, during the fifth year each student conducts an independent study project in one of the five departments. In the current year, about 15 percent of the students are doing their project in the agricultural engineering, 34 percent in animal science, 19 percent in crop science, 19 percent in rural economy and 13 percent in soil sciences. Student numbers have increased steadily and are expected to stabilize at 100 students per class.

An important part of the undergraduate programme is the emphasis on practical training and field work. A student has 30 weeks of practical activities during his undergraduate studies. These are conducted during vacation periods and include 10 weeks on the university farm, extended period on a private farm and the special project in the fifth year. The University farm is located about 20 kilometers from the main campus. It is 680 hectares, about a third of which is arable.

A small portion of the farm is allocated to research and the rest is managed commercially. A small area of five hectares is available on the campus for student and faculty use.

The school has an impressive building programme currently underway. Three departments will move into new quarters at the end of this year. This will alleviate the current crowded conditions, particularly lack of classroom space. A new school of veterinary medicine has just been developed and with Japanese assistance, a building programme is in progress. The programme expects to admit about 14 students a year.

The school is operating under a fairly tight budget. The annual budget of the School of Agriculture is about 1 million Kwacha (approximately US \$430,000 at official exchange rates). This does not include the costs of student meals and accommodations or general administration expenses. The budget has not been increased in the last three years. Foreign currency for books, journals, chemicals, etc., is extremely limited and the research budget for the whole university in 1984 was only 20,000K (about US \$8,600). However, the School of Agriculture has received substantial financial support in bilateral programmes. This has been particularly helpful for the scholarships associated with the staff development programme. CIDA has assisted the crop science department; NUFFIC the agricultural engineering department; Belgium the soil science department; NORAD the animal science department and DAAD and USAID the rural economy and extension department.

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Table 7. School of Agriculture Faculty, 1985

<u>Department</u>	Established Posts	Current Local	Staff Expatriate	Staff Development Fellow
Agricultural Engin.	8	2	3	2
Animal Science	8	5	2	2
Crop Science	9	5	3	5
Rural Economy and Extension	8	1	2	4
Soil Science	<u>7</u>	<u>3</u>	<u>4</u>	<u>2</u>
Total	40	16	14	15

Table 8. Current Enrollment, 1985

First year	67
Second year	66
Third year	48
Fourth year	36
Fifth year	<u>47</u>
Total	264

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UNIVERSITY OF ZIMBABWE

HARARE, ZIMBABWE

The faculty of Agriculture is located on the main campus of the University of Zimbabwe in Harare. It was established at the University of Zimbabwe in 1979, just prior to independence. However, a degree in agriculture had been offered by the Faculty of Science for 20 years prior to this. Since its independence, Zimbabwe has attached special importance to rural and agricultural development; agricultural education is part of this focus. In addition, at the regional level, Zimbabwe has food security responsibility for SADCC. An ambitious expansion and development programme is underway in the Faculty of Agriculture to increase undergraduate enrollment; add one year to the undergraduate programmes; increase the flexibility in student programmes and develop the university farm.

The faculty has three departments: animal science, crop science and land management. Land management includes soil science and agricultural economics, and eventually the department will probably be divided into two departments along disciplinary lines. There are currently 29 faculty members on campus; 18 from Zimbabwe (five Africans and 13 Europeans) and 11 are expatriates. Nine of the Zimbabwe staff have their Ph.D., eight have Master's degrees and one has a Bachelor's degree. Other plans include an increase in established faculty posts to 42 by 1987.

The faculty expansion plan includes both staff and capital development. The approach to staff training is creative and rather unique. It depends on cooperative arrangements with foreign universities, where staff development fellows spend six to 12 months attending courses abroad. However, they are registered for a M.Phil.

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or D.Phil. at the University of Zimbabwe. Thesis research is conducted at home and the university is responsible for supervising this research. The degree is given by the University of Zimbabwe. There are several advantages in this arrangement: 1) it is less expensive, 2) the thesis and the degree are more relevant to the local agricultural problems, 3) the students are more a part of the faculty and contribute to it by teaching and doing research during their degree studies, and 4) the probability of students joining the department at the conclusion of their studies is higher. Currently, there are 14 staff development fellows, and plans are to increase the number to about 30 during the next two years.

At the present time there are 196 undergraduate students in the three-year B.Sc. programme. The entrance requirements are two "A" level passes in scientific subjects. The number of qualified students seeking admission greatly outstrips available places, and competition for admission is increasing every year. As a result, the qualifications have also risen. In 1984, 250 applications were received and 79 were accepted. Enrollment has also increased steadily since independence, and plans are to stabilize the enrollment at 100 students a year.

While only a general B.Sc. in agriculture is offered, students specialize in one of four areas: agricultural economics, animal science, crop science or soil science. Furthermore, they choose

their speciality upon entrance. Table 9 shows the current distribution of students by specialisation in each year of the undergraduate programme. The faculty also offers a M.Sc. in food science in conjunction with the Department of Biochemistry.

Graduate programmes (thesis only) are offered in all areas in the faculty. Currently, 21 students are registered in the graduate programme (10 at the D.Phil. level and 11 for an M.Phil.).

The capital development programme involves the addition of offices, laboratories and classrooms. This expansion is financed by a grant from USAID of US \$6,332,000. The grant also includes the purchase of a farm and sponsors research and study programmes.

The university farm was purchased for the Faculty of Agriculture in 1984. It is located about 10 kilometers from the campus and is 1,700 hectares in size. Maize and beef cattle production are the most important enterprises. One hundred and forty hectares are irrigated and used for winter wheat production. The plans are to maintain the farm as a commercial operation with a small area allocated to student and faculty use. In the first year of operation under the management of the faculty, students in the undergraduate programmes visit the farm regularly and are exposed to the various facets of farm management. Student practicals will be conducted there in the future.

The 1985 budget of the faculty is Z\$1,400,000. Currently, fees for students are Z\$2,000, including accommodation. Foreign student fees are double this amount. However, there are very few places for foreign students unless there is a government to government agreement. There is also a new Faculty of Veterinary Medicine at the University, which began in 1983. Current student enrollment is about 17 students per year and academic staff number 12.

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The most pressing issue facing the faculty is to maintain the quality of the education programme during the rapid expansion period. A second priority is to modify the curriculum to give more attention to improving traditional agriculture in the communal sector. The faculty has a number of research projects under way that focus on Zimbabwe's communal areas. Recurrent costs in foreign currency may pose problems in the future, but at the present time the emphasis is to push for local training of the agricultural scientists that Zimbabwe needs to sustain its post-independence development.

Table 9. Student Enrollment in the Faculty of Agriculture,

University of Zimbabwe, 1985

	1st year	2nd year	3rd year	Total
Agricultural Economics	25	20	14	
Animal Science	20	24	20	
Crop Science	28	16	12	
Soil Science	<u>6</u>	<u>5</u>	<u>6</u>	
Total	79	65	52	196

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