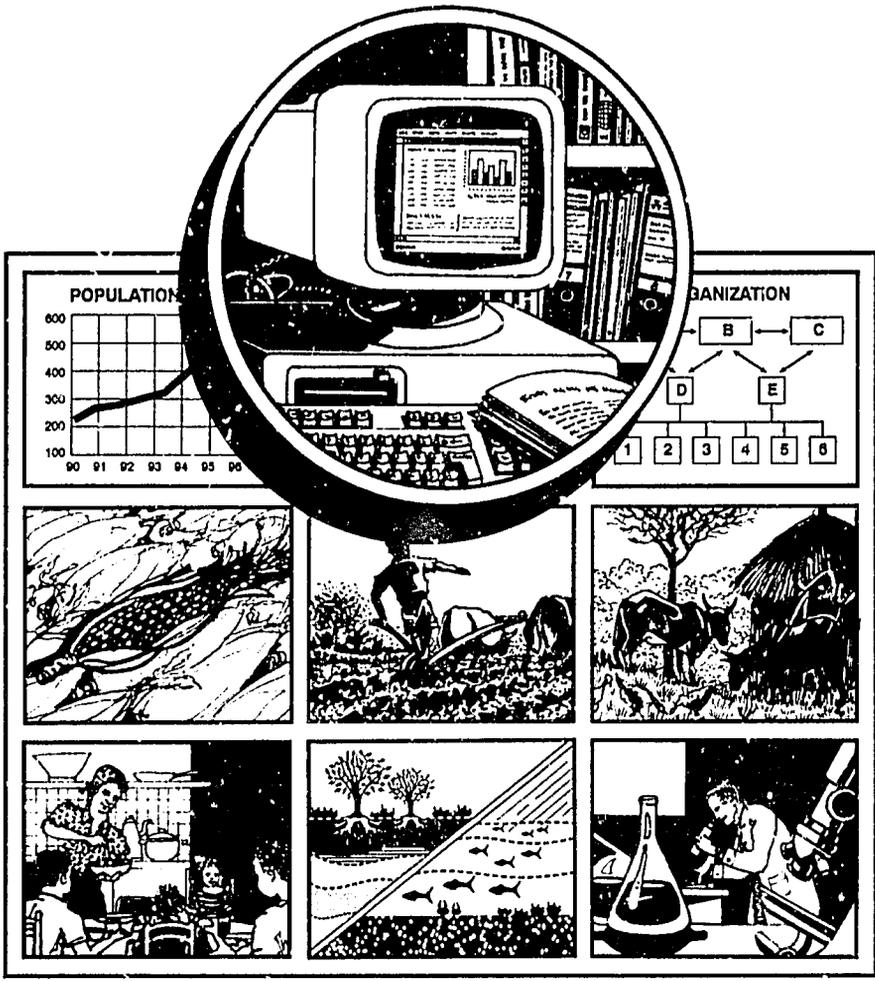


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Managing Information Resources and Services for Agricultural Research in Swaziland

Makana Mavuso
and
Peter Ballantyne



The mandate of the International Service for National Agricultural Research (ISNAR) is to assist developing countries in bringing about lasting improvements in the performance of their national agricultural research systems and organizations. It does this by promoting appropriate agricultural research policies, sustainable research institutions, and improved research management. ISNAR's services to national research are ultimately intended to benefit producers and consumers in developing countries and to safeguard the natural environment for future generations.

ISNAR offers developing countries three types of service, supported by research and training:

- For a limited number of countries, ISNAR establishes long-term, comprehensive partnerships to support the development of sustainable national agricultural research systems and institutions.
- For a wider range of countries, ISNAR gives support for strengthening specific policy and management components within the research system or constituent entities.
- For all developing countries, as well as the international development community and other interested parties, ISNAR disseminates knowledge and information about national agricultural research.

ISNAR was established in 1979 by the Consultative Group on International Agricultural Research (CGIAR), on the basis of recommendations from an international task force. It began operating at its headquarters in The Hague, The Netherlands, on September 1, 1980.

ISNAR is a nonprofit, autonomous institute, international in character and apolitical in its management, staffing, and operations. It is financially supported by a number of the members of the CGIAR, an informal group of donors that includes countries, development banks, international organizations, and foundations. Of the 18 centers in the CGIAR system of international centers, ISNAR is the only one that focuses specifically on institutional development within national agricultural research systems.



This publication is part of a project entitled "Managing Scientific Information in Agricultural Research Systems in Small Countries," jointly sponsored by the Technical Centre for Agricultural and Rural Cooperation (CTA) and ISNAR

STUDY PAPER # 9

Managing Information Resources and Services for Agricultural Research in Swaziland



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AGROVOC Descriptors

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CABI Descriptors

agricultural research; case studies; management; organization of research; research; research policy; technology transfer; Swaziland

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ISNAR Small-Country Project

Introduction

In 1989, ISNAR began a global study of agricultural research systems in small, low-income developing countries with populations of fewer than five million people. Because of resource limitations and the inherent constraint of size that restrict the scale of the research effort in these countries, their national agricultural research systems (NARS) are small — often under 50 researchers. Nonetheless, these NARS have varied and complex tasks to perform in their respective countries.

The major goals of this study are to identify the strategic role of NARS in small countries and to determine how essential research tasks can be carried out in small research systems. Several

cases are to be examined in depth, and for these, the study will assess the research capacity and resources that are currently available or needed to conduct agricultural research. This is examined in light of their mandates under the agricultural development policy of their respective countries, as well as requirements for conserving the country's natural resource base.

The project is funded largely by the Italian Government with additional support from the Rockefeller Foundation, the Danish International Development Agency (DANIDA), and the CTA (Technical Centre for Agricultural and Rural Cooperation, ACP-EC Lomé Convention).

Objectives

- To create and maintain a data base on 50 small countries, containing information on their agricultural research needs and national agricultural research systems.
- To devise means of measuring and classifying key factors related to agricultural research so that the NARS of small countries can be analyzed and compared. Such factors include agroecological zones, the scale of research systems (e.g., human and financial resources, sizes and types of institutes, types and quantity of local research programs), internal demand for technology, external sources of information on new technologies, and linkages to those sources.
- To identify suitable organizational models for NARS, as well as mechanisms and strategies for setting priorities and allocating resources to research.
- To evaluate national and regional research environments so as to help small countries exploit opportunities for acquiring new technologies from outside.
- To identify and assess mechanisms that enable NARS to manage their links with policymakers, local producers, and external sources of knowledge and technology.
- To identify the skills needed by small-country research leaders to manage the alternative strategies open to them.

Project Activities

A Global Data Base on NARS in Small Countries

Fifty developing countries are included in a global data base on agricultural research needs and the state of the NARS. These countries have populations of less than five million (1980 census) and meet at least three of the following four criteria:

- The economically active agricultural population is 20 percent or more of the total economically active population.
- Per capita income is less than US\$2,000 (1980 US constant dollars).
- AgGDP per capita for the economically active agricultural population is less than US\$2,000.
- AgGDP is 20 percent or more of GDP.

For each country, this information will be used to assess the national demand for research as well as existing national research capacity. The data base should provide cross-country indicators of common constraints, options, and trends.

Country Case Studies

Honduras, Jamaica, Sierra Leone, Togo, Lesotho, Mauritius, and Fiji have been selected for in-depth study. The studies cover institutional development, research organization and structure, external linkages, and information flows to the country.

Regional Studies

Regional studies will be conducted in parts of West Africa, the Caribbean, and the South Pacific. The goal of the regional studies is to assess research capacity in regions where small countries predominate. The regional studies will also identify mechanisms and strategies by which national systems can increase their effectiveness and efficiency and gain access to the information and technology they need. The studies will consider the division of labor between NARS in a regional context as well as the role of regional research organizations and collaborative networks.

Methods and Concepts

The ISNAR project will develop methods for analyzing research needs and capacity in small countries. These will identify key issues and employ the following concepts:

- **Scale:** the inherent research capacity of a national system; the combination of a NARS's human and financial resources, knowledge base, and infrastructure.
- **Scope:** the institutional agenda of a NARS, the set of research topics and objectives to which it is committed. Scope has two dimen-

sions: the range of research programs and the level of sophistication of the research.

- **Technology Gradients and Information Flows:** the varying intensities and levels of complexity in technology generation among national systems and the network of information exchange. An analysis of structure and levels of technology generation and transfer in a region is crucial for guiding the flow of information to smaller research systems. The study of gradients and flows also examines the capacity NARS must have in

place to have access to the technology and information they need.

- **Linkages:** linkages to institutions and systems outside the NARS itself. The study will explore two key sets of linkages that are

essential for the national agricultural research system. The first includes linkages to policymakers and to farmer knowledge systems in the country. The second includes linkages to external sources of knowledge, technology, and resources.

Managing Scientific Information

In collaboration with the CTA (Technical Centre for Agricultural and Rural Cooperation, ACP-EC Lomé Convention) and agricultural research information specialists from developing countries, a study is underway to explore the management of scientific information in small research systems with limited resources.

Access to scientific information that is relevant to the development of objectives and appropriate to the conditions of developing countries is crucial for agricultural research systems. It is particularly critical in small countries because the resources to do all the research that farmers need are not always available. The scope of

research in a country can be increased through effective information management. Information can also be used to supplement or replace some kinds of research, releasing scarce resources to be used for programs that must be conducted locally.

NARS in small countries are often limited in their ability to identify and receive the information they need to conduct adaptive and resource management research. This study will assess and propose mechanisms for identifying and obtaining scientific information for research programs in small countries. It will then focus on mechanisms of managing this information.

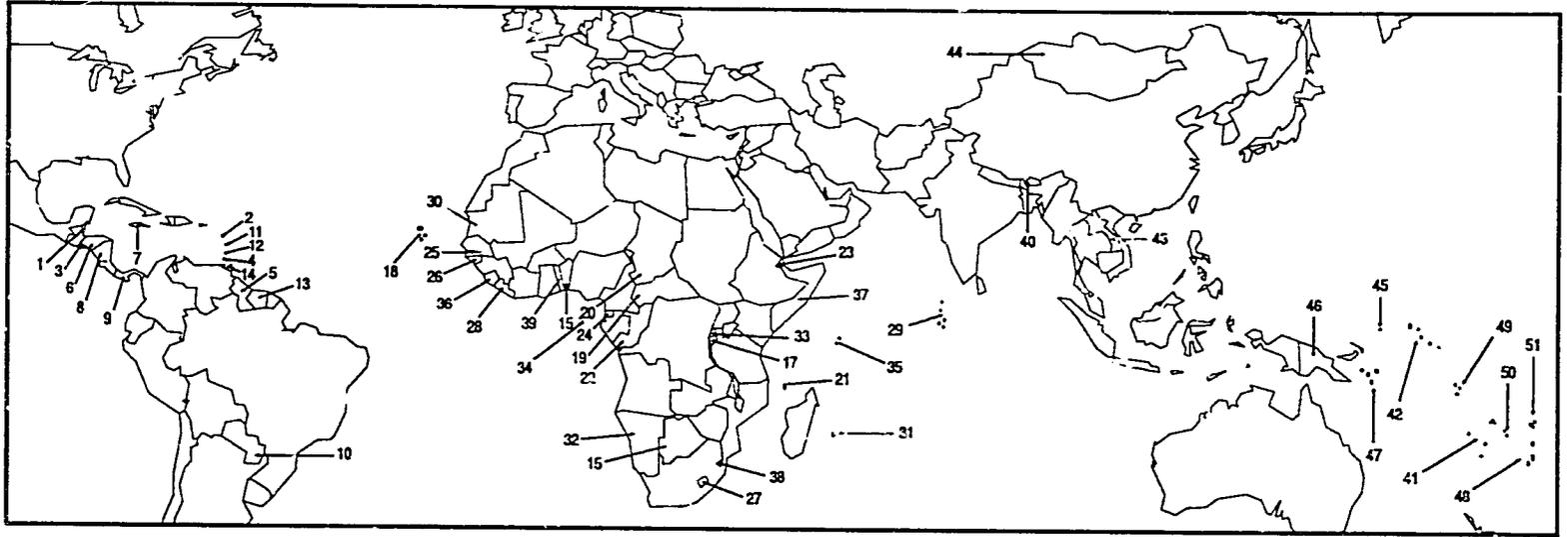
Dissemination of Results

Seminars/Workshops: Workshops are the key to disseminating the results of this study. The first workshop, held in The Hague in January 1990, reviewed project methodology and began implementation of country and regional studies. When the main phase of the study is complete, a global workshop of research leaders from small developing countries will be held. At this workshop, the conclusions of the study will be validated and applied.

Advisory Service and Training: In collabora-

tion with national and regional agricultural research organizations, the methods developed in the study will be used for strategic planning and to produce improved management techniques for small research systems.

Publications: The data base, case studies, and issues papers will be published and made available to agricultural research managers, scientists, and development agencies concerned with agricultural growth and sustainability in developing countries.



Small Countries (as Defined by this Project)

Latin America and Caribbean:

- 1 Belize
- 2 Dominica
- 3 El Salvador
- 4 Grenada
- 5 Guyana
- 6 Honduras
- 7 Jamaica
- 8 Nicaragua
- 9 Panama
- 10 Paraguay
- 11 St. Lucia
- 12 St. Vincent
- 13 Suriname
- 14 Trinidad and Tobago

Africa and the Indian Ocean:

- 15 Benin
- 16 Botswana
- 17 Burundi
- 18 Cape Verde
- 19 Central African Republic
- 20 Chad
- 21 Comoros
- 22 Congo
- 23 Djibouti
- 24 Equatorial Guinea
- 25 Gambia
- 26 Guinea-Bissau
- 27 Lesotho

- 28 Liberia
- 29 Maldives
- 30 Mauritania
- 31 Mauritius
- 32 Namibia
- 33 Rwanda
- 34 Sao Tome e Principe
- 35 Seychelles
- 36 Sierra Leone
- 37 Somalia
- 38 Swaziland
- 39 Togo

Asia and the Pacific:

- 40 Bhutan
- 41 Fiji
- 42 Kiribati
- 43 Laos
- 44 Mongolia
- 45 Nauru
- 46 Papua New Guinea
- 47 Solomon Islands
- 48 Tonga
- 49 Tuvalu
- 50 Vanuatu
- 51 Western Samoa

Preface

The basic hypothesis underlying this study is that research in small countries is different from research in large countries: in the way it is organized and managed, in the amount of resources available to it, and in its priorities and orientation. These differences suggest that the role of information services for research in small countries will also be different.

In general, small developing countries do not have sufficient capacity in research to generate the knowledge and information that their agricultural sector requires. They must therefore rely on external institutions for much of their technology and information needs. This suggests that research systems in small countries must have the capacity in the system to scan, identify, evaluate, and acquire potential technologies or knowledge about them. Without it, they will be unable to obtain what they need. The issue for research managers is to determine what resources and efforts are required to build the capacity that their system needs.

This case study is part of a joint ISNAR and CTA project entitled "Managing Scientific Information in Agricultural Research Systems in Small Developing Countries." Its objectives are to identify mechanisms and strategies that can be used by agricultural research systems in small developing countries to gain access to relevant scientific information. Four case studies of national experiences in Mauritius, the Seychelles, Swaziland, and Trinidad and Tobago have been commissioned by the project. They provide a description and a basis for discussion of approaches to supporting the information needs of agricultural research in each country. These will form the basis for further discussion with research managers and information specialists, and they will be incorporated into guidelines on how best to organize scientific information systems in small countries.

This study is not intended to be a prescription for information development in Swaziland; instead, it is a study of information services in relation to the research system that they serve. The intention is to learn from Swazi experience and disseminate the lessons to a wider audience. At the same time, major information issues that need to be addressed by research managers and information specialists are raised and discussed. Any subsequent changes or modifications to the systems and services are for national staff to debate and implement where appropriate.

Acknowledgements

The authors would like to thank all those who gave their time and participated in the discussions that led to the writing of this report: the Dean, Faculty of Agriculture and his staff at Luyengo; the Chief Research Officer and his staff at Malkerns Research Station; the Economic Planner in the Ministry of Agriculture; Dr. Mushala and his project partners in the Faculty of Science; and agronomists from Usuthu Pulp, Shiselweni Forestry, Swazican, Swaziland Sugar Association, Simunye Sugar Estate, Mhlume Sugar Estate, and Inyoni Yami Swaziland Irrigation Scheme. We would not also forget the staff from the different libraries; the Vice-Chancellor of the University of Swaziland for allowing this study to be undertaken; and CTA for funding. At ISNAR, we are grateful to Pablo Eyzaguirre, Warren Peterson, and Richard Vernon for their useful comments and to Kathleen Sheridan for her editorial skills.

Abstract

This case study discusses the approaches used by the agricultural research system of Swaziland to obtain and manage scientific information. Information access is reviewed in relation to the demand for information by the research system, the sources of information that it has access to, and the mechanisms used to actually obtain and manage the information. One thing that has a significant influence on the demand for information is the existence of two main types of agricultural production systems, which rather neatly divides the agencies conducting agricultural research into two main groups. Channels for gaining access to information are similarly divided — the private sector relies on its own personal and commercial sources, while the public sector is linked more closely to formal information mechanisms such as libraries and research networks. One significant conclusion of the paper relates to the various roles and functions that information mechanisms have. Often the different mechanisms compete to deliver the same information, and an information system based on several mechanisms, each delivering different information, is advocated. In this case, libraries need to assess the information available through research networks and other mechanisms, and then deliver the information that these other mechanisms cannot provide. Access to locally produced information is an area where libraries might have a comparative advantage. Other significant factors that are discussed include the regional context for information services, participation in information networks, collaboration at the national level, the role of agricultural development projects, and the need for trained information personnel.

Résumé

Cette étude de cas analyse les approches utilisées par le système de recherche agricole du Swaziland pour obtenir et gérer l'information scientifique. La recherche agricole, et par conséquent l'information nécessaire, est considérablement influencée par l'existence de deux types principaux de systèmes agricoles de production. De même, l'accès à l'information reflète cette division — le secteur privé compte sur ses propres sources personnelles et commerciales, tandis que le secteur public dépend plus étroitement des mécanismes d'information plus conventionnels tels que les bibliothèques et les réseaux de recherche. Une conclusion importante de l'étude de cas est liée aux divers rôles et fonctions des mécanismes d'information. Les différents mécanismes se font souvent concurrence pour donner la même information. Un système d'information basé sur différents mécanismes est recommandé, chaque système délivrerait des informations différentes. Dans ce cas, les bibliothèques doivent chercher l'information disponible par le biais des réseaux de recherche et autres mécanismes pour ensuite transférer l'information qu'elles ne sont pas en mesure de donner. L'accès à l'information produite localement est un domaine dans lequel les bibliothèques pourraient avoir un certain avantage. Parmi les autres éléments importants analysés figurent le contexte régional des services d'information, la participation aux réseaux d'information, la collaboration au niveau national, le rôle des projets de développement agricole ainsi que la nécessité de disposer d'un personnel d'information bien formé.

Resumen

Este estudio de caso analiza el planteamiento que el sistema de investigación agrícola del Swazilandia utiliza para obtener y manejar la información científica. Esta información es analizada y actualizada con relación a la demanda de información del sistema de investigación, su acceso a las fuentes de información y los mecanismos que utiliza para obtener y manejar dicha información. La existencia de dos tipos principales de sistemas de producción tiene una influencia significativa en la demanda de información ya que claramente divide en dos grupos importantes las agencias que conducen investigación agrícola. Asimismo los canales para tener acceso a la información están divididos en la misma forma — el sector privado depende de su propio personal y fuentes comerciales, mientras que el sector público está más vinculado a los mecanismos de información formales como bibliotecas y las redes de investigación. Una conclusión importante refiere a los distintos roles y funciones que tiene cada mecanismo de información. Frecuentemente los diferentes mecanismos están en competencia para proporcionar la misma información. El estudio propone un sistema de información basado en varios mecanismos, cada uno proporcionando diferente tipos de información. En este caso, las bibliotecas deben evaluar la información disponible a través de las redes de investigación y otros mecanismos, y entonces proveer la información que ellos no pueden obtener. El acceso a información generada localmente es una área en la cual las bibliotecas podrían tener una ventaja comparativa. Otros factores importantes que se discute incluyen el impacto del contexto regional para los servicios de información, la participación en las redes de información, la colaboración a nivel nacional, el rol de los proyectos de desarrollo agrícola, y la necesidad de capacitar a personal en el manejo de información.

Acronyms

AGRIS	International Information System for the Agricultural Sciences
ARD	Agricultural Research Division (MOAC)
AVRDC	Asian Vegetable Research and Development Center
CABI	CAB International
CARIS	Current Agricultural Research Information System
CD-ROM	compact disk-read-only memory
CIAT	Centro Internacional de Agricultura Tropical
CIMMYT	Centro Internacional de Mejoramiento de Maíz y Trigo
CIP	Centro Internacional de la Papa
CSFRI	Citrus and Subtropical Fruit Research Institute (RSA)
CSREP	Cropping Systems Research and Extension Training Project (ARD)
CTA	Technical Centre for Agricultural and Rural Cooperation
DRP	Department of Research and Planning (MOAC)
DVS	Division of Veterinary Services (MOAC)
EPAS	Economic Planning and Analysis Section (MOAC)
FAO	Food and Agriculture Organization of the United Nations
IARC	International agricultural research center
ICFR	Institute for Commercial Forestry Research (University of Natal)
ICRISAT	International Crops Research Institute for the Semi-Arid Tropics
IFDC	International Fertilizer Development Center
IITA	International Institute of Tropical Agriculture
ILCA	International Livestock Centre for Africa
ISNAR	International Service for National Agricultural Research
ITDL	Individual Title Deed Land
IUFRO	International Union of Forestry Research Organizations
IYSIS	Inyoni Yami Swaziland Irrigation Scheme
MOAC	Ministry of Agriculture and Cooperatives
NARS	national agricultural research system(s)
OFI	Oxford Forestry Institute (United Kingdom)
PPRI	Plant Protection Research Institute (RSA)
RSA	Republic of South Africa
SACCAR	Southern African Centre for Cooperation in Agricultural Research
SADC	Southern African Development Community (formerly the Southern African Development Coordination Conference (SADCC))
SARCCUS	Southern African Commission for the Conservation and Utilization of the Soil
SCB	Swaziland Cotton Board
SNL	Swazi Nation Land
SNRC	Swaziland National Research Council
SSA	Swaziland Sugar Association
SSRU	Social Science Research Unit (UNISWA)
TCRI	Tobacco and Cotton Research Institute (RSA)
UNISWA	University of Swaziland
VDL	Veterinary Diagnostic Laboratory (MOAC)

Agricultural Sector and Agricultural Research

Swaziland is a small landlocked country located in Southern Africa (see figure 1). It borders the Republic of South Africa to the south, west, and north, and Mozambique to the east. Swaziland's economic and foreign policy has tended to be conservative, recognizing the economic reali-

ties of its large, influential neighbor on three sides and the war-ravaged economy on the fourth. The economy as a whole and the agricultural sector in particular have therefore developed many linkages to South Africa. Examples of these connections include the link between the na-

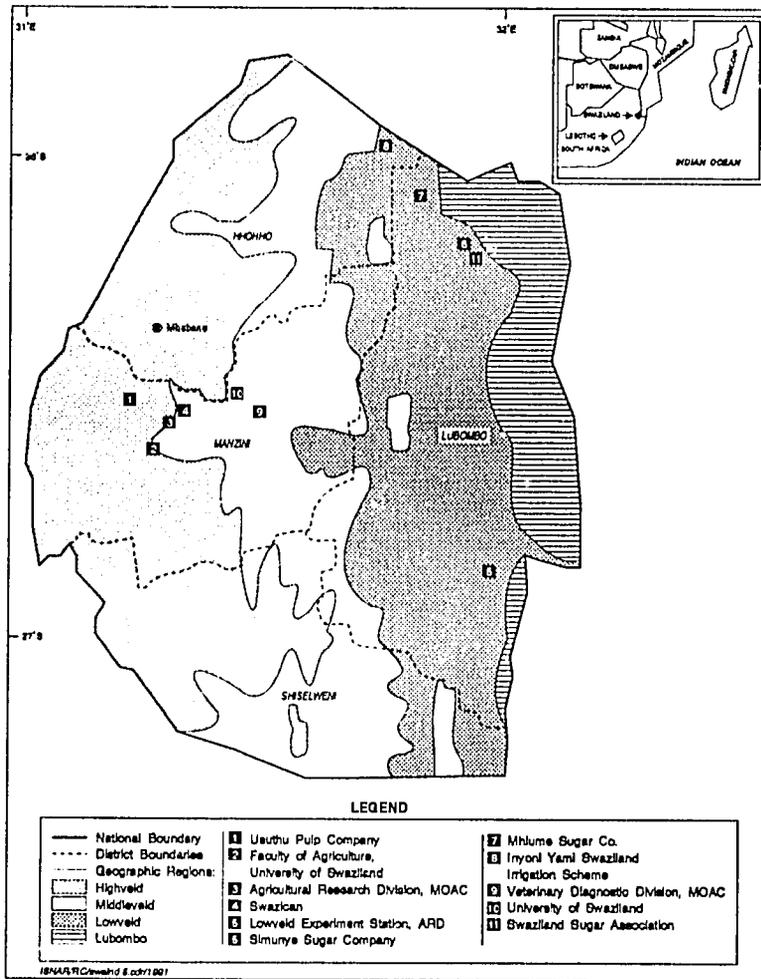


Figure 1. Map of Swaziland showing agricultural research system

tional currency and the South African rand, Swaziland's membership in the Southern African Customs Union, major investments by South African companies in the Swazi private sector, and the importance of South Africa as a source of tourists to Swaziland and as a market for many of Swaziland's export products. As a result, the economy has been relatively robust — the gross national product per capita (US\$810 in 1990) is substantially above the regional average for southern Africa.

Other than South Africa, the main external influence on Swaziland and its agricultural research system is the regional Southern African Development Community (SADC) (formerly the Southern African Development Coordination Conference [SADCC]) and its Southern African Centre for Cooperation in Agricultural Research (SACCAR). These organizations are made up of the so-called "front-line" states in the region¹ and are intended to offer alternative economic and research links to Southern Africa through collaboration. SACCAR's regional activities are particularly important for agricultural research and information in Swaziland.

Agriculture plays an important role in the economy, both as a livelihood for large numbers of rural people and as a source of revenue from exports — mainly sugar, cotton, and wood pulp. The agricultural sector can be divided into two main sub-

sectors according to the dominant land tenure systems and production patterns. These will be shown later to have a significant influence on the organization and research focus of the research system, and consequently the patterns of information needs and flows.

The agricultural policy of the country is to intensify agricultural production among small-scale farmers on Swazi Nation Land (SNL), while recognizing also that the performance of large farms and plantations on Individual Title Deed Land (ITDL) is crucial to export growth and overall economic development.

Agricultural systems in Swaziland can be classified according to whether they are subsistence-based on SNL or commercial on ITDL. The clientele for research in each group is different, as are their purposes and crops. Thus, large companies on ITDL are looking for maximum productivity and income, whereas self-sufficiency is the goal for individual small farmers on SNL. These differences are reflected in the research programs of the different research institutes that work with each subsector. Commercial growers on ITDL tend to be served by private-sector companies, whereas subsistence farmers on SNL are served by the Ministry of Agriculture and Cooperatives (MOAC) and its Agricultural Research Division (ARD). University research is a mixture of both, with SNL needs more dominant.

Organization of Agricultural Research

Agricultural research in Swaziland is carried out by both the public and private sectors. Table 1 lists the organizations involved, and figure 1 shows their location.

The Ministry of Agriculture and Cooperatives carries out research through ARD, the Division of Veterinary Services (DVS), and the Economic Planning and Analysis Section (EPAS). The ARD is located at Malkerns in the center of the country, and it has experimental farms and experiment stations located in all of the agroclimatic zones of the country. Table 2 shows the qualifications and the distribution of ARD

1. Angola, Botswana, Lesotho, Malawi, Mozambique, Namibia, Swaziland, Tanzania, Zambia, and Zimbabwe.

Table 1. Organizations Involved in Agricultural Research, October 1991

Organization	Status	Major programs	Scientists	Information Staff
Agricultural Research Division	MOAC	Crops Pastures	16	0
Veterinary Diagnostic Laboratory	MOAC	Animal health	1	0
Economic Planning and Analysis Section	MOAC	Socioeconomics	3	0
Faculty of Agriculture	University	Crops Livestock Socioeconomics Agroprocessing	50*	2
Faculty of Science	University	Soil erosion	1	0
Social Science Research Unit	University	Socioeconomics	0.5	1
Swaziland Sugar Association	Commodity	Sugarcane	3	0
Inyoni Yami Swaziland Irrigation Scheme	Donor Project	Sugarcane Citrus	3 1	0
Simunye Sugar Co	Private Sector	Sugarcane	4	0
Mhlume Sugar Co	Private Sector	Sugarcane	2	0
Ubombo Ranch	Private Sector	Sugarcane	1	0
Swazican	Private Sector	Pineapples	1	0
Usuthu Pulp	Private Sector	Forestry	4	0
Shiselwini Forestry Co	Private Sector	Forestry	1	0
Total			91.5	6

*Research is not the main activity of university staff.

staff by commodity or discipline.

The major goals of the MOAC in crop production are the achievement of national self-sufficiency in maize, the expansion of fruit and vegetable production as a means of increasing rural income and improving nutrition, and the encouragement of small-farmer cash crops such as cotton and tobacco.

Staff in the University of Swaziland (UNISWA) Faculty of Agriculture, Faculty of Science, and Social Science Research Unit (SSRU) also conduct agricultural and related research, although much of their time is devoted to teaching. Table 3 shows the qualifications, and distribution of staff among different departments in the Faculty of Agriculture.

Companies in the private sector are extremely active in research on major export and cash crops, such as sugarcane, citrus, and forestry — mainly adaptive and testing.

Most of the sugar estates do their own site-specific agronomic and plant protection research. These include the Royal Swazi Sugar Corporation, the Mhlume Sugar Company, Ubombo Ranch, and the Inyoni Yami Swaziland Irrigation Scheme. Together they employ 10 agronomists to work on sugarcane. In addition, growers and millers provide funds to the Swaziland Sugar Association (SSA) to do research and marketing on their behalf, often in close cooperation with the South African Sugar Association. This research is carried out by SSA's extension service, which employs three agronomists. Repre-

Table 2. ARD Research Staff Allocations by Program, October 1991

Section	BSc	MSc	PhD	Total
Cereals (Includes tobacco section)	—	1	1	2
Grain legumes	—	1	—	1
Horticulture	—	1	—	1
Pasture & animal nutrition	—	1	—	1
Cotton	1	1	1	3
Socioeconomics	2*	1	—	3
Crop protection	1	1	1	3
Soil fertility & crop nutrition	—	1	—	1
Biometry	—	—	—	—
Administration	—	1	—	1
Total	4	9	3	16

*On study leave (one rural sociologist is also seconded to ARD from EPAS).

Table 3. University of Swaziland Faculty of Agriculture Staff Allocations by Department, October 1991

Department	BSc	MSc	PhD	Total
Economics & Management	1	3	2	6
Animal Production & Health	2	3	4	9
Crop Production	—	4	5	9
Home Economics	—	7	1	8
Land Use & Mechanization	1	6	1	8
Education & Extension	1	5	2	8
Administration	—	—	2	2
Total	5	28	17	50

Note: Ten staff members are on study leave (3 BSc, 7 MSc).

representatives of the estates gather each year at a meeting of the SSA extension committee to discuss and prioritize the SSA's research programs. Forestry research is

carried out by five researchers in two companies: Usuthu Pulp Company and the Shiselwini Forestry Company.

Coordination of Agricultural Research

There is no formal coordination of research activities among or between the various organizations. There are, however, informal arrangements among scientists whereby research projects are undertaken jointly by personnel from the Ministry of Agriculture and the Faculty of Agriculture. Within the Ministry of Agriculture there is some coordination be-

tween units: socioeconomists with EPAS, for example, are seconded to ARD to work on research activities that involve rural sociology or other economic skills.

In the past, there were arrangements for different parastatal and even private-sector organizations to centralize their research efforts within the ARD to build up

the critical mass that the country needs. Thus, Usuthu Pulp at one time had its researchers located at Malkerns Research Station along with ARD staff. In this case, the agreement has lapsed and the forestry researchers have their own site closer to the plantations where they do their work. For cotton, the Swaziland Cotton Board still has an agreement to fund some aspects of cotton research, and at least one researcher working within the ARD on cotton is supported by the Board.

In the private sector, the SSA is supported by all the major estates, and it carries out

research on their behalf. There are examples of cooperation between the association and staff of the Faculty of Agriculture, and several students have projects involving sugarcane. Each sugar company also carries out its own specific research for its own use. To ensure that the ministry knows what is going on, even though there is no coordination per se, the chief research officer of ARD is a member of the management or advisory committees of the SSA, and the cotton and forestry boards. In this way he is able to maintain an overview of what programs and activities are in progress.

Programs and Scope of Research

The information given in this section on the scope of research is based on discussions with research directors and managers, current documents and work plans, and data about current agricultural research projects collected by the Swaziland CARIS Centre in 1989. This has been used to draw a broad picture of commodity emphasis both nationally and by institution.

Table 4 gives an analysis of the 1989 research projects in the CARIS database. The overwhelming dominance of crop research is demonstrated, especially in the ministry and the private sector. Most livestock, natural resource, and socioeconomics research, by way of contrast, is done in the university.

A further grouping of agricultural research activities in this section is based on the characterization of research topics and technologies developed by Eyzaguirre (1991) (table 5). He suggests that commodities can be grouped according to the way in which research is conducted on them globally. These groupings also influence the flows of information for a specific crop. Thus, crops like beans, maize, and groundnuts fall into a group of "global staples," each of which is a major focus of

international, publicly funded research. Although the crops themselves are very different, patterns of information dissemination are similar. The producers of this information use widely available journals and publications as well as research and information networks to disseminate their results.

This can be contrasted with cash crops like sugarcane, cotton, or tobacco which are traditionally grown for export, often on a large scale. Again, the crops are quite different, but the kinds of places where the information is likely to be available are similar. In this case, there is more involvement by private-sector or parastatal agencies, a greater tendency towards adaptive information, and less availability overall of information through published sources. Instead, greater use is made of personal and trade contracts for sharing technical information.

This breakdown of research domains facilitates the assessment of information sources and flows. It is also useful for categorizing current programs of research so that the links between research efforts and information sources can be made more explicit.

Table 4. Percent Distribution of Projects by CARIS Subject Category Code, 1989-1990

CARIS Subject Category	University	MOAC	Others	All Institutions
Plant Science and Production	25.0	76.1	78.4	62.6
Agronomy	(15.6)	(67.4)	(75.7)	(55.6)
Genetics and Breeding	(9.4)	(6.5)	—	(5.2)
Physiology & Taxonomy	(2.2)	(2.7)	(1.8)	
Plant Protection	9.4	11.0	13.5	11.3
Pests	—	(6.6)	(8.1)	(6.1)
Diseases	(3.2)	(4.4)	—	(2.6)
Misc. Disorders	(3.1)	—	(2.7)	(0.9)
Weed Control	(3.1)	—	(2.7)	(1.7)
Livestock	21.9	4.3	—	7.8
Fisheries	—	—	—	—
Forestry	—	—	2.7	0.9
Natural Resources	3.1	—	—	0.9
Engineering	3.1	—	2.7	1.7
Soils	6.2	4.3	—	3.5
Processing	—	—	—	—
Economics	12.5	4.3	2.7	6.1
Human Nutrition	3.1	—	—	0.9
Postharvest Technology	—	—	—	—
Others	15.7	—	—	4.3
Total Projects	32.0	46.0	37.0	115.0

Source: SACCAR (1990).

Global Staples

Research on major staple crops in Swaziland is undertaken by both the ARD and the Department of Crop Production of the Faculty of Agriculture in the University of Swaziland. The major staples with which ARD deals are divided into cereals (maize, sorghum, millet, and wheat) and grain legumes (beans, cowpeas, groundnuts, and jugo beans). Research on these commodities is carried out for both subsistence and commercial farmers. Both on-station and on-farm research is undertaken by ARD; UNISWA does not do field research.

Traditional Export Crops

Sugar is the country's most important export commodity, accounting for approximately 30% of the value of all exports. Although production continues to rise, its

share of total export value is declining slowly as other exports increase in value. In addition to the industry-wide research conducted by the SSA, each estate has agronomists on its staff who do research for the estate's own use.

Cotton research is conducted at the Lowveld Experiment Station of the ARD. This research is a joint effort by ARD and the Swaziland Cotton Board (SCB) and is focused on cotton breeding and entomology. The SCB raises funds through a levy on producers, which is used to pay for some operational costs of the research — the Ministry of Agriculture provides facilities and staff. As a result of staffing problems, however, the SCB is likely to employ its own breeder to work with ministry staff.

The cotton breeding program has experienced problems with staff turnover and no

Table 5. Categories of Research Topics and Subjects

Global Staple	Traditional Export	Minor Food Crop	High-Input, Non-traditional Export	Livestock	Socioeconomics & Rural Engin.	Natural Resource Management
Bananas Beans Cassava Cowpeas Groundnuts Maize Potatoes Pulses Rice Sorghum Soya Wheat	Cashew nuts Cinnamon Cloves Cocoa Coconuts Coffee Cotton Oil palm Rubber Sisal Sugar Tea Tobacco	Apples Barley Breadfruit Broad & mung beans Cabbage Carrots Castor beans Chick peas Citrus fruits Date palms Figs Fruits (local use) Garlic Leulils Melons Millet (<i>Elusine</i> , <i>Digitaria</i>) Mustard (seed) Nectarines Oats Okra Onions Pandanus Peas (garden-) Pears Peppers Pigeon peas Plantain Radishes Safflower (oilseed) Scsame Soya Sunflowers Sweet potatoes Swiss chard Taro (<i>Xanthosoma</i> , <i>Colocasia</i>) Tomatoes Triticale Turnips Vegetables (local use) Yams (<i>Dioscorea</i>)	Asparagus Broccoli Brussels sprout Cardamou Citrus Flowers/ ornamentals Fruits Ginger Grapes Grapefruit High-value vegetables Jotoba Kava Mangoes Papaya Passionfruit Peaches Pineapples Plums Pyrethrum Quinquina Ramie (textile fiber) Sour sop Strawberries Sunflowers Vanilla Ylang-Ylang	SMALL RUMINANTS: Goats Sheep LARGE ANIMALS: Cattle Horses Camels Donkeys POULTRY/SWINE: Chickens Ducks Turkeys Swine Animal traction Dairy technology Diseases and pests Husbandry and management Nutrition/fodder/ forage Zootechnology	Farm production & management Farm structures Farming systems research Marketing research Postharvest and storage Machinery/tools/ power irrigation Rural engineering	Agroforestry Fisheries (fresh-water/marine) Forestry Pests, diseases, weed control and management Plant genetic resources Range/pasture management Seed technology Soil (fertility/erosion/conservation) Irrigation/water management

new varieties have been released since 1979. The current priority is to develop cotton cultivars suited to local conditions that are high yielding, have a long staple length, and are disease-resistant. Staple length has been a recurring problem as the current variety no longer meets the requirements of the South African market. Cotton research is done in close collaboration with the Tobacco and Cotton Research Institute (TCRI) in South Africa. TCRI has provided germplasm for testing and supervision for research while local staff are unavailable.

The entomology program for cotton is intended to provide farmers with effective, safe, and practical recommendations for the control of cotton pests. Emphasis is on reducing the costs of control while maintaining its effectiveness. Most work is focused on evaluation of sprayers, varietal screening for insect resistance, studies of American bollworm biology and behavior, and screening and evaluating commercial insecticides before they are released to farmers.

Nontraditional Export Crops

Pineapples are cultivated commercially for canning and export, as well as for local consumption. Swaziland employs an agronomist who used to manage a small research program. As a result of a recent policy change, little research is now conducted by the company. Instead, supplier companies are provided with land and facilities on the estate to demonstrate their products, and this "research" is used as the basis for decision making on such things as pesticides and fertilizers. Most information on pineapples, especially for varietal choice, is obtained from the Republic of South Africa.

Citrus fruit is grown by estates at Tabankulu, Tambuti, and on the Inyoni Yami Swaziland Irrigation Scheme. Most information on citrus is obtained from South Africa, Zimbabwe, or Malawi; some research on citrus diseases and control is

conducted at Inyoni Yami.

Livestock

Research on livestock has received relatively little attention, especially when the major role of cattle in the country is considered. Both the Faculty of Agriculture and MOAC do some research in conjunction with the Natural Resource Institute in the UK. Most livestock research in the ministry is in the Department of Veterinary Services (DVS), which has programs in cattle breeding and improvement, range management, and animal health. In ARD there is a pasture and nutrition section which evaluates grasses, legumes, browse, and other fodder crops for local suitability.

Socioeconomics and Engineering

Although the ministry has some capacity in socioeconomics and food technology research, most work is in the university's Social Science Research Unit and the Faculty of Agriculture's Department of Home Economics. Food technology and food security, especially at the household level, are their main interest. The USAID-supported Cropping Systems Project at ARD had a major focus on socioeconomics and farming systems, and the division employed three individuals in this area. Two of them are presently out of the country for further training. At ministry headquarters, the Economic Planning and Analysis Section has four rural sociologists, one, who works mainly on impact studies in agriculture, irrigation, and rural development projects, is attached to the ARD. Private-sector companies rely on sources outside the country, mainly South Africa, for agroindustrial and technological research.

Natural Resource Management

Commercial forestry (for wood pulp) comprises about 7% of Swazi land area and accounts for approximately 25% of the value of Swaziland's exports. All forestry

research is conducted by the private sector, notably the Usuthu Pulp Company and the Shiselweni Forestry Company. The Usuthu Company manages about half of the land under forestry and does most of the research. Research at Usuthu began in 1969 and is focused on fast-growing conifers, mainly for pulp. It is characterized by a strong emphasis on fieldwork. Research programs cover tree improvement (breeding), site improvement, plant protection, and site classification. Contracting or collaborating with other research institutes is a major feature of the research, particularly with Usuthu's parent company in South Africa and other institutions in South Africa and the UK.

Research at Shiselweni Forestry Company (SFC) is concentrated on areas that will directly benefit the company. It draws on results from the whole region. The principal areas of research can be grouped under three main headings: provenance research on timber species, re-

search on oil-bearing species, and seed production.

There is no research on fisheries in the country at present, although the potential for both fisheries and aquaculture will be investigated through a number of baseline surveys during the current development plan period (1991/92-1993/94).

Land degradation and erosion are serious problems, especially as a result of overgrazing. Current research is centered in the Faculty of Science at the university where the European Economic Community is funding a three-year collaborative project with Silsoe College in the UK and the University of Munster in Germany. This is intended to generate basic information about the status of soils and soil erosion in Swaziland with the objective of generating recommendations on soil conservation. There is also some work in the Animal Production Division of the ministry on rangeland degradation due to livestock and overgrazing.

Management of Scientific Information

Three main aspects of information flow and management can be expected to have a strong influence on the way in which information is accessed and managed in small countries. These are the *demand* for information from research, the potential

sources of needed information, and the *mechanisms* that managers use to identify and acquire it. This approach and the concepts underlying it are discussed in more detail by Ballantyne (1991).

Demand for Research Information

Managers of research respond to their staff's information demands by providing information services and facilitating scientists' contacts with one another. This section assesses the demand for agricultural research information in Swaziland

and discusses some of the factors associated with the research system itself that influence the shape and nature of the demands.

Swazi Production Systems

Swazi Nation Land is farmed by small farmers whose main crops are maize, beans, sorghum, vegetables, cotton, and tobacco. Cotton and tobacco are the traditional cash crops for export. Vegetables to supply local markets are increasingly seen as potential commercial options for these farmers. Livestock, particularly cattle, sheep, and goats, are widely raised. The main problems in this sector are livestock diseases, the need for improved pasture, and land degradation and erosion caused by overgrazing.

On Individual Title Deed Land, the focus is on large-scale commercial farming of cash crops for export, particularly sugarcane, pineapples, citrus fruit, and forest products. Large ranches also raise livestock on a commercial basis.

The characteristics of the crops and livestock, and their uses, have a major impact on the information requirements of researchers working in these sectors. Research for the large numbers of small farmers in the SNL is concerned with improved varieties and agronomic practices for staple crops, as well as information about other income-generating crops or enterprises. For cattle-rearing, approaches are needed that will improve the animals and their productivity and take into account the traditional attitudes of Swazis who regard cattle as a sign of wealth and status. Most problems are location-specific, and the amount of really useful information that can be obtained from outside Swaziland is limited.

The situation on the ITDL is almost the reverse. Although there is an element of local adaptation and research, most of the technologies and methods are brought into the country from outside sources without major research by Swazi companies. There is almost no need for research on socioeconomics and rural sociology, and the focus is agronomic and oriented towards large-scale production. The most

useful information is available from within the industry, mostly from abroad, and it circulates through personal and technical contacts.

Collaborative Research

One distinguishing characteristic of agricultural research in Swaziland is the degree to which research institutions in the country work with external partners, especially those located abroad. This collaboration is exemplified by ARD, many of whose programs involve extensive participation in regional and international trials of promising new varieties, mostly organized through research networks. Private-sector companies, on the other hand, tend to work directly with specific institutions.

The underlying assumption is that for most research problems in Swaziland, there is little or no useful data available in the country, and the best way to generate the needed information is by adapting external knowledge to local conditions. This external collaboration is not matched by similar levels of formal collaboration between in-country institutions, except in specific areas such as sugar where the different estates work together and with their association.

The strong contacts that develop between local researchers and their external counterparts during this collaborative work means that researchers have little use for other sources or avenues of information, unless they provide something that the network or contact institutions cannot. The patterns of national research demand may be created or influenced by the external collaborators themselves, who "push" or "pull" research activities in certain directions and towards certain sources of information. Thus, the demand created by a collaborative research activity rarely exceeds the capacity of the network or other external partner to satisfy it, and local information services that should support national scientists may find themselves sidelined or replaced.

Local information mechanisms can intervene in the one important area where information demands are not currently being satisfied by collaborative activities — they can provide researchers with access to local information if it exists. The greatest weakness of research networks and foreign institutes, and therefore, the greatest potential strength of local mechanisms, such as libraries, is the ability to provide access to locally generated information.

Cropping or Farming Systems Research

Since 1981, the ARD, with USAID assistance, has used a cropping systems approach in their research. This is characterized by an awareness of and attention to on-farm conditions and involves multidisciplinary teams and a greater role for research staff in socioeconomic disciplines. This new approach has required Swazi researchers to learn new methods and techniques, and this demand has been satisfied through foreign training and technical assistance.

Two main features of cropping systems research that influence the demand for information are the emphasis on location-specific, on-farm data and the systems approach, which looks at agricultural enterprises in their entirety, moving beyond agronomy or livestock towards households and their activities. Most of these data are collected in the field, and relatively little comes from other national sources. There is, however, a large demand for background socioeconomic data on population, income, and land use, for example, but these data are especially difficult to locate. It has been suggested that the data were never collected or, once collected, it has not been analyzed and made available. The problem is exacerbated by the involvement in data collection of nonagricultural government ministries and departments with which agricultural researchers have few contacts.

Division of Research Responsibilities

In part because of the clear division of the agricultural sector into two subsectors — SNL and ITDL — the research system also shows a division of effort across research commodities and client groups. The university, probably because of its broad scope, is the exception to this. Thus, SNL problems are dealt with by the ARD in the Ministry of Agriculture, and ITDL research is done by the private sector.

Demand for information, therefore, can also be split between the two groups. There is relatively little demand among private companies for research information on staple crops, small-scale cattle-rearing, or other problems faced by SNL farmers. The reverse is true for private-sector commodities such as sugarcane. However, there is an element of research system coordination or management in the MOAC which needs to know what the private sector is doing, but probably not in much technical or scientific detail.

Staff Turnover and Continuity

One problem that faces any small research group with broad responsibilities is to ensure that a sufficient critical mass of staff is available to work in each priority area. In a country such as Swaziland where research personnel are relatively few, it has sometimes been difficult to maintain continuity of effort. The prime example in the past 10 years has been cotton breeding. Each time a person has been selected for training, he or she is lost to the program either through promotion or by leaving the research system. This has forced the country to rely on external technical assistance, and the Cotton Board presently employs its own breeder alongside the ministry person to ensure that the program is not tied to one person again in the future. During this period, there have been times when little or no cotton breeding was done, and information available for growers was substantially reduced.

Kinds of Research

University research has been classified by a ministry researcher as "academic," compared to the ministry's "applied" focus. The academic aspect probably results from the predominance of student projects, many of which are designed to satisfy academic requirements rather than to serve farmers' needs. Much of the infor-

mation required for this work, because it is not farmer oriented, can be obtained from traditional information sources such as textbooks and journals that explicitly cater to this market. This academic focus will change as departmental projects involving joint action by staff and students within the Faculty of Agriculture become the norm.

Mechanisms to Acquire Information

In this section, the mechanisms used in Swaziland to access scientific information are described and discussed in relation to the agricultural research system and its demands for information. These mechanisms include libraries and information centers, information networks, research networks, and personal contacts.

Libraries and Information Centers

Few institutions have functioning libraries. The Ministry of Agriculture has a library at its headquarters in Mbabane which houses some reports, materials from the United Nations Food and Agriculture Organization (FAO), and some books. The collections of documents scattered throughout the ministry's offices are often more comprehensive than the collection in the library — hopefully some will find their way to the library.

A major drawback in the ministry libraries is the lack of trained librarians or other information staff who can organize and disseminate the wealth of information in the ministry. There is also a lack of attention and commitment to information on the part of management in the ministry; libraries do not have any budget allocations and must survive on donations.

The DVS has a small library, which is really a large bookcase, with rather old publications on veterinary science. There has been a recent request to the Faculty of Agriculture for library personnel to help

organize this library, and improvements are expected in the near future.

The ARD library at Malkerns Research Station is small but contains a surprisingly extensive collection of research reports produced by the ARD staff, as well as some journals, reports from other research organizations, and books. This collection is strong on reports and publications from research institutions outside Swaziland, and some back-runs of journals are extensive and probably the longest in the country. However, there are few current journal subscriptions. There is also a small library at the Lowveld Experimental Station. It is focused on cotton (especially breeding, entomology, and pest control) but is rather old and outdated.

The university's Faculty of Agriculture maintains a library to support the learning, teaching, research, and extension activities of six departments of the faculty, namely, Animal Production, Crop Production, Agricultural Education and Extension, Agricultural Economics and Management, Home Economics, and Land Use and Mechanization. It has the usual books and journals and also a special collection of reports and publications produced within Swaziland as well as publications on agriculture from within the region.

Each library has its own users, although some serve a wider community than is

apparent from the mandates of their parent organizations. Many researchers and agronomists from other research agencies in the country use the resources and services of the faculty's library. This is partly because most of them were once students at the faculty and have maintained their contacts, but it is also because there are few other information centers or libraries in other organizations.

Outside of the ministry and the university, there are almost no libraries or information centers in organizations that conduct agricultural research. For access to literature and documents, their research staff rely on their own personal contacts, research networks, small institutional collections of documents which are usually old and unorganized, and the library of the faculty itself.

Information Networks

The lack of any infrastructure for organized information in the country, together with the low priority given to information, means that Swaziland is not an active participant in many international or regional agricultural information networks. For Swaziland to be able to participate effectively, there is a critical need to create a climate that would allow for such participation and to build local capacity in the MOAC libraries. This would require facilities, trained personnel, and regular budget allocations.

Since the early 1980s, there has been talk of one of the libraries becoming the center for the International Information System for the Agricultural Sciences (AGRIS) and another to be the CARIS center. These activities have had to wait for support and interest within the Ministry of Agriculture, which is the official contact point for FAO programs in the country. There are indications that the ministry is beginning to recognize the need for effective management of its documentation, and some initial contacts have been made with FAO to investigate their support for a project to

strengthen their central library and information facilities and perhaps to make more use of the services and activities associated with AGRIS.

In 1989, the university library, with support from SACCAR and the Technical Centre for Agricultural and Rural Cooperation (CTA), began to collect data on current agricultural research projects for input to CARIS. This proved to be a useful exercise which facilitated some of the data collection and analysis for this study; however, it needs to be updated. Perhaps the FAO project will generate further activities and resources in this direction.

Collaboration among Information Centers

There has been no formal collaboration among the libraries and information centers involved in agriculture. The university's library is involved in an inter-library-loan scheme administered by the state library in South Africa, which allows users to gain access to documents held by participating libraries throughout the region. However, the system for cooperation within the country does not function as well as the scheme, which involves outside institutions. This can be attributed to the lack of trained personnel in the various Swazi libraries and information centers who would be able to administer such a scheme.

Information personnel in the country are involved in various types of informal collaboration, and proposals from FAO for increased collaboration are under active discussion. Closer collaboration between the libraries within the ministry is anticipated, and better contacts between the libraries of ARD at Malkerns Research Station and the university's Faculty of Agriculture at Luyengo will receive high priority. Their close physical proximity and concentration of researchers should be a positive feature, and there are many opportunities for greater resource sharing that could build upon the differing but

complementary resources, services, and expertise at each location.

Research Networks

Agricultural researchers, especially in ARD, collaborate with many regional and international research networks. The benefits of network participation are recognized and welcomed by Swazi researchers and managers, such that most researchers in ARD are members of at least one research network dealing with their interests. Participation in these networks usually requires Swazi research staff to become involved in testing crop varieties for a network under local conditions. Staff also have opportunities to attend seminars, workshops, and coordination meetings and to go on study tours. This is extremely useful for making contacts with peers and experts in the field, as well as for obtaining scientific information and technical know-how. However, the demands on limited staff time can be a problem for research managers.

Another benefit from network participation is the information dissemination that is associated with networks. Most networks produce a newsletter or a journal, while many offer current-awareness and alerting services. Some offer document delivery and photocopy services from an associated information unit, located at an international agricultural research center such as the International Livestock Centre for Africa (ILCA) in Ethiopia. Active network participation means that Swazi researchers have access to colleagues and peers who are researching similar problems, they have contacts with leading experts in the field, and they can receive the products of formal information services. All of these sources, if effectively used, can ensure that national research is well informed without substantial national investments in time, resources, or information services.

The ARD is the national contact point for most of the regional networks associated

with SACCAR, and it is represented on the steering committees of each one. These include regional networks on maize, groundnuts, cowpeas, sorghum, beans, and vegetables (which also involve international agricultural research centers), the SADC regional gene bank in Zambia, as well as other networks such as the Pastures Network for Eastern and Southern Africa (PANESA). The latter is based at ILCA and it increases the range and diversity of contacts that Swazi participants can make. Through these contacts, Swazi researchers have become acquainted with research in the region, as well as research further afield at international centers and in other regions.

In addition to these networks, Swazi researchers participate in the activities of the Southern African Commission for the Conservation and Utilization of the Soil (SARCCUS). This is based in South Africa but covers a number of countries throughout the region. It operates differently from the SACCAR networks, but it offers Swazi researchers similar access to resources and expertise, mainly in South African research institutes. SARCCUS is used by Swazi researchers to obtain assistance on a wider range of crops, such as the export crops that are not covered by the SACCAR networks. SARCCUS is especially useful for crops such as cotton, tobacco, and sugarcane, which are important subjects of research in South Africa where production conditions are similar to Swaziland.

Personal Contacts

Informal communication among individual scientists is widely practiced in Swaziland. Researchers get a lot of information through this mechanism, not only within the country but also from outside the country from scientists in the Southern African Region. Most of this information is individualized so it is only used by those who request it and it is kept in personal collections or libraries. Such information is not shared with other sci-

entists who may need it, unless they perhaps know the individual concerned.

Donor projects such as the USAID Cropping Systems Project in ARD can be powerful tools for creating networks of personal contacts between Swazi and foreign researchers. A project brings in visiting scientists and experts and provides overseas educational opportunities to Swazi scientists. These situations have allowed Swazi researchers to make their own networks and to use them for ARD's benefit. However, once a project is finished, as memories of past education fade, and without any recurring contacts to maintain the link, ARD staff must seek other sources for their information needs — research networks increasingly seem to be serving this function.

Information Technology

Until recently (November 1991), when Swaziland received a CTA/SACCAR CD-ROM project, there was almost no use of computers and new information technologies in agricultural information centers and libraries. Since then, the Faculty of Agriculture at the university has been able to retrieve information from a number of international agricultural databases such as CAB Abstracts, AGRIS, and TROPAG. The university has publicized the availability of these services to researchers in the ARD and elsewhere, and it is hoped that these resources represent a facility that can be shared with interested organizations.

Information Sources and Flows

On a global level, knowledge and information flows for individual commodities or research domains vary, and the use and effectiveness of each mechanism for getting access to information differs between crops and domains. Choosing the appropriate blend of mechanisms and approaches is a critical component of information delivery in Swaziland and must take account of existing information sources and flows.

The categorization of technologies developed by Eyzaguirre (1991) and illustrated above in table 5 is a useful framework for assessing these flows; it will be used for the following discussion. As was noted earlier, commodities can be grouped according to the way in which research is conducted on them globally, and these groupings influence the flows of information for a specific crop. This section describes the different sources and suppliers of information that are presently used by the research system in Swaziland and discusses their role in relation to the research system's demand for information.

Global Staples

Information for research on maize, beans, cowpeas, groundnuts, and sorghum is obtained from traditional sources such as books, journals, reports, and conference papers stored in the libraries. Additionally, Swazi researchers participate in the regional research networks coordinated by the international research centers. CIMMYT, IITA, ICARISAT, and CIAT. Information on these crops is therefore relatively easy to identify and locate; information management problems are more associated with selectivity to ensure that this large quantity of available literature can be sorted into manageable chunks. The information from the networks poses an additional problem — ensuring that what an individual receives is stored and made available to others in the institute or the country as necessary.

Traditional Export Crops

Sugar research depends largely on the Republic of South Africa for information,

and researchers in the sugar industry work closely with scientists in South Africa. Since most research on sugarcane is adaptive, the close links with South African researchers and institutes ensure that upstream research results are accessible. Personal and trade contacts also play a major role, especially since institutional linkages are reduced by commercial competition. Membership in professional associations such as the South African Sugar Association is valued for the contacts it affords, especially through the technical and professional meetings and the journal that it sponsors.

As with sugarcane research in the private sector, public-sector research on cotton and tobacco is done in close collaboration with South African institutions and personnel. In recent years, because of staff shortages for cotton breeding, the Cotton Board has requested technical assistance from South Africa to maintain its research programs until local staff can be trained.

In all three crops, South Africa is a major buyer of the produce and its quality standards determine the targets for Swazi growers. In this kind of relationship, it is natural for private-sector producers to have strong links with their customers. On the information side, these relations stretch to include almost mandatory institutional and personal memberships in the relevant South African trade and professional societies which are the dominant sources of information and expertise for Swazi researchers.

Minor Food Crops

For a long time, information and knowledge on apples and peaches was obtained directly from the US through the contacts of expatriate staff at Pennsylvania State University who worked with the ARD on the Cropping Systems Project. This project has now been completed, and the contacts are beginning to be lost; the research system must seek other sources for this information.

A horticultural network for the SADC region has just been established in Tanzania in association with the Asian Vegetable Research and Development Center (AVRDC). This will undoubtedly become an important source of information on vegetable crops.

Nontraditional Export Crops

Research on pineapple and citrus is mostly in the private sector, and researchers draw their information from South Africa, Zimbabwe, and the United Kingdom. Again, a sizable amount of information on these commodities is obtained through personal contacts.

Livestock

Information on livestock is a problem in Swaziland. The DVS has a small library at its Veterinary Diagnostic Laboratory, but this is totally inadequate for scientists' needs, and they rely on interpersonal contacts instead. In the university, staff rely on their library but also on ILCA, which supplies information to the library as well as to individual researchers.

Natural Resource Management

Forestry research is done by the private sector, and researchers depend on their parent companies and outside sources for the bulk of their information needs. In Swaziland, where there is very limited national capacity in forestry and where there are few specialized laboratories and facilities, researchers tend to look outside the country for what they need.

A good example of the private-sector approach to obtaining research information is provided by the Usuthu Pulp Company. They have a very small library but prefer to make use of the libraries at Malkerns, the university, or abroad if necessary. Since current information is important, they ensure that their staff have access to several key forestry journals, including *Forestry Abstracts*, and that each re-

searcher has an opportunity to attend a professional meeting every two years. In total, about 20% of the research budget is spent on information: journals, books, travel to meetings, and consultants.

In addition to these information mechanisms, Usuthu Pulp exploits external institutions and uses consultants and experts to bring them the information and expertise that they need. Thus, they have access to the facilities and information resources of the Institute for Commercial

Forestry Research (ICFR) at the University of Natal. They maintain strong links with the Plant Protection Research Institute (PPRI) in South Africa and the Oxford Forestry Institute in the UK, and the researchers are active members of the specialized working groups of the International Union of Forestry Research Organizations (IUFRO). These contacts are both institutional and personal and serve to ensure that the information resources, expertise, and knowledge that the company needs can be found quickly and efficiently.

Conclusion: Issues and Lessons from Swaziland

The Swazi experience with research information raises several interesting and challenging issues. If the university is excluded, researchers in Swaziland are almost totally dependent on personal contacts and research networks for scientific information. This enthusiasm for research networks and personal contacts is such that few in-country sources for this kind of information have been developed. This will probably change in the future, and more formal mechanisms will also be required.

At this early stage in the development of ARD, when scientists have only recently returned from further studies and networks are particularly active, it is to be expected that these personal sources will continue to be important mechanisms for getting needed information. The problem is that in the future, as scientists move within the research system or even leave it, they will take their contacts with them and the precious information resources that are currently linked to individuals will become inaccessible or lost.

This potential loss, along with the increase in the amount of information that is generated in-country and the growing amounts of network information collected by individuals, will force research institutes to rediscover the original purposes and role of a library — as a memory for information throughout the institute, as an institutional resource, and as a labor-saving device that offers central information handling and access services that are now done by individual scientists.

An important challenge for research managers is to ensure that the research system is prepared for this situation. They will need to design an information system that maintains present levels of personal contacts and network interaction, as well as strengthening complementary mechanisms such as libraries that fulfil other necessary information roles. This will require sustained commitment and support from senior management, adequate resources and facilities, and qualified staff who can deliver the desired level of service.

Another challenge is to increase the exchange of information within the country. It is apparent that, with the exception of the university, there are no effective mechanisms in national institutions to document, disseminate, or share the large amounts of information pouring into almost every research institution. This is particularly relevant for information from outside the country, which is received through many channels but which tends to remain at the point of entry. It is not shared; it often does not reach the libraries and information centers that can best organize and store it for easy retrieval.

The outward-looking orientation of Swazi research institutions suggests that information services in Swaziland must try to provide useful information from other external sources, if possible without duplicating the information that researchers receive through their personal and network contacts. They must also balance the flow of information by ensuring that locally produced information is equally accessible. This requires an information system that incorporates the whole spectrum of information mechanisms and channels that are being used.

Research Networks and the Role of the Library

Scientists in the Agricultural Research Division rely almost entirely on research networks for current scientific information. In contrast, staff at the university's Faculty of Agriculture rely more on their library for current information. Thus, we have examples of two different information mechanisms, each carrying out the same current-awareness function. In the ministry, libraries are almost nonexistent and efforts to strengthen them have received little support from managers or researchers, possibly because so many information needs are satisfied by the networks. In the university, formal research networks are mostly insignificant.

Although researchers obtain a lot of information from research networks and from personal contacts, they still need well-organized library and information services. The very strength and usefulness of the networks suggests, however, that agricultural libraries in Swaziland need to focus

on their role and function *in relation* to the activities of the networks and to design their services accordingly.

While libraries and documentation centers are one approach to ensuring that information storage and retrieval functions are carried out, it is clear that there are different mechanisms can take the lead role for each function.

If the networks can deliver current external information directly to researchers, the libraries can concentrate more on other areas such as improved access to local information. Their present orientation towards foreign information partly duplicates what is provided by the networks and is not very cost effective. An appropriate role for the libraries is to concentrate on identifying, collecting, indexing, and disseminating local materials and to *complement* network activities, rather than competing with them.

The Regional Context

Almost all contacts with other countries in the region use regional arrangements

of some sort. However, there is little direct country-to-country contact between re-

searchers, and except where regional networks are active, there is little awareness of what other NARS are doing. The extent to which this is due to a lack of initiative or awareness among Swazi researchers or a lack of available information from other countries is debatable. It is probably a bit of both.

Regional organizations have major information roles and functions, but direct ties between regional entities and research are much more developed than they are between regional entities and the national information services. Far greater priority is given to linking researchers than to

linking information professionals or to strengthening national information capacity. National policymakers and managers take their cue from regional and donor representatives.

At present, there are relatively weak contacts between agricultural libraries in Swaziland and regional or international institutes working in agricultural research. Strengthening library links with agencies such as SACCAR might lead to the library and information staff working more closely with the researchers at ARD, who have excellent research linkages with both SACCAR and SARCCUS.

Information Networks

The benefits of the AGRIS and CARIS systems have not been fully utilized by Swaziland. Allocation of national responsibilities for AGRIS and CARIS is not clear and the comparative strengths of the different institutions that could participate

in such national systems needs to be assessed. Any division of responsibility will depend on resources being made available both to MOAC and the university, along with the creation of political support in the ministry.

Collaboration and Coordination at the National Level

Although researchers in the different institutions and organizations have participated in joint research projects, there is almost no in-country collaboration on information services. Informal discussions are proceeding, but there needs to be a strong desire to share information and

resources and to make an institutional commitment to promote increased collaboration. Coordination is necessary, but it may be more effectively achieved once the researchers and their managers agree on how to best coordinate research itself.

Awareness of Information Issues

To be effective, information management must be recognized by senior researchers and policymakers as an important component of research, and its functions and roles must be identified. This awareness and the recognition of the

role of information seem to be lacking in the Ministry of Agriculture, greatly hindering the development of a research library in the ministry.

It is difficult to define why this is so and

what should be done to improve the situation. Certainly, libraries have played a small role in the past and their potential functions and services, beyond acting as a storehouse for books, are little understood. The proposed project developed

with FAO may generate some interest — certainly some impact and outputs must be seen to result from the information units if they are to receive any sustained commitment or resources from management.

Human Resources for Information

Most of the agricultural libraries in the country are manned by unqualified personnel. It is crucial to employ or train information staff who will be able to offer the services that researchers need. There is therefore a need for MOAC to create

such posts for those libraries for which it is responsible. The lack of qualified personnel has led to researchers losing faith in the library services and keeping information in their offices.

Donor Projects

In the past, donor projects have neglected the national capacity for research information. There was one project that lasted for over 10 years in the ARD, but it gave little attention to information. Only at the end of the project was a consultant commissioned to make recommendations for the improvement of the national agricultural information system, and at that time, little follow-up was possible or could be funded. The only effort to train infor-

mation personnel was a six-month program for one person to visit libraries in the US. Future donor-funded projects should incorporate an element for information access to ensure that project staff are well informed, and also to ensure that Swaziland is able to make the best use of information generated and acquired by the project, even after the activity has been completed.

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