Recent World Bank Discussion Papers

No. 124  The New Fiscal Federalism in Brazil. Anwar Shah
No. 125  Housing Reform in Socialist Economies. Bertrand Renaud
No. 126  Agricultural Technology in Sub-Saharan Africa: A Workshop on Research Issues. Suzanne Gnaegy and Jock R. Anderson, editors
No. 128  Research on Irrigation and Drainage Technologies: Fifteen Years of World Bank Experience. Raed Safadi and Hervé Pasqueuillez
No. 129  Rent Control in Developing Countries. Stephen Malpezzi and Gwendolyn Ball
No. 130  Patterns of Direct Foreign Investment in China. ZaFar Shah Khan
No. 131  A New View of Economic Growth: Four Lectures. Maurice FG. Scott
No. 132  Adjusting Educational Policies: Conserving Resources While Raising School Quality. Bruce Fuller and Akilhu Habte, editors
No. 133  Letting Girls Learn: Promising Approaches in Primary and Secondary Education. Barbara Herz, K. Subbarao, Masooma Habib, and Laura Raney
No. 135  A Strategy for Fisheries Development. Eduardo Loayza, in collaboration with Lucian M. Sprague
No. 137  Deferred Cost Recovery for Higher Education: Student Loan Programs in Developing Countries. Douglas Albrecht and Adrian Ziderman
No. 138  Coal Pricing in China: Issues and Reform Strategy. Yves Albouy
No. 139  Portfolio Performance of Selected Social Security Institutes in Latin America. Carmelo Mesa-Lago
No. 140  Social Security and Prospects for Equity in Latin America. Carmelo Mesa-Lago
No. 142  Restructuring Socialist Industry: Poland's Experience in 1990. Homi J. Kharas
No. 143  China: Industrial Policies for an Economy in Transition. Inderjit Singh
No. 144  Reforming Prices: The Experience of China, Hungary, and Poland. Anand Rajaram
No. 145  Developing Mongolia. Shahid Yusuf and Shahid Javed Burki
No. 147  The Effects of Economic Policies on African Agriculture: From Past Harm to Future Hope. William K. Jaeger
No. 148  The Sectoral Foundations of China's Development. Shahid Javed Burki and Shahid Yusuf, editors
No. 149  The Consulting Profession in Developing Countries: A Strategy for Development. Syed S. Kirmani and Warren C. Baum
No. 150  Successful Rural Finance Institutions. Jacob Yaron
No. 151  Transport Development in Southern China. Clell G. Harral, editor, and Peter Cook and Edward Holland, principal contributors
No. 152  The Urban Environment and Population Relocation. Michael M. Cernea

(Continued on the inside back cover.)
AFRICA TECHNICAL DEPARTMENT SERIES

Technical Paper Series
No. 122  Dessing, Support for Microenterprises: Lessons for Sub-Saharan Africa
No. 130  Kiss, editor, Living with Wildlife: Wildlife Resource Management with Local Participation in Africa
No. 132  Murphy, Casley, and Curry, Farmers’ Estimations as a Source of Production Data: Methodological Guidelines for Cereals in Africa
No. 135  Walshe, Grindle, Nell, and Bachmann, Dairy Development in Sub-Saharan Africa: A Study of Issues and Options
No. 141  Riverson, Gavinia, and Thriscutt, Rural Roads in Sub-Saharan Africa: Lessons from World Bank Experience
No. 142  Riverson, Gaviria, and Thriscutt, Rural Roads in Sub-Saharan Africa: Lessons from World Bank Experience
No. 143  Walshe, Grindle, Nell, and Bachmann, Dairy Development in Sub-Saharan Africa: A Study of Issues and Options
No. 149  Walshe, Grindle, Nell, and Bachmann, Dairy Development in Sub-Saharan Africa: A Study of Issues and Options
No. 157  Walshe, Grindle, Nell, and Bachmann, Dairy Development in Sub-Saharan Africa: A Study of Issues and Options
No. 161  Walshe, Grindle, Nell, and Bachmann, Dairy Development in Sub-Saharan Africa: A Study of Issues and Options
No. 165  Walshe, Grindle, Nell, and Bachmann, Dairy Development in Sub-Saharan Africa: A Study of Issues and Options
No. 179  Walshe, Grindle, Nell, and Bachmann, Dairy Development in Sub-Saharan Africa: A Study of Issues and Options
No. 181  Walshe, Grindle, Nell, and Bachmann, Dairy Development in Sub-Saharan Africa: A Study of Issues and Options

Discussion Paper Series
No. 82  Psacharopoulos, Why Educational Policies Can Fail: An Overview of Selected African Experiences
No. 83  Craig, Comparative African Experiences in Implementing Educational Policies
No. 84  Kiros, Implementing Educational Policies in Ethiopia
No. 85  Eshiwani, Implementing Educational Policies in Kenya
No. 86  Galabawa, Implementing Educational Policies in Tanzania
No. 87  Thelejani, Implementing Educational Policies in Lesotho
No. 88  Magalula, Implementing Educational Policies in Swaziland
No. 89  Odaet, Implementing Educational Policies in Uganda
No. 90  Achola, Implementing Educational Policies in Zambia
No. 91  Maravanyika, Implementing Educational Policies in Zimbabwe
No. 132  Fuller and Habte, editors, Adjusting Educational Policies: Conserving Resources while Raising School Quality
No. 147  Jaeger, The Effects of Economic Policies on African Agriculture: From Past Harm to Future Hope
No. 175  Shanmugaratnam, Vedeld, Massige, and Bovin, Resource Management and Pastoral Institution Building in the West African Sahel
No. 181  Shanmugaratnam, Vedeld, Massige, and Bovin, Resource Management and Pastoral Institution Building in the West African Sahel

No. 179  Speirs and Olsen, Indigenous Integrated Farming Systems in the Sahel
No. 181  Mining Unit, Industry and Energy Division, Strategy for African Mining
Agricultural Research in Southern Africa

A Framework for Action

Andrew Spurling
Teck Y. Pee
Godwin Mkamanga
Christopher Nkwanyana

The World Bank
Washington, D.C.
Discussion Papers present results of country analysis or research that is circulated to encourage discussion and comment within the development community. To present these results with the least possible delay, the typescript of this paper has not been prepared in accordance with the procedures appropriate to formal printed texts, and the World Bank accepts no responsibility for errors.

The findings, interpretations, and conclusions expressed in this paper are entirely those of the author(s) and should not be attributed in any manner to the World Bank, to its affiliated organizations, or to members of its Board of Executive Directors or the countries they represent. The World Bank does not guarantee the accuracy of the data included in this publication and accepts no responsibility whatsoever for any consequence of their use. Any maps that accompany the text have been prepared solely for the convenience of readers; the designations and presentation of material in them do not imply the expression of any opinion whatsoever on the part of the World Bank, its affiliates, or its Board or member countries concerning the legal status of any country, territory, city, or area or of the authorities thereof or concerning the delimitation of its boundaries or its national affiliation.

The material in this publication is copyrighted. Requests for permission to reproduce portions of it should be sent to the Office of the Publisher at the address shown in the copyright notice above. The World Bank encourages dissemination of its work and will normally give permission promptly and, when the reproduction is for noncommercial purposes, without asking a fee. Permission to copy portions for classroom use is granted through the Copyright Clearance Center, 27 Congress Street, Salem, Massachusetts 01970, U.S.A.

The complete backlist of publications from the World Bank is shown in the annual Index of Publications, which contains an alphabetical title list (with full ordering information) and indexes of subjects, authors, and countries and regions. The latest edition is available free of charge from the Distribution Unit, Office of the Publisher, Department F, The World Bank, 1818 H Street, N.W., Washington, D.C. 20433, U.S.A., or from Publications, The World Bank, 66, avenue d'Iena, 75116 Paris, France.

ISSN: 0259-210X

Andrew Spurling is principal agriculturalist in the Agriculture Division of the Africa Technical Department of the World Bank. Teck Y. Pee is the Deputy Executive Secretary of the Special Program for African Agricultural Research (SPAAR). Godwin Mkamanga is the Director of the SADCC Regional Gene Bank in Lusaka, Zambia. Christopher Nkwanyana is the Principal Programs Officer of the Southern African Centre for Cooperation in Agricultural Research (SACCAR).

Library of Congress Cataloging-in-Publication Data

Agricultural research in southern Africa: a framework for action / Andrew Spurling ... [et al.].
    p. cm. — (World Bank discussion papers. Africa Technical Department series)
    Includes bibliographical references.
    ISBN 0-8213-2282-6
    SS42.A356A36 1992 92-35157
    630'.72068—dc20  CIP
Abstract

Dynamic, productive and responsive agricultural research systems are critical if the rich potential of the SADCC region in Sub-Saharan Africa is to be more fully realized. The Framework for Action in Agricultural Research, which has been developed by a small task force appointed by the SACCAR and SPAAR Secretariats, identifies six principal elements of importance and makes recommendations on how these should be incorporated in the national agricultural research systems of SADCC. The Framework concludes with a vision in the medium-term of increasingly dynamic and responsive NARSs with a clearer pattern of specialization among the different sectors (cash/export crops, intensive livestock and factor research by the private sector; staple foodcrops, extensive livestock and environmental and social concerns by the public sector; and basic and applied (under contract) research by the universities). Accelerated development of a stream of technologies for different sectors of the farming community should be possible provided that there is a coordinated effort by all the stakeholders.
Acknowledgements

The authors wish to express their appreciation to all the research managers and scientists of the national and regional research teams in the SADCC countries who provided intellectual input and encouragement during the development of this Framework for Action in Agricultural Research. We also wish to thank all those from outside the region who have given us the benefit of their experience, as we developed the elements of the Framework.

The authors wish to thank Dr. Moctar Toure, Executive Secretary, SPAAR and Dr. Martin Kyomo, Director, SACCAR for their close support during the development of the Framework. Thanks are due to Mmes. Bhagwanti Khushlani and Marie-Claude Verlaeten who assisted with the research and compilation of statistics for the tables in the Framework. The authors thank Mr. Bokary Guindo for his assistance in compiling and classifying the information on research activities from the SPAAR Information System (SIS) database. The authors are also most grateful to Mmes. Marie-Claude Verlaeten, Marie-Bernadette Darang and Christina Dhanaraj for their patience and skill in processing the final text.

Any errors of omission or commission remain the responsibility of the authors.
Foreword

Africa is facing an economic crisis of formidable proportions—one that has been exacerbated by the nexus of rapidly increasing population, degradation of natural resources and the environment, and persistent low agricultural productivity. The continent urgently needs to develop and adopt improved farming technologies if it is to begin to reverse this worsening crisis. Such a breakthrough will depend on dynamic, creative, and strong national agricultural research systems. Such systems are, unfortunately, rare in Sub-Saharan Africa.

The Special Program for African Agricultural Research (SPAAR) was established in 1985 by a group of donors as a forum for collaborating on programs to strengthen African agricultural research systems. SPAAR’s initial efforts did not have the desired impact on agricultural research systems. Therefore, in 1990 the SPAAR membership decided to adopt a new approach based on regional frameworks for action. These are related to the major eco-political groupings of Sub-Saharan Africa (SSA) and are prepared jointly with the managers of the national agricultural research systems.

This paper is the Framework for Action in Agricultural Research developed for the ten countries of the Southern African Development Coordination Conference (SADCC). The new strategic agenda was elaborated within the existing regional research program managed by the Southern African Centre for Cooperation in Agricultural Research (SACCAR). The elements for the Framework were developed through an iterative process of workshops, in-country consultations, and literature review by a small task force appointed by the SPAAR and SACCAR Secretariats.

The Framework has been accepted by both SPAAR and SACCAR and is being piloted for the SADCC region by Tanzania. In partnership with its donor community, Tanzania will introduce new actors to its national agricultural research system including private, academic, and international institutions. Its public sector agricultural research institutions will be given greater management autonomy. The focus of its research effort will be on carefully prioritized programs of work.

SACCAR and SPAAR expect that the principles of this Framework will soon be adopted by Malawi, Zambia, and Zimbabwe. This long-term collaborative program to reinvigorate agricultural research will then be instituted as soon as possible in Angola, Botswana, Lesotho, Mozambique, Namibia, and Swaziland.

Ismail Serageldin
Director
Technical Department
Africa Region
## Table Of Contents

Abbreviations And Acronyms .......................................................... xi

Executive Summary .................................................................................. xiii

1. The SACCAR/SPAAR Initiative .......................................................... 1
   - SADCC - Southern African Development Coordination Conference ......... 1
   - SACCAR - Southern African Centre for Cooperation in Agricultural Research ...... 1
   - SPAAR - Special Program for African Agricultural Research .................. 2
     The Framework for Action .............................................................. 2

2. The SADCC Region and Its Natural Resources ..................................... 3
   - Overview of the Region .................................................................... 3
   - Overview of SADCC’s Natural Resources ............................................ 6
     - Agro-climatic Potential .................................................................. 8
     - Land Potential .................................................................................. 9
     - Land-use ......................................................................................... 9
     - Agricultural Production and Productivity ........................................ 9
     - Demography ................................................................................... 13
     - Regional Food Situation in SADCC .................................................. 14
     - Trade in Agricultural Products ....................................................... 14
     - Agricultural Growth Prospects ..................................................... 15
     - Transport ....................................................................................... 17
     - National Agricultural Policies in the SADCC Region ............................ 17
     - SACCAR and the Agricultural Research and Training Sector ............... 17
     - National Agricultural Research Systems (NARSs) in the SADCC Region .... 17
     - International Agricultural Research Centers (IARCs) ......................... 18

3. The Problem and the Challenge ......................................................... 20
   - The Problem ..................................................................................... 20
   - The Challenge .................................................................................. 24

4. Framework for Action ........................................................................ 26
   - Introduction ...................................................................................... 26
     - Elements of the Proposed Framework for Action ................................ 27
     - Detailed Features of the Framework for Action .................................. 28
     - Research Fund .............................................................................. 28
     - Enabling Environment .................................................................... 29
     - Policy Analysis ............................................................................... 29
     - Privatization of Research ............................................................... 30
     - Enhancing the Quality of Science and Technology ................................. 30
     - Intensification and Diversification of Agriculture .................................. 31
     - Exploitation of Natural Resources .................................................... 31
5. The Long-Term Strategy ........................................ 33
   Introduction ......................................................... 33
   Public Sector Research and Extension Services .................. 33
   The Universities .................................................... 33
   Regional Agricultural Research and Training - SACCAR ......... 34
   International Agricultural Research Centers ..................... 34
   The Private Sector .................................................. 35

6. Regional Agricultural Research .................................. 36
   Introduction .......................................................... 36
   SACCAR Portfolio .................................................... 36
   Projected Devolution of the SACCAR Portfolio ..................... 38
   Proposed Structure for Regional Research Networking in Maize,
   Wheat and Rice ....................................................... 39
   Donor-Funded Agricultural Research Programs and Projects in the Region ........................................ 39
   Human Resource Development ........................................ 39
   High-Value Crops and the Private Sector ............ .............. 40
   Next Steps--Implementation of the Framework ..................... 40

7. Expectations ...................................................... 42
   A Vision of Research Systems in the SADCC Region ................. 43

Annexes
Annex 1: The Political Economy of Wheat Consumption and
         Production in Sub-Saharan Africa .............................. 44
Annex 2: Rural Community Participation in Integrated
         Wildlife Management and Utilization (IWMU) .............. 47
Annex 3: Biotechnology: A Potential Tool for The SADCC Region .... 51
Annex 4: Contract Research ........................................... 54
Annex 5: Agricultural Research Activities of SIS Focal
         Points in the SADCC Member Countries ....................... 56

Notes ............................................................................. 57

Bibliography .................................................................... 58

Boxes
Box 1: Regional Agricultural Responsibilities in SADCC ............... 1
Box 2: A National Agricultural Research System ....................... 3
Box 3: Zimbabwe ................................................................ 20
Box 4: Tea ....................................................................... 20
Box 5: Cotton .................................................................... 21
Box 6: Tobacco ................................................................... 22
Box 7: Malawi .................................................................... 22
Box 8: Intensive Livestock Production .................................... 24
Box 9: Research Software .................................................. 26
Box 10: SACCAR Portfolio .................................................. 37
Tables
Table 1: Selected Socio-Economic Indicators for SADCC Member Countries, 1987 .... 4
Table 2: Fisheries Catches .............................................................. 7
Table 3: Wildlife Conservation Areas .............................................. 8
Table 4: Cereal Crop Production and Productivity, 1989 .......................... 11
Table 5: Export Crop Production and Productivity, 1989 ......................... 12
Table 6: Livestock Population, 1988 .............................................. 13
Table 7: Demographic Indicators, 1990 - 2010 .................................. 14

Annex Tables
Table A-1: Changes (%) in Daily Food Calories per Capita obtained from different Staples in Africa, 1961/65 to 1975/77 ................................. 45
Table A-2: Major Wheat Production Environments and Production Issues in SSA .... 46

Maps
Map 1: SACCAR/SPAAR Framework for Action in Agricultural Research
Map 2: SADCC Regional Transport Routes
### Abbreviations And Acronyms

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ADMADE</td>
<td>Administrative Management Design for Game Management Areas</td>
</tr>
<tr>
<td>AFRENA</td>
<td>Agroforestry Research Network for Africa</td>
</tr>
<tr>
<td>AIDS</td>
<td>Acquired Immunodeficiency Syndrome</td>
</tr>
<tr>
<td>ARRA</td>
<td>Agricultural Research Resource Assessment</td>
</tr>
<tr>
<td>ART</td>
<td>Agricultural Research Trust</td>
</tr>
<tr>
<td>BRI</td>
<td>Biotechnology Research Institute</td>
</tr>
<tr>
<td>CAMPFIRE</td>
<td>Communal Area Management Program for Indigenous Resources</td>
</tr>
<tr>
<td>CARIS</td>
<td>Current Agricultural Research Information System</td>
</tr>
<tr>
<td>CFB</td>
<td>Commercial Farmers Bureau</td>
</tr>
<tr>
<td>CIAT</td>
<td>International Tropical Agricultural Center</td>
</tr>
<tr>
<td>CGIAR</td>
<td>Consultative Group on International Agricultural Research</td>
</tr>
<tr>
<td>CIMMYT</td>
<td>International Maize and Wheat Improvement Center</td>
</tr>
<tr>
<td>CIP</td>
<td>International Potato Improvement Center</td>
</tr>
<tr>
<td>DRC</td>
<td>Domestic Resource Cost</td>
</tr>
<tr>
<td>CTA</td>
<td>Technical Center for Agricultural and Rural Cooperation</td>
</tr>
<tr>
<td>FAO</td>
<td>Food and Agricultural Organization</td>
</tr>
<tr>
<td>FFA</td>
<td>Framework for Action</td>
</tr>
<tr>
<td>GDP</td>
<td>Gross Domestic Product</td>
</tr>
<tr>
<td>IARC</td>
<td>International Agricultural Research Center</td>
</tr>
<tr>
<td>ICRAF</td>
<td>International Center for Research in Agroforestry</td>
</tr>
<tr>
<td>ICRISAT</td>
<td>International Crops Research Institute for the Semi-Arid Tropics</td>
</tr>
<tr>
<td>IDRC</td>
<td>International Development Research Center</td>
</tr>
<tr>
<td>IFAD</td>
<td>International Fund for Agricultural Development</td>
</tr>
<tr>
<td>IFPRI</td>
<td>International Food Policy Research Institute</td>
</tr>
<tr>
<td>IFS</td>
<td>International Foundation for Science</td>
</tr>
<tr>
<td>IITA</td>
<td>International Institute for Tropical Agriculture</td>
</tr>
<tr>
<td>IRRI</td>
<td>International Rice Research Institute</td>
</tr>
<tr>
<td>ISNAR</td>
<td>International Service for National Agricultural Research</td>
</tr>
<tr>
<td>ME</td>
<td>Maize Equivalent</td>
</tr>
<tr>
<td>NARM</td>
<td>National Agricultural Research Masterplan</td>
</tr>
<tr>
<td>NARS</td>
<td>National Agricultural Research Service</td>
</tr>
<tr>
<td>NGO</td>
<td>Non-Governmental Organization</td>
</tr>
<tr>
<td>NR</td>
<td>Natural Resources</td>
</tr>
<tr>
<td>ODA</td>
<td>Overseas Development Administration</td>
</tr>
<tr>
<td>PTA</td>
<td>Preferential Trade Area</td>
</tr>
<tr>
<td>SACCAR</td>
<td>Southern African Center for Agricultural Research</td>
</tr>
<tr>
<td>SADCC</td>
<td>Southern African Development Coordination Conference</td>
</tr>
<tr>
<td>SirDC</td>
<td>Scientific and Industrial Research and Development Center</td>
</tr>
<tr>
<td>SIS</td>
<td>SPAAR Information System</td>
</tr>
<tr>
<td>SPAAR</td>
<td>Special Program for African Agricultural Research</td>
</tr>
<tr>
<td>SSA</td>
<td>Sub-Saharan Africa</td>
</tr>
<tr>
<td>UNDP</td>
<td>United Nations Development Program</td>
</tr>
<tr>
<td>USAID</td>
<td>United States Agency for International Development</td>
</tr>
<tr>
<td>UZ</td>
<td>University of Zimbabwe</td>
</tr>
</tbody>
</table>
Executive Summary

The objective of this Framework for Action is the development of a strategic agenda for the SADCC region that will strengthen the National Agricultural Research Systems (NARSs) of the member states. The task force believes that the focus of the framework, at this stage, must be on the research software, that is, on national scientists and their work environment.

The food, agricultural and natural resources sector occupies a central position in SADCC's economy. In the member states where agriculture is dominant, up to 80 percent of the population and labor force still depend on agriculture for their livelihood; and, approximately 23 percent of the regional Gross Domestic Product (GDP) is derived from the sector.

The current population of about 84 million is growing at a rate of about 3 percent per annum, which is below the growth rate of agricultural production (1986-1989) in the majority of the SADCC member states. However, many people in the region have experienced a decline or stagnation in living standards since 1980. Significant increases in agricultural productivity will be required to improve food security and the quality of life. This will need strong, responsive and sustainable research and extension systems.

The SADCC region is probably the richest in Sub-Saharan Africa in terms of its renewable natural resources of land, water, livestock, forests, wildlife and fish.

Although there are significant areas of intensive commercial agriculture, the agricultural potential of the SADCC countries is currently under-used, with nearly 90 percent of the planted area under foodcrops. Much of the area is under low-input subsistence farming. It is desirable to gradually transform this subsistence mode of production to higher value commercial labor-absorbing enterprises. This change will require the continuous development of a stream of technologies for different target groups and agro-ecological zones.

The domestic availability of the major staples, in the 1990-91 marketing season, was reported to be 8 percent in excess of regional food requirements. However, its distribution between countries was skewed because of difficulties with intra-regional trade. Food availability within countries is also characterized by inequities between areas and income groups. Moreover, food production is very dependent on the weather with much of crop production being rain-fed despite the potential for irrigation. The widespread and persistent drought throughout the region in 1991-92 underscored the fragility of regional food security.

The agricultural commodities in the region that appear to have the most promising prospects for growth include: maize, wheat, rice, oilseeds, tobacco, cotton, fruit and vegetables, dairy products and poultry, tree nuts and wildlife.

Available statistics indicate that the number of trained scientists and the total research budget have increased markedly during the past decade in most SADCC member countries. While the data show that the average research expenditure per scientist has not been lower than that in Asia and Latin America, output is much lower in...
terms of quantity and quality. However, these statistics do not tell the whole story. Two-thirds of the aggregate expenditure is outside the control of African governments, a high proportion of which is for the operation of the International Agricultural Research Centers (IARCs) and for technical assistance provided by external agencies. Information about activities funded by donors in the SIS database indicates that most SPAAR donor members are active supporters of agricultural research in the region, but that there has been duplication of research effort and over-emphasis in some areas.

In general, most national programs manage research programs on their major commodities, but there is need to do more on sustainability (soil fertility and management); crop loss reduction (particularly pests and diseases); marketing, processing and utilization; and possibly some aspects of livestock research. A more serious problem not revealed by the aggregate expenditure figures is that insufficient money is allocated for recurrent expenditure, since few donors or external agencies make adequate provision for funding of recurrent costs. The assumption is that governments will be able to assume the responsibility for recurrent funding of non-incremental activities. This has not proved to be the case. Consequently, the funds available for recurrent expenditure have proven inadequate to provide African scientists with the operating funds to undertake even a minimal level of research activities. The mitigation of this deficiency, which is part of the disenabling environment in which most African scientists work, is the centerpiece of this proposed Framework. An assurance of sustainable recurrent funding for the operational costs of priority research programs is fundamental to the reinvigoration of the NARSs.

The elements of the proposed FFA in agricultural research and training are expected to provide the research software and address critical gaps in agricultural research in the region. It will require the cooperation of the SADCC member states and the donor members of SPAAR, in concert with the IARCs and private sector research institutions, to put the following six interactive elements in place.

1. Establish a **consolidated programming and funding mechanism** for each NARS to ensure the adequacy of financial resources for the priority programs of the national agricultural research masterplans (NARM) and thereby improve the **enabling environment** for SADCC scientists.

2. Develop a **capacity for policy analysis** within each NARS to assist governments in setting sound market-oriented policies (production, pricing, marketing, processing, utilization and trade) for the NR sector.

3. Encourage private sector involvement in the formulation and implementation of the national and regional agricultural research programs. Such a **pluralistic approach** to agricultural research will draw on the relative strengths of the public, private and academic sectors. This collaboration can be expected to lead to a symbiotic relationship in the development of appropriate science and technology for the region.

4. Improve the **quality of science and technology** in the region through the establishment of specialized regional technical expertise that will enable African scientists to establish leadership in selected scientific fields, and to participate more fully in the global research agenda.

5. **Intensify existing farming systems** in the arable farming areas and diversify the commodity base with the goal of increasing and sustaining the agricultural growth rate.

6. Assist the **rural poor** in the **arid and marginal** areas of the region through on-farm research and extension on crops and livestock; through the application of
biotechnology; and through support for wildlife management and utilization programs.

The report defines the roles and responsibilities of the major players (public sector research services, the regional research institution (SACCAR), universities (agricultural faculties), IARCs, and the private sector) involved in agricultural research over the short-, medium-, and long-term.

SACCAR's current portfolio consists of ten programs (including the establishment of SACCAR), of which eight have been funded and are at various stages of implementation. A further eight programs have been identified and appraised and are awaiting funding. A major long-term plan has been developed for professional training in the food, agriculture and natural resources sector. A possible path for the devolution of the present portfolio to the NARSs has been proposed by the task force.

Following the technical validation of the Framework by the SACCAR Board in April, 1991 and its subsequent endorsement the following month by the SPAAR membership, it was agreed to pilot implementation of its principles in one SADCC member state. Tanzania, which had already been the focus of the first effort by the SPAAR membership to coordinate donor efforts in support of agricultural research within a country was proposed as the pilot country. This choice was endorsed by SPAAR and SACCAR and subsequently agreed to by the government of Tanzania.

The government decided to host the first Donor Coordination meeting in Dar-es-Salaam in November, 1991 prior to a Donor-Government Workshop in March, 1992 to launch the piloting of the Framework through the implementation of its recently-completed (1991) National Research Masterplan (NARM).

The region has the natural resources to realize and sustain an accelerated agricultural growth rate. The proposed Framework can provide the catalyst for increasing and sustaining growth. But, the improvements will take time. As the elements of the proposed Framework are put in place, it can be envisaged that the scientists in the NARSs of SADCC will become increasingly able, motivated and imbued with a sense of mission to respond more directly to the demands and challenges of the food, agriculture and natural resources sector.
1. The SACCAR/SPAAR Initiative

It may be useful at the outset to provide some background information on the Southern African Centre for Cooperation in Agricultural Research (SACCAR) and the Special Program for African Agricultural Research (SPAAR), and indicate why SACCAR and SPAAR decided to jointly undertake this ambitious venture of preparing a Framework for Action (FFA) in support of agricultural research in the SADCC region.

SADCC - Southern African Development Coordination Conference

The Heads of State and Governments of nine countries in Southern Africa decided on April 1, 1980 to launch SADCC to pursue policies aimed at economic liberation and the integrated development of their national economies. At that time the SADCC member countries comprised Angola, Botswana, Lesotho, Malawi, Mozambique, Swaziland, Tanzania, Zambia and Zimbabwe. Namibia, which gained independence on March 21, 1990 joined SADCC on April 1, 1990, coinciding with the tenth anniversary of the organization. Since 1980, SADCC has built up a conceptual framework for regional cooperation based on the direct involvement of member states in the initiation and implementation of programs and projects. Political consensus now largely exists in the region and a number of regional programs are under implementation.

One of the productive sectors in which the SADCC member countries decided to work together was food, agriculture and natural resources (hereinafter referred to as the natural resources (NR) sector). Within this sector, SADCC assigned responsibility for coordinating regional programs to different member states (Box 1).

<table>
<thead>
<tr>
<th>Box 1: Regional Agricultural Responsibilities in SADCC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall coordination</td>
</tr>
<tr>
<td>Agricultural Research and Training</td>
</tr>
<tr>
<td>Fisheries, Forestry and Wildlife</td>
</tr>
<tr>
<td>Food Security</td>
</tr>
<tr>
<td>Livestock Production and Animal Disease Control</td>
</tr>
<tr>
<td>Soil and Water Conservation and Land Utilization</td>
</tr>
</tbody>
</table>

SACCAR - Southern African Centre for Cooperation in Agricultural Research

SACCAR was established in 1984 in Gaborone, Botswana by SADCC. The objectives of SACCAR are to:

- Promote cooperation in agricultural research
- Facilitate the exchange of information among the national research systems
- Promote the development of the human resources necessary to operate the agricultural research systems
- Promote coordination of SADCC agricultural research activities.

Since its establishment, SACCAR has received full support and cooperation from the government of Botswana, the rest of the SADCC member states and from cooperating partners, especially Canada, the European Community, Germany, Norway, Sweden, the United Kingdom, the Nordic countries as a
group and the United States of America. SACCAR has a portfolio of regional agricultural research and training programs and projects, of which more than half are under implementation. The priorities for the future include implementation of the already approved "Blueprint for Training;" development of a network of information exchange and scientific communication, including libraries and regional scientific publications for different audiences; and regional programs of operational research.

**SPAAR - Special Program for African Agricultural Research**

SPAAR was established in 1985 by a group of donors who decided that there was much to be gained by working together towards a common goal: the strengthening of African agricultural research systems. SPAAR has two major objectives:

1. To strengthen African agricultural research systems in the public and private sectors and, through them, develop and test relevant technologies in support of sustainable agricultural development.
2. To increase the effectiveness of donor assistance to African agricultural research systems through better coordination of existing resources; avoidance of duplication of effort; exchange of information on past, current, and future activities; and collaborative initiatives to address particular problems in agricultural research.

SPAAR's definition of agriculture is broad. SPAAR provides a forum for addressing issues relating to donor support for research on the sustainable use and development of renewable natural resources, including agriculture, agroforestry, livestock, fisheries, and associated socioeconomic, human resource, and environmental issues. The SPAAR group pursues only those activities where there is broad interest and which are not covered by other organizations. The emphasis is on identifying problems and gaps in support of African agricultural research which can be addressed through collaborative ventures between the SPAAR members at national and regional levels. The SPAAR group decided during its 10th Plenary Session in Brussels in May, 1990, that a research strategy is needed as a basis for consensus building and concerted action. The proposed strategy should ensure that:

- All aspects of research were adequately covered to achieve the targeted 4 percent agricultural growth for Sub-Saharan Africa.
- The institutional arrangements for agricultural research were optimal.
- The operational and administrative problems presently apparent in the region were minimized.

It was decided to develop regional strategies for the major eco-political regions starting with the Sahel and SADCC regions. The SPAAR donors emphasized that this initiative should not take the form of further studies but rather should be developed as an operational action plan.

**The Framework for Action**

The SACCAR and SPAAR cooperative effort to strengthen national agricultural research systems (NARSs) in the ten SADCC countries was launched during a workshop in Gaborone, Botswana in November, 1990. The foundation for this coordinated activity was to be the development of a strategic agenda for the region by a SACCAR/SPAAR Task Force, working in close partnership with their respective member countries. The strategic agenda was to be framed within the context of the existing SACCAR regional program which is itself a component of SADCC's Strategy for the Food, Agricultural and Natural Resources Sector. The proposed agenda will be regularly updated by consensus, by both governments and donors. This will be a long-term process, requiring the creation of an "enabling environment" that will provide scientists with the necessary research tools, recurrent resources, incentives, and motivation for high-quality research.
2. The SADCC Region and Its Natural Resources

The objective of the proposed SACCAR/SPAAR Framework for Action (FFA) is the development of a strategic agenda for the SADCC region that will enable the NARSs (Box 2) of the member states to become more responsive to the technical problems of their farmers. The proposed framework will strengthen and sustain the NARSs and so enable them to develop appropriate technologies for dissemination by the extension services. The region’s farmers and economies will only benefit from more effective research systems if appropriate and active extension systems are available and effectively linked with research services. Although the task force recognizes that research and extension are inextricably linked, the main focus of this framework is on agricultural research. The development of this strategic agenda will require the agreement and support of both the SADCC member states and SPAAR members.

The implementation of this framework is expected to help the NARSs to become increasingly able, motivated and imbued with a sense of mission to respond more directly to the demands and challenges of the natural resources sector. The ultimate objective is to promote growth and equity in the agricultural economies of the region.

Overview of the Region

The natural resources sector occupies a central position in the economic structure of the SADCC region. Simple statistics tell the story. Approximately 23 percent of SADCC’s GDP is derived from agriculture (Table 1). Recent growth rates in AgGDP (1989) were mostly in the range of 1.2 - 3.7 percent, with the exceptions being -18.9 percent (Lesotho) and +5.5 percent (Tanzania). In the member states that are not dominated by mining, agriculture contributes about 60 percent of the foreign exchange earnings and up to 80 percent of the population and labor force are now dependent on agriculture for employment and income. The population of the region, currently estimated at 84 million, is growing by approximately 2 million per year and is, therefore, likely to exceed 100 million by the year 2000 and then double to 200 million by the year 2020. Presently, about 74 percent of the population live in rural areas with rural-urban migration increasing. The share of the urban population is expected to increase from 30 percent in 1990 to 43 percent in 2010. Increasing the productivity of agriculture is essential for assurance of food security, for stimulating development and for raising the standard of living of the people in the region.

Box 2: A National Agricultural Research System

A National Agricultural Research System (NARS) encompasses the entire spectrum of agricultural research activities undertaken within a country by a multiplicity of organizations, including government research services in the different natural resources sectors, the universities (particularly the agricultural faculties), the international research centers, the regional research institutions, parastatal commodity and seed organizations, the private sector (including foundations financed by producers of various commodities and research institutes) and charitable foundations.
Table 1: Selected Socio-Economic Indicators for SADCC Member Countries, 1987 a/

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Angola</td>
<td>10.0</td>
<td>841</td>
<td>46</td>
<td>124.7</td>
<td>31.5</td>
<td>71</td>
</tr>
<tr>
<td>Botswana</td>
<td>1.1</td>
<td>1382</td>
<td>3</td>
<td>60.0</td>
<td>5.3</td>
<td>34</td>
</tr>
<tr>
<td>Lesotho</td>
<td>1.6</td>
<td>169</td>
<td>16</td>
<td>3.0</td>
<td>0.9</td>
<td>53</td>
</tr>
<tr>
<td>Malawi</td>
<td>7.9</td>
<td>141</td>
<td>37</td>
<td>11.9</td>
<td>3.3</td>
<td>110</td>
</tr>
<tr>
<td>Mozambique</td>
<td>14.6</td>
<td>102</td>
<td>50</td>
<td>80.2</td>
<td>40.5</td>
<td>84</td>
</tr>
<tr>
<td>Namibia</td>
<td>1.2</td>
<td>1,171 4/</td>
<td>11 4/</td>
<td>82.4</td>
<td>20.0 4/</td>
<td>n/a</td>
</tr>
<tr>
<td>Swaziland</td>
<td>0.7</td>
<td>527</td>
<td>24</td>
<td>1.7</td>
<td>0.4</td>
<td>152</td>
</tr>
<tr>
<td>Tanzania</td>
<td>23.9</td>
<td>129</td>
<td>61</td>
<td>94.5</td>
<td>45.0</td>
<td>88</td>
</tr>
<tr>
<td>Zambia</td>
<td>7.2</td>
<td>282</td>
<td>12</td>
<td>75.3</td>
<td>25.0</td>
<td>98</td>
</tr>
<tr>
<td>Zimbabwe</td>
<td>9.0</td>
<td>582</td>
<td>11</td>
<td>39.1</td>
<td>3.5</td>
<td>65</td>
</tr>
</tbody>
</table>

Note: a/ 1987 was the latest year for which figures were available for all indicators.

Sources: 1/ World Bank, Sub-Saharan Africa: From Crisis to Sustainable Growth, 1989.

Achieving a marked improvement in productivity will require the establishment of strong and sustainable research systems.

Considerable diversity characterizes SADCC's natural resource base, the structure of its economy, its population density, its agro-ecology and its agricultural productivity. The SADCC region has possibly the richest natural resource base in Africa, marketing virtually all the major internationally-traded minerals - oil, gas, uranium, diamonds, iron ore, copper, chromium, coal, zinc- and many minor ones. Mining contributes over 60 percent of the region's export earnings. It is also rich in its renewable natural resources of land, water, livestock, forests, wildlife and fish. The region is a major producer of beef, cereals and commercial crops. In 1989-90 and 1990-91 (marketing years), the region has statistically been self-sufficient in maize - its principal cereal staple. However, problems with intra-regional trade hampered distribution within the region. The widespread and devastating drought of 1991/92 has left the region with a huge deficit of cereal staples. Coffee, tea, groundnuts and tobacco contribute, on average, about 20 percent of the region's export earnings (but 43 percent in Zimbabwe, 75 percent in Tanzania and 84 percent in Malawi). The region is self-sufficient in sugar cane. Apart from agricultural commodities, significant foreign exchange earnings are realized each year from wildlife (e.g. Botswana, Malawi, Namibia, Tanzania, Zambia, Zimbabwe); forestry (e.g. Malawi, Swaziland, Tanzania and Zimbabwe); and, fisheries (e.g. Angola, Malawi, Mozambique, Namibia, Tanzania, and Zambia). The political evolution now taking place in the Republic of South Africa will be increasingly felt in the SADCC region as the regional strategy shifts from reduction of dependence on South Africa to the incorporation of South Africa in the economic transformation of the whole southern Africa region.

The total land area of the ten member countries is nearly 572 million hectares, equivalent to 17 percent of the African continent. About 30 percent of the total land area has potential for crop production, the remaining 70 percent being forests, range land and deserts. But the potential productivity of substantial areas of the 155 million hectares...
suitable for crop production is constrained by soils that are old, fragile and acidic. Only about 15 percent of the potential agricultural land was cultivated in 1986, of which nearly 90 percent was planted to food crops, and only 2 percent cropped under irrigation. The livestock industry is sizeable with presently over 30 million cattle of which 15 percent are milking cows, 14 million sheep and 15 million goats. Much poultry meat, eggs and pork is also produced for home consumption and for sale in urban markets. There are 12 million hectares of inland waters and lakes and 900,000 tones of fish are harvested each year from marine and inland fishing. One-third of the region is now under woodland and forest and 9 percent of total land has been set aside for environmental management, including land under conservation and headwater catchment protection. Farming systems are diverse with various combinations of crops and livestock, varying levels of intensification and farm sizes ranging from rangeland farming through small-scale subsistence farming to large capital-intensive commercial farms in private or public ownership.

Food supplies will need to grow at 4 to 5 percent per year in most of the countries to meet the forecast growth in population and income — an awesome task in the light of worldwide historical experience. On average, seven out of ten people are presently living in rural areas and the number of food deficit households is unacceptably high. Most of the people will still be living in rural areas by the year 2000, because of the stark inability of the industrial and service sectors to generate sufficient jobs. While rapid growth has taken place in the modern sectors of the region’s economies, production per person has stagnated or declined in the smallholder agricultural sectors. The common explanations of the underdevelopment of the indigenous sectors in this region is often attributed to historical neglect and policy discrimination or the institutional biases that favored and continue to favor large-scale, modern, urban and capital-intensive production over small-scale peasant farming. The major influences on agricultural production in Botswana and Lesotho were the simultaneous introduction of market consumer goods and off-farm wage opportunities, which encouraged farm households to engage in market production through wage employment rather than commercial farming. However, migration to wage employment in mining and industrial centers did not reduce population (human and cattle) pressures on the land, since most migrants retained their rural home base.

The food and agriculture strategy must improve employment opportunities as well as foodcrop and export crop production. SADCC member states recognize the special role of women. Policies and measures are being developed to enhance and facilitate the participation of women, not only in the chores of production, but in the appropriate planning and decision-making processes.

The overall GDP growth of about 3.5 percent in 1989/90 was disappointing lower than the 4.5 percent achieved the previous year. The overall GDP of US$23.3 billion showed marked variability between member countries (Table 1) and an average GDP per capita of about US$282 in 1987 (Table 1). The share of agriculture and natural resources in the regional GDP was 23.4 percent. The primary reasons for the slowing down of the economic growth rate were: weakening commodity prices, continuing foreign exchange difficulties and, in some cases, socio-economic and security problems. With population increasing rapidly, most member states have experienced a decline or stagnation in living standards since 1980.

Four lessons flow from these disappointing results. First, large and continuing public and private investment in agriculture is needed, to keep up with the demands of population growth, and to ensure food security and an improved quality of life. Second, increased attention to environmental issues, including long-term research on developing sustainable production systems for food and cash crops, fisheries, forestry and wildlife will be necessary. Third, effective agricultural research must be established and sustained in order to underpin the development of a diversified agriculture offering a wider range of income options. And fourth, policies must be evolved that stimulate the development of rural non-farm activities.
Overview of SADCC's Natural Resources

Land and Water Resources

Table 1 shows that Angola has the largest land area (1.2 million square kilometers) followed by Tanzania and Namibia (0.94 million and 0.84 million square kilometers respectively). Swaziland and Lesotho have the smallest land surfaces (0.02 and 0.03 million square kilometers respectively). Whereas Malawi and Swaziland have the highest percentage of arable land (20 percent and 10 percent respectively), Namibia and Botswana have the least (0.08 percent and 2.3 percent respectively). Zimbabwe, Tanzania and Malawi have the largest percentage area of forest and woodland (62 percent, 48 percent and 48 percent respectively). Most countries have considerable areas of land that are neither arable nor forested; these range and wildlands have great importance for livestock production, wildlife and conservation.

The water systems of the region comprise eight major drainage systems (the Ruvuma, the Zambezi, the Limpopo, the Sabi, the Komati, the Orange (Senqu), the Kunene and the Okavango rivers); and some of the largest lakes on the African continent (Lake Malawi, spanning the territories of Malawi, Mozambique and Tanzania; Lake Benguela in Zambia and parts of Lake Tanganyika and Victoria) and thousands of man-made reservoirs (amongst which the largest are Lake Kariba and Lake Cabora-Bassa on the Zambezi river).

The responsible use of these land and water resources is the foundation for any development of the region. Conservation of the soil and its fertility is a sine qua non for increased agricultural production and food security. The water resources are vital for consumption and energy-generation for urban and industrial development, and also have great potential for protein production from fisheries. In addition, their potential as a tourist attraction has not yet been fully realized.

Plant Resources

Forest, woodland, savanna and grassland cover more than 60 percent of the region, of which approximately 0.25 million square kilometers have been set aside specially for forestry purposes. By 1981, about 7800 square kilometers of commercial plantations and woodlots had been established for saw-timber, pulpwood and fuelwood. Forest resources provide a wide range of goods and services including saw-logs, pulpwood, fuelwood, poles, wood-based panels, fodder, edible fruits, medicines, honey, beeswax and protection for the land resource. The natural forest resources are often over-exploited, and are generally declining in quality and quantity. The per capita consumption of fuelwood in the region is amongst the highest in the world; deforestation, with consequent erosion of topsoil and decertification, is becoming a common feature; and insufficient attention is being given to re-afforestation. Intra-regional trade in forest products is negligible, and many manufactured wood products are imported.

Grasslands

Grasslands support grasses that are important for grazing, house-thatching, soil and water conservation, and aesthetics; and wild herbs and shrubs, some of which are invaluable medicinally and as indigenous vegetables. Over-grazing, burning and over-exploitation are severely degrading grasslands and some species are threatened with extinction. A SADCC Regional Gene Bank for plant genetic resources has been established in Lusaka, Zambia, to conserve plant genetic resources. The Gene Bank provides support to national plant genetic resource centers being established in each of the ten member states.

Fish Resources

Almost 16 percent of the SADCC region (0.9 million square kilometers) is natural lakes, swamps, rivers, man-made lakes and dams. This is a very important freshwater fish resource. The region also has more than 5000 kilometers of coastline, supporting an even more important marine fish resource. Total fish production in the SADCC region is about 832,000 metric tones per annum, of which about 38 percent originates from marine
Table 2: Fisheries Catches  
(metric tonnes)

<table>
<thead>
<tr>
<th></th>
<th>Marine</th>
<th>Artisanal</th>
<th>Industrial</th>
<th>Total</th>
<th>Inland</th>
<th>Total Catches</th>
<th>Aquaculture</th>
<th>% of AgGDP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Angola</td>
<td></td>
<td>11,735</td>
<td>61,604</td>
<td>73,339</td>
<td>8,000</td>
<td>81,339</td>
<td>2</td>
<td>4.0</td>
</tr>
<tr>
<td>Botswana</td>
<td></td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1,900</td>
<td>1,900</td>
<td>n/a</td>
<td>19.0</td>
</tr>
<tr>
<td>Lesotho</td>
<td></td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>16</td>
<td>16</td>
<td>26</td>
<td>neg.</td>
</tr>
<tr>
<td>Malawi</td>
<td></td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>72,852</td>
<td>72,852</td>
<td>83</td>
<td>2.0</td>
</tr>
<tr>
<td>Mozambique</td>
<td></td>
<td>19,719</td>
<td>14,876</td>
<td>34,595</td>
<td>767</td>
<td>342,700</td>
<td>390,475</td>
<td>32</td>
</tr>
<tr>
<td>Namibia</td>
<td></td>
<td>n/a</td>
<td>n/a</td>
<td>164,158</td>
<td>50</td>
<td>164,208</td>
<td>8</td>
<td>17.0</td>
</tr>
<tr>
<td>Swaziland</td>
<td></td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>neg.</td>
</tr>
<tr>
<td>Tanzania</td>
<td></td>
<td>40,609</td>
<td>7,166</td>
<td>47,775</td>
<td>342,700</td>
<td>342,700</td>
<td>390,475</td>
<td>32</td>
</tr>
<tr>
<td>Zambia</td>
<td></td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>68,189</td>
<td>68,189</td>
<td>695</td>
<td>5.2</td>
</tr>
<tr>
<td>Zimbabwe</td>
<td></td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>17,500</td>
<td>17,500</td>
<td>1,752</td>
<td>3.0</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td><strong>72,063</strong></td>
<td><strong>83,646</strong></td>
<td><strong>319,867</strong></td>
<td><strong>511,975</strong></td>
<td><strong>831,842</strong></td>
<td><strong>2,603</strong></td>
<td></td>
</tr>
</tbody>
</table>


Fisheries and 62 percent from inland fisheries and aquaculture (Table 2). Although fish constitutes one of the most important animal protein sources and provides cash income to rural people, none of the SADCC member states has a well-developed fisheries industry based on sound management of the resource. Lack of trained manpower, equipment and funds, poor handling and transport facilities, and inadequate research services are the major constraints to a fuller exploitation of the region's fisheries potential.

**Wildlife Resources**

The region's wildlife is exceptionally diverse. Of Africa's 84 species of larger herbivores, for example, more than half are found in the region. Many species have direct economic value; others have scientific, medical or ritual significance. All wild animals are dependant upon specific habitats, and wildlife resources are therefore best seen in terms of the bio-geographical zones and plant resources. In particular, the more arid savanna zone contains very important populations of game animals well-adapted to the often agriculturally marginal environment. But in many areas, large indigenous herbivores have been and are still being replaced by less well-adapted non-indigenous cattle. In this process, game is often seen as competing with cattle and threatening the livestock industry with disease. The detrimental effects of cattle ranching on marginal lands, such as land degradation and decertification, are ignored.

However, most of the semi-arid savanna woodlands of Angola, Mozambique, Tanzania, Zambia and Zimbabwe and the arid thorn-bush steppe of Botswana still support significant game populations. Subsistence hunting still furnishes most of the animal protein for the rural population. A recent study in eastern Zambia showed greater contributions to household income from this source than from livestock production.
### Table 3: Wildlife Conservation Areas  
(thousand hectares)

<table>
<thead>
<tr>
<th>Country</th>
<th>Total Land Area</th>
<th>National Parks</th>
<th>Other Conservation Areas</th>
<th>Total Land Area under Conservation</th>
<th>Percentage of Total Land Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>Angola</td>
<td>124,670</td>
<td>5,466</td>
<td>2,765</td>
<td>8,231</td>
<td>6.6</td>
</tr>
<tr>
<td>Botswana</td>
<td>58,173</td>
<td>5,737</td>
<td>6,197</td>
<td>11,934</td>
<td>20.5</td>
</tr>
<tr>
<td>Lesotho</td>
<td>3,035</td>
<td>7</td>
<td>0</td>
<td>7</td>
<td>0.2</td>
</tr>
<tr>
<td>Malawi</td>
<td>11,848</td>
<td>698</td>
<td>369</td>
<td>1,067</td>
<td>9.0</td>
</tr>
<tr>
<td>Mozambique</td>
<td>80,159</td>
<td>1,590</td>
<td>3,810</td>
<td>5,400</td>
<td>6.7</td>
</tr>
<tr>
<td>Namibia</td>
<td>84,429</td>
<td>n/a</td>
<td>n/a</td>
<td>10,133</td>
<td>12.0</td>
</tr>
<tr>
<td>Swaziland</td>
<td>1,736</td>
<td>0</td>
<td>54</td>
<td>54</td>
<td>3.1</td>
</tr>
<tr>
<td>Tanzania</td>
<td>94,509</td>
<td>3,752</td>
<td>9,709</td>
<td>13,461</td>
<td>14.1</td>
</tr>
<tr>
<td>Zambia</td>
<td>75,261</td>
<td>6,369</td>
<td>16,049</td>
<td>22,418</td>
<td>29.8</td>
</tr>
<tr>
<td>Zimbabwe</td>
<td>39,058</td>
<td>2,700</td>
<td>2,290</td>
<td>4,990</td>
<td>12.8</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>572,878</strong></td>
<td><strong>26,319</strong></td>
<td><strong>41,243</strong></td>
<td><strong>77,695</strong></td>
<td><strong>11.5</strong></td>
</tr>
</tbody>
</table>


As increased demand for wildlife products leads to higher prices and subsistence hunting is being replaced by unlawful commercial poaching. Unless exploitation of the wildlife resource is controlled, it is likely to be destroyed within the next few decades. Apart from its importance for human nutrition, wildlife is the backbone of the region's tourism industry and a rich potential source of foreign exchange. Table 3 shows that about 12 percent of the region's land area is set aside as National Parks or equivalent reserves. Wildlife-based tourism is of particular economic importance as the percentage of total area set aside for wildlife conservation demonstrate: Zambia—29.8 percent, Botswana—20.5 percent, Tanzania—14.1 percent, Zimbabwe—12.8 percent, Namibia—12 percent, and Malawi—9 percent.

Many of the conservation areas of the region — like the Serengeti steppe and Ngorongoro Crater in Tanzania, Lake Malawi, the Luangwa Valley in Zambia, the Gorongosa area in Mozambique and the Okavango Delta in Botswana — are not only of economic importance, through tourism, but have been designated by the UNESCO Convention on World Cultural and Natural Heritage as sites of great scientific and educational value for the world.

**Agro-climatic Potential**

The wide diversity of agro-climates — ranging from dry deserts to humid forests and from tropical coastal plains to temperate highlands — provide the base for varied agricultural production patterns. The agro-climatic potential sets the pattern of land use and prospects for agriculture. It also influences public and private decisions that can, in turn, affect agricultural growth. Past policies have resulted in large numbers of resource-poor smallholders practicing subsistence agriculture on the less productive lands of the region. This poses many difficulties for the development of sustainable agriculture. Regional research agendas must take account of the differences in
agro-climatic potential in developing technologies for different farming groups.

Land Potential

The total land area with potential for crop production is estimated at 190 million hectares, of which only 25 million hectares is currently cultivated. Cropping potential is limited by the low and unreliable rainfall, and by the inherently infertile, fragile and acidic soils. An estimated 13 million hectares have potential for irrigated cropping but less than 5 million hectares are now being so used. Nearly 8 million hectares of the land under forests are planted to commercial plantations, but further production of forestry products is constrained by transport difficulties and the lack of profitable outlets. Land classification has been carried out in several of the SADCC member states (Botswana, Lesotho, Malawi, Swaziland, Tanzania, Zambia and Zimbabwe), the countries being sub-divided into zones of agricultural potential according to effective annual rainfall and the probability of dry periods during the growing season. For example, Zimbabwe's 39 million hectares of land have been classified into five "natural regions." Intensive rainfed crop and livestock farming is possible in less than 2 percent of the total area, semi-intensive in about 34 percent of the area and semi-extensive (more extensive livestock systems and drought-resistant crops) in 38 percent while 26 percent of the total area is low altitude with low and erratic rainfall. A portion of the latter is used for irrigated farming.

The land-use pattern in the communally-owned areas of most member states is determined not by the natural region and inherent land potential but by the population land-pressure. The agricultural potential is currently greatly under-exploited. Full exploitation will necessitate intensified land-use through both soil and water conservation and radical changes in the structure of the agricultural sector.

Land-Use

Land-use in the SADCC countries is predictably as heterogeneous as the variability in climate, soil types, population density and input intensity of the farming sector. Malawi is at one extreme of the range with many agro-climatic zones and comparatively good rainfall and soils. But, with one of the highest rural population intensities in Sub-Saharan Africa (74 persons per square kilometer), little more of its potential cultivable land can be opened to cropping without investment in either irrigation or erosion protection. At the other extreme is Namibia with agricultural potential constrained by low and variable rainfall and infertile soil with less than 1 percent of its total land area under permanent cultivation.

While an estimated 30 percent of the total regional land area has potential for crop cultivation, only 4.3 percent was being so used in 1986 with nearly 90 percent of that planted to cereal and non-cereal staple foodcrops. The implications of this diversity in land use for the research agenda are clear; technologies must be developed for many different situations and target groups, such as land-saving technologies for Malawi and profitable small-scale irrigation technologies for the drought-prone countries of Botswana, Lesotho and Namibia. There is also much regional diversity in the land tenure arrangements under which land is held, used, transferred, ceded to, or inherited. Land tenure and land-use policy issues (including grazing rights) will be of increasing strategic importance in the next twenty years as the need for agricultural intensification increases and as unused land becomes scarce. Technical, economic and social conditions shape a diversity of farming production systems with combinations of cropping and livestock systems ranging from extensive range through small subsistence farms to large capital-intensive commercial farms in private or public ownership.

Agricultural Production and Productivity

Foodcrops

Agricultural production is dominated by foodcrop production (Table 4). Although the region attained a net surplus of 1.43 million metric tones maize equivalent in staple food production during the 1989/90 marketing year, productivity (Table 4) was extremely variable with the resource-rich farmers in the more
favored agro-ecological zones registering almost ten times the yield of maize per hectare as the smallholders in the drier and less fertile areas.

Because maize is the preferred cereal staple for most people, some farmers in the drier areas are now switching from sorghum to maize. Average maize yields range from about 2,000 kg/ha in the surplus countries (Zimbabwe, Tanzania and Zambia), through approximately 1,000 kg/ha for the intermediate group (Malawi, Swaziland and Lesotho), to under 500 kg/ha for the deficit group (Angola, Botswana and Mozambique). Research yields in the surplus countries are usually 6-7,000 kg/ha while the best commercial farmers in Zimbabwe averaged 4,350 kg/ha in the period 1980-85. The productivity of wheat grown under irrigation on large commercial farms in Zambia, Swaziland and Zimbabwe (average 4,529 kg/ha) is comparatively high as is that for rice (average 5,417 kg/ha) grown by resource-rich farmers in Swaziland and Zimbabwe. In contrast, in the same year, average wheat yields on smallholder farms were 988 kg/ha and rice yields were 1,259 kg/ha. Research has to develop a stream of technologies that will enable resource-poor smallholders to progressively increase the intensity of their production within acceptable risk limits.

Export crops

The production and yields of the principal export crops (Table 5) are highly variable between both countries and producing sectors (i.e. large-scale commercial and smallholder). For example, the average seed cotton yields range between 544 kg/ha in Tanzania to 1053 kg/ha in Zimbabwe. The comparatively higher average yields of Zimbabwe are a reflection of the provision to growers of a reliable supply of essential production inputs together with the maintenance of a well-directed research and extension service. Zimbabwe effectively refocussed its plant breeding program on cotton to meet the requirements of both new spinning technologies and market quality requirements. By contrast, Tanzania’s cotton production has been adversely affected by a lack of continuity in research, by the unreliability of input supplies and by adverse price and marketing policies. Similar lessons can be drawn from the other principal export crops, such as tea, coffee and tobacco. Again, an urgent review of the research and extension agenda is indicated.
Table 4: Cereal Crop Production and Productivity, 1989

<table>
<thead>
<tr>
<th>Production (000 mt)</th>
<th>Maize</th>
<th>Sorghum</th>
<th>Millet</th>
<th>Rice</th>
<th>Wheat</th>
<th>Barley</th>
</tr>
</thead>
<tbody>
<tr>
<td>Angola</td>
<td>204</td>
<td>63</td>
<td>18</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Botswana</td>
<td>4</td>
<td>50</td>
<td>2</td>
<td>-</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Lesotho</td>
<td>75</td>
<td>28</td>
<td>-</td>
<td>-</td>
<td>19</td>
<td>1</td>
</tr>
<tr>
<td>Malawi</td>
<td>1,510</td>
<td>20</td>
<td>11</td>
<td>46</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>Mozambique</td>
<td>330</td>
<td>145</td>
<td>1</td>
<td>55</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Namibia</td>
<td>16</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Swaziland</td>
<td>135</td>
<td>2</td>
<td>-</td>
<td>3</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Tanzania</td>
<td>3,159</td>
<td>503</td>
<td>300</td>
<td>570</td>
<td>96</td>
<td>5</td>
</tr>
<tr>
<td>Zambia</td>
<td>1,861</td>
<td>37</td>
<td>26</td>
<td>13</td>
<td>47</td>
<td>2</td>
</tr>
<tr>
<td>Zimbabwe</td>
<td>1,931</td>
<td>81</td>
<td>141</td>
<td>1</td>
<td>274</td>
<td>30</td>
</tr>
<tr>
<td>Total</td>
<td>9,225</td>
<td>866</td>
<td>544</td>
<td>706</td>
<td>452</td>
<td>38</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Productivity (kg/ha)</th>
<th>Maize</th>
<th>Sorghum</th>
<th>Millet</th>
<th>Rice</th>
<th>Wheat</th>
<th>Barley</th>
</tr>
</thead>
<tbody>
<tr>
<td>Angola</td>
<td>291</td>
<td>n/a</td>
<td>630</td>
<td>1,000</td>
<td>800</td>
<td>-</td>
</tr>
<tr>
<td>Botswana</td>
<td>308</td>
<td>333</td>
<td>200</td>
<td>-</td>
<td>5,000</td>
<td>-</td>
</tr>
<tr>
<td>Lesotho</td>
<td>750</td>
<td>560</td>
<td>-</td>
<td>-</td>
<td>633</td>
<td>n/a</td>
</tr>
<tr>
<td>Malawi</td>
<td>1,188</td>
<td>672</td>
<td>624</td>
<td>1,787</td>
<td>670</td>
<td>-</td>
</tr>
<tr>
<td>Mozambique</td>
<td>550</td>
<td>725</td>
<td>250</td>
<td>786</td>
<td>1,250</td>
<td>-</td>
</tr>
<tr>
<td>Namibia</td>
<td>480</td>
<td>480</td>
<td>506</td>
<td>-</td>
<td>1,000</td>
<td>-</td>
</tr>
<tr>
<td>Swaziland</td>
<td>1,688</td>
<td>800</td>
<td>-</td>
<td>7,500</td>
<td>3,250</td>
<td>-</td>
</tr>
<tr>
<td>Tanzania</td>
<td>1,755</td>
<td>979</td>
<td>1,000</td>
<td>1,683</td>
<td>1,574</td>
<td>n/a</td>
</tr>
<tr>
<td>Zambia</td>
<td>2,303</td>
<td>822</td>
<td>675</td>
<td>1,039</td>
<td>4,857</td>
<td>n/a</td>
</tr>
<tr>
<td>Zimbabwe</td>
<td>1,612</td>
<td>492</td>
<td>479</td>
<td>3,333</td>
<td>5,480</td>
<td>n/a</td>
</tr>
<tr>
<td>Average</td>
<td>1,093</td>
<td>651</td>
<td>546</td>
<td>2,447</td>
<td>2,451</td>
<td></td>
</tr>
</tbody>
</table>

Sources: Various, including FAO and World Bank Agricultural Sector Survey Reports.
### Table 5: Export Crop Production and Productivity, 1989

<table>
<thead>
<tr>
<th>Seed Cotton (metric tonnes)</th>
<th>Tobacco (all types)</th>
<th>Tree Nuts (metric tonnes)</th>
<th>Coffee (metric tonnes)</th>
<th>Tea (metric tonnes)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Angola</td>
<td>12,000</td>
<td>3,900</td>
<td>1,200</td>
<td>15,000</td>
</tr>
<tr>
<td>Botswana</td>
<td>3,000</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Lesotho</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Malawi</td>
<td>29,388</td>
<td>86,615</td>
<td>225</td>
<td>6,807</td>
</tr>
<tr>
<td>Mozambique</td>
<td>30,200</td>
<td>2,900</td>
<td>45,000</td>
<td>8,000</td>
</tr>
<tr>
<td>Namibia</td>
<td>142</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Swaziland</td>
<td>30,000</td>
<td>300</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Tanzania</td>
<td>105,880</td>
<td>15,055</td>
<td>22,000</td>
<td>52,000</td>
</tr>
<tr>
<td>Zambia</td>
<td>27,780</td>
<td>4,300</td>
<td>-</td>
<td>1,000</td>
</tr>
<tr>
<td>Zimbabwe</td>
<td>186,546</td>
<td>135,205</td>
<td>some</td>
<td>14,000</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Productivity (kg/ha)</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Angola</td>
<td>1,152</td>
<td>987</td>
<td>?</td>
<td>?</td>
</tr>
<tr>
<td>Botswana</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Lesotho</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Malawi</td>
<td>580</td>
<td>965</td>
<td>1,198</td>
<td>1,016</td>
</tr>
<tr>
<td>Mozambique</td>
<td>474</td>
<td>1,074</td>
<td>?</td>
<td>714</td>
</tr>
<tr>
<td>Namibia</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Swaziland</td>
<td>1,333</td>
<td>?</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Tanzania</td>
<td>409</td>
<td>708</td>
<td>537</td>
<td>465</td>
</tr>
<tr>
<td>Zambia</td>
<td>178</td>
<td>1,229</td>
<td>-</td>
<td>945</td>
</tr>
<tr>
<td>Zimbabwe</td>
<td>813</td>
<td>2,233</td>
<td>?</td>
<td>1,158</td>
</tr>
</tbody>
</table>

Sources: Various, including FAO, USDA, World Bank, and national data from individual countries.

### Livestock

In 1988, almost 20 percent of the cattle and 10 percent of the sheep and goats in Sub-Saharan Africa (Table 6) were in the SADCC region. Traditional extensive systems of livestock management continue to be the norm but some intensification is occurring. Ranching and stall feeder fattening is found in a number of countries and milk production is expanding through crossbreeding, particularly in Zimbabwe and Malawi. Poultry production is expanding. Sheep and goats remain relatively neglected except in Lesotho, Namibia and Zimbabwe. Productivity data is unreliable, but generally speaking, productivity per animal remains very low and has substantial potential for profitable improvement.
<table>
<thead>
<tr>
<th>Country</th>
<th>All Cattle</th>
<th>Milking Cows</th>
<th>Sheep</th>
<th>Goats</th>
</tr>
</thead>
<tbody>
<tr>
<td>Angola</td>
<td>4,400</td>
<td>n/a</td>
<td>n/a</td>
<td>2,000</td>
</tr>
<tr>
<td>Botswana</td>
<td>2,350</td>
<td>290</td>
<td>220</td>
<td>1,100</td>
</tr>
<tr>
<td>Lesotho</td>
<td>525</td>
<td>80</td>
<td>1,440</td>
<td>1,130</td>
</tr>
<tr>
<td>Malawi</td>
<td>1,000</td>
<td>95</td>
<td>210</td>
<td>950</td>
</tr>
<tr>
<td>Mozambique</td>
<td>1,360</td>
<td>390</td>
<td>119</td>
<td>375</td>
</tr>
<tr>
<td>Namibia</td>
<td>2,050</td>
<td>169</td>
<td>6,400</td>
<td>2,500</td>
</tr>
<tr>
<td>Swaziland</td>
<td>650</td>
<td>153</td>
<td>35</td>
<td>320</td>
</tr>
<tr>
<td>Tanzania</td>
<td>13,500</td>
<td>2,800</td>
<td>4,700</td>
<td>6,600</td>
</tr>
<tr>
<td>Zambia</td>
<td>2,685</td>
<td>270</td>
<td>80</td>
<td>420</td>
</tr>
<tr>
<td>Zimbabwe</td>
<td>5,700</td>
<td>143</td>
<td>580</td>
<td>1,650</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>34,220</strong></td>
<td><strong>4,390</strong></td>
<td><strong>13,784</strong></td>
<td><strong>17,045</strong></td>
</tr>
</tbody>
</table>

*Source: FAO Production Yearbook, 1989.*

**Demography**

Population growth forecasts for the SADCC region (Table 7) indicate that during the next twenty years, thereby the population will practically double from 84.35 million in 1990 to 155.55 million in 2010 despite an expected slowing in the growth rate from 3.02 percent (1990) to 2.41 percent (2010). But, although the rural population is expected to decrease in percentage terms from 70.35 percent (1990) to 57.39 percent (2010), the rural population intensity per hectare of cultivable land will be higher. The statistics indicate an increasing population: land intensity from the current regional average of 2.95 ha/caput to 2.14 ha/caput in 2010. The urban population is expected to increase from nearly 20 million (1990) to about 66 million in the next twenty years, thereby increasing considerably the urban demand for food. The structure of the population in a number of SADCC countries (particularly Lesotho and Swaziland) is affected by the many males who seek employment in South Africa. The high proportion of women-headed households demands special efforts by the national research and extension services to develop appropriate messages for crop and livestock husbandry.

These population forecasts take no account of the expected morbidity and mortality caused by AIDS which is endemic in many parts of Sub-Saharan Africa. Some forecasts predict no increment in population from the year 2005, while others predict that the population growth rates may be only marginally less than now forecast. The development pattern of AIDS across countries is very heterogeneous. Moreover, the disease is particularly likely to affect the economically active sector of the work force (i.e. the age cohort between 15 and 64 years). The result will be a rise in the dependency ratio - the ratio of the old and the young relative to workers in the more productive age group. A decrease in the agricultural labor force is possible as rural people are drawn into the urban area to fill vacancies.
Table 7: Demographic Indicators, 1990 - 2010

<table>
<thead>
<tr>
<th>Country</th>
<th>Population ('000s)</th>
<th>Growth Rate (%)</th>
<th>Rural (%)</th>
<th>Density (per sq.km.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Angola</td>
<td>10,013</td>
<td>18,060</td>
<td>2.84</td>
<td>2.70</td>
</tr>
<tr>
<td>Botswana</td>
<td>1,212</td>
<td>1,824</td>
<td>2.28</td>
<td>1.49</td>
</tr>
<tr>
<td>Lesotho</td>
<td>1,765</td>
<td>2,827</td>
<td>2.57</td>
<td>1.92</td>
</tr>
<tr>
<td>Malawi</td>
<td>8,699</td>
<td>17,168</td>
<td>3.45</td>
<td>3.17</td>
</tr>
<tr>
<td>Mozambique</td>
<td>15,861</td>
<td>28,849</td>
<td>3.17</td>
<td>2.61</td>
</tr>
<tr>
<td>Namibia</td>
<td>1,345</td>
<td>2,327</td>
<td>2.95</td>
<td>2.25</td>
</tr>
<tr>
<td>Swaziland</td>
<td>790</td>
<td>1,443</td>
<td>3.16</td>
<td>2.52</td>
</tr>
<tr>
<td>Tanzania</td>
<td>26,674</td>
<td>51,364</td>
<td>3.39</td>
<td>2.89</td>
</tr>
<tr>
<td>Zambia</td>
<td>8,066</td>
<td>15,710</td>
<td>3.47</td>
<td>2.95</td>
</tr>
<tr>
<td>Zimbabwe</td>
<td>9,925</td>
<td>15,976</td>
<td>2.88</td>
<td>1.63</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>84,350</strong></td>
<td><strong>155,548</strong></td>
<td><strong>3.02</strong></td>
<td><strong>2.41</strong></td>
</tr>
</tbody>
</table>

Note: no attempt has been made to incorporate mortality due to AIDS in these forecasts.


Regional Food Situation in SADCC

The aggregate output of major staples in the SADCC region (excluding Namibia) was estimated at 16.36 million (1988/89), 15.55 million (1989/90) and 18.5 million metric tones (1990/91) maize equivalent (ME). The 1990/91 harvest was theoretically 8 percent above the aggregate food requirements of 17.15 million metric tones ME. But, the widespread and devastating drought throughout the region in 1991/92, which has created the need for considerable emergency imports of food, underscores the current fragility of food security.

Only Tanzania, Zambia and Zimbabwe achieve staple food surpluses in average rainfall years. The other six countries usually import food, either on a commercial basis or as food aid. The production in Angola and Mozambique is still adversely affected by civil unrest. These two countries needed respectively 565,000 and 479,000 metric tones ME in commercial or food aid imports in the 1990/91 marketing season.

The import needs of all deficit countries combined in 1990/91 amounted to 1.38 million metric tones ME while the surpluses of the other three countries combined amounted to 2.73 million metric tones ME. Wheat and maize represent 69 percent of the region's staple food import needs. Since no SADCC country has a wheat surplus for export, 531,000 metric tones of wheat had to be secured from outside the region.

Trade in Agricultural Products

The SADCC member states wish to expand intra-regional trade to increase food security. The level of recorded intra-SADCC official trade is only 4-5 percent. Constraints on
expanded intra-region agricultural trade include: food and agricultural pricing policies; shortages and official rationing of foreign exchange; overvalued exchange rates; state monopolies on trading; bureaucratic red tape; and established trading patterns with former colonial powers.

While SADCC has successfully enlisted international support for a number of regional undertakings (transport and communication sector projects, triangular food aid shipments within the region, etc.), it has not yet addressed national level policy issues that impede regional trade. The widespread presence of consumer subsidies and pan-seasonal and pan-territorial prices prevent both the private sector and parastatal bodies from engaging in profit-generating trade. Official price structures for food staples such as maize do not currently allow for trade expansion without increased financial losses for parastatals that are already operating at substantial deficits. Such trade is not sustainable if source country governments consistently lose money in the form of export subsidies and importing country governments lose money through consumer subsidies. Pricing policies will have to be changed before maize trade can become remunerative.

Over-valued exchange rates greatly impede intra-regional trade and are among the most difficult constraints to overcome. Further, certain SADCC currencies are over-valued with respect to one another.

Information from a survey of agricultural trading firms in five SADCC countries revealed that transaction costs are higher for intra-regional trade than for trade with the rest of the world. Cumbersome regulations, a paucity of market information, unreliable transportation, complicated payments procedures, and lack of confidence in the willingness of SADCC governments to facilitate trade were reported as significant barriers to regional trade.

Perhaps most important, yield-enhancing and cost-saving technologies must be developed and adopted to assure that intra-SADCC agricultural trade becomes more competitive with extra-regional import sources in the long run. There will only be truly sustainable gains from trade if SADCC consumers are allowed to benefit from lower food prices while producers simultaneously earn adequate margins to maintain profitability.

The Preferential Trade Area for Eastern and Southern African States (PTA) (another regional organization with eight of the ten SADCC members among its eighteen country signatories) is attempting to promote cooperation in trade, agriculture, customs, monetary matters, transport and communications among its member states. The goal of PTA is the eventual creation of the Eastern and Southern African Common Market by the year 1992, and an African Common Market and an Economic Community by the year 2000.

Agricultural Growth Prospects

A preliminary assessment of the potential prospects and constraints (technical, economic, trade, land, people, etc.) that are likely to influence agricultural growth in the SADCC region during the next twenty years, indicates that the following commodities or sub-sectors merit special attention:

1. Food Commodities. Given the forecast for increased urbanization and evolving consumption patterns, the task force feels that in addition to the research on traditional cereal staples, such as maize, more research on wheat (Annex 1), rice, potatoes (Irish), oilseeds, fruits and vegetables, dairy and poultry may be desirable. However, much will depend on the comparative advantage of the region in the production of one or more of these crops. Following the initial intensification of research input through SACCAR/IARC programs, the task force considers that NARS research supported by appropriate technical back-stopping from the IARCs and regional networks on maize, sorghum, millet and grain legumes should be sufficient to provide the required appropriate technology. The potential for significant increases in intra-regional trade in basic foodstuffs is considered slight in the medium term.

2. Traditional Commercial Crops. The main commercial crops grown in the region are tobacco (several types), cotton, maize, wheat, tea, coffee, groundnuts, pyrethrum, cashew nuts and other horticultural crops. Feedback from
the region and a number of recent studies indicate that the region has comparative advantage in several of these crops, e.g. cotton, tobacco, maize, wheat and selected horticultural crops.

3. **High-value crops.** There is an increasing need and potential for crop diversification on smallholdings in the intensively-populated high-potential agricultural areas of the region. There is strong domestic market demand for oilseeds and possible export demand for certain essential oil crops. Some international market demand would appear to exist for non-traditional export crops, including macadamia nuts, spices (turmeric, cardamom, etc.) and horticultural commodities. In addition, the market demand for cashew nuts is satisfactory. Intensified research programs on these commodities will be essential if potential growth prospects are to be realized.

4. **Production input/factor research.** SADCC’s agricultural performance is still highly dependant on weather conditions with most of the farmed area being rainfed. The region has enormous irrigation potential, and research into irrigation technology in the various agroecological zones could be expected to have a high return. Unfortunately, the current capacity for irrigation research in the region is limited. Fertilizer response curves for the different crops need to be identified, with appropriate fertilizer recommendations being subsequently diffused to different client groups of the farming community. Adoption of yield-improving technologies is often constrained by labor bottlenecks in agricultural systems that are predominantly manual, and returns on investments in research on agricultural tools and farm implements can therefore be expected to be high.

5. **Exploitation of the natural resources of the arid and marginal areas.** A number of initiatives have already been started in the region (Annex 2) with community management of both non-consumptive and consumptive exploitation of a few of the many wildlife protection areas (Table 3). It is considered that protection of these agriculturally marginal and fragile areas through expansion of the initiatives now under way in Botswana, Zambia, and Zimbabwe to other countries and protected areas will offer considerable potential for increased foreign exchange earnings, rural employment and greater food security. These programs would involve management of game and the associated tourist trade; non-destructive exploitation of wild honey, silkmoths, mushrooms, etc.; development of rural industries based on game products etc. complemented by participative adaptive research and extension programs on foodcrops for the arid areas. In this connection, commercial exploitation of the wild Silkmoth has commenced in Botswana and Zimbabwe, and a spinning mill has been established by the private sector in Botswana. The responsible and productive development of these areas will require a well-directed multi-disciplinary regional research program.

6. **Livestock.** The internal demand for livestock products, particularly meat and milk, will continue to expand. The beef export market which is now served by Botswana, Namibia, Swaziland and Zimbabwe is unlikely to offer much scope for further expansion. The region has been generally self-sufficient in meat, but milk imports are increasing. Maintaining meat self-sufficiency in some countries will require intensifying systems of production, particularly if growth in the economy takes place. The SADCC region has good potential to both ensure self-sufficiency and to meet these market opportunities. Beef will continue to be important, but supplies of meat from small ruminants, pigs and poultry offer good opportunities for expansion. Smallholder milk production has great potential and need (as shown in Malawi). Livestock offers significant diversification opportunities that can increase incomes of smallholders and offer new processing possibilities in rural and urban areas. Increased research effort will be needed in animal health (particularly on diseases associated with intensification), and in feeding and management systems. Breeding techniques will also play an important role.
Ten major rail transport corridors connect the SADCC countries to the main ports of Dar-es-Salaam, Nacala, Beira, Maputo, Durban, Port Elizabeth and Lobito (Map 2). In 1988/89, these corridors carried an estimated 6.8 million metric tones of international transit traffic to and from the land-locked states plus about 3 million metric tones of domestic traffic. Past operating problems have impeded import/export flows and caused considerable economic losses to some member states. Malawi, for example has experienced cumulative losses of over US$75 million due to the payment of additional transport charges. The total annual capacity of the major SADCC rail corridors is about 62 million metric tones. Rail is the dominant form of corridor transport for longer distance freight. Internal transport corridors both within and between countries are often in poor condition due to limited maintenance. The efficiency of the agricultural sector is highly dependant on low cost and efficient road and rail transport for the carriage of both production inputs and outputs.

National Agricultural Policies in the SADCC Region

SADCC member states have agreed to adopt the following policies in respect of their agricultural sectors:
1. Pursue policies to increase staple food production and reduce imports.
2. Recognize that both small- and large-scale farmers have an essential role to play in national agricultural production.
3. Implement policies, including price policy reform, aimed at increasing agricultural production, and seek to increase the role of private enterprise, especially in agro-industry and marketing.
4. Implement policies aimed at attracting local and foreign investment for agriculture.
5. Give high priority to strengthening agricultural institutions, particularly extension, research, marketing, credit and input supply.
6. Seek to develop their scientific, technological and manpower capabilities in order to shift to a science-based agriculture.

The regional strategy is designed to reinforce the capacity of member states to feed their people, to provide productive employment, to reduce food dependence on international sources and to enhance the capacity of the agricultural sector to speed up the economic transformation of SADCC’s economies. Four long-term problems will need special focus:
1. Food production-population imbalance
2. Lack of jobs in rural areas
3. Poverty, malnutrition and household food insecurity, and
4. Environmental degradation.

SACCAR and the Agricultural Research and Training Sector

The overall objective of the regional strategy for the sector is the strengthening of NARSs of member states so that they have a capacity to plan, manage, monitor and evaluate location-specific research that can generate technologies to improve the productivity of agriculture. SACCAR is also concerned with professional human resource development for the food, agriculture and natural resources sector. SACCAR’s initial portfolio consisted of projects that were designed to achieve household, national and regional food security through developing food and cash crops that would increase farm incomes and provide a basis for agro-industry, job creation and export earnings. In addition to these project activities, SACCAR provides research and travel grants to regional scientists, regularly publishes a newsletter and is assisting Zimbabwe with the printing of the SADCC/Zimbabwe Journal of Agricultural Research.

National Agricultural Research Systems (NARSs) in the SADCC Region

Each SADCC member state has a NARS, the size and complexity varying considerably from country to country. The base of each
NARS is the government research service conducting research into agricultural (crop and livestock), forestry, fisheries and wildlife problems. Public sector research in Angola, Mozambique and Namibia is currently comparatively small; it is much stronger in Malawi, Tanzania, Zambia and Zimbabwe. The scientists in the university system are generally well-qualified for research but their efforts are normally directed at topics of personal interest and are constrained by severe limitations of both time and recurrent resources. The greater participation of the universities in the national agricultural research agenda is an important objective of the Framework.

All member states, except Namibia, now have agricultural faculties. Malawi has producer-financed research foundations for tobacco and tea; Zimbabwe for tobacco, pigs and tea (share in the Malawi institute); while the commercial sugar cane companies (Malawi, Mozambique, Swaziland, Tanzania, Zambia and Zimbabwe) finance their own research programs. Plant breeding and selection of annual crops is undertaken by national and international commercial seed companies in Malawi, Zambia and Zimbabwe. In Zimbabwe, the Agricultural Research Trust (ART) financed by the commercial farmers has established a research farm. The Commercial Farmers Bureau (CFB) of Zambia is proposing to set up a similar research farm. The major agricultural countries in SADCC have various permutations of National or Agricultural Research Councils that are concerned with coordination of research efforts (usually only in crops and livestock). The mandates, membership, financing arrangements and levels of activity vary greatly from one country to another. Further pluralism is added to the research effort in some countries by such charitable foundations as the Rockefeller Foundation. SADCC is thus fortunate in having a multiplicity of actors who complement one another in the research sub-sector.

Three of the SADCC countries (Malawi, Tanzania and Zambia) have developed masterplans and prioritized their research agendas. Zimbabwe, Botswana and Lesotho have now reviewed their national research systems, assisted by ISNAR. The other SADCC countries are also engaged in this review and prioritization process. The total number of professional scientists in SADCC was about 1250 in 1989.6

In addition to the core funding provided by donors to the IARCs for undertaking agricultural research, considerable resources have been invested by donor organizations in direct support of agricultural research networks (at present there are about 40) and activities in the SADCC region, as well as through research carried out in the universities and research institutions of donor countries for the benefit of the region. As the future regional strategy is developed, it is important that the national masterplans take into account all of the research activities now being funded by different donors and implemented by the public, university and private sectors.

The retention and continuity levels of professionals in the public sector departments of agricultural research is low and a general malaise of low morale and lack of motivation is also widespread. Amongst the many reasons for this serious situation is the poor state of the "enabling environment" in which the scientists work - particularly as compared to their peers working in either the private sector research foundations/institutes or in commercial firms or in the universities. The unreliability and insufficiency of operating expenses for a satisfactory and full program of work, the comparatively low salaries and unavailability of non-salary benefits, the generally poor quality of personnel management and spasmodic opportunities for regular job-related in-service training inter alia contribute to the current lack of interest amongst many of the public sector scientists.

International Agricultural Research Centers (IARCs)

The IARCs have been active in eastern and southern Africa since the early 1970s. Initial activities were on a bilateral basis until the CGIAR adopted a regional mode of organization in the mid-1970s. Since the advent of SADCC, the IARCs have gradually reorganized their
programs in congruence with the new political grouping. Most of the activities under CIAT, CIMMYT, ICRISAT and IITA have been or are being consolidated within SACCAR's regional program. These IARCs act as Executing Agencies for SACCAR projects in their relevant areas of expertise. The SACCAR program in research management training is executed by ISNAR. ICRAF, which moved into location-specific research through their Agroforestry Research Network for Africa (AFRENA) in 1987, plan and implement their network under the SACCAR regional umbrella.
3. The Problem and the Challenge

The Problem

Each member state of SADCC has a National Agricultural Research System (NARS) that is supported to varying degrees by the international (IARCs) and regional (SACCAR) research systems and by many active research networks. Available statistics indicate that the number of trained scientists and the total research budget (national plus external contributions) have increased markedly during the past decade in most SADCC member countries. The figures on the average research expenditure per scientist for countries in the region (and Africa generally) compare favorably with those in Asia and Latin America. However, although the output of African NARSs generally compares unfavorably with their counterparts elsewhere in terms of quality, quantity and productivity, there have been several success stories (see Boxes 3 to 8). Why have the NARSs in Africa not performed better?

Box 3: Zimbabwe
The development of the dent hybrid maize variety, SR52, followed a long sustained breeding program by a small group of breeders between 1932 and 1960. The variety eventually released was so suited to the needs of farmers that its subsequent wide-scale adoption in the region required no special extension program. Yields achieved by commercial farmers were amongst the highest in the world.

Box 4: Tea
The development of vegetative propagation techniques for tea by the research team at the Tea Research Foundation (TRF), based in Malawi, made possible the rapid multiplication and distribution of selected high yielding clonal material with good processing characteristics for the region. This, together with other innovations, has put the TRF in the forefront of international tea research.

Before going to the reasons or causes for the lackluster performance of African NARSs, it should be pointed out that the statistics on the funding of African agricultural research do not tell the whole story. The statistics have been part of the problem. They can and have been used to present a particular point of view or even, at times, to obfuscate. The general malaise in the NARSs has several root causes, chief of which is the low priority accorded by national governments to agricultural research. This has been exacerbated by the debt crisis that has beset many governments in the region. One inevitable result is the lack of sustainable funding for agricultural research by national governments, which on average provide about a third of the total reported agricultural research expenditure in Africa. Two-thirds of the aggregate expenditure is outside the control or purview of African governments. These funds are used by the IARCs for their operations in Africa and for the implementation
of donor-funded programs/projects - a large part of which is in the form of technical assistance (TA). The chronic uncertainty of funding from national sources along with the conflicting priorities, stringent conditionalities and short lending horizons of external donors have created a work environment for national scientists that is antithetical to productive and high-quality scientific research.

The main source of the region's agricultural growth has come from crop production. Despite their latent potential, the other NR sub-sectors in the SADCC region (i.e. livestock, fisheries, forestry and wildlife) have so far played a subordinate role. This is because government policies, and funding, have consistently favored rainfed crop development, particularly maize. As an example, Zambia's record 20 percent increase in agricultural production in 1988 was propelled by a real 90 percent growth in maize production. Given the region's self-sufficiency in maize for human and livestock consumption in a normal year and limited export prospects for maize, more attention should now be directed to the region's well-endowed natural resources. These can provide considerable potential for future economic growth through commodity diversification. Supportive government policies and services are needed to encourage their profitable development.

For sustainable agricultural growth in the region, some necessary preconditions are that the technologies made available to the farming community fit their needs and that priority is given to the development of appropriate land-use technologies. The research agenda must be demand-driven—not the demand of someone outside the production sector (perhaps a donor) but the demand of the producers and their market. Africa needs results from its agricultural research service that will fuel and sustain an accelerated growth rate of agricultural production and utilization. In other words, the focus should increasingly be on research and development (R&D) rather than research per se. Research has been defined as "original investigation directed to the discovery of new scientific knowledge," while development is defined as "technical activity concerned with non-routine problems encountered in translating research findings into products and processes." Regular in-service training of national scientists, both by scientists from within and outside the region, must become an integral part of the research agenda. This will enable national scientists to regularly upgrade their skills and knowledge base.

A sine qua non for addressing the problems of low productivity and sustainability in the region's NR sector must be the development of SADCC's human capital in science and technology. While there has been a significant increase in the numbers of professional agricultural research staff during the past ten years, little has been done to provide incentives and to make the work environment more conducive to the application of their skills and the production of appropriate technology. It should be said unequivocally that while most SADCC scientists are as competent and motivated to carry out a research function as anybody else in the world, the environment in which they now work does not encourage productive or creative work. The obstacles that they face, apart from low salaries include insufficiency and discontinuity of (a) non-salary recurrent budgets; (b) reliable library and

**Box 5: Cotton**

There have been a number of advances in cotton technology that have enabled the farmers and the industry of several member states to maintain their comparative advantage. The development of pest scouting routines has minimized the need for pesticide use to the benefit of both the producers and the environment. The recent cotton breeding program in Zimbabwe has led to the development of high-yielding varieties with fiber characteristics suited to the new spinning technologies used by the cotton industry.
Box 6: Tobacco
Private sector research funded by the tobacco industries of Zimbabwe, Malawi and Zambia have enabled these SADCC member states to maintain their comparative advantage in the production of flue-cured and burley tobacco. This has involved the development of both appropriate varieties and cultural and curing practices.

information services; (c) clear career paths and incentives; and, (d) experienced and effective research management.

Research is a long-term endeavor. It takes time before returns are realized and therefore research does not usually feature high on the "pecking order" for increased budget allocations. Also, many governments are obliged to provide employment to all graduating nationals with the inevitable result of even smaller proportions of already limited budgets being available for non-salary recurrent costs. In general, donors are quite willing to fund capital improvements, external training and expatriate technical assistance but are reluctant, sometimes prohibited, from providing funds for operating (recurrent) costs unless these are incremental. Hence, while the structure, system and national research team gets larger, there is no corresponding increase in recurrent resources. The result is a further reduction of already meager operating funds per scientist. The large number and high cost of expatriate scientists in the region has not generally been cost-effective. Their presence has probably delayed the training and enhancement of the national human resource base. New (incremental) research activities tend to be adequately financed, albeit for shorter than desirable periods, but the core of the on-going research program (the principal food and export crops and livestock) is frequently underfunded. In some countries, up to 90 percent of the recurrent cost budget is absorbed by salaries leaving only 10 percent for operating expenses and maintenance. Experience now suggests that the budget allocation should, in fact, be of the order of 35 percent for salaries, 55 percent for operating expenses and 10 percent for maintenance of the research structure.

Experienced, efficient and motivated management is critical to a productive and healthy NARS. Unfortunately, few research managers can devote enough time to run their institution and manage its research program. Much of their time is now taken up in attending to the requirements of government and donors (in respect of finance, recruitment, priorities and conditionalities) and meeting visitors. While some donors and IARCs have provided NARSs with opportunities for training in research management, they have not helped to create a work environment where the managers can put into practice the skills they have just learnt. Since funds are scarce and will likely continue to be so, management must be given all assistance to do a good job. Unless the work environment for high-echelon research managerial positions such as the Director of Agricultural Research is improved, there is little prospect of reversing the trend of research directors taking early retirement or resigning before they have built any effective leadership.

Can the unsatisfactory output of the NARSs be attributed to the possibility that their research program priorities may have been the wrong ones? This will become clearer when Research Masterplans that outline priorities for research are developed for all the SADCC member states. These plans are usually prepared by government research services.

Box 7: Malawi
The breeding and selection of the groundnut variety, Chalimbana, enabled smallholder farmers to gain a significant market share of the confectionery groundnut market in the United Kingdom. A regional SACCAR program, being executed by an ICRISAT team based in Malawi, is building on this foundation.
under conditionalities from donors (most notably the World Bank). Since not all the donors necessarily agree with the priorities established in these master plans, they frequently establish and fund their own pet projects and priorities. This has led to the present dispersed and piecemeal effort in support of NARSs - with usually insufficient operating finance to maintain and sustain the non-externally funded program.

There is apparently little or no culture of accountability built into the public research service. This may account for the fact that commercial agricultural producers prefer to deal with the private sector. Professional or peer review of research work is now rarely undertaken in the public sector. There is presently little motivation and incentive for scientists to do rigorous and useful work since they will receive neither recognition nor reward for their work. It can be fairly said that the absence of regular monitoring and evaluation procedures with key indicators may have contributed to the current malaise of the public research services.

Some of the countries in the region now possess the necessary research "hardware", i.e. infrastructure, buildings and equipment, to pursue an active research program. In fact, some countries now face an embarrassment of riches, with many more research stations and associated laboratory equipment, research farms and their equipment, vehicles, etc. than they can satisfactorily maintain. As a result, the capital resource of the research system is being steadily depleted. Farm operations and experiments are often delayed or carried out inefficiently. Scientific staff are unable to keep abreast of new advances.

An effective library retrieval and information service is essential for good research. Such a service is indispensable to scientists who wish to publish their research results in an internationally refereed journal. The opportunity to publish in such journals provides an important incentive for quality work and enables national scientists to earn international recognition in their professional disciplines. In most countries, however, the availability of journals and abstract series are now in a parlous state. While the introduction of CD-ROM technology has made bibliographic information more accessible, the system will remain inadequate unless national scientists can be provided with full texts of the documents that they need. Apart from bibliographic databases, project databases of on-going and planned agricultural research programs/projects are needed. Access to computerized project information databases (e.g. the SIS and CARIS) will enable the research scientist, research management and government to keep abreast of what research is currently being undertaken or planned.

The present annual growth rate of agricultural production in the SADCC region does not provide an acceptable level of food security, let alone a sufficient margin for agro-based industrialization. While the mean calorific and protein intake per capita for all the SADCC countries, except Mozambique, appears to meet sufficiency standards, its distribution amongst income groups, and between gender and age groups within the household is inequitable. Food security is also adversely affected by the lack of purchasing power and access to land. In most of the SADCC member states, growth in agriculture will have to reach and be sustained at a level of at least 4 percent a year.

Sustained production will require continuing to accord high priority to the conservation of soil (structure and fertility), water, forests, grasslands, wildlife and fisheries. While three of the SADCC member states have now developed masterplans for their public agricultural research programs, these have largely excluded the private sector and NGO initiatives in the NR sector. Some SADCC member states (particularly Malawi, Swaziland, Zambia and Zimbabwe) have encouraged the development of private sector research that has provided substantial benefits to their cash crop producers. A more pluralistic approach in other commodities and in other countries could pay handsome dividends. Realization of the potential of the diverse natural resources sector of the SADCC region will require both more direct involvement of the private sector, more efficient research and extension systems and market-oriented government policies.

There is, presently, little capacity for policy analysis in the agricultural research sub-sector in most SADCC countries. The development
of such a capability within each member state to provide government with sound advice on policy issues relating to pricing, marketing, trade and utilization and the policy implications of new agricultural technologies is needed to promote both national and regional agricultural growth. Upstream linkages between the research system and the finance and planning ministries are currently weak. Downstream linkages between research with the extension service and farmers have improved, but these need to be institutionalized.

While weakening commodity prices, inimical government policies, foreign exchange difficulties and adverse weather patterns have continued and will continue to influence the agricultural growth rates of individual member states, there are other major variables that will need redressing before the potential for accelerated agricultural growth in SADCC can be fully realized. These include:
1. Civil unrest and insecurity in Angola and Mozambique.
2. National and regional policies that adversely affect the terms of trade for the agricultural sector.
3. National and regional policies that limit the development of intra-regional trade.
4. Public research and extension services that fail to fully respond to the felt needs and circumstances of their farm clientele.

5. The absence of South Africa in the overall economic development of the southern African region.

The Challenge

A key priority for SADCC member governments and their cooperating partners must be the development of a conducive work environment for all research personnel, including national scientists, support staff and their managers in order to restore morale, infuse enthusiasm and instill a sense of mission in their work. It is critical for the success of NARSs that they have effective research leaders; a major challenge for this initiative will be the provision of enabling conditions for leadership to develop and flourish. Such a work environment will encourage them to make fuller use of their training and skills. However, this is a long-term venture requiring the full support and cooperation of all the parties involved (national, regional and international).

Any strategy for the future development of the agricultural research systems of the SADCC member states must involve the various research actors (the private sector, private foundations, the international agricultural research system, the regional agricultural research system (SACCAR), universities, agricultural parastatals and the government research service) around a National Research Masterplan. Such a plan must focus on priorities that will promote the growth and conservation of natural resources. It must detail the roles of the different players over the short- (less than 5 years), medium- (5-15 years) and long-term (15 years and beyond). It must identify the comparative advantage of each national research system in the overall economic development of the SADCC region. It must specify the role and responsibilities of SACCAR in strengthening the national agricultural research systems (NARSs). It must clarify and detail the support required from the international agricultural research system, particularly the IARCs, in strengthening the NARSs. It must assist with the strengthening of external scientific linkages. It must have a mechanism to sustain the human and financial

---

Box 8: Intensive Livestock Production

Research scientists in the SADCC region, borrowing ideas from East Africa, developed the technology during the 1960s for stall-feeding of dairy cows and beef cattle. The technology involved the construction of simple sheds from local materials and the use of farm residues and by-products for feeding. This technology enabled farmers in the peri-urban intensively-populated areas to service the urban demand for livestock products while increasing their farm incomes and improving their soil fertility through incorporation of high-quality farmyard manure.
resources of the various research systems over the long-term. It must provide SADCC scientists with the opportunities and incentives to enhance the quality of their research. It must progressively diminish the need for external technical assistance. It must have procedures for strengthening and sustaining upstream and downstream linkages.

The strategy will attempt to incorporate pertinent lessons from the successful agricultural and demographic transition in East and Southeast Asia. These will include:

(a) removing the bias in the terms of trade against agriculture in favor of the urban areas; (b) optimal exploitation of foreign linkages; (c) gearing production to market requirements, both in terms of cost and quality; (d) development of efficient means of using foreign technology; (e) development of a strong R & D program — both by borrowing and creating; (f) fostering private sector development; and, (g) government's role in providing a conducive and stable market-oriented economic environment.
4. **Framework for Action**

**Introduction**

The centerpiece of the Framework is the strengthening of the NARSs in SADCC so as to provide the technology necessary to realize the region's potential for agricultural growth. The task force believes that the focus for the Framework, at this stage, must be on the research software (Box 8). The research hardware (buildings and infrastructure) is no longer the principal limiting factor for improved technology output in the region, but the research software (the scientists and their work environment) needs priority support. In other words, the focus of the framework is people, both those who create the technology (scientists) and the ultimate beneficiaries (producers and consumers). The task force is of the opinion that strengthening the research software will resuscitate the NARSs without the need for other radical reforms.

The proposed Framework for Action is built around six major elements, each of which is closely interlinked and can be expected to reinforce one another. The elements involve both the institution of research and its substance. However, the SACCAR/SPAAR task force believes that unless the major institutional components of the work environment for agricultural research, referred to as the software for research, is addressed, no research program of action for the region can be expected to be fully effective or sustainable. The development and eventual implementation of the proposed Framework for Action will be a major long-term undertaking. The full commitment and cooperation of all parties involved (governments, donors, IARCs and the private sector organizations) in this venture is critical to the reinvigoration of the NR research effort in SADCC.

The principal objective of the Framework is to strengthen the National Agricultural Research Systems (NARSs) of the SADCC member states. SACCAR is a regional organization established by SADCC to strengthen the NARSs of member states. SACCAR has responsibility for coordination but not for direct implementation of regional research. The SACCAR/SPAAR task force is not proposing that a superstructure of regional research institutions be established. Instead, it advocates that regional research activities be interwoven into and thus reinforce the work of the NARSs. This does not imply that there is no role for specialized regional research institutions, such as the Tea Research Foundation of Central Africa based in Malawi, which now provides research services to the tea producers in Malawi, Zimbabwe and Zambia and is proposing to extend its membership to two other SADCC tea producers, Mozambique and Tanzania. The task force considers that there could be justification for supporting or even establishing specific specialized regional research institutions, when this has the concurrence of the NARSs and where it is deemed to be beneficial to the region as a

---

**Box 9: Research Software**

As used by the Task Force, software refers to all elements of the research environment (including the scientists, recurrent resources for carrying out research work, salaries and non-salary benefits, management, information services, training, etc.) that drives the hardware (buildings, infrastructure, equipment, etc.) of the research institution to produce the output demanded by the clients (agricultural producers and consumers).
whole. SACCAR has the responsibility to assist the NARSs in identifying research areas where they have comparative advantage to undertake work on behalf of other NARSs in the region. SACCAR will continue to assist the NARSs with intensifying ongoing or starting up new research activities. It may enlist the assistance of the IARCs, other international and donor agencies in fulfilling its responsibilities. When the existing SACCAR regional programs that are currently being executed by the IARCs and/or donor agencies on behalf of SACCAR are devolved to the NARSs, SACCAR will help to sustain them through appropriate networking arrangements, organization of workshops, provision of in-service training, information exchange, etc.

The development of this Framework has essentially been carried out from the bottom-up. The main elements proposed for this Framework first emerged from the views expressed by senior representatives of the NARSs on their priorities and concerns; by the representatives of the IARC executing agencies; by donor representatives; and, by experienced scientists from the SADCC region during a Workshop held in Botswana in November, 1990. These elements were then developed by the task force through a process of consultation in the region with both individual scientists and donor representatives. This process was complemented by extensive reviews of a wide range of pertinent reports and studies on the region.

Elements of the Proposed Framework for Action

The elements of the proposed Framework for Action in agricultural research will provide the research software and address critical gaps in agricultural research in the region. It will require the cooperation of the SADCC member states and the donor members of SPAAR in concert with the IARCs and private sector research institutions to put the following six interactive elements in place:

1. National Research Strategies (Masterplans) developed and maintained up-to-date by each SADCC member state, complemented by a Regional Research Plan. Program pooling, by governments with their cooperating partners, will help to ensure the adequacy of funding for vigorous national and regional research on agreed research priorities. Supervision of research outputs, together with regular updating of the masterplans and supporting finance, will be managed by the respective member states with their cooperating partners. Regional research could be funded by the NARSs from their national research funds. The assurance of sufficient and stable funding for agreed programs through a consolidated funding mechanism will be a key component in improving the work environment for SADCC scientists and research managers.

2. A capacity for policy analysis will be developed within each NARS to provide government with policy advice that will be supportive of advances in technology and so contribute to the development of an enabling environment for agricultural producers. The development of national policy analysis units will be supported through regional networking within the member states and assisted by twinning with appropriate overseas institutes.

3. The institutional base of the NARSs will be broadened to encourage the involvement of all interested organizations in the formulation and implementation of national/regional agricultural research programs. A pluralistic approach to agricultural research will be promoted to draw on the relative strengths of the public and private sectors, including the universities, the NGOs, the private foundations and the producers. This collaboration can be expected to lead to a symbiotic relationship between the public and private sectors in the development of appropriate science and technology for the region.

4. The quality of science and technology in the region will be improved by strengthening selected technical teams and their external scientific linkages. This will assist SADCC scientists to establish leadership in selected scientific fields. The Framework will also encourage the academic staff of the universities to increasingly participate in national research programs.

5. Research on existing commodities will be intensified through the use of improved technologies supported by regional lead centers and research networks. Diversification into commodities with agro-ecological and market
potential will be facilitated through research and networking.

6. The rural poor in the arid and marginal areas of the region will be assisted, thereby improving equity, through extending support for wildlife management and utilization programs to all appropriate areas of the region; by means of on-farm participative research and extension programs, and through the exploitation of biotechnology (Annex 3).

Future growth of the AgGDP and the economy of each member state will be stimulated by having these elements in place along with supportive government policies.

**Detailed Features of the Framework for Action**

This section contains open-ended ideas and suggestions, culled from a variety of sources, on how the elements of the Framework for Action may be implemented.

**Research Fund**

Is it necessary to establish a research fund or consolidated funding mechanism for each NARS? The lack and discontinuity of recurrent resources for agricultural research inhibits the timely and full implementation of the research program. The current piecemeal and ad hoc financing of projects by donor agencies adversely affects the integrity of the national program. Moreover, since donor funding usually only covers capital and incremental recurrent costs, the implementation of the program is often seriously compromised. For these and other reasons, the task force purposes that the recurrent costs of implementing the national research masterplan be provided through the pooling of national and donor support behind that plan. It also recommends that government should establish, together with all interested donors, a national research masterplan together with, where feasible, an associated funding mechanism. ISNAR should continue to assist the NARSs with development and updating of their national research masterplans. Further, the task force suggests that regional research programs under SACCAR could be funded from contributions drawn from the individual member states, until such time as the regional programs become regional lead centers (when the programs are devolved to the host NARSs).

Should this funding mechanism cover the cost of staff salaries as well as operating expenses? Should it include funds for non-salary benefits and rewards for scientists? Should it include funds that can be used for contracting out research to the universities and to the private sector? Should the size of the pool be calculated on the basis of the number of scientists in the government research service multiplied by a coefficient (notionally US$15,000 per scientist) plus an additional amount for contract research? How should recurrent costs for agricultural research be considered by donors? Is it reasonable to treat all costs associated with a long-term investment such as research as investment costs—at least for a longer time-horizon than now observed by most donors? There is agreement that the pooling of resources would provide benefits all round. Provision of resources could be either "restricted" or "unrestricted" for specific parts or components of a program. Neither governments nor donors can be expected to provide the full capital endowments required by each Fund to yield an annual income stream sufficient to meet the recurrent cost needs of the public sector research program. Perhaps a system of rolling pledges similar to that used by the CGIAR in obtaining core budget funding for the IARCs may be appropriate. There would have to be a commitment by all parties (government and donor agencies) not to deviate from the agreed pooled program of activities. To ensure that the funding mechanism meets the particular needs of each country, it will be necessary to customize it.

The mechanics and governance of funding such a pooled program will need to be agreed to and worked out by all parties involved. However, it is certain that each consolidated funding mechanism will have to be governed by a Board of Trustees representing the different stakeholders. The Board of Trustees will be responsible for ensuring that funding is sufficient to support an agreed national research masterplan and that proper accounting procedures are observed. Supervision of the research activities will have to be a coordinated affair, government being responsible for the
organization of regular meetings of the Board of Trustees.

Effective monitoring systems are essential to the credibility and efficiency of the proposed national research masterplans and their associated funding. In each country, the monitoring system should perform three functions:

1. Accountability for the allocation and use of funds.
2. Good management within each program, and coordination across programs (adjustment of implementation schedules, methodologies, and plans).
3. Together with the findings of selected evaluations, contribute to good management and forward planning of the national masterplan (identification of future programs and strategy choices).

Evaluations would preferably be undertaken under contractual agreements with universities and private socio-economic research organizations, in cooperation with the appropriate government oversight agencies and the Board of Trustees.

A detailed description of accounting, monitoring, and evaluation systems, including clear identification of responsibilities for implementation, utilization and oversight should be a conditionality for the approval of research funding. Within this Framework, each program proposal should include a detailed description of key indicators, monitoring mechanisms, accounting, and evaluation plans. Implementation of a monitoring system would normally be the responsibility of the senior manager for the program, under the purview of the Board of Trustees. During each supervision mission, the team will evaluate the results of the monitoring systems. Regular audits of the funding would be undertaken each year by independent auditors, acceptable to the Board of Trustees.

**Enabling Environment**

What is meant by the enabling environment? It refers to more than the work place and the resources (technical, human and financial) required by scientists to do their work. It includes, for want of a better word, research ambience: a pleasant and stimulating work environment and a package of incentives to motivate scientists to give of their best by using their skills and training to the fullest extent possible. It is not sufficient to merely initiate programs to increase the supply and improve the quality of trained personnel. The enabling environment within which the scientists work, and the incentives to remain with the organization rather than seek employment elsewhere, are critical. The present low morale, low output and poor retention of staff in the public sector particularly reflect the insufficiency and unreliability of operating expenses for research, lack of clear career paths supported by experienced personnel management and clear personnel policies. Continuity of assured resources (both human and financial) is essential over relatively long periods (15 years and beyond) if targeted research results are to be achieved. The present lack of continuity in program direction (priorities), qualified program research staff and operating expenses has severely constrained the effectiveness of the scientific human resource in the SADCC region. The task force considers that the establishment of consolidated programming and funding mechanisms by each member state for its research effort will go a long way towards improving the enabling environment for scientists and consequently their research output.

**Policy Analysis**

A capacity for policy analysis is needed in each country to assist government in setting sound market-oriented policies (production, pricing, marketing, processing, utilization and trade) for the agricultural sector, that will both enable and encourage investment in crop and livestock productivity or quality improvements. Here the concern is to foster the development of an enabling environment for the agricultural producer. Is there a need to provide each NARS with a capacity for policy analysis or should this be the responsibility of the Ministry of Agriculture or of the national Economic Planning Unit? Given that there are currently few experienced policy analysts in the region, is there justification for the establishment of a regional Policy Research facility? If so, can
this be linked with the multi-donor African Capacity Building Foundation (ACBF)? What is the future role for twinning with external universities or research institutions in order to speed up the development of this capacity (e.g. University of Zimbabwe/Michigan State University)? Is there a role for IFPRI? How should ISNAR best contribute to the building of this capacity?

Privatization of Research

It was the view of several country participants at the Gaborone Workshop that some of the research currently undertaken by the public sector could be usefully devolved to the private sector. Why privatization? Because it can complement the work of the public sector, as demonstrated in practice both within and without the SADCC region (e.g. tea, tobacco and seeds). It provides opportunities to spread the cost, the tasks, the risks and the responsibilities beyond the public sector research service. Organizations that are directly financed and therefore driven by their clients (the farming community) are usually more responsive and accountable. This can have a demonstration effect on the public sector. Each sector has its own area of comparative strength or advantage. The public sector, by virtue of its mandate, is better equipped to deal with broad societal concerns such as environmental protection, the provision of technology for staple food crops and for resource-poor farmers. The public sector must also provide certain control functions, e.g. plant importation and quarantine and registration of new plant varieties which the private sector cannot legitimately provide. The private sector, being more driven by the profit motive, is primarily concerned with developing technology in those areas where it can establish and retain property rights (examples are hybrid seeds and tea clones) or which result in increased product sales (fertilizer, plant protection chemicals).

A private sector can operate efficiently only if it works within the environment of a well-functioning market system, which provides price signals that accurately reflect the social costs and benefits of production. If the market environment is highly distorted - in the sense that there are great discrepancies between social and financial costs or benefits due to monopolies, monopsonies, externalities, or government intervention - the private sector is likely to be inefficient. The existence of a sizable and strong private sector is not sufficient to ensure efficient development. It also requires that the market environment in which the private sector works be improved, so that those activities already carried out in the private sector may be done more efficiently.

To facilitate the development of a pluralistic research system, it will be important for governments to improve the political and economic climate (a stable macro-economic environment, moral suasion, tax incentives, repatriation of dividends, work permits, etc.) to encourage the development of private sector initiatives. In this regard, donor agencies may be able to assist governments in identifying external partners and help develop external scientific linkages (twinning, etc). Encouragement should also be given to charitable foundations to contribute to the national research plan.

Enhancing the Quality of Science and Technology

The Framework would enable scientists in the university system to increasingly undertake research in furtherance of the National Masterplan. It can be expected that this will strengthen the region's scientific capacity as both research output and training quality improves. Specifically, the region is expected to develop a capacity in biotechnology led by the Crop Science Department of the University of Zimbabwe. While biotechnology can be expected to provide benefits for all crop and livestock producers, the region will be supported in developing a specific biotechnology agenda for resource-poor farmers. It can be expected that biotechnology can assist with the more rapid development of virus-resistant crop varieties and their rapid multiplication by tissue culture. In the longer term, improvements might be achieved in rhizobial fixation of nitrogen by legume crops and by the development of some disease resistance. The task force, therefore, recommends that a capacity for research in
biotechnology for resource-poor farmers be developed within the NARSs of the SADCC region. The region could benefit in at least two ways. First, smallholders in the marginal areas would be able to increase their production at minimum risk and second, a scientific capacity with a unique agenda would be established in the region. The capacity of the NARSs would be strengthened through both regional networking and twinning arrangements with appropriate external institutions (including the Free University of Amsterdam and ISNAR).

Intensification and Diversification of Agriculture

SADCC has a very diversified agricultural sector, but due to the disenabling environment resulting from inequitable government policies and weak agricultural support services, it has failed to maintain its comparative advantage and therefore realize its production potential. The capacity of the NARSs to provide appropriate technology for the intensification and diversification of agriculture will be enhanced through the proposed regional research effort.

Research on the principal foodcrops of the region (maize, sorghum, millet and grain legumes) are now being supported by SACCAR/IARC programs centered in different member states. These concentrated research efforts, led by the IARCs, which are yielding valuable results, will be progressively devolved to the NARSs with future regional support coming from appropriate networking and information exchange arrangements, workshops etc. under the auspices of SACCAR. In its second-generation projects, SACCAR, with the assistance of the IARCs, is expected to assist the NARSs with building their research capacities in wheat, rice, potatoes (Irish), oilseeds, fruit and vegetables, dairy and poultry. With effective agricultural services (research, extension, input supplies and marketing), increasing urbanization and supportive government policies, the agricultural growth rate can be expected to exceed the rate of population growth.

The regional research program will include support for those NARSs with capacity to contribute to the greater diversification of the commodity base into high-value crops. To this end, discussions are now under way with the Tea Research Foundation for Central Africa, based in Malawi, to extend their mandate to other perennial tree crops (including cashew and macadamia nuts, and coffee) and their membership to all SADCC member states. SACCAR will also be seeking to establish joint ventures (e.g. perhaps with Australia for the further development of the young macadamia nut industries in Malawi, Swaziland, Tanzania, Zambia and Zimbabwe) with external companies. This will ensure that experience gained elsewhere is rapidly transferred into the region and that the final product meets market requirements.

The intensification of SADCC's agriculture will depend increasingly upon the effective use of production inputs including fertilizers, farm implements and irrigation. Currently, the human resource capacity in SADCC in these fields is weak. To enhance this capacity, SACCAR will need to develop appropriate external linkages that will help strengthen the capacity for factor research through networking arrangements, workshops and in-service training, etc.

The task force recommends that SACCAR commission "State of the Art" reviews of world-class technologies used in the production of those commodities/factors that can accelerate growth in the agricultural sector.

Exploitation of Natural Resources

The arid and marginal areas of the SADCC region are extensive and, for many reasons, pose considerable problems for increased agricultural output (Annex 2). Although technology has been developed and is constantly being improved for the main foodcrops (sorghum, millet, maize and cowpea), smallholders in these areas often cannot afford to take the financial risks to adopt the improved technologies, partly on account of the absence of other non-farm sources of income. Wildlife is an important economic resource in SADCC that offers opportunities for increasing employment and income. Management of the wildlife in these marginal areas, involving community participation, will help to protect the environment and bio-
diversity. Encouraging new developments in Botswana, Zambia and Zimbabwe, which have been built around the active involvement of the local rural communities, can provide a sound basis for future utilization of these areas.

The regional research program will encourage the non-consumptive exploitation of SADCC's valuable natural resources. SACCAR has prepared a research project to support the further development of the Gonometia silkmoths in the wild mopane woodlands. To assist the member states in their exploitation of other natural resources, such as wildlife, the task force recommends that SACCAR seeks the financial support of external organizations, such as NGOs and donor agencies.
5. The Long-Term Strategy

Introduction

This chapter will attempt to define the roles and responsibilities of the major players involved, directly or indirectly, in the agricultural research activities of the region. Since the Framework will require time to evolve, the roles, commitments and governance of the different organizations will be outlined over the short- (less than 5 years), medium- (5-15 years) and long-term (20 years and beyond). Before doing so it may be useful to re-capitulate what is meant by a NARS. As defined here, a national agricultural research system (NARS) encompasses the entire spectrum of agricultural research activities undertaken within a country by a multiplicity of organizations, including the public sector research service in the different natural resources sectors, the universities (particularly the agricultural faculties), the international agricultural research centers, the regional agricultural research institutions, the parastatal organizations, the private sector (including producer-financed foundations and research groups/institutes) and charitable foundations.

Public Sector Research and Extension Services

The public sector research and extension services serve as the cornerstone of each NARS; they have the responsibility for providing a wide spectrum of services (basic, applied, adaptive, extension) to all components of the natural resources sector. The research service has the major responsibility for carrying out the country’s national agricultural research plan and for contributing to the realization of national production targets. The extension service has the responsibilities of both assisting research with the identification of field problems for solution and for the subsequent dissemination of the solutions to farmers. An effective process of technology generation and diffusion requires strong agricultural services and effective linkages between research and extension and their clients - the farming community. While it can be expected that the NARSs in the SADCC region will increasingly delegate responsibilities for some aspects of their research and extension programs to the private sector, the public sector will continue to retain the responsibility for providing technology for the resource-poor farmers, including women, and for the conservation of natural resources. In these tasks, the NARSs will require the support of SACCAR, the IARCs and of donor agencies. The overall coordination of the national research effort should be vested in the public sector research and extension services under the Ministry of Agriculture. These responsibilities will apply over the short-medium- and long-term.

The Universities

The capacity of the universities in the region for research is considerable, although they currently play a relatively minor role in the agricultural research effort. Their main task has been teaching with the production of increasing numbers of graduates ranking high on the political agenda. Resources (human and financial) have been insufficient to permit much research in the universities. The task force believes that SADCC must provide more opportunities for university staff to undertake research as part of the national program. The universities have comparative advantage in undertaking certain research tasks, many of which can involve the students.

Contract research (Annex 4) provides a promising vehicle for involving the universities in agricultural research; contracts are now being awarded and financed by the public
sector, by donors and the private sector. Contract research can provide a much needed source of funds for research in the universities and will help to link the universities more closely to the needs of the agricultural sector. It can also help to build national research capacity in the region.

The present skewed distribution of time between teaching and research (perhaps 95:5) should be progressively improved so that by the end of the short-term the ratio is 90:10, by the end of the medium-term it is 75:25 and in the long-term, 60:40. However, unless more money is available, this change may lead to a reduction in student numbers.

**Regional Agricultural Research and Training - SACCAR**

The SADCC member states committed themselves to share agricultural training and research facilities. In research, this would be based on a collaborative regional research system that is built on the strengths of each NARS. The regional effort would be a coordinated set of activities involving a number of NARSs. The technical output of these research activities would be used for the benefit of the region.

The stated objectives of SACCAR are:
1. To promote cooperation in agricultural research among the national agricultural research systems of the member states.
2. To facilitate the exchange of information among the national research systems.
3. To promote the development of the human resources necessary to operate the agricultural research systems.
4. To promote coordination of SADCC agricultural research activities.

The SADCC member states established SACCAR to carry out the following functions, as detailed in the Memorandum of Understanding:
1. Maintenance of up-to-date information on the agricultural research, training and extension resources in the SADCC region.
2. The promotion and/or publication of research materials.
3. The convening of workshops, seminars and meetings on topics of regional concern.
4. The promotion of training, both within and outside the research programs of the various national agricultural research systems, in consultation with the member state responsible for coordinating manpower.
5. The promotion of effective use of research agencies external to the SADCC countries.
6. The coordination of the work of donors in support of agricultural research and technology generation within the region.
7. Identification of regional research programs, negotiating their funding and appointing executing agencies. Control of such programs is vested in SACCAR, which is responsible for monitoring and reporting on their progress and direction to SADCC through the government of Botswana.

SACCAR will not engage in research *per se* except when it relates directly to its objectives.

The task force endorses these stated objectives and functions, but recommends that provisions be made for the establishment of mechanisms to gradually devolve SACCAR regional programs to the NARSs. SACCAR has a sizable and expanding portfolio of regional programs/projects. As the small size of its Secretariat may constrain the effective monitoring of this portfolio, care should be exercised in the selection of future programs. Priority should be given to only those activities that will have potential for strengthening the NARSs. A program for devolution needs to be agreed with the executing agencies of the regional programs. The task force considers that there will continue to be an important role for SACCAR over the long-term.

**International Agricultural Research Centers**

The CGIAR endorsed, during their Centers' Week in October 1990, the TAC review recommendations that the future responsibilities of the CGIAR should be: (a) germplasm; (b) natural resource management; (c) policy and management; and, (d) global information. For Africa, the CGIAR proposed to transform some of its global commodity centers to eco-regional centers which would be closely linked to the NARSs and regional systems. The eco-regional centers might be modelled on the IITA with a broadening of its
commodity mix; just as the research agenda of the ICRISAT Center at Niamey, Niger could be broadened to enable it to function as an eco-regional center for the semi-arid tropics.

The task force believes that the changes espoused by the CGIAR warrant careful examination in view of the overriding need in SADCC to strengthen the NARSs. It would seem that the IARCs can best contribute to the strengthening of the NARSs through the exchange of germplasm; provision of networking; information exchange; and in-service training - functions which are now effectively carried out by the existing global commodity centers.

The task force endorses the views of the SACCAR/Rockefeller Foundation/CGIAR Task Force on Africa Consultation, March, 1989. These were:

1. Introduction by the IARCs of budget line items for assistance to national programs based on the needs of the client (NARSs) rather than the desires of the IARC research teams.
2. That the IARCs should work on problems identified by and with the NARSs.
3. That IARC scientists should work in and with the NARSs.
4. That over the longer term, the major contribution of IARCs should be towards:

   - joint research and publication with national scientists
   - training and human resource development
   - supervision of higher degrees
   - documentation and information exchange
   - inculcating sound research management and experimental techniques
   - working with the NARSs in identifying and prioritizing research issues.

   All this would be in addition to basic research and the supply of germplasm appropriate to the needs of national and regional agricultural research and development.

The Private Sector

The private sector is already playing a relatively active and important role in the region. Most of the research on tobacco, tea and sugar cane; much of the research on improved crop varieties and some of the research on pineapples and pigs is now undertaken by the private sector in SADCC. The recent proposal by the Commercial Farmers Bureau (CFB) in Zambia to establish a Research Farm, similar to the Agricultural Research Trust research farm already operating effectively in Zimbabwe, is an indication of increasing private sector interest in carrying out agricultural research. There is potential for extending the role of the private sector into other commodities and products, particularly cotton, oilseeds, horticulture, tree nuts (cashew and macadamia), coffee, dairy and poultry, fertilizers and plant protection products. This will require government encouragement and supportive government policies. Macroeconomic conditions in a country influence the private sector through their effects on the production and investment climate.

Donors could assist governments with private sector development by identifying relevant external partners. The work of the private sector should be complementary to that of the public sector, provided that the latter is willing to delegate parts of the national research agenda to the private sector. At present, there is often wasteful duplication as the public sector attempts to retain "hands-on" responsibility for the whole of the national research program. Over time, one can anticipate that some of the private sector's dynamism and close linkage with its clients will be transferred to the public sector.
6. Regional Agricultural Research

Introduction

The SADCC Council of Ministers delegated responsibility for the regional coordination of agricultural research and training to the government of Botswana. Within the government, the Permanent Secretary in the Ministry of Agriculture is the responsible official. He has further delegated functional responsibility to the Chief Agricultural Economist. The Chairman of the Board of SACCAR is the Director of Agricultural Research, Botswana. SACCAR has responsibility for coordinating research in the Agriculture, Food and Natural Resources sector but is currently only involved with the coordination of agricultural research in crops and livestock. However, there is now a transition period during which SACCAR will progressively assume responsibility for the coordination of research in the other NR sub-sectors of fisheries, forestry and wildlife. It should be noted that the responsibility for training is closely coordinated with the government of Swaziland, which has the responsibility for the region's Human Resources Development.

This chapter can only provide a partial picture of regional activities in agricultural research in SADCC coordinated by SACCAR. It has drawn on the SPAAR Information System (SIS) for details of regional programs, projects, networks and small grants and the SACCAR Progress Report, 1990/91.

SACCAR, in conjunction with the executing agencies, is in the process of developing a devolution pattern for each of the current SACCAR programs. The information on regional and donor-funded activities in the SIS database indicates that there is duplication of effort and an evident need for rigorous review by both donors and governments to ensure greater rationalization in the future.

SACCAR Portfolio

The SACCAR portfolio (Box 10) contains ten programs including SACCAR itself. Funding is being sought for eight programs which have been fully developed and appraised. Funding is also being sought for the new program on professional training in the Food, Agriculture and Natural Resources sector. External reviews have already been carried out on six of the SACCAR projects. They are: Establishment of SACCAR; Phase I of the Land and Water Management Research Program; Agroforestry; Sorghum and Millet Improvement Program; Bean Improvement Project (component of the Grain Legume Improvement Program - GLIP); and In-Service Training in Research Management. In general, the results of the reviews have been positive.

The first full year of SACCAR commenced on April 1, 1985. A mid-term evaluation was carried out in August-September, 1988. The Review recommended, inter alia, that since SACCAR would not have used all the funds committed by the end of the first phase (1989/90), it should be extended until 1991/2 without additional financing. A review of Phase I was undertaken in July/August, 1991 with the review panel composed of one representative each from USAID, CIDA and four from SADCC. While SACCAR did not initiate many new activities during 1990/91 in order to ensure that available funds would be sufficient for 1991/92, it continued to undertake its core and coordinating functions during the period.
Box 10: SACCAR Portfolio

Current and Completed Programs

(a) Land and Water Management Research Program (L&WMP) - Phase I
(b) Land and Water Management Research Program (L&WMP) - Phase II
(c) Sorghum and Millet Improvement Program (SMIP) - Phase I
(d) Sorghum and Millet Improvement Program (SMIP) - Phase II
(e) Plant breeding in relation to the utilization of sorghum and millet for food, beverages and animal feeds - Phase I
(f) Grain Legume Improvement Program (GLIP) - Bean (Phaseolus vulgaris) project
(g) Grain Legume Improvement Program (GLIP) - SADCC Cowpea Project - Phase I
(h) Grain Legume Improvement Program (GLIP) - Groundnut (Arachis hypogaea) Project
(i) Establishment of the Southern African Center for Cooperation in Agricultural Research and Training (SACCAR) - Phase I
(j) In-service training in Research Management - Phase I
(k) Agro-forestry research program for the savanna woodland grassland ecology - Malawi, Tanzania, Zambia and Zimbabwe
(l) SADCC Crops and Forest Seeds Genebank (SRGB)
(m) SADCC Maize and Wheat Improvement Network
(n) Strengthening Faculties of Agriculture, Forestry and Veterinary Medicine in SADCC
(o) Program to develop Scientific and Technical Professional Manpower for Agriculture and Natural Resources in SADCC (REPSAF) - Part I

Proposed and Planned Programs

(a) Livestock improvement in SADCC
(b) Collaborative network of vegetable research and development in the SADCC region (CONVERDS)
(c) Network on Farm Power and Equipment for Smallholder and Large-scale Farming Systems in SADCC
(d) Biological Control of introduced pests of Maize and Cassava
(e) Wool and Mohair Improvement in SADCC - Phases I (market studies) and II
(f) Management of Black Cotton Soils (Vertisols) in SADCC
(g) Improvement of Research Station Development and Management in SADCC
(h) Research on the ecology and biology of Gonomete silkmoths in SADCC
1. Service functions (core): SACCAR provides the Secretariat for the SACCAR Board of Governors comprising the ten Directors of Agricultural Research, six Deans of the Faculties of Agriculture, Forestry and Veterinary Medicine and two representatives of the Directors of Agricultural Extension - a Board of 19 members including the Director of SACCAR as Secretary. The Board meets twice a year - in April and November. The November meeting is a joint meeting involving the Board, Team Leaders of Regional Research and Training projects and programs and donors. SACCAR, with USAID financial support, has undertaken an initial Agricultural Research Resource Assessment (ARRA) for nine SADCC member states. A similar study for Namibia was commissioned in 1990/91. It is proposed to update the ARRA data for all countries as soon as possible. SACCAR will also continue to undertake the following core activities:

- Award research grants (12 or more per annum)
- Award travel grants (15 or more per annum)
- Publish a newsletter (4 issues)
- Publish jointly with the Zimbabwe Department of Research and Specialist Services a SADCC/Zimbabwe Journal of Agricultural Research (2 issues)
- Organize at least four one-week workshops/seminars on subjects of regional concern
- Commission at least two studies on subjects of interest to the region.

2. Coordination functions: SACCAR works with its Board to identify, develop, approve and recommend for inclusion into the SADCC program of work the regional program in agricultural research and training. It is also responsible, on behalf of the government of Botswana, for overseeing regional agricultural research and training projects and programs.

3. Steering Committees: Steering Committees for regional programs/projects are an important management tool for SACCAR. These involve the NARSs in the planning, management and monitoring of regional programs. Most of the regional programs now have steering committees functioning on approved guidelines.

Projected Devolution of the SACCAR Portfolio

Since the overall objective for having regional research projects in the SADCC member states is the strengthening of the NARSs, it is important that regional research programs be located at the existing national research centers. This is to ensure that national scientists can work closely with their counterparts in the executing agencies (IARCs and/or donor agencies). This would also help to secure the complementarity of national and regional programs. It is important that initial planning of the medium- and long-term projects should include a responsible phased devolution possibly commencing during the inception of the second phase. The devolution chain agreed to by the Nordic donor group involves a gradual phasing out over a realistic time-frame of 20 years. The task force recommends that at the project preparation phase, a path of devolution should be an integral part of the project design. It is important that during the devolution phase, the executing agencies provide both scientific backstopping and funding to ensure a smooth transition.

If the NARSs were to assume some of the responsibilities from the SACCAR Executing Agencies, they could face funding problems. For example, the handing over of the Sorghum and Millet Program at Matopos and the Groundnut Improvement Project at Chitedze to Zimbabwe and Malawi, respectively, would put extra pressures on their national research budgets. It is evident from this that close coordination of all the many disparate research activities is required from the outset. The core institutional element of the proposed Framework, i.e. the establishment of the National Masterplans with supporting consolidated funding could help to address these and other potential funding and coordination problems.
Proposed Structure for Regional Research Networking in Maize, Wheat and Rice

Maize is the most important staple foodcrop in SADCC and the demand for wheat and rice is expected to increase significantly as the urban population of the region increases. The objective of establishing networks in maize, wheat and rice would be to facilitate the acquisition and exchange of germplasm and information and to provide logistical support to the NARSs involved in the networks. These networks would help to reduce duplication. This reinforces the need for a comprehensive computerized database on agricultural research activities to facilitate information exchange among governments, donors, IARCs and private organizations. The SIS database is now ready to be transferred to the NARSs in the SADCC region.

Human Resource Development

SACCAR has initiated a number of studies and convened several workshops to develop a long-term strategy for the training of professional manpower. A study, sponsored by the Federal Republic of Germany in 1987, recommended a program of support for developing four special M.Sc. courses in the SADCC region (Animal Science at the Banda College of Agriculture, Malawi; Agricultural Engineering and Irrigation at the Sokoine University of Agriculture, Tanzania; Crop Science at the University of Zambia; and, Agricultural Economics at the University of Zimbabwe). The project was started in the 1988/89 Academic Year with donor support provided for scholarships, equipment and technical assistance. Additional studies were undertaken by SACCAR in collaboration with various donors to explore further areas of cooperation in postgraduate and undergraduate training.

A team comprising the Deans of the Faculties of Agriculture, Forestry and Veterinary Medicine was then commissioned by SACCAR to synthesize the various studies and develop a Blueprint for Training (A Long-term Strategy for Training of Professional Manpower in the SADCC Region for the Agriculture and Natural Resources sector). They were assisted in this effort by the SPAAR Working Group on Education and Training. This Blueprint was approved by SACCAR and later (June, 1990) by the sectoral Ministers of Agriculture and Natural Resources.
The number of professional and technical staff employed in the private and public institutions involved directly with agriculture in SADCC was estimated at 36,000 in 1990 (the Williams report sponsored by the World Bank). Expected demand was for an annual growth rate of 6 percent, resulting in an estimated 64,000 professional and technical staff by the year 2000. Estimates indicated that the current training capacities would be able to meet the requirements for technicians trained to certificate and diploma levels. But, the region’s current training capacity would be unable to meet the demand for professionals with specialized training at the bachelor’s, master’s and doctorate level without a significant expansion of the current training institutions. The regional program tabled to the SADCC Council of Ministers is a long-term one, requiring at least 20 years of sustained support. It would develop inter-university activities and linkages to strengthen teaching and research, including staff and student exchange; and establish specialized degree (undergraduate and post-graduate) training programs at selected regional centers of specialization. The total estimated cost for Phase I (1991-2000) is expected to be about US$150 million.

Programs to increase the supply, and improve the quality of trained personnel, need to be complemented by incentives and policies which promote individual initiative and help to retain professional cadres and efficiency at work. Research institutions in SADCC need scientists who are innovative, and whose work can help to make existing farming more productive. While the development of human resources by university training is an essential part of an efficient research system, this must be matched with regular and appropriate in-service training programs to ensure the stimulation of ideas and enable scientists to hone and keep their skills up-to-date. The task force considers that the establishment of an enabling environment should receive priority. A component of this enabling environment must be regular in-service training. Some “decompression” of scientific strength may be required to ensure that all scientists in post can receive sufficient recurrent resources to undertake an active research program.

High-Value Crops and the Private Sector

Effective development of the potential for perennial, horticultural and other non-traditional cash crops will depend upon the private sector which appears to have a comparative advantage in the production of these crops. The task force therefore recommends that SACCAR initiate discussions with the private sector on ways of developing linkages with relevant external organizations. At the same time, SACCAR should discuss with governments the possibilities for provision of investment incentives, such as duty-free imports of equipment and remittance of dividends.

The proposed extension of the Tea Research Foundation’s mandate from tea to coffee and tree nuts will require very close examination. To do so, it will have to establish a close working relationship with producing members of the respective industries, as it is now doing with tea. It is important that the financing of this research continues to remain closely linked to the industries it serves.

Next Steps—Implementation of the Framework

The SACCAR Board discussed the Framework and gave its technical validation at its Board Meeting on April 11, 1991. The Framework was then presented to participants at the Eleventh SPAAR Plenary Session in Abidjan, Cote d’Ivoire, on May 13-14, 1991. The SPAAR membership endorsed the Framework for the SADCC region. It was agreed that implementation should start with one or two countries in the region. Tanzania was proposed by the representative from Tanzania, endorsed by the Director of SACCAR and its Board Chairman, and accepted by participants at the meeting. Following the SPAAR Plenary, the SPAAR Secretariat was officially informed by the government of Tanzania that it welcomed the selection of Tanzania as the first pilot country in SADCC. SPAAR was invited to send the SACCAR/SPAAR task force to Dar-es-Salaam in July, 1991 to help the government prepare for the implementation of the Framework.
Following extensive and comprehensive discussions with government officials and the donor community, the task force assisted the government to introduce its recently completed Research Masterplan to the scientific and donor communities in Tanzania at a Workshop held in Dar-es-Salaam in March, 1992. The government plans to follow this up with regular meetings with its cooperating partners and with the establishment of an Agricultural Research Fund to support research grants, contract research and provide incentives for scientists. Donors are being requested to provide financial support for the priority research programs and for the rehabilitation of key research stations.

The SIS database, containing information on externally-funded regional and national research activities (programs, projects, networks, small grants), could be immediately transferred to SACCAR and to the member states (Ministry of Agriculture and the Universities). This information system will provide a key element in coordinating national and regional research efforts. SPAAR, in cooperation with CTA, will provide the necessary hardware, software and the training to use the database. This can be implemented immediately.

Financing should be provided as soon as possible to enable a detailed plan to be developed for both the strengthening of research in biotechnology and for the expansion of the wildlife management areas in the region. These plans can be developed by national scientists. Further support will be required from the SPAAR membership for "State of the Art" technology reviews for important agricultural commodities produced in the region.
The region has the natural and human resources to realize and sustain an accelerated agricultural growth rate. The proposed Framework can provide the catalyst for increasing and sustaining growth and equity in the region. But, the improvements will take time. As the elements of the proposed Framework are put in place, it can be envisaged that the scientists in the NARSs of SADCC will become increasingly able, motivated and imbued with a sense of mission to respond more directly to the demands and challenges of the Food, Agriculture and Natural Resources Sector.

The central element of the proposed Framework is the amelioration of the enabling environment for SADCC scientists, thus providing conditions to motivate and enable them to use their skills and training in the development of useful technologies. The task force recommends that sufficient operating expenses should be assured through the establishment of appropriate funding mechanisms in each country. These mechanisms will be used to support the proposed national research masterplans. The integrity of the national research effort within the bounds of a national research masterplan can only be maintained if all parties (government and cooperating partners) work closely together on the programs and priorities in the plan. To make the best use of the limited resources available, a reformulation of the budget is desirable to ensure sufficient funds for operation and maintenance.

Intensification through productivity improvements in SADCC is clearly feasible given the wide yield disparities in the crop and livestock sub-sectors. The diversity of agro-ecologies and the natural resource base in SADCC offers potential for the production and development of a wide range of commodities. While the realization of this potential demands many things (inter alia, supportive government policies, markets, production inputs, interested producers), profitable production will require a stream of production technologies. It can be expected that the re-invigorated NARSs would be better able to help farmers with their technical problems.

The development of a capacity for policy analysis in the NARSs can be expected to lead to more supportive and equitable government policies in the agricultural sector. This should result not only in increased agricultural production and trade, but also in greater equity in the distribution of the resulting output to the more needy and vulnerable groups - those living in the arid and marginal areas and the rural and urban poor. A capacity for policy analysis could also help to promote the importance of science and technology within government.

The encouragement of pluralism in agricultural research and extension can lead to more dynamic research and extension systems in the region. The sharing of responsibility for agricultural research by the public sector with other interested parties would enable government to concentrate its efforts on staple foodcrops, socio-economic and environmental issues. The private sector could then focus on cash crop and factor (production inputs) research. The increasing involvement of the universities in research will not only contribute to the region's output of science and technology, but also to the quality of their teaching. The involvement of a multiplicity of actors, each with their particular strengths and clientele, should ensure that a multiplicity of actors, each with their particular strengths and clientele, should ensure that producers are better provided with the technologies they need. The opportunities for staff advancement within a pluralistic research system can better motivate and stimulate scientists.

The extensive areas of arid and marginal land in the region pose a special challenge to scientists to produce or adapt technology for the
resource-poor farmers in these degraded and fragile environments. The task force considers that biotechnology has potential for contributing to the production of appropriate low-cost farm technologies.

The exploitation of the natural resource potential of the marginal areas would be assisted by the proposed support for community management programs in the protected wildlife areas. This would provide employment and income from the non-consumptive exploitation of natural resources in these fragile environments. The introduction of participative R&D in the farming areas of these zones can be expected to enhance arable crop yields, improve the carrying capacity of natural grazing and advance the technical and practical competence of research and extension staff, and farmers.

The establishment of the appropriate funding mechanisms would require effective monitoring and evaluation. The private sector can provide some lessons on how to produce results from investments in research. The identification of key indicators linked to the implementation of the National Masterplans would introduce a much-needed element of accountability into the NARSs. The closer coordination by governments of all donor investments in agricultural research, from information provided by computerized databases such as the SIS, can help to minimize duplication and ensure more efficient use of the available resources. It can be expected that the development of more rigorous, result-oriented research management, supported by coordinated long-term donor support, would have a significant effect on the productivity of the NARSs.

A Vision of Research Systems in the SADCC Region

An expected scenario for the medium-term is the emergence of increasingly dynamic and responsive NARSs with a clearer pattern of specialization among the different sectors, i.e. cash/export crops, intensive livestock and factor research by the private sector including private research foundations; staple foodcrops, extensive livestock and environmental and social concerns by the public sector; and, basic and applied (under contract) research by the universities. It can be expected that the NGOs and private foundations will become more active amongst resource-poor farmers in the arid and marginal areas of the region. Research in the fisheries sub-sector can be expected to be more active as the industry and fishermen’s associations are encouraged by governments to participate in research activities. Research for the industrial forestry sub-sector can be expected to remain with the private sector, while social forestry continues to be the responsibility of the public sector. The international research system will be providing a critical input for the development of technology through both their established commodity centers and technical back-stopping to the developing NARSs as scientists from the IARCs increasingly work alongside national scientists. It can be envisaged that as the tempo of private sector development increases in the NARSs, the recurrent financing obligation of the donors would be steadily replaced by research cestuis/levies raised from producers.
One of the most dramatic changes in dietary patterns during the past two-and-a-half decades has been the increasing role of wheat as a staple food in developing countries. Wheat consumption has risen rapidly both in countries where wheat is a traditional staple (e.g. in the Middle East and North Africa) and in countries where wheat is an "introduced" food, especially in the tropical countries lying between 23° N and 23° S latitude.

Wheat imports to developing countries doubled during the 1970s and now accounts for two-thirds of world wheat trade. Even in the 1980s when wheat imports in most developing countries had levelled off or declined, wheat imports to tropical countries have continued to increase, especially in Sub-Saharan Africa (SSA).

In tropical America, wheat has already become a staple food for a large proportion of the population, with consumption averaging about 50 kg/capita/year. Average consumption in SSA is only 15 kg/capita, but with per capita income averaging less than one-third that of tropical Latin America, the potential for continued increases in wheat consumption is evident.

Will SSA follow the example set by Latin America, with wheat becoming over time the main staple substituting for coarse grains, roots and tubers? What are the political and economic implications of such a change in dietary patterns? What policies and strategies can African countries adopt now to slow these trends? To what extent might domestic wheat production reduce dependency on food imports and at the same time contribute to economic efficiency and food security objectives?

Perhaps the most revealing statistic of all is that wheat consumption has been increasing in SSA, even as per capita food consumption has been falling. While per capita cereal consumption in SSA decreased by about 10 percent during the last two decades, the share of wheat among all cereals consumed increased from about 5 percent to over 10 percent. Hence, increased wheat consumption has come about entirely from substitution for other staple foods. Table A-1 shows that food calories supplied by wheat have substituted largely for sorghum, millet, and roots and tubers. Rice in West Africa and maize in East Africa have also increased their share of food calories.

While per capita wheat consumption in Africa has increased rapidly, per capita wheat production has fallen. Wheat is a significant crop (over 25,000 ha) in only five African countries, of which only two, Tanzania and Zimbabwe, increased wheat production faster that consumption from 1960 to 1980 — and even Tanzania and Zimbabwe have once again increased their import dependency during the 1980s.

Both domestic and international actors influence wheat consumption. On the domestic side, the main actors are: (a) producers, (b) consumers, and (c) local grain transport, storage, and processing industries. The main international actors are private and public agencies involved in the world wheat trade. In some cases, such as in grain shipment and processing, international and domestic actors may be closely linked.
Table A-1. Changes in Daily Food Calories per Capita Obtained from Different Staples in Africa, 1961/65 to 1975/77 (percent)

<table>
<thead>
<tr>
<th>Region</th>
<th>Wheat</th>
<th>Rice</th>
<th>Maize</th>
<th>Other Cereals</th>
<th>Roots + tubers</th>
<th>All Staples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Africa</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Eastern and Southern</td>
<td>26</td>
<td>11</td>
<td>48</td>
<td>-58</td>
<td>21</td>
<td>6</td>
</tr>
<tr>
<td>Western</td>
<td>29</td>
<td>30</td>
<td>11</td>
<td>-95</td>
<td>5</td>
<td>17</td>
</tr>
</tbody>
</table>

Source: FAO

Governments in both importing and exporting countries are key actors whose intervention in wheat markets consistently reinforce market phenomena and rapidly accelerate the substitution of wheat products for traditional staples. According to Byerlee and Morris (1988), these include: (a) interventions in production of wheat and competing food staples; (b) investments, taxes and subsidies, and controls on the marketing and processing of wheat, both domestic and imported; (c) explicit consumer subsidies on wheat products; and (d) influences on consumers' preferences through market promotion and development. Governments of both importing and exporting countries influence the price of imported wheat, for example through: (a) trade and exchange rate policies; (b) subsidies and credit facilities for wheat exports; (c) the provision of food aid (largely wheat); and (d) marketing and promotion policies by private and public agencies of exporting countries.

A number of influential private sector interest groups are also important in biasing policy interventions toward wheat consumption and imports. These interest groups include middle-income urban consumers (who often are able to influence food policy decisions), the wheat processing sector (which exercises considerable market power in protecting its vested interests), and exporting interests in developed countries, such as grain exporters or milling and shipping industries (which frequently have strong commercial linkages with processors in importing countries). In addition, interest groups in exporting countries also succeed in distorting the policies of these countries toward wheat exports to the developing world. These interest groups appear to reinforce one another in promoting wheat consumption.

Only a small proportion of Sub-Saharan Africa is classified as suitable for wheat production. Most of the area that is suitable lies in Ethiopia, Kenya and Tanzania where wheat production is well established. Zimbabwe and Sudan are also significant wheat producers. In all of these countries, except Ethiopia, wheat is a non-traditional crop, and the area planted to wheat is relatively small. In addition to these established producers, a number of countries are attempting to establish a domestic wheat industry (e.g. Zambia, Mali, Nigeria, Madagascar, Cameroon), sometimes with very large investment costs.

The environments in which these wheat schemes are being established vary widely throughout Africa, with distinct problems as summarized in Table A-2.
### Table A-2: Major Wheat Production Environments and Production Issues in SSA

<table>
<thead>
<tr>
<th>Environment</th>
<th>Example</th>
<th>Biological</th>
<th>Economic</th>
</tr>
</thead>
<tbody>
<tr>
<td>High elevation rainfed (71500 m)</td>
<td>Kenya</td>
<td>Appropriate genotypes</td>
<td>Competing use of land for other temperate cropland or livestock enterprises</td>
</tr>
<tr>
<td></td>
<td>Tanzania</td>
<td>available, but stripe rust a major problem</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Malawi</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mid- to low-elevation rainfed</td>
<td>Madagascar</td>
<td>Serious disease problems (e.g. Helinthosporium)</td>
<td>Some competition from staple crops such as maize and sorghum</td>
</tr>
<tr>
<td>or growing season rainfall)</td>
<td>Zambia</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mid-to-high elevation irrigated</td>
<td>Zimbabwe</td>
<td>None</td>
<td>High cost of irrigation, competing use of scarce water</td>
</tr>
</tbody>
</table>

It is very difficult to generalize about the potential for wheat production in Sub-Saharan Africa. In some cases biological factors (e.g. the lack of disease-resistant or heat-tolerant varieties) constitute the major constraint to local production, while in others economic factors are more important.

Available evidence on the economics of wheat production in Zimbabwe and Zambia indicates that the two SADCC countries have comparative advantage in wheat production, under normal rainfall and irrigated conditions. The most commonly used measure of comparative advantage is the domestic resource cost (DRC). The DRC measures the efficiency of domestic use of resources in generating foreign exchange. A DRC of less than 1 indicates that domestic resources are used relatively efficiently in the production of a commodity and, hence, its production can be expanded for export or import substitution. Morris (1988) estimated that in Zimbabwe, where wheat is grown under normal rainfall conditions, wheat can be efficiently grown, with Z$ 0.28 of domestic resources required to save Z$ 1.00 of net foreign exchange. In Zambia, a recent (1991) World Bank Agricultural Sector Strategy team concluded that the adoption of improved technology has enabled the efficient use of domestic resources in the production of most commodities, including wheat, despite currency overvaluation.

Agricultural research to produce varieties with better heat-tolerance and disease-resistance can be expected to slowly expand the frontiers for efficient wheat production in SADCC and other regions of Sub-Saharan Africa, but technological changes alone are unlikely to enable production to keep pace with the present rate of growth in consumption.
Annex 2 - Rural Community Participation in Integrated Wildlife Management And Utilization (IWMU)

Rationale

The arid and marginal lands of the SADCC region pose considerable problems for increased agricultural output on account of, *inter alia*, the fragility of the soil base, the unreliability of rainfall, the comparatively narrow commodity choice, a farming community which is usually resource-poor and, frequently, the remoteness of the markets. Technical packages involving improved varieties and fertilizers have been developed for foodcrops but given the element of risk in the environment for crop production and the low risk-threshold of the farming community, adoption rates are generally low. Attempts to increase production and to sustain food self-sufficiency frequently lead to irreparable degradation of the environment and consequent loss of food security.

Wildlife is an important economic resource in the region. If well managed, it can be utilized on a sustainable basis to generate revenue (particularly foreign exchange), to create employment and to increase the productivity of rural communities. Foreign exchange earnings from tourism are very significant in several SADCC countries, most of which are derived from the game parks. In Zimbabwe, earnings from tourism rank third in importance after mining and agriculture. In the SADCC region, earnings from tourism in 1987 totalled US$148 million. However, the potential remains mostly untapped, due to under-development, misplacement of emphases in conservation efforts and the attendant social problems which have threatened the existence of wildlife. The SADCC region has set aside 14 percent of its total land area for protection, 5 percent of it as wildlife reserves.

Encouraging new developments in Botswana, Zambia and Zimbabwe that are built around the active involvement of local rural communities in the management and utilization of this resource provide a sound base for future utilization of these areas. The SACCAR/SPAAR Framework for Action will endorse this development option by supporting a research agenda, including wildlife, NR management and associated crop production.

The achievement of food security and an improved quality of life for the local communities of these areas will be aided by the emergence and development of rural non-farm activities. In addition to IWMU, various other rural activities are now gathering speed in some of the wild mopane and acacia woodlands of these agriculturally marginal areas. These activities include the collection of cocoons of the *Gonometa* silkmoth in Botswana and Zimbabwe with subsequent spinning in Botswana; the collection of wild honey in northern Zambia and Malawi; and, the harvesting and marketing of wild mushrooms in several countries. These new initiatives in community participation in wildlife management provide an instrument for responsible exploitation of the considerable NR resource in SADCC with significant future benefits to rural communities. This development option offers many opportunities for rural women to spread their income sources beyond crop production and small livestock.

There clearly is a conflict between wildlife and tourism activities on the one hand and increasing settlement with associated small-scale agriculture and extensive livestock on the other. There are three distinct lobbies pleading their case, i.e. wildlife, agriculture and resettlement. If short-term political imperatives are to be balanced by rational long-term land-use considerations, a more definitive comparative analysis needs to be made of the costs and benefits of wildlife exploitation strategies and the economic potential...
and long-term effects of other options. Community participation in wildlife management and utilization as a complement to crop and livestock development offers a holistic approach to the development of these areas.

The reality of this land-use option has already been amply demonstrated by the early successes of the five examples given in the following section.

**Background**

There are currently five of these programs under way in the SADCC region:

1. **ADMADE, Zambia.** A program initiated by the Zambian Government's National Parks and Wildlife Service in early 1988 with financial assistance from the World Wildlife Fund (WWF), (USA). The program covers 74,110 square kilometers or 10 percent of the country and involves twenty-five chiefs and their village communities. The communities are involved in the decision-making processes concerning Wildlife Conservation and Management and share in the revenue gained. Progress has been impressive with the generation of US$1.3 million gross income accrued of which US$0.7 million or 55 percent was used to manage the wildlife. US$0.45 million (35 percent) was disbursed to the local communities to meet their development needs and US$0.13 million (10 percent) was used by government to promote tourism. The program provides jobs for more than 500 villagers mostly engaged as Village Scouts and general workers. Most important, in a very short period of time, attitudes towards wildlife conservation have changed markedly from illegal hunting to conservation and management.

2. **Luangwa Integrated Development Project, Zambia.** The LIRDP was formally initiated in May, 1986 with financial assistance from the Norwegian Agency for Development Cooperation (NORAD) and the WWF. The program covers about 14,000 square kilometers and a community of over 35,000 people. An initial phase of program development through discussion with sectoral departments, local representatives and potential donors established the outlines of the institutional structures to be created and the work programs to be implemented. These were finalized at a major workshop involving all potential participants in June, 1987. Low-level implementation started with funding from the Zambian government, NORAD and WWF. Major bilateral funding was assured for five years by NORAD in October, 1988 and accelerated implementation began. The primary objective of the project is to improve the standard of living of the people of the project area through the sustainable use of the full range of natural resources available to them. The project involves a women's program; a cooperatives program; a works and supply unit; an evaluation unit; and a major road improvement program. LIRDP has developed an institutional structure that has enabled gradual decentralization including establishment at the local level of a Local Leaders’ Sub-committee, providing the primary avenue for local participation and decision-making in the project area. Progressively, control over revenues earned in the project area and over decisions concerning land and resource use is being transferred to this group. A revolving fund has been established to receive and manage funds received from the Ministry of Finance, from donors, and, from public revenues raised within the project area (hunting license fees, concession fees, Park entry fees, tourism levies, forestry, fishing and water license fees), service charges on agricultural credit facilities, earnings from maize mills, stores etc. Earnings from the project have been divided with 60 percent being retained by the project for project operation and 40 percent being handed to the Local Leaders Sub-committee for use as decided by the sub-committee. Apart from the use of funds for various local purposes (clinics, upgrading of schools, purchase of transport etc.), significant progress has been made in strengthening local peoples’ self-confidence and technical competence. In 1988 and 1989, a total of US$96,500 (40 percent of the gross revenue) has been made available for community projects.

3. **The WWF-Zambia Wetlands Project.** Six percent of Zambia can be classified as wetlands and wildlife is a significant resource in these areas. The two Core Project Areas cover approximately 13,500 square kilometers comprising parts of 14 Chiefdoms and a total of 160,000 people. The projects were established under the Department of National Parks and Wildlife Service (Ministry of Tourism) and are being implemented in conjunction with ADMADE. The revenue from these areas is
divided with 40 percent used for Wildlife Management, 35 percent for Community Development, 15 percent for National Parks Development and 10 percent for a Contingency Fund (originally meant for Tourism Development). The revenue is derived from non-consumptive tourism and from game-capture and various categories of hunting, culling and cropping (consumptive).

4. The CAMPFIRE Program in Zimbabwe. Conceived in the Ministry of Natural Resources and Tourism, the CAMPFIRE program is concerned with natural resource management only on communal land. Thus, the program is specifically designed to deal with the challenges posed by common ownership, usage and management of land by disparate traditional communities. This program has initially focussed on wildlife resources because they have obvious commercial value, are relatively easily renewable and are highly responsive to sustainable utilization. However, the ultimate goal is to include other elements such as water, soil and vegetation, in a holistic perspective on ecological preservation with development. The delegation of authority from the central to the local level is the key to the success of the CAMPFIRE program and common property management. The program has been so successful since its inception in the late 1970s that by 1990 there were thirteen districts with the right to directly implement CAMPFIRE programs. A number of non-government agencies have been providing a complementary mix of expertise and financial assistance. In 1985, a research unit funded by the Ford Foundation and IDRC was set up under the University of Zimbabwe's Centre for Applied Social Sciences (CASS) to undertake monitoring and evaluation of the socio-economic implications of the CAMPFIRE approach. In the first year of operation of one of the areas, a net profit of US$200,000 was made from international sport-hunting alone. These resources allow the community to finance their own management, pay compensation for elephant-caused crop damage, build up a revolving fund and pay direct benefits to the community. In addition, the district has been able to crop 1500 impala and distribute 30,000 kilograms of meat at cost price. The resource utilization potential with regard to non-consumptive wildlife tourism, or of secondary industries, or of ranching crocodile or lake-based activities, has hardly been tapped.

5. Wildlife Utilization, Botswana. While Botswana is behind Zambia and Zimbabwe with regard to wildlife utilization programs, positive results are now being achieved from wildlife conservation. The planning process in Botswana moves from the village level upwards to the central government. Designated Wildlife Management Areas cover 22 percent of the land and wildlife utilization is the only land-use permitted in these areas. The government of Botswana adopted a National Parks policy in 1976, which clarified the intention of government to pursue wildlife utilization as a form of land-use with potential for sufficient economic returns to assure its sustainability. The process of development of these areas is proceeding with each district setting its own pace of development. The local community makes all decisions from planning to implementation and the department acts as an adviser. Some of the plans have been prepared by consultants from donor-funded projects, a recent example being that funded by the EEC. Recent analysis (1990) suggests that implementation of present plans could produce a four-fold increase in the economic contribution of the sector over the next fifteen years; the contribution to GDP increasing from Pula 2.1 million to P 8.8 million. There is a need for an applied research program on the key parameters relating to the efficiency of wildlife utilization, e.g. involving studies on game enclosure technology and maintenance of sex ratios which optimize reproduction rates in addition to the ongoing work on management issues and pure biology. There is also an urgent need for more training in the wildlife sector.

Proposed Activity for SACCAR/SPAAR

The SACCAR Secretariat will work with the Malawi-based SADCC Coordination Unit for the Forestry, Fisheries and Wildlife Sector to define the details of a pertinent research program. The initial draft program was to be detailed by the end of 1991, with start-up of implementation scheduled for 1992. SACCAR will establish an appropriate network and communication system to ensure that experiences are regularly shared and debated amongst all SADCC countries.
The SACCAR/SPAAR Framework for Action will assist the gradual responsible expansion of these initiatives from Botswana, Zambia and Zimbabwe to the other SADCC countries. Initially, this will probably involve Malawi, Namibia and Tanzania. Subsequently, following the lessening of security problems, SACCAR/SPAAR will help to support the development of this program in Angola and Mozambique.

During their joint supervision missions, the SPAAR group of donors will seek consensus on which donors, institutions, NGOs, charities and private individuals can best provide the assistance required.

The SACCAR/SPAAR program will also support adaptive participative on-farm research programs on foodcrops with the communities in these areas, where such land-use fits within the gazetted rules for the land. For instance, such a program might be appropriate in association with the CAMPFIRE projects in Zimbabwe.

Probable Areas for Research

The following topics were identified by the Malawi-based Coordination Unit and presented at the SACCAR Consultation on Research Priorities held in Francistown, Botswana, September, 1990.

- Resource Inventory Studies;
- Social science research to evaluate the social, cultural and/or traditional perceptions of improved environmental management;
- Research to determine the economic viabilities and biomass production potential of either domestication or ranching programs of single or mixed wildlife species;
- In conjunction with veterinary research staff, research into wildlife/livestock diseases, particularly modes of transmission;
- Effects of agro-chemicals on the environment in general and wildlife species in particular; and
- Research into non-exploitative harvesting cycles of such indigenous resources as silk, honey and mushrooms.

Potential Value and Output

- Protection of the natural resources of a fragile environment with its optimum land-use;
- Increase in the contribution of the wildlife sub-sector to the GDP;
- Employment generation, especially non-farm opportunities for women;
- Diversification of income source for rural communities;
- Assistance to rural communities with participatory development of their environment;
- Provision of entrepreneurial opportunities; and
- Improved food security through increased productivity of foodcrops and spread of income-sources in the arid and marginal lands.
Annex 3 - Biotechnology: A Potential Tool for The SADCC Region

Introduction

Biotechnology is a new biological tool that can provide exciting opportunities for improving agricultural yield and output. The biotechnology techniques in use range from comparatively simple tissue culture to the much more complex genetic manipulation of biological material. The simplest techniques can be employed in relatively unsophisticated environments, while the more complex ones require carefully managed and controlled conditions. The industrial countries, led by their private sectors, have invested heavily in the development and use of biotechnology, from which they are confident of reaping handsome dividends by the end of the century. Are these technological developments going to further marginalize farmers, particularly smallholders, in the SADCC region? This could happen, unless the region seizes the initiative to learn from developments in the industrial countries, and establishes a capacity to exploit the potential benefits of different biotechnology techniques for agricultural improvement in the region.

Capacity-Building and Application in SADCC

The establishment of a capacity for biotechnology applications in SADCC is warranted in view of the likely long (five- to ten-year) gestation period between the development and commercial application of biotechnology techniques. SPAAR can assist the SADCC member states to identify scientific/commercial partners and, possibly, with financing to establish a substantive biotechnology research program as quickly as possible. The inclusion of biotechnology as an element of the SACCAR/SPAAR Framework for Action is intended to spur the region to capitalize on the opportunities offered by biotechnology. This is expected to produce the desired multiplier effect on the SADCC member states. SACCAR could serve as the all-important regional coordinating mechanism to promote its development, and to ensure that national scientific capacity and interest in biotechnology are sustained through networking, both within the region and with external scientific partners.

In Zimbabwe, the establishment of a Scientific and Industrial Research and Development Centre (SIRDC) under the Research Council of Zimbabwe (RCZ) has been approved by the government of Zimbabwe. The RCZ plans to establish a Biotechnology Research Institute (BRI) within the proposed SIRDC to undertake plant breeding through the use of genetic engineering and micro-propagation, animal breeding and food processing technologies (including fermentation). The plant breeding program will benefit the "orphan" commodities (cassava, sorghum and millet) grown by smallholders in the arid and marginal zones. There are also plans to include medical biotechnology to produce vaccines for both people and livestock. Apart from the SIRDC, the Crop Science Department of the University of Zimbabwe (UZ) started a two-year M.Sc course in Biotechnology in April, 1991, with an initial intake of ten students. The program is open to students from countries in the region. The first semester courses will cover basic microbiology and fermentation, basic plant biotechnology and recombinant DNA technology. The second semester will include advanced courses on fermentation, enzyme technology, plant biotechnology, immunology and virology, and cloning technology. The course can be taken either on campus in Zimbabwe or at an approved site off campus.

The Crop Science Department of UZ, which has made considerable progress in the
development of its research and teaching capacity in biotechnology, has established strong technical links with the Department of Genetics at the Free University of Amsterdam in the Netherlands. Thus, in the University of Zimbabwe and the proposed SIRDC, the SADCC region has a base on which to develop capacity in the science of biotechnology.

The Sokoine University of Agriculture, Tanzania has begun to develop a capacity in biotechnology in micro-biology. Biotechnology techniques are also being used by universities and scientific institutions outside the SADCC region to solve technical problems important to SADCC's farming community.

The Faculty of Biology (Free University of Amsterdam) has published "Biotechnology for Small-Scale Farmers in Developing Countries: Analysis and Assessment Procedures", following extensive fieldwork carried out in Zimbabwe, Bolivia and Pakistan. The potential of biotechnology for small-scale farmers was discussed at a very well-attended Public Debate organized by the Free University in Amsterdam on April 8-9, 1991.

A useful agenda in biotechnology could be created for the future benefit of resource-poor farmers in cowpea, cassava, sweet potato, potato, millet and sorghum. The current demand for virus-free seed potatoes in Zimbabwe is great. It should be noted that monocotyledonous plants are more difficult (more time-consuming) to generate from a single cell and thus, it is desirable to "crack" the problem (perhaps involving identification and transfer of a specific gene) in maize and wheat first, since industrial support is more likely to be available for these commercial crops. The technique, once it proves effective, could be used for sorghum and millet.

**Lucrative Genes.** A likely source of revenue for biotechnology applications as well as patents is from the identification and later manipulation of genes for nematode resistance.

**Tissue Culture.** Simple village-based tissue culture applications could be developed in sweet potato, potato, and cassava for production of disease-free (virus particularly) planting material. Such household-based applications, which have been developed for virus-free potato multiplication, are now being used in Vietnam.

For the arid areas of SADCC, the exploitation of industrial cassava crops for the production of butanol may offer a potential commercial crop for the resource-poor farmers in these areas; tissue culture applications can be developed in the short-term but the economics of production are not yet clear.

**Future Program.** At this stage of the game, it is important to decide on the most promising programs to work on, and which programs (based on experience elsewhere) have the highest probability of providing a successful outcome in the medium-term. It is probably desirable that the early programs should focus on the manipulation of the DNA-molecule, followed by the propagation of clean planting material from single-cell culture. Identification of genes for viral, pest and herbicide resistance and changes in food quality (oils and fat contents of seeds) are likely to offer the best prospects for success; drought-tolerance is a function of many genes and manipulation is not likely to be possible in the foreseeable future.

**Regional Program**

The development of a national capacity in biotechnology will depend on (a) the organization of a critical mass of participating scientists; and (b) the availability of seed money to start up the work. The food processing and other agro-based industries are likely sources of financial support, once the program comes on stream. Effective exploitation of complicated biotechnology applications will need teams of a certain critical mass. One way of putting together a team is to involve the different private crop associations (tobacco, coffee, cotton, etc.) operating in the region. They could be asked to fund or second one or more competent scientists to the proposed regional biotechnology program.

A capacity in biotechnology is best built into strong national plant breeding programs backed by the normal field testing processes and a capacity for diagnosis of problems. The capacity-building exercise should commence with a crop/animal problem, for which there is already experience elsewhere, and for which finance is available on a long-term sustained basis.

The SACCAR Secretariat should assist the NARSs (including the universities) in developing
a capacity for biotechnology through the provision of advice on suitable technical contacts (both within and outside the region). The SPAAR Secretariat could assist SACCAR with the identification of interested donors and technical partners.

The United Kingdom and the Netherlands are already funding a number of research programs using biotechnology applications in their domestic universities and research institutions. The German Agency for Technical Co-operation (GTZ) has expressed interest in funding biotechnology efforts in Zambia, while the Netherlands and Sweden are providing support to Zimbabwe.
Annex 4 - Contract Research

Contract research\textsuperscript{11} dates back to the 1800s, when university professors in Germany accepted external sources of funds to conduct research. Besides providing a new source of research funds, additional revenues were often generated through the sale of the inventions developed through contract research.

In assessing the potential of African universities or research institutes to undertake contract research, several issues need to be considered. They include: operational mechanisms, contract specifications, reliance on local expertise, university potential, conflict between research/teaching/national responsibilities, conflict between client/government research priorities, and university/government linkages.

Operational mechanisms for contract research in Africa are often lacking. Where they exist, these mechanisms may differ from country to country and on a case-by-case basis. It is often easier for prospective clients to make use of the international contracting network than to negotiate under uncertainty with domestic contractors. Clients contemplating contract research should be aware of the legal requirements in the country of operation. When awarding a research contract to an institution, they should reserve the right to select the researchers they want. Selection of researchers should not be left to the contracting institution. In the case studies prepared, the least successful ones involved clients that could not or did not select their own researchers.

Lack of operational mechanisms on contract research may result in university or research institute staff accepting private contracts on top of their full-time responsibilities. Such contracts may compete with official work to the detriment of their employing institutions. (This may be a particular danger in the SADCC region at this time (1992) since salary levels are so low and opportunities for research within the institutional work program are so few).

Contract specifications relating to remuneration, joint venture responsibilities, quality expectations, and proprietary rights to research results must also be considered.

Payment for contract research is a major issue, especially if contract researchers with similar qualifications are paid different rates. Payment for local contractors is often much lower than for their international counterparts and animosity is often the result. Since market rate consultant fees have not been established, African contract researchers have little negotiating power.

Where a contract is to be awarded to a university or research institute, it may be prudent for the client to have a separate contract with the researchers undertaking the work. Such dual research contracts, one with the university or research institute and another with the actual contract researchers, tend to produce better results. The additional incentive to contract researchers through dual research contracts makes it possible for quality research to be completed within a given time-frame.

Joint-venture contract research, involving local African and external organizations, is a useful approach to employ as it brings together a wide range of expertise.

Proprietary rights to research results may pose a potential problem. Contracts should clearly specify who owns the research results and the rights of contract researchers or institutions.

While there may be advantages in contracting research to local experts, local researchers are often handicapped by the lack of research facilities and equipment, such as libraries and computers. Moreover, many
clients prefer to use international contractors on regional projects that require a cross-country perspective or on projects requiring external evaluation. Local government officials may not accept domestic contractors on political grounds, or because they resent the higher salary earned by former colleagues.

African universities represent one of the two major components of NARSs in Africa. In some countries, over one-third of agricultural researchers are found in the universities. However, teaching requirements and lack of resources often lead to under-utilized research capacity.

A few universities have established research institutes which depend on funds generated from undertaking contract research. This dependency may lead to conflict of interest between client and national research priorities. Research institutes that are highly dependent on contract research may learn to "respond" to client requests rather than develop their own research priorities.

Based on the experiences of a small group of informants, it appears that, with proper care and planning, there is potential for using African universities and research institutes as contract researchers. In the process, contract research can help to build national capacity and further research in Africa.

To get the best results from contract research, the following suggestions are offered:

1. A system should be developed to review client research requests to ensure that they are consistent with national research priorities.
2. Local contractors should be included in contracting teams to take advantage of local knowledge and to help develop national capacity.
3. Higher-echelon management in development organizations should encourage the use of domestic contractors.
4. There should be a system under which contract researchers who are employees of the universities or research institutes can be remunerated for their outside work (provided that it does not interfere with their regular responsibilities).
5. Contract mechanisms need to be systematized and legalized in African countries. This would include coordination of local expertise and establishment of market rate consultant fees.
## Annex 5 - Agricultural Research Activities* of SIS Focal Points in the SADCC Member Countries

<table>
<thead>
<tr>
<th>SADCC Member Countries</th>
<th>AO</th>
<th>BW</th>
<th>LS</th>
<th>MW</th>
<th>MZ</th>
<th>NA</th>
<th>SZ</th>
<th>TZ</th>
<th>ZM</th>
<th>ZW</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SPAAR Members</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AfDB</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Australia</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>11</td>
<td></td>
</tr>
<tr>
<td>Belgium</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Canada</td>
<td></td>
<td></td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>4</td>
<td>2</td>
<td>18</td>
</tr>
<tr>
<td>CEC</td>
<td>1</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>3</td>
<td>3</td>
<td>1</td>
<td>5</td>
<td>4</td>
<td>627</td>
</tr>
<tr>
<td>Denmark</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>FAO</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td></td>
<td>3</td>
<td></td>
<td>4</td>
<td>2</td>
<td>3</td>
<td>519</td>
</tr>
<tr>
<td>France</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td></td>
<td>4</td>
<td>2</td>
<td></td>
<td>214</td>
</tr>
<tr>
<td>Germany, F.R.</td>
<td>2</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>5</td>
<td>1</td>
<td>5</td>
<td>1</td>
<td>519</td>
<td></td>
</tr>
<tr>
<td>IDRC</td>
<td>2</td>
<td>12</td>
<td>6</td>
<td>16</td>
<td>6</td>
<td>7</td>
<td>46</td>
<td>10</td>
<td>30135</td>
<td></td>
</tr>
<tr>
<td>IFAD</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>4</td>
<td>3</td>
<td></td>
<td>216</td>
<td></td>
</tr>
<tr>
<td>Italy</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Japan</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Netherlands</td>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td>5</td>
<td>7</td>
<td>215</td>
</tr>
<tr>
<td>Norway</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>7</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Rockefeller Foundation</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Sweden</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td></td>
<td>13</td>
</tr>
<tr>
<td>Switzerland</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>7</td>
<td>1</td>
<td>8</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>2</td>
<td>2</td>
<td>8</td>
<td>1</td>
<td>1</td>
<td>13</td>
<td>4</td>
<td>839</td>
<td></td>
<td></td>
</tr>
<tr>
<td>UNDP</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>4</td>
<td>9</td>
<td>4</td>
<td>124</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>United States</td>
<td>7</td>
<td>16</td>
<td>9</td>
<td>17</td>
<td>8</td>
<td>16</td>
<td>15</td>
<td>10105</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Winrock International</td>
<td>2</td>
<td>3</td>
<td>3</td>
<td>13</td>
<td>5</td>
<td>2</td>
<td>25</td>
<td>12</td>
<td>1075</td>
<td></td>
</tr>
<tr>
<td>World Bank</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>SUBTOTAL</strong></td>
<td>17</td>
<td>44</td>
<td>23</td>
<td>68</td>
<td>34</td>
<td>24</td>
<td>149</td>
<td>73</td>
<td>85518</td>
<td></td>
</tr>
<tr>
<td>IFS</td>
<td>1</td>
<td>1</td>
<td>14</td>
<td>2</td>
<td>2</td>
<td>32</td>
<td>8</td>
<td>1373</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>NARS-TRANS</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SADCC/SACCAR</td>
<td>2</td>
<td>4</td>
<td>2</td>
<td>7</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>6</td>
<td>6</td>
<td>536</td>
</tr>
<tr>
<td><strong>International Centres</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IBRAM</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3</td>
<td>2</td>
<td>18</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ICRPE</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td>2</td>
<td>15</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ICRAF</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td>1</td>
<td>14</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ICRISAT</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td></td>
<td>1</td>
<td>1</td>
<td>15</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IFDC-Africa</td>
<td>1</td>
<td>2</td>
<td></td>
<td></td>
<td>3</td>
<td>2</td>
<td>210</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ISNAR</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Others</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td>1</td>
<td>14</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CIBC</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1</td>
<td>14</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td>19</td>
<td>53</td>
<td>28</td>
<td>94</td>
<td>39</td>
<td>2</td>
<td>27</td>
<td>198</td>
<td>96</td>
<td>110666</td>
</tr>
</tbody>
</table>

* Activities may refer to programs, projects, small grants, or networks, SIS, October 1990.
Ao-Angola; BW-Botswana; LS-Lebsoho; MW-Malawi; MZ-Mozambique; NA-Namibia; SZ-Swaziland; TZ-Tanzania; ZM-Zambia; ZW-Zimbabwe.

56
Notes

1. This takes no account of the probable negative effects on agricultural and economic growth of the acquired immunodeficiency syndrome (AIDS) virus.

2. September - August.

3. 1 billion = 100 million


5. SADCC Policies on Food, Agriculture, Natural Resources and the Environment, SACCAR Occasional publication No. 4, 1990 revision.


8. The following abstracts were taken from the proceedings of a mobile training seminar held in June 1990 in the SADCC region on Integrated Wildlife Resource Use, edited by Professor S.S. Ajayi, FAO Consultant, July 1990.

9. Administrative Management Design for Game Management Areas (GMAs).


Bibliography


Asian Vegetable Research and Development Centre. (1990), "CONVERDS: The Collaborative Network for Vegetable Research and Development in the Southern Africa Region." Taiwan: SADCC.


---. (1991f), "A Commission of the Southern African Development


Overs, Jr., M. (1991), personal communication.


---. (1990c), "The Establishment of a Regional Maize and Wheat Network in the SADCC Region: Review of the SACCAR Consultant Report." Mbabane, Swaziland: SACCAR.


Coordination Conference (SADCC):
Food, Agriculture and Natural Resources Sector." Gaborone, Botswana: SACCAR.


SADCC. (1985a), "Memorandum of Understanding Establishing the Southern Africa Centre for Cooperation in Agricultural Research (SACCAR)." Gaborone, Botswana: SADCC.


---. (1990h), "Food, Agriculture and Natural Resources." Annual Sector Reports for the Annual Consultative Meetings with the Donor Community. Gaborone, Botswana: SADCC.


<table>
<thead>
<tr>
<th>Country</th>
<th>Address/Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>ARGENTINA</td>
<td>Carlos Hirsch, SRL&lt;br&gt;Galeria Guemes&lt;br&gt;Florida 156, 4th Floor-Ofc. 453/465&lt;br&gt;1333 Buenos Aires</td>
</tr>
<tr>
<td>AUSTRALIA</td>
<td>PAPUA NEW GUINEA, FIJI, SOLOMON ISLANDS, VANUATU, AND WESTERN SAMOA D.A. Books &amp; Journals&lt;br&gt;648 Whitehorse Road&lt;br&gt;Mitcham 3132&lt;br&gt;Victoria</td>
</tr>
<tr>
<td>AUSTRIA</td>
<td>Gerold and Co.&lt;br&gt;Garten 31&lt;br&gt;A-1011 Wien</td>
</tr>
<tr>
<td>BANGLADESH</td>
<td>Micro Industries Development Assistance Society (MIDASA)&lt;br&gt;House 5, Road 16&lt;br&gt;Dhaka 1209</td>
</tr>
<tr>
<td>BELGIUM</td>
<td>Jean De Lannoy&lt;br&gt;Av. du Roi 202&lt;br&gt;1060 Brussels</td>
</tr>
<tr>
<td>CANADA</td>
<td>Le Diffuseur&lt;br&gt;C.P. 85, 1501B rue Ampfière&lt;br&gt;Boucherville, Québec&lt;br&gt;J4B 5R6</td>
</tr>
<tr>
<td>CHINA</td>
<td>China Financial &amp; Economic Publishing House&lt;br&gt;81, Da Fo Siding Jie&lt;br&gt;Beijing</td>
</tr>
<tr>
<td>COLOMBIA</td>
<td>Inforplace Ltd.&lt;br&gt;Apartado Aereo 34270&lt;br&gt;Bogota D.E.</td>
</tr>
<tr>
<td>COSTA RICA</td>
<td>COTE D'IVOIRE&lt;br&gt;Arespond Espanol&lt;br&gt;2145 Blvd. Brussels&lt;br&gt;1006 Brussels</td>
</tr>
<tr>
<td>CYPRUS</td>
<td>Cyprus College Bookshop&lt;br&gt;6, Digenes Street, Engomi&lt;br&gt;P.O. Box 2006&lt;br&gt;Nicosia</td>
</tr>
<tr>
<td>DENMARK</td>
<td>Samsundl, Litteratur&lt;br&gt;Rosenlund Alle 11&lt;br&gt;DW-1979 Frederikberg C</td>
</tr>
<tr>
<td>DOMINICAN REPUBLIC</td>
<td>Editores Taller. C per A.&lt;br&gt;Restaurante e Isla la Catolica 399&lt;br&gt;Apartado de Correos 2190 Z-1&lt;br&gt;Santo Domingo</td>
</tr>
<tr>
<td>EGYPT, ARAB REPUBLIC OF AL AHSAN</td>
<td>Al Galaa Street&lt;br&gt;Cairo</td>
</tr>
<tr>
<td></td>
<td>The Middle East Observer&lt;br&gt;41, Street Cairo</td>
</tr>
<tr>
<td>EL SALVADOR</td>
<td>Fusades&lt;br&gt;Alam Dr. Manuel Enrique Arauzo #3330&lt;br&gt;Edificio SISMA, 1st, Piso&lt;br&gt;San Salvador 011</td>
</tr>
<tr>
<td>FINLAND</td>
<td>Akaatominen Kirjakauppa&lt;br&gt;P.O. Box 128&lt;br&gt;SF-00101 Helsinki 10</td>
</tr>
<tr>
<td>FRANCE</td>
<td>World Bank Publications&lt;br&gt;66, avenue d'Inte&lt;br&gt;75116 Paris</td>
</tr>
<tr>
<td>GERMANY</td>
<td>UNO-Verlag&lt;br&gt;Peppeleiterer Allee 55&lt;br&gt;D-5300 Bonn 1</td>
</tr>
<tr>
<td>GUATEMALA</td>
<td>Libertas Piedra Santa&lt;br&gt;Sa. Calle 7-55&lt;br&gt;Zone 1&lt;br&gt;Guatemala City</td>
</tr>
<tr>
<td>HONG KONG, MACAO</td>
<td>Asia 2000 Ltd.&lt;br&gt;46-48 Wyndham Street&lt;br&gt;Winning Centre&lt;br&gt;2nd Floor&lt;br&gt;Central Hong Kong</td>
</tr>
<tr>
<td>INDIA</td>
<td>Allied Publishers Private Ltd.&lt;br&gt;751 Mount Road&lt;br&gt;Madras - 600 002</td>
</tr>
<tr>
<td>JAPAN</td>
<td>Eastern Book Service&lt;br&gt;Hongo 3-Chome, Bunkyo-ku 113&lt;br&gt;Tokyo</td>
</tr>
<tr>
<td>KENYA</td>
<td>Africa Book Service (E.A.) Ltd.&lt;br&gt;Quaran House, Mfangano Street&lt;br&gt;P.O. Box 45245&lt;br&gt;Nairobi</td>
</tr>
<tr>
<td>KOREA, REPUBLIC OF</td>
<td>Pan Korea Book Corporation&lt;br&gt;P.O. Box 101, Kwangwhaem Seoul</td>
</tr>
<tr>
<td>MALAYSIA</td>
<td>University of Malaya Cooperative Bookshop, Limited&lt;br&gt;P.O. Box 1127, Jalan Pantai Baru&lt;br&gt;59700 Kuala Lumpur</td>
</tr>
<tr>
<td>MEXICO</td>
<td>INFOPEC&lt;br&gt;Apartado Postal 22-860&lt;br&gt;14060 Taipeh, Meixico D.F.</td>
</tr>
<tr>
<td>NETHERLANDS</td>
<td>De Linboevoir/In-Or-Publicatie&lt;br&gt;P.O. Box 200&lt;br&gt;7480 AA Haaksbergen</td>
</tr>
<tr>
<td>NEW ZEALAND</td>
<td>EBSCO NZ Ltd.&lt;br&gt;Private Mail Bag 99914&lt;br&gt;New Market&lt;br&gt;Auckland</td>
</tr>
<tr>
<td>NIGERIA</td>
<td>University Press Limited&lt;br&gt;Three Crowns Building Jericho&lt;br&gt;Private Mail Bag 5956&lt;br&gt;Ibadan</td>
</tr>
<tr>
<td>NORWAY</td>
<td>Narvensen Information Center&lt;br&gt;Bank Department&lt;br&gt;P.O. Box 6133&lt;br&gt;Elstetad&lt;br&gt;N-0620 Oslo 6</td>
</tr>
<tr>
<td>PAKISTAN</td>
<td>Mizra Book Agency&lt;br&gt;65, Shahrah-e-Quaid-e-Azam&lt;br&gt;P.O. Box N. 729&lt;br&gt;Lahore 54000</td>
</tr>
<tr>
<td>PERU</td>
<td>Editorial Desarrollo SA&lt;br&gt;Apartado 3624&lt;br&gt;Lima 1</td>
</tr>
<tr>
<td>PHILIPPINES</td>
<td>International Book Center&lt;br&gt;Fifth Floor, Filipino Life Building&lt;br&gt;Ayala Avenue, Makati&lt;br&gt;Metro Manila</td>
</tr>
<tr>
<td>POLAND</td>
<td>ORPAN&lt;br&gt;Palace Kultury i Nauki&lt;br&gt;90-901 Warszawa</td>
</tr>
<tr>
<td>PORTUGAL</td>
<td>Livraria Portugal&lt;br&gt;Rua Do Camo 70-74&lt;br&gt;1200 Lisbon</td>
</tr>
<tr>
<td>SAUDI ARABIA</td>
<td>Jadi Book Store&lt;br&gt;P.O. Box 2196&lt;br&gt;Riyadh 11471</td>
</tr>
<tr>
<td>SINGAPORE, TAIWAN, MYANMAR, KOREA</td>
<td>Information Publications&lt;br&gt;Private, Ltd.&lt;br&gt;02-06-1st Fl., Pei-Pu Industrial&lt;br&gt;24 New Industrial Road&lt;br&gt;Singapore 1953</td>
</tr>
<tr>
<td>SOUTH AFRICA, BOTSWANA</td>
<td>For single titles: Oxford University Press&lt;br&gt;Southem Africa&lt;br&gt;P.O. Box 1141&lt;br&gt;Cape Town 8000</td>
</tr>
<tr>
<td>SWITZERLAND</td>
<td>For single titles: Librairie Payot&lt;br&gt;1, rue de Bourg&lt;br.CH-1002 Lausanne</td>
</tr>
<tr>
<td>SWEDEN</td>
<td>For single titles: Fritzes Fachbuchverlag&lt;br&gt;Kergersangatan 12, Box 1656&lt;br&gt;1-101 27 Stockholm</td>
</tr>
<tr>
<td>TRINIDAD &amp; TOBAGO, ANTGUAR</td>
<td>For single titles: Librairie Payot&lt;br&gt;1, rue de Bourg&lt;br.CH-1002 Lausanne</td>
</tr>
<tr>
<td>UNITED KINGDOM</td>
<td>For single titles: Librairie Payot&lt;br&gt;Service des Abonnements&lt;br&gt;Case postale 2012&lt;br&gt;CH-1002 Lausanne</td>
</tr>
<tr>
<td>VENEZUELA</td>
<td>Summary of Studies Unit&lt;br&gt;99 Water Street&lt;br&gt;Curepe&lt;br&gt;Trinidad, West Indies</td>
</tr>
<tr>
<td></td>
<td>UNITED KINGDOM&lt;br&gt;Microtext Ltd.&lt;br&gt;P.O. Box 3&lt;br&gt;Alton, Hampshire GU4 2PG&lt;br&gt;England</td>
</tr>
<tr>
<td></td>
<td>LIBRERIA DEL ESTE&lt;br&gt;Aptito 60, 337&lt;br&gt;Cancas 1060-A</td>
</tr>
<tr>
<td>No.</td>
<td>Title</td>
</tr>
<tr>
<td>---------</td>
<td>----------------------------------------------------------------------</td>
</tr>
<tr>
<td>153</td>
<td>Funding Mechanisms for Higher Education: Financing for Stability, Efficiency, and Responsiveness</td>
</tr>
<tr>
<td>154</td>
<td>Earnings, Occupational Choice, and Mobility in Segmented Labor Markets of India</td>
</tr>
<tr>
<td>155</td>
<td>Managing External Debt in Developing Countries: Proceedings of a Joint Seminar, Jeddah, May 1990</td>
</tr>
<tr>
<td>156</td>
<td>Developing Agricultural Extension for Women Farmers</td>
</tr>
<tr>
<td>157</td>
<td>Awakening the Market: Viet Nam's Economic Transition</td>
</tr>
<tr>
<td>158</td>
<td>Wage Policy during the Transition to a Market Economy: Poland 1990–91</td>
</tr>
<tr>
<td>159</td>
<td>International Trade and the Environment</td>
</tr>
<tr>
<td>160</td>
<td>International Migration and International Trade</td>
</tr>
<tr>
<td>161</td>
<td>Civil Service Reform and the World Bank</td>
</tr>
<tr>
<td>162</td>
<td>Rural Enterprise Development in China, 1986–90</td>
</tr>
<tr>
<td>163</td>
<td>The Balance between Public and Private Sector Activities in the Delivery of Livestock Services</td>
</tr>
<tr>
<td>165</td>
<td>Fisheries Development, Fisheries Management, and Externalities</td>
</tr>
<tr>
<td>166</td>
<td>The Building Blocks of Participation: Testing Bottom-up Planning</td>
</tr>
<tr>
<td>167</td>
<td>Seed System Development: The Appropriate Roles of the Private and Public Sectors</td>
</tr>
<tr>
<td>168</td>
<td>Environmental Management and Urban Vulnerability</td>
</tr>
<tr>
<td>169</td>
<td>Common Property Resources: A Missing Dimension of Development Strategies</td>
</tr>
<tr>
<td>170</td>
<td>A Chinese Province as a Reform Experiment: The Case of Hainan</td>
</tr>
<tr>
<td>171</td>
<td>Issues for Infrastructure Management in the 1990s</td>
</tr>
<tr>
<td>172</td>
<td>Japanese National Railways Privatization Study: The Experience of Japan and Lessons for Developing Countries</td>
</tr>
<tr>
<td>173</td>
<td>The Livestock Sector in Eastern Europe: Constraints and Opportunities</td>
</tr>
<tr>
<td>174</td>
<td>Assessing Development Finance Institutions: A Public Interest Analysis</td>
</tr>
<tr>
<td>175</td>
<td>Resource Management and Pastoral Institution Building in the West African Sahel</td>
</tr>
<tr>
<td>176</td>
<td>Public and Private Sector Roles in Agricultural Research: Theory and Experience</td>
</tr>
<tr>
<td>177</td>
<td>The Regulatory Impediments to the Private Industrial Sector Development in Asia: A Comparative Study</td>
</tr>
<tr>
<td>178</td>
<td>China: Reforming Intergovernmental Fiscal Relations</td>
</tr>
<tr>
<td>179</td>
<td>Nippon Telegraph and Telephone Privatization Study: Experience of Japan and Lessons for Developing Countries</td>
</tr>
<tr>
<td>180</td>
<td>China's Reform Experience to Date</td>
</tr>
<tr>
<td>181</td>
<td>Combating AIDS and Other Sexually Transmitted Diseases in Africa: A Review of the World Bank's Agenda for Action</td>
</tr>
<tr>
<td>182</td>
<td>Privatization Problems at Industry Level: Road Haulage in Central Europe</td>
</tr>
<tr>
<td>183</td>
<td>Participatory Development and the World Bank: Potential Directions for Change</td>
</tr>
</tbody>
</table>