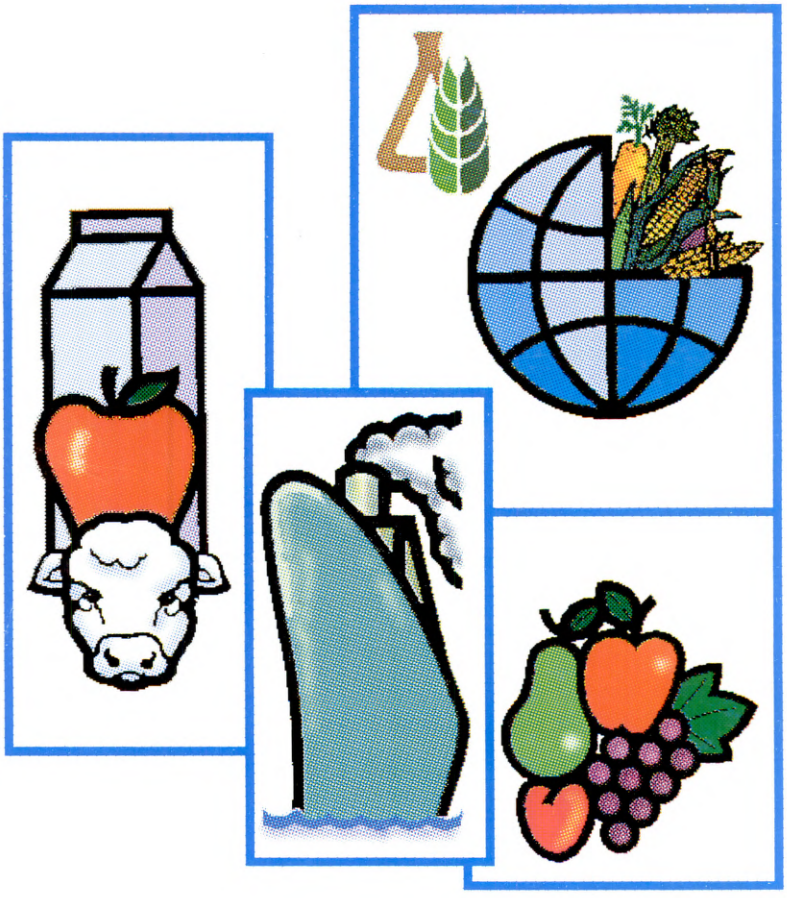
PUBLIC AND PRIVATE SECTOR ROLES IN THE PROVISION OF AGRICULTURAL SUPPORT SERVICES



PROCEEDINGS OF THE INTERNATIONAL SYMPOSIUM
San Jose, Costa Rica, May 17-19, 1993

Inter-American Institute for Cooperation on Agriculture (IICA)
The World Bank
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TABLE OF CONTENTS

LIST OF BOXES

LIST OF TABLES

Appendix Tables

LIST OF FIGURES

ACRONYMS

ACDI	Canadian International Development Agency (CIDA)
ADBs	Agricultural development banks
AECI	Spanish Agency for International Cooperation, Spain
AKRSP	Aga Khan Rural Support Program, Pakistan
ALCOSA	Vegetable processor in Guatemala
ALIDE	Latin American Association of Development Finance Institutions
ALIMENTARIA	Specialized Trade Fair in Barcelona, Spain
AMUL	Anand Milk Union Ltd., Gujarat, India
ANDE	Agency for Livestock Development
APMP	Agro-Production and Marketing Program, Thailand
AV	Association Villagois, Mali
CATT	Centers for Technology Adjustment and Transfer of INIA, Chile
CBI	Crop Breeding Institute, Zimbabwe
CENICAÑA	Sugar Cane Research Center, Colombia
CETA	French Consortia for Agricultural Technology Experimentation, France
CGIAR	Consultative Group on International Agricultural Research
CIANO	Center for Agricultural Research of the Northwest, Mexico
CIAT	International Center for Tropical Agriculture
CIMMYT	International Maize and Wheat Improvement Center
CINVESTV	Research and Advanced Studies Center, Mexico
CIP	International Potato Center
CIPCA	Research and Small-Farmer Outreach Center, Bolivia
CIRAD	Center for International Cooperation in Agricultural Research for Development
COINCA	Integrated Small-Farmers' Cooperative, Bolivia
CONAPEX	National Export Promotion Council, Guatemala
CONFEXI	National Export Promotion and Investment Council, Honduras
CONIA	National Agricultural Research Council, Venezuela
CREA	Rural Consortia of Agricultural Experimentation
DANIDA	Danish International Development Agency, Denmark
DCS	Dairy Cooperative Society, India
DDC	Dairy Development Corporations, India
DIECA	Directorate for Sugar Cane Research and Extension Services, Costa Rica
DNA	Deoxyribonucleic acid
DU	District union
ECF	Enzootics Control Fund, Germany
ECLAC	Economic Commission for Latin America and the Caribbean
EDI	Economic Development Institute of the World Bank
EEC	European Economic Community
EMBRAPA	Brazilian Institute of Agricultural Research, Brazil
FA	Farmers' associations
FAO	Food and Agriculture Organization of the United Nations
FEDEARROZ	Colombian Rice Producers Association, Colombia
FHIA	Honduran Agricultural Research Foundation, Honduras
FMD	Foot-and-mouth disease
FNEC	National Federation of Central African Livestock Producers
FONAIAP	National Agricultural Research Fund, Venezuela
FRR	Financial rate of return

FUNDAGRO	Agricultural Development Foundation, Ecuador
FUNDEAGRO	Agricultural Development Foundation, Peru
FUSADES	Salvadoran Economic and Social Development Foundation, El Salvador
FUSAGRI	Farmers' Services Foundation, Venezuela
GATT	General Agreement on Tariffs and Trade
GKSI	Association of Milk Cooperatives of Indonesia
GSP	Generalized System of Preferences
AI	Artificial insemination
IAs	Agricultural engineers
IBRD	International Bank for Reconstruction and Development
IBTA	Bolivian Institute of Agricultural Technology, Bolivia
ICA	Colombian Agricultural Research Institute, Colombia
ICRISAT	International Crop Research Institute for the Semi Arid Tropics, India
ICTA	Agricultural Science and Technology Institute
IDB	Inter-American Development Bank
IDIAP	Agricultural Research and Development Institute
IDRC	International Development Research Centre
IFAD	International Fund for Agricultural Development
IFPRI	International Food Policy Research Institute
IMF	International Monetary Fund
IICA	Inter-American Institute for Cooperation on Agriculture
INDAP	Agricultural Development Institute, Chile
INIA	National Agricultural Research Institute, Chile
INIAA	National Agricultural and Agroindustrial Research Institute, Peru
INIAP	National Institute of Agricultural Research
INIFAP	National Institute of Forestry, Agricultural and Fisheries Research, Mexico
IRRI	International Rice Research Institute
ISNAR	International Service for National Agricultural Research, The Netherlands
INTA	National Agricultural Technology Institute, Argentina
IPD	International Physical Distribution
ISAAA	International Service for the Acquisition of Agri-biotech Applications
ITC	International Trade Center (UNCTAD/GATT)
IVO	Instituto de Estudios de Desarrollo, The Netherlands
JARP	Jamaican Agricultural Research Program, Jamaica
KUD	Kooperative Union Desa, Indonesia
LAC	Latin America and the Caribbean
LAICA	Sugar Cane Industrial League, Costa Rica
LATU	Technological Laboratory of Uruguay
LDCs	Less-developed countries
MAG	Ministry of Agriculture and Livestock, Costa Rica
NARS	National agricultural research systems
NCVR	Nonconventional virus resistance
NFP	Not-for-profit services
NGOs	Nongovernmental organizations
NTAE	Nontraditional agricultural export
ODA	Overseas Development Administration, United Kingdom
OECD	Organization for Economic Cooperation and Development
OTA	Office of Technology Assessment of the U.S. Congress
PAF	Private agribusiness firms

PCR	Polymerase chain reaction
PDTA	Agricultural Technology Development Program, Ecuador
PS	Primary society
R & D	Research and development
SAICO	Siam Agro Industry Co. Ltd., Thailand
SANCOR	Santa Fe-Cordoba United Cooperatives, Argentina
SIFCO	Siam Food Products Company, Thailand
SIPA	Agricultural Research and Outreach Service
T & V	Training and visit
TIS	Trade information services
TNCs	Transnational corporations or companies
TPO	Trade Promotion Office
UNCTAD	United Nations Conference on Trade and Development
USAID	United States Agency for International Development
VLUs	Veterinary livestock units

INTRODUCTION

FOREWORD

Most developing countries are adjusting their strategies so they can pursue growth objectives at the same time they address social and environmental concerns, in a context of international competition and a greater role for the market in the allocation of resources.

Market liberalization is part and parcel of the structural adjustment programs that were adopted by a growing number of developing countries in the 1980s and the early 1990s. This has involved redefining the roles of the state and private sector, as well as the ways in which they interact. The agricultural sector, and agricultural support services in particular, have also been affected by this trend.

Whereas in most developing countries agricultural production is a private-sector activity, agricultural services, including agricultural research and extension, seed development and marketing, and veterinary and financial services, have usually been provided by the public sector.

The roles of the public and private sectors in providing agricultural services are evolving as agriculture itself changes, as ever stronger links are forged with the international economic systems, and as a result of institutional reforms under way in the countries.

Before determining under which conditions certain services (or specific functions within a service) should be provided by private agents, or when state intervention is preferable, an in-depth analysis of the nature of each function is required. Certain functions may be sufficiently profitable to be provided efficiently by private enterprises. Others, however, may be considered public goods, or may be subject to other market failures, requiring that the state take corrective action or provide the service directly itself.

The roles the public and private sectors take on in providing agricultural support services will vary in each country, depending on the structure of agriculture in each. This means that institutional reform must take into account the needs and possibilities of different types of farmers. Furthermore, a detailed analysis and additional information are required on the experiences of the countries, to serve as inputs for discussions to clarify what would be appropriate roles for the private and public sectors in the provision of such services, and on the strategy to be followed during the transition period.

Accordingly, the World Bank and the Inter-American Institute for Cooperation on Agriculture (IICA), with support from the Center of International Cooperation on Agricultural Research for Development (CIRAD) and the Governments of France and Denmark, held a symposium in San Jose, Costa Rica, on May 17-19, 1993, to discuss appropriate roles for the private and public sectors in the provision of agricultural services. Participants in the meeting included experienced professionals from the public and private sectors of developing countries and officials from international development organizations with experience in this field. In the course of the meeting, the results of studies recently conducted by the sponsoring institutions were discussed and papers were presented by participants from the countries.

These proceedings are comprised of summaries of the studies, the principal papers, presentations on experiences in the countries, general discussions, as well as recommendations for effective management of the agricultural support services sector.

In publishing these proceedings, the aim of the World Bank and IICA has been to provide the participants, as well as authorities and development officials in the countries, with reference material that will be useful in planning reforms of the systems in their respective countries. At a later date, a more detailed book will also be published. In addition, other actions will be taken to follow

up on the recommendations made during the symposium.

This document is divided into three parts. The introductory section is followed by the speeches delivered during the inaugural session by the representatives of the two principal co-sponsoring institutions and by the Minister of Agriculture and Livestock of Costa Rica, Juan Rafael Lizano.

The third section covers the working sessions, by topic or specific service: agricultural research, seeds and genetic material, agricultural extension and information, livestock services, financial services and foreign trade promotion services. Each session contains one or more key papers, comments by country participants and a summary of the general discussion. This section concludes with a review of the session dealing with the transition to a new equilibrium.

Finally, the document presents a list of participants, the list of base and complementary documents presented during the symposium, and the program of the event.

Carlos Pomareda
IICA

Gershon Feder
The World Bank

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The World Bank and the Inter-American Institute for Cooperation on Agriculture (IICA) wish to express their sincere gratitude to the co-sponsors of the event: the Center for International Cooperation in Agricultural Research for Development (CIRAD) and the Ministry of Foreign Affairs of France, as well as the Danish International Development Agency (DANIDA) and the Government of Denmark, for their effective support in making this symposium possible.

We also wish to acknowledge and thank the Government of Costa Rica, the country which served as the site of the event, and in particular, the Ministries of Livestock and Agriculture and of Foreign Relations, for their valuable support.

We would also like to express our appreciation to all the personnel of IICA, as host institution, and of the World Bank, who participated in successfully organizing and conducting the meeting. A special thanks to Rafael Trejos, who served as technical coordinator of the symposium and who also collaborated in preparing these proceedings, to Leda Avila, coordinator of the Secretariat, to Roxana Montero, Chief of the Conference and Meetings Unit at IICA, to Anna Schliemann, coordinator of the symposium on the World Bank side, and Felicitas Doroteo-Gomez, who helped with arrangements for participants.

GLOSSARY OF ECONOMIC TERMS

PUBLIC vs PRIVATE GOODS

The principles of subtractability and excludability determine whether a good or service is closer to being a public or private good. Subtractability applies when one person's use or consumption of a good or service reduces its value to others (e.g., a person's consumption of an apple makes it unavailable to others). Excludability applies when access can be denied to those who have not paid for the product (e.g., the apple is available only to the person who bought it). A pure **private good** is characterized by high subtractability and excludability, for example, the consumption of the apple. A pure **public good** has low excludability and subtractability: if it is available to one person, it is available to all. Private firms will find it unprofitable to supply public goods, because it is difficult to restrict use to people who pay for them (also known as the "free rider" problem). Therefore, it will be up to governments to produce or finance the delivery of these goods, while using their powers of taxation to force all beneficiaries to pay for them.

EXTERNALITIES

Externalities arise when an individual, in the course of rendering (or consuming) some service for which payment is received (is made), coincidentally also renders services or disservices to other persons for which payment cannot be exacted from the benefited parties or compensation enforced on behalf of the injured parties. A typical example is that of a coal-burning power generation facility spewing smoke into its surrounding environment. Unlike a public good, these incidental services need not be identical in nature or quantity to the service for which the payment is made. Typically, individuals causing the externality will not take the positive or negative effects of their actions into consideration when deciding what levels of services they should produce or consume; thus, either too little (in case of positive externalities) or too much (in the case of negative externalities) is produced or consumed. These externalities, therefore, justify government intervention, such as the subsidization (taxation) of activities, to raise (reduce) production or consumption to socially desirable levels.

MORAL HAZARD PROBLEM

Moral hazard problems arise because consumers are unaware or are unable to assess visibly and directly the quality of the product they are purchasing: For example, the difference between an active and inactive vaccine. This creates incentives for producers to pass on substandard goods to consumers who are unable to tell the difference at the time of purchase. To overcome the moral hazard problem, the state generally monitors these producers' operations and/or imposes regulations governing quality standards. In situations of critical public significance, the state assumes full control of the sector and engages in the activity itself.

MONOPOLY

A **monopoly** may exist because entry by other firms is limited or production is subject to economies of scale (**economies of scale** result in falling costs as output increases due to a large proportion of fixed costs). Being the sole supplier in the industry, the monopolist will set output below and prices above competitive levels. Government regulatory measures are therefore necessary to ensure that prices and output remain at socially desirable levels.

INFANT INDUSTRY PROMOTION

Infant industry promotion is based on the premise that the production of some goods and services is subject to economies of time. **Economies of time** result in falling costs over time, primarily due to the accumulation of experience and knowledge. Economies of time are characteristics that may justify government subsidies for particular industries in their initial stages, because a firm may not be competitive early on in its operational life, but show clear evidence of profitability in the long term.

INAUGURAL SESSION

WELCOMING ADDRESS

Martin E. Piñeiro [1/]

Mr. Minister of Agriculture of Costa Rica, Eng. Juan Rafael Lizano; Dr. Michel Petit, Director of Agriculture of the World Bank, the principal co-organizer of the symposium; colleagues at the head table, participants and friends.

First of all, I would like to welcome you to Inter-American Institute for Cooperation on Agriculture (IICA), the House of Agriculture in the Americas, and to express my satisfaction in seeing so many visitors from outside the Americas, from countries that share problems similar to ours. In this respect, I should like to make special mention of the participants from the countries of Eastern Europe and to congratulate them for the efforts they are making to rejoin the world economy under very difficult circumstances. I think that many of the things we are going to discuss in relation to the problems we have in Latin America may also be useful to you.

I would also like to give a very special thanks to the co-sponsors of this event: the Center of International Cooperation in Agricultural Research for Development (CIRAD), the Government of France and the Danish International Development Agency (DANIDA) of the Government of Denmark, for their collaboration and for having chosen IICA to host the meeting. It also gives us the opportunity to introduce you to IICA.

In these brief opening remarks, I would like to give you an idea of why this topic has led Latin America and the Caribbean, and ourselves, as an inter-American agency, to focus our attention on the topic of the symposium. These comments are primarily for the visitors from outside the region, who perhaps are unaware of the profound changes that have taken place in the Americas over the past ten years.

After World War II, Latin America pursued development following an industrial import-substitution strategy which contained innovative elements designed and developed by Latin Americans, primarily at the headquarters of one of the major United Nations agencies, the Economic Commission for Latin Ameria and Caribbean (ECLAC). This development strategy was based on three central ideas: a) protected markets; b) priority for industrial development, particularly for durable consumer goods; and c) an important role for the state in economic activity, not only in providing traditional public services, but also at the core of the countries' economies.

This strategy was successful for at least thirty years. Although it created negative distortions in the agricultural sector, due to the emphasis on industry, it still generated considerable growth in services; led to the creation and consolidation of important public research and technology transfer agencies; and gave rise to major special projects for the most disadvantaged sectors within agriculture. Through subsidized or state credit, the state took on a major role in domestic and foreign marketing. Agriculture, then, developed within the context of a strategy in which the public sector played a key role.

During the 1980s, the entire region was submerged in a severe crisis, the main causes of which were the countries' inability to repay their debts and the galloping inflation generated, in part, by fiscal deficits in almost all of our countries. During the latter part of

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[1/] Director General, IICA

the 1980s, however, the countries of Latin America worked continously to redefine their development strategy, seeking to further open their economies to international markets. In addition, they undertook major efforts to restructure their economies, which led to economic specialization. This fostered growth or at least the creation of new opportunities for expansion of the agricultural sector. What I would like to emphasize here is the fact that since one of the major problems of the crisis was the fiscal deficit, it was necessary, as part of the strategy, to rapidly reduce the size of the state and, consequently, the extent of its intervention in the economy. This had a strong impact on the services provided by the public sector.

Although the downsizing of the state was necessary and unavoidable, both because of the debt crisis and the fiscal deficits, we should recognize, perhaps with a measure of self-criticism of ourselves as Latin Americans, that it was done without sufficient thought and without a clear idea of what the state's final role should be in the economy.

We are currently at the end of the process to reduce state intervention, with the resulting weakening of the public sector and the emergence of new private players in the provision of services. It is now necessary to reflect on the type of model we want. I do not mean the economic development strategy, for which there is already a clear political decision by all the countries of Latin America to move in the direction mentioned earlier. What we need to reflect on now is how and to what extent the state should intervene in providing agricultural support services. That is why the topic of this symposium is vital for the region. At the same time, we believe that the experiences gained recently in Latin America can be useful to other regions of the developing world. In this connection, it is important that we ask ourselves three questions that are of key importance; in any event, these are the questions I ask myself when thinking about this matter:

1. What should the state do? Which public services represent public goods that cannot be delegated by the state?

2. In the process of privatization and in efforts to delegate some of the functions carried out by the public sector to the new players in the these sectors, how can we ensure that these services also reach the least advantaged sectors of agriculture, whose access to markets are minimal and who have a weaker negotiating capacity in the market?

3. How can we integrate the functions of the public sector with those of the private sector, recognizing that this signifies a step backwards for the public sector and a step forward for new social players?

I think that we should not only think in terms of the progressive privatization of services, but also of how we can incorporate the demands and activities of the private sector into the administration and operation of traditional public sector agencies. This idea, in turn, requires that we ask ourselves how to organize our economy, particularly the agricultural sector, to make sure it is fairly represented and suitably organized, with democratic management and administration of public sector agencies. I think these are three general, but key, ideas which we will need to discuss over the next few days.

I would like to conclude by saying that I hope this will be a productive symposium, that it will represent an important turning point in our deliberations here in the Americas, and that it will give each and every one of us fresh and innovative ideas on how to approach this important topic.

OVERVIEW OF THE PUBLIC AND PRIVATE SECTOR ROLES IN THE PROVISION OF AGRICULTURAL SUPPORT SERVICES

Michel Petit[2/]

Introduction

Defining the relative roles that governments and the private sector have to play to ensure sustainable economic growth is, perhaps, one of the greatest challenges facing the development community today. In particular, the ongoing transition from planned to market economies occurring in Eastern European countries and the newly independent states of the former Soviet Union has sharpened the focus on the appropriate roles of the public and private sectors in the economy. Similarly, the escalating fiscal deficits in many developing countries have increasingly redirected attention toward market liberalization and privatization options.

While this debate is topical today, it is one of the oldest debates in economics. Adam Smith's invention of the invisible hand was in reaction against the prevailing convictions among the mercantilists that governments had a very important role to play in determining the wealth of nations. This conviction was widespread in my own country, France. It has been historically a strong component of the national culture, from Colbert, who promoted the development of manufactures in the 17th century, to Pompidou, who was instrumental in bringing about the modernization of industry in the 1970s.

Between the invisible hand of Adam Smith, according to whom the pursuit of private interest leads to the public good, and the heavy hand of government intervention, the challenge is to define the proper role of government as that of a helping hand, promoting economic development. There are many examples of such a helping hand playing a critical role: from the creation of a customs union, the "collverein" at the beginning of the German unification process, to the modernization of Japan following the Meiji revolution. All of these demonstrate that governments do have a role to play in certain functions of a country's economic and social life, even if the pendulum has recently swung toward a contraction of the role of the government, leading to the current emphasis on privatization. At the same time, the transfer of economic functions, including agricultural support services, from the public to the private sector itself raises several related issues. Will private sector delivery necessarily imply greater efficiency and equity? What are the social as well as income distributional implications, particularly with respect to potentially inequitable access of various segments of the population, such as small farmers and the rural poor?

Economic Issues

Promoting economic efficiency and growth lies at the heart of the market liberalization and privatization agenda. However, as noted above, this does not necessarily imply complete surrender of all public sector responsibilities. Furthermore, the nature and extent of public intervention in different sectors, including agricultural support services, will be largely governed by the nature and magnitude of the market failures prevailing in the sector; these include: (i) the case of public goods, (ii) the presence of externalities, (iii) moral hazard problems, (iv) infant industry situations, and (v) the existence of monopolies.

[2/] **Director of Agriculture and Natural Resources Department, The World Bank.**

The very nature of **public goods** prevents private sector provision because of the difficulty of restricting use to people who have paid for them and because their supply is not reduced by the consumption of others. Since private firms find it unprofitable to produce these goods and services, it will be left to the government to provide them directly or to finance their delivery, while using its powers of taxation to make all direct and indirect beneficiaries pay for these goods and services. Government provision becomes especially relevant in circumstances where the risks are so high that potential investors are simply unwilling to assume that risk, or in such instances when the market is inadequate to carry the ventures through into development, for example, the inadequacy of the financial markets available to the newly-private farmers in the countries of the former Soviet Union. Also, there are the more obvious public goods. In agriculture, these include most infrastructure, education, basic research and public information. But even in those cases, delivery of some services may be contracted out by the government to private entities or local user groups. In all situations, concern for general human welfare, particularly the alleviation of poverty, should be dealt with with the utmost urgency. To paraphrase an ex-Bank colleague, Mahbub ul Haq (1992), we must not allow the demise of socialism to be the demise of our social objectives.

In the case of **externalities**, government intervention (not to be confused with government ownership) is essential because individuals will not take into account the positive or negative effects of their actions when deciding what levels of services they should produce or consume, with the result that either too little of the service is produced or consumed in the case of positive externalities, or too much is produced or consumed in the case of negative externalities. Therefore, government intervention can go a long way in correcting such imbalances and resource misallocations with measures ranging from the enforcement of regulations and/or taxation to reduce the negative effects of particular activities, for example, regulatory control of environmental pollution, or the subsidization of underconsumed services, such as vaccination programs against contagious diseases, to raise usage levels to socially optimal levels.

Moral hazard problems become critical for commodities whose quality cannot be explicitly evaluated, thus creating incentives for producers to supply sub-standard products. In most cases, sub-standard products can have deleterious effects on consumers, necessitating strict government regulation and quality control. Similarly, government intervention to regulate **market monopolies** are necessary, although incentives to encourage competition do not necessitate the establishment of public control over such functions. Finally, the promotion of **infant industries** provides temporary justification of government subsidies to particular industries. Such short-term government protection derives from economies of scale and time, which make operations uncompetitive in the initial stages of the firm's operational life, but show clear evidence of profitability in the longer term.

Overview of Issues in the Privatization of Agricultural Support Services

This symposium aspires to provide a more concrete framework for defining the appropriate roles of the public and private sectors in six types of agricultural support services: agricultural research and extension, veterinary services, seed development and marketing, financial, and trade promotion services. In most developing countries, these services have been traditionally publicly provided. However, recent studies on the structure of the agricultural research and extension, seed, and rural finance sectors indicate that there is clear evidence of widespread inefficiencies in their provision by

public agencies, as frequently manifested by declining quantity and quality of services. Such inefficiencies are often attributed to two major factors: too much government, resulting in fiscal difficulties, and overall poor governance, reflected in inadequate motivation, irregularities, and inefficiency. For example, government-owned agricultural credit systems in many countries have experienced low recovery rates and have accumulated heavy losses, draining government agricultural budgets. These problems, which are referred to as "government failures," are as important as the "market failures" which motivate government intervention to begin with. Alleviating such government failure problems will involve shedding some of the public sector activities and opening opportunities for greater private sector participation in delivering these support services. For example, the transfer of veterinary drug distribution from the government to the federation of livestock producers in the Central African Republic increased the availability and supply of veterinary drugs, such that sales jumped from about US$49,000 in 1981 when the government ended its distribution operations to about US$140,000 a year later when the farmer's federation took over, reaching US$5.7 million by 1988. At the center of this issue, then, is how much of these traditionally public services should be transferred to the private sector? In using the term "private sector," I also include all associations of farmers, other community groups and what is often called the informal sector.

It is clear that complete arbitrary transfer of all support services to the private sector is not the answer. As I emphasized earlier, it will be the economic characteristic of each service, namely the extent of market failure, that will determine the best avenue for delivery. Particular characteristics such as public goods, externalities, moral hazard problems, infant industries and monopolies will demand public sector intervention. Since private sector investments are driven by the returns on the investments and the appropriability of those returns, specific areas where these criteria are not fulfilled will be ignored by the private sector. For example, there is limited research being done by the private sector in self-pollinated crops such as rice and wheat, important staples in many developing countries, because of difficulties in appropriating the returns from their development. Therefore, it may be left to the public sector to conduct, or at least finance, the research on technologies that are socially desirable, but privately unprofitable. Similarly, the regulation of standards for quality control, whether for veterinary pharmaceuticals, vaccines, or seeds, must ultimately remain a public sector decision and responsibility, although actual performance may be subcontracted to private entities. Moreover, special circumstances in some countries, such as the stage of private-sector development and cultural and social considerations, may be critical factors influencing the balance between public and private sector relationship. For example, the unprofitability of providing agricultural support services to more remote areas, where often the poorest farmers reside, will discourage private sector provision and the public sector will have to assume the responsibility. This also implies that the appropriate public and private sector roles in some sectors will evolve as the respective service sectors and the overall economy graduate to different stages of development.

How then shall we proceed with this endeavor? As an initial step, which we are going to undertake in the next three days, it is necessary to identify areas where the public sector can withdraw in the short term, because it is assuming, duplicating, or impeding activities which the private sector can efficiently perform. Subsequently, there is a need to identify where gradual public sector withdrawal can be undertaken and where state intervention or support is required to develop an institutional framework, encouraging sustained private sector operations in the various agricultural services industries. Simultaneously, we need to identify areas toward which the public sector should focus

its attention, and where it is essential that the responsibility for service delivery (e.g., financial services) is maintained by the government, because it is not likely to be handled by non-governmental entities. Greater consideration should also be directed toward the advantages of using economic signals (i.e., taxes and subsidies) and regulations, rather than government ownership of services, for services which involve externalities. Fulfilling these objectives will require a package of measures that will foster an enabling environment for private sector performance of agricultural support activities. Specifically, these may include the dismantling of parastatals, the subcontracting of some services to private entrepreneurs, providing a legal status for producer associations to handle some public goods, the removal of monopoly privileges and implicit and explicit subsidies, and strengthening the framework for property rights protection. Administrative capacity-enhancing programs, specifically targeted toward strengthening the legal and enforcement capacities of government agencies, will be required. However, concurrent with the proposed public sector restructuring, provisions for the protection of the weak and the poor must be ensured and remain foremost in the formulation and implementation of any adjustment program.

Conclusion

In the pursuit of the right balance between public and private provision of agricultural support services, we must recognize that the structure of the agricultural sector differs across countries and that the agricultural sector within any country is changing over time. This implies changing public and private sector interactions, and therefore there is no rigid formula for public and private sector roles which fits all countries uniformly. The analysis and policy prescription must be handled in a country- and service-specific manner, and will require the dedicated efforts of governments, the private sector and the ultimate users of the service, aided by international donors if necessary. I hope that in sharing our varied experiences in the management of agricultural services over the next three days, we will leave this symposium with knowledge that will enable us to formulate reforms and restructuring in our areas of responsibility in the future. In the World Bank, we are working with governments, through our technical assistance and lending programs, in identifying areas where private sector participation can be encouraged and enhanced, and proposing policy reform and public sector restructuring which can be undertaken to provide a more attractive economic environment for private sector participation.

I wish all of you success and I would like to thank all those who have contributed to the organization and funding of this event: IICA, DANIDA, CIRAD, the Foreign Ministry of France, USAID, ODA, and my colleagues at the World Bank.

OPENING REMARKS

Juan Rafael Lizano [3/]

It has fallen to the men and women of the twentieth century to be both actors in and witnesses to profound changes in their economic, political, scientific, social and cultural settings.

They have seen dreams come true they never thought possible, and they have accomplished things never dreamed of. Progress in the field of nuclear energy, ventures into space, the fall of totalitarian regimes and laser surgery are but a few examples of the lightning-fast progress of our times.

With so much transformation, the world economy could hardly remain unchanged, nor could the economic situation at the regional level and, consequently, in individual countries.

Today, the greatest challenge facing our generation is to establish and adjust development models so that they guarantee each nation the fair and reasonable use of its resources and possibilities: within a framework of real competitiveness, in unrestrained markets, with total respect for the ideas and sovereignty of the peoples of the world, with a heightened sense of social awareness, with the least possible negative environmental impact, and with a true spirit of collaboration, in the great community that embraces all the nations of the world.

Today, changes are occurring within each country: the role of the state is being redefined; institutional schemes are being adjusted and modernized; macroeconomic policies are being reoriented; the relationship between the public and private sectors are changing; and, perhaps most important of all, attitudes are changing.

Today, there are new ways of visualizing, analyzing and solving major and minor problems that crop up along the way, or which have been aggravated by the protectionist attitudes of development models which were in place in almost all our countries for many years.

These radical changes in philosophy, in the state and its institutions, and in attitudes have reached the agricultural sectors in all the countries, making it necessary to identify specific problems and solutions for meeting the needs involved in modernizing the sector, to ensure a coherent and balanced progress of the economy as a whole.

The symposium we are inaugurating today reflects, and at the same time is the result of, the new task we have before us, and of the need to exchange information and experiences with a view to identifying the best possible options for managing situations in a way that is tailored to the specific conditions of each country.

The purpose of this activity is to foster a broad discussion among authorities from the different nations and organizations that honor us with their presence, and who have the difficult task of making or supporting decisions to transform their economies and, particularly, the development philosophy of their respective states.

Our aim is to conduct an in-depth analysis of the different experiences and proposals making up the agenda of this meeting and to create an large pool of innovative ideas for designing the new or corrective strategies needed by each country.

I urge you to consider in your discussions the elements that will enable the state to fulfill its role in orienting, facilitating and managing

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[3/] **Minister of Agriculture and Livestock of Costa Rica**

the processes to change the patterns of production and services, within the current framework of economic liberalization.

Obviously, this means a complete reform of the state. It is important that this reform be envisaged not only from a fiscal standpoint, but also from the standpoint of the new role the state should fulfill. This implies answering in advance certain critical questions, such as: Where should overall development be headed? Which strategy is most consistent with a country's possibilities? How can responsibilities best be distributed to ensure the proper use and strengthening of private sector potential and the most rational use of state resources?

In this new framework of public and private action, we must acknowledge that, in most cases, we have little or no experience in this area; this is true in the case of new economic and trade policies designed to achieve a better position in third world markets. An ongoing examination and discussion of the topic among countries will enrich the criteria we use and result in a more timely identification of problems or errors made, precisely because of our lack of experience.

A similar situation exists with regard to the services provided to support trade opening and growing international relations. Here, greater attention should be given to defining the spheres of competence of the public and private sectors, under the premise that there is ample room for the participation of private enterprise.

In this sense, emphasis should be placed on upgrading the capabilities of private enterprise, instead of concentrating this capacity in state entities. This is a point that will be well worth our while to discuss over the next few days.

I think that, in one way or another, the points I have raised illustrate a situation that is common to most of the countries represented here.

Costa Rica is no exception. We are committed to a rapid modernization of agriculture, to include both production performance *per se* and changes in the institutional framework of the sector, with regard to functions, methods, training and the number of officials, the decentralization of resources and functions, and differentiation of client groups, among others.

In this nationwide effort, we are all involved and working together in unity, as required to make real progress, and we have brought about change in the public-private relationship. Today we can affirm that there is true complementarity of functions and that the private sector is highly motivated to take on new responsibilities.

It is important to note that, with regard to the above, in negotiations carried out in different fora, the state has become the representative of the private sector. This sector always attends the negotiations, supporting what we call "the work going on in the next room,"[1/] where we discuss the pros and cons of decisions that must be made, with the clear understanding that the position of the private sector will be the one defended by the public sector.

Clearly, this type of work is only viable if, as is the case in Costa Rica, the private sector is fully aware of its share of responsibility in modernizing agricultural development.

It has been primarily through this process that the private sector has been able to get a clearer idea of the opportunities that exist for participation, principally in support services and, above all, to understand the government's position that it is better to support and complement than to compete in this field.

I would like to point out that the private sector in Costa Rica is not a newcomer to this field and that, at the international level, it is well known that the private sector's active role in providing services explains, to a great extent, the progress made in improving the production and marketing efficiency of our principal traditional and nontraditional export commodities.

The private sector is also playing an ever greater role in scientific and technological development, in the production of improved planting materials, in financing investments in and operating farms, and in promoting exports. It is on this experience that we base our conviction of the private sector's capacity to assume new and greater responsibilities.

We know it is not an easy task, and that it requires greater amounts of resources to develop new capabilities in the public and private sectors, and a new style of working together, with shared responsibilities.

I cannot deny that we have stumbled on our way to progress, nor can I state that all our efforts have been successful. That is why I am confident that our participants in this event will be able to make valuable contributions to your discussions.

Costa Rica and, I am sure, all the other countries represented here today, have great expectations about the outcome of this meeting. I realize that you all have a great responsibility, for the changes that will be implemented in the agricultural economies throughout the world will depend, to a certain degree, on the recommendations and ideas arising from this meeting.

Therefore, I urge you to take advantage of every minute of this time and invest all your knowledge and the experience you have acquired in your work to make this international symposium as successful as possible, to the benefit of all the countries here and the international community as a whole.

I am sure that it will be necessary to hold many similar events to continue making the necessary changes in the best manner possible. That is why our progress here will be of key importance to the success of subsequent events.

In wishing every success to the participants, speakers and panelists, I would also like to express to the sponsors and organizers of the symposium the gratitude and appreciation of Costa Rica for the honor of selecting it as the site of this event and for the benefits we will reap from holding and participating in an event of this nature in our country.

On behalf of my government, I would like to take this opportunity to warmly welcome our distinguished visitors to Costa Rica and to wish you a pleasant stay in our country, which we believe is beautiful, peaceful and exemplary.

With my best wishes for success and progress for all peoples, I hereby declare the International Symposium on Public and Private Sector Roles in the Provision of Agricultural Support Services open.

Thank you very much.

1/ Translator's note: During negotiations, a room next to the negotiating room was provided for representatives from the private sector. When issues of importance to both sectors arose, negotiators from the public sector had easy access for consultation with representatives from the private sector.

DISCUSSION PAPERS

AGRICULTURAL RESEARCH

PUBLIC-PRIVATE SECTOR RELATIONS IN AGRICULTURAL RESEARCH AND DEVELOPMENT: NOTES ON EXPERIENCES AND ISSUES [1/]

Eduardo J. Trigo [2/]

Summary

The course taken by technology generation and transfer worldwide has considerable impact on the policies and organization of research and development, since it lays the foundation for new mechanisms to link the public and private sectors. In the specific case of Latin America and the Caribbean, a series of changes has heightened the interest and participation of the private sector in agricultural research and technology development.

In the early years of technology development, only public institutions could cover the costs of research. Agricultural research was thus considered to be a public good and the institutional model in place at the time was able both to guarantee the generation of technology, and to ensure that the cost of research was assumed by society. Furthermore, developed countries frequently transferred technology directly to developing countries, which required an infrastructure that could adapt existing technology to local conditions. In open economies, where countries must compete on world markets, greater importance is being placed on the ability to innovate than on the origin of the innovations.

As these conditions changed, new types of relationships between the public and private sectors have also developed in connection with agricultural research. A number of joint efforts between organized producers and public institutions, and, more recently, the creation of research foundations, are clear examples of this trend. These initiatives not only contribute to overall research capabilities and the broadening of the funding base for research, but also fill critical gaps in the traditional model.

The first is the need to link technology generation with how it will be used, something which public institutions have not done efficiently. Second, they provide an institutional "bank" for channelling private resources to research, since they are more attractive to private funding sources. For them to become permanent features of the institutional scene, some of their weaknesses will have to be resolved. These include: a) institutional instability, frequently due the lack of long-term funding, and b) limited technical capabilities, which makes it necessary for them to compete with the public sector.

1/ The author wishes to acknowledge the comments of Carlos Pomareda, Director of Program I: Agricultural Policy Analysis and Planning, on an early draft of this document and the contributions of the staff of IICA's Program II: Technology Generation and Transfer, particularly Walter Jaffé and María Ileana Mora, as well as Michael Snarskis's editorial assistance.

2/ Director, Program II: Technology Generation and Transfer, Inter-American Institute for Cooperation on Agriculture (IICA).

The increasing importance of markets for technological inputs is paving the way for a special type of relationship between research institutions and enterprises of the private technological input industry. Within this context, there are numerous opportunities for joint ventures, in which public institutions can provide their scientific and technological capabilities, and the private sector, the financial resources and market expertise. This type of relationship is of great consequence since it broadens the funding base of public institutions and, at the same time, increases the competitiveness of local companies which otherwise would not have access to research and technology development facilities, given their limited scale of operations.

These trends are further reinforced by the growing importance of biotechnology and the increased possibility of patenting and protecting the property rights of technological innovations related to agriculture. This is going to be an issue of growing importance as more and more relevant knowledge is taken out of the public domain and free access to scientific knowledge becomes a critical assumption in the operational design of today's national research institutions.

Transnational corporations are other important actors. Their participation may bring some problems, but it may also be an asset. To the degree that these corporations conduct research at the world level, privatization of applied research could benefit developing countries, particularly as regards export markets, by providing them with rapid access to the latest technological innovations, at the same time and the same cost as for other countries. Nevertheless, this involves a series of associated problem, such as a decrease in the genetic base of some crops and greater dependence on the corporations for technological inputs. Moreover, since transnational corporations focus their efforts on crops and technologies for which large markets exist, many crops and problems will not be covered by their R&D activities.

All of these factors underscore the importance of ensuring that national R&D institutions continue to provide their services, together with a specific policy governing the participation of transnationals on local agricultural input markets. With the emergence of new private research organizations, the deterioration of public institutions becomes more and more evident, and the situation will only worsen with time. This could have serious consequences for small producers, who are not targeted for service by private enterprise, since their wide range of working conditions do not represent profitable alternatives. It is, therefore, essential to take another look at the role of public institutions in developing agricultural technology, to enable them to function within the new economic and institutional context, and to continue providing their services to the traditional sector.

Introduction [1/]

Scientific discovery and resulting innovative technological processes could be the most important elements in 20th century civilization. In agriculture, new cultivars and important capital inputs have not only augmented yields and production, but also dramatically transformed agricultural societies and the well-being of individual groups. On the other hand, the pervasive impact of technical change on the economic and social organization of society has increased preoccupation with the development of mechanisms to control both the direction and intensity of technical change.

In Latin America and elsewhere in the less-developed world, discussion has revolved around the creation of national research institutions that could guarantee adequate state participation in the production of agricultural technology. However, the economic and institutional developments in these countries during the past two decades have spawned private and semi-public organizations that are

active in specific aspects of technology generation and transfer (Trigo and Kaimowitz 1993).

In market economies, the development of nonpublic research institutions is an integral part of the agricultural modernization process. This development is determined primarily by the formation of necessary preconditions related to the demand for technological inputs, production organization, the appearance and organization of social sectors with economic interests in technical change, and the growth of technological potential. In the last decade, these elements have been reinforced by the emergence of biotechnology, which changed not only the scientific base of agricultural research and development, but also the nature of the resulting technologies and the institutional context of the technological process in agriculture (Trigo and Piñeiro 1981).

This scenario has profound implications for both the policy and organizational dimensions of national agricultural research and development systems, and the capacity of developing countries to fully exploit the potential of science and technology for agricultural development and economic growth as it sets the stage for a new style of public-private interactions in technology generation and transfer.

In the context of the political, economic and scientific changes taking place in the region, the traditional, centralized, top-down, supply-driven concept of technology generation and transfer, where public institutions played the central role and technological change was visualized as a lineal process in which the sources of knowledge were clearly defined, is rapidly becoming obsolete. Now it is more appropriate to conceive of an "innovation system," with multiple sources of knowledge and different actors participating in a permanently evolving process of incremental changes. In this environment, public-private interactions play a critical role in promoting the needed technical change. In open economies attempting to compete in world markets, what is important is the capacity to innovate (new products, new processes, new capabilities, etc.), not so much the origin of the innovation. Without diminishing the importance of generating new technology, the focus of policy making should be on developing the capacity to incorporate new technological concepts into the production-marketing chain, and not so much on who generates the new knowledge (Avalos 1993).

In this document, we review some of the main forces behind this process with an emphasis on the growth of the private sector in agricultural research and technology development, then discuss the new institutional situation, attempting to highlight some of the forms of public-private collaboration that are emerging, as well as other important aspects to consider in a policy agenda oriented to promote innovation in the agricultural sector. The discussion focuses primarily on Latin America. However, since the basic forces behind this process are phenomena of a generic nature (for example, the role of technological development in market economies), the discussion could also be relevant to other regions of the developing world.

Agriculture Modernization and Institutional Change

The nature of technology has important implications for the relative role of the public and private sectors in technology development. In the early stages of development, the quasi-monopolistic role played by public research institutions was a matter of practical fact—only the state could absorb the costs of research. These initial costs are:

a. relatively high due to the lack of trained personnel and the absence of an adequate research infrastructure;

b. associated with high risks due to the lack of knowledge, absence of markets of adequate size, etc.; and

c. difficult to recuperate, given that private appropriation of the benefits from research was uncertain because a large proportion of the knowledge required referred to agronomic practices and simple technological know-how not associated with capital inputs.

Under these conditions, agricultural technology can be seen as a pure public good, and the institutional model that emerged assured the supply of technology and socialized research costs (Pray and Echeverría 1991; Umali 1992). In developing countries the problem was viewed as one of transferring technologies from developed to developing countries, which required an infrastructure capable of adapting available technologies to local conditions. This formed the conceptual basis for international assistance that supported the development of public research institutions, usually following the U.S. land-grant model (Trigo and Kaimowitz 1993)[2/].

As agricultural modernization progressed over the last three decades in Latin America and the Caribbean (LAC), several changes provoked increased interest and participation by the private sector in agricultural research and technology development.

The Public-Sector Role in the Development of Research Infrastructure and Human Resources

The initial efforts of national agricultural research systems (NARS) in Latin America, as well as in other parts of the world, were oriented toward human and natural resources as well as other information considered essential for applied and adaptive research. Work in both of these areas was undertaken with extensive funding and technical support from the international donor community (Trigo 1986). The result was a dramatic increase in available, adequately trained personnel and a widening of the information base for applied research activities[3/]. Both aspects affected the costs of research and development (R & D) activities for the private sector. Private firms interested in developing R & D units preferred to hire researchers away from the public sector. This process was facilitated by the salary restrictions in public research institutions and universities[4/]. At the same time, greater basic agricultural knowledge also lowered the risks associated with R & D, and even made possible work in other areas such as agrochemical evaluations and fertilization.

Producer and Nongovernmental Organizations in Technology Generation and Transfer

Technology has gained importance in the production decision-making process in both the public and private spheres. In general, as the availability of previously unused land diminishes, technological change becomes the only means of increasing production. Moreover, the increased use of non-neutral technological inputs, in terms of their effects on income distribution, has affected the direction and intensity of technological change. As this process evolved, cooperative agricultural producer organizations and, more recently, nongovernmental organizations and research foundations, have become important actors in the agricultural R & D process. In each case, interactions with traditional public sector institutions followed different patterns.

Producer organizations are important where production is homogeneous and technological potential already exists. The rice and sugarcane growers' associations in Colombia are good examples of how producer groups increasingly participate and interact with national research institutions in technology development. In the case of rice, research and transfer activities began in the 1950s at the Colombian Agricultural Institute (ICA), but responsibilities were gradually transferred to FEDEARROZ as this

organization consolidated and developed its technical capacities. After CIAT (International Center for Tropical Agriculture) initiated its rice activities in the early 1970s, creating substantial "technological potential," the direct participation of FEDEARROZ was important in a triangular partnership with CIAT and ICA. The case of sugarcane was somewhat different, because the sugarcane trade association (formed mainly by mill owners) created an independent research center with ties to the public system through the participation of government representatives on its board.

This center, CENICAÑA, was formally mandated to undertake all sugarcane research in the country (Samper 1982). The two cases highlight different types of interactions at opposite ends of the spectrum: reinforcement of capabilities in the case of rice, as opposed to the transference of responsibilities in sugarcane.

Box 1.1. Public-Private Sector Interactions at the National and International Levels Rice Improvement in Colombia

The agreement between the Colombian Rice Producers Association (FEDEARROZ), the Colombian Agricultural Institute (ICA) and the International Center for Tropical Agriculture (CIAT) for rice improvement in Colombia is a long-standing, successful experience of public-private sector interaction in agricultural R&D activities. This triangular relationship was initiated almost 20 years ago by the Rockefeller Foundation, ICA and FEDEARROZ, with the objective of introducing, adapting and diffusing in Colombia the dwarf rice varieties developed by IRRI in the Philippines. CIAT took over from the Rockefeller Foundation in 1969.

Since the very beginning, there was a clear division of labor among the participating institutions. Initially, ICA provided the physical infrastructure and the human resources for adaptation work and multiplication at the experimental level; FEDEARROZ had responsibilities for regional and farm trials, as well as for the development of the management components of the technological package; and the Rockefeller Foundation provided funding assistance for key activities and high-level scientific and technical support. As CIAT took over, it assumed further responsibilities in the provision and development of promising materials. Program decisions (what materials to introduce, multiply and release as commercial varieties) are made jointly by the three institutions through five-year national rice development plans, which are reviewed every two years, to keep activities in line with scientific opportunities and farmers' needs.

The essence of the program is the collaborative effort of the three institutions, each participating on the basis of its comparative advantages. Over all, very few resources have been transfered from one institution to the others, as each provides the funding for its activities as part of its regular budget. This has been key in the stability and continuity of the research program.

Work done under the ICA-FEDEARROZ-CIAT agreement has been internationally recognized as one of the "Green Revolution" success stories, and for having transformed the Colombian rice production situation, benefiting large segments of the country's rural and urban populations.

Source: Posada 1993. Personal communication.

Box 1.2. Public-Private Collaboration in Research Priority Setting
The Case of the Directorate for Sugar Cane Research and Extension Services (DIECA)

Historically, the sugar cane agroindustry has been a very important activity in Costa Rica. With the discovery of rust in 1978, smut in 1981 and leaf scad in 1984, the country faced a technological crisis, which forced it to re-evaluate and adjust its research and technical assistance programs, conducted up to that point by the Ministry of Agriculture and Livestock (MAG). As a result, it was decided that the best alternative was to create a technological organization with specific functions that would bring together the financial resources of the Liga Industrial de la Caña (LAICA), a private association, and the human resources and facilities of MAG's infrastructure. With this mandate, the Directorate for Sugar Cane Research and Extension Services (DIECA) was created in 1984. The Board of Directors includes two representatives of the Federation of Association of Sugar Cane Producers, two representatives of the Association of Sugar Cane Industrialists, one representative of the Minister of Agriculture and Livestock, and the Director General of Research and Extension of that Ministry.

The actions carried out by DIECA have allowed the centralization and regulation of sugar cane germ plasm at the national level, with the consequent rationalization of the varieties grown in the country, greater genetic diversity, and better alternatives for the producer. This has made it possible to select well-adapted varieties, with an excellent agroindustrial yield, which can be grown in different agroecological conditions. Furthermore, DIECA has generated promising varieties from local hybrids obtained with sexual seed, giving LAICA world-wide recognition.

Other achievements have been the identification of the main pests and diseases of sugar cane at the regional level, and advances in the biological control of these pests. A relevant example is the use of entomopathological fungi and biological agents, generated by DIECA, which not only meet national requirements, but have also been exported to Ecuador and Mexico.

Source: Chaves 1993. Personal communication.

The influence of farmer organizations extends well beyond direct participation in research activities. As their institutional and technical capabilities consolidated, they have also played an increasing role in setting the research agendas of public institutions and in funding research activities. The cases of the Directorate for Sugar Cane Research and Extension Services (DIECA) in Costa Rica and the Agricultural Research and Experimentation Board of the State of Sonora in Mexico are two good examples of this type of initiative. Other cases include the National Maize and Cotton Funds in Peru, wheat and cocoa in Colombia, and industrial tomatoes in the Dominican Republic and Panama (Barsky 1985; ISNAR 1983; Paz and Planas 1985).

Producer organization involvement in the adaptation and dissemination of technology has also become significant. In some cases, producers have virtually assumed the role of the public extension system through the development of their own technical assistance mechanisms. Following the model developed by the French Consortia for Agricultural Technology Experimentation (CETA), the Rural Consortia of Agricultural Experimentation (CREA) groups in Argentina exemplify this trend. Arising in the late 1950s, the CREA model spread quickly during the following decade, becoming especially strong in the 1970s. In the early 1980s in Argentina, there were about 150 local groups with more than 1500 individual members. The model has

spread to other Southern Cone countries, notably Chile and Uruguay, and there are indications of similar initiatives in a number of other countries of the region (Martínez Nogueira 1985).

Nongovernmental organizations (NGOs) are becoming important institutional actors, particularly at the interphase between technology generation and technology utilization[5/]. Although most NGOs have small agricultural programs, there are several dozen with important agricultural technology-related activities, and successful examples of coordination between them and formal research institutions exist. These include, among others, an institutional triangle between INIA, INDAP and several NGOs in Chile to provide adaptative research and technical assistance for small farmers; the joint management of research stations between the Centro de Investigaciones en Agricultura Tropical (CIAT) and CIPCA, an NGO in Santa Cruz de la Sierra, Bolivia; and the post-harvest program in Honduras (Berdegué 1990; Kaimowitz 1992).

Research foundations are another increasingly important institutional development since the mid-1990s. Within this group, it is necessary to distinguish between those mandated to perform research themselves and those that fund research undertaken by other public and/or private research organizations; both imply different styles of interactions with the public-sector research institutions[6/]. FUSAGRI in Venezuela, the Honduran Agricultural Research Foundation (FHIA) in Honduras, and "Fundación Chile" are cases of the first type. Even though each responds to a particular situation, all were created to mobilize technological knowledge with a problem-solving orientation, using a highly flexible, nonbureaucratic administrative structure. Although applied research is the core activity, they have very strong transfer programs, and organizations such as Fundación Chile go as far as the design and implementation of agroindustrial projects to exploit specific production or market opportunities.

Research-funding foundations are more recent, and are still in the development stage.

The FUNDEAGRO in Peru, the "Fundación Dominicana de Investigación Agropecuaria" in the Dominican Republic and FUNDAGRO in Ecuador belong to this group. Other institutions of similar nature, but of more recent origin include FUSADES, in El Salvador; "Fundación Pro Bolivia," in Bolivia; "Corporación Colombia," in Colombia, and JARP, in Jamaica. In most cases, these foundations developed as external donors sought to provide alternative sources of funding. They still must consolidate operations and prove their long-term financial viability; most depend on external donor grants (primarily USAID).

Regardless of whether they perform R & D activities themselves or are restricted to funding research, the foundations are important because they add to a country's research capability, as well as widening the research support base. Potentially, they can fill two critical niches in the process of technology generation and transfer. The first is to link technology generation with technology utilization, something that public institutions have not done efficiently. This is particularly important for agroindustrial crops, but is also proving critical for food crops, as some of the FUSAGRI experiences in regional development and the work of a number of NGOs show[7/]. Second, they can provide an institutional "bank" for private sector resources to support research. Improved technology is increasingly recognized as a critical input for agricultural development, but in most cases the domestic private sector lacks the economic size to directly undertake needed R & D activities. Because of their bureaucratic image and bad track record, public sector organizations are not an attractive alternative as direct recipients

of private sector funding. In this context, research foundations could provide an ideal base for project development and monitoring, with the research itself conducted by either the public sector centers, universities, or other research institutions.

Box 1.3. Farmer Support of Public Research: The Agricultural Research and Experimentation Board of the State of Sonora in Mexico

The Patronato para la Investigación y Experimentación Agrícola del Estado de Sonora (Agricultural Research and Experimentation Board of the State of Sonora) was created in 1968 to channel funds from farm and credit organizations to agricultural research in the State of Sonora and facilitate technology transfer through the reproduction of breeder seed produced by the Center for Agricultural Research of the Northwest (CIANO). The initiative was taken in response to the perception that government response to farmers' technological needs was too slow, and that lack of proper funding was a major limiting factor. In view of this, the farmers decided to raise the funds among themselves and to sponsor complementary research in conjunction with the existing public research program implemented at CIANO. The association was seen as mutually beneficial, as CIANO had the human resources and infrastructure as well as an on-going research program already funded by the Mexican Government. In exchange for the Patronato's funding support, the Ministry of Agriculture agreed to provide them with 50% of the breeder seed produced by CIANO.

Initially there were 24 farm and credit organizations, concentrating exclusively on wheat research and experimentation. As the experience became a success, with significant impact on wheat yields and farmers' profits, other organizations joined and the Patronato's mandate was extended to include crops such as cotton, soybeans, chickpeas, walnuts, grapes, other fruits and oilseeds. Eventually the Patronato donated 400 ha to CIANO and four new research stations were created in other parts of Sonora.

Over the years, the Patronato has created a variety of mechanisms to finance the activities it supports. These have involved agricultural inputs suppliers, government grain-buying agents, agricultural commodities and seeds exports, the milling industry, and international donor agencies, but the most important source of funding has remained the contributions by member farmers, based on crop yield improvements.

Source: Hobbs 1989.

Box 1.4. The NGO Role in Mobilizing Agricultural Technology
The INIA-INDAP-NGO Triangle in Chile

In 1990, the National Agricultural Research Institute (INIA) and the Institute for Agricultural Development (INDAP) signed an agreement to develop and adapt technologies for small farmers, giving special consideration to agro-ecological areas and their potential. The agreement is coordinated and impemented by a Regional Committee, composed of staff from both institutions, from agricultural NGOs, and a representative of the small-farmer organizations.

The agreement defines a mechanism which allows for joint work between INIA's and INDAP's professionals, with the objectives of adjusting, validating, transferring and diffusing appropriate technologies for different types of producers assisted by INDAP. These technologies are also validated by INIA's Centers for Technology Adjustment and Transfer (CATT).

This mechanism also makes it possible for INDAP to hire NGOs, universities or private companies to perform specific tasks. These organizations have to participate in public tenders to be awarded research projects. The methodology, objectives and other instruments are specified by INDAP. The project's technical staff, administration, planning and implementation are solely the responsibility of the selected organization. To maintain control over the quality of the research conducted, work is evaluated by INDAP twice a year. Also, INDAP charges overhead costs of only 10% of the total cost of the project.

Source: de la Fuente 1992.

Box 1.5. Honduran Agricultural Research Foundation (FHIA)

The FHIA was created in 1984 by the Government of Honduras and the USAID, to promote and execute research on traditional and non-traditional export crops. Institutionally, FHIA is an private, independent non-profit organization; it inherited the physical and experimental facilities of "La Lima" previously operated by the Tropical Agricultural Research Division of the United Brands Company, including the largest musa (banana) germ plasm collection in the world.

Funding for research and other activities was provided initially by USAID through an institutional support project, but in 1992 a trust fund was constituted by donations from the Government of Honduras (100 million lempiras*) and different private sector sources (about 6 million lempiras in March 1993). Other international donor agencies contribute funds through special project support. Program decisions are made by a nine-member Board of Trustees, and any entity contributing to the trust fund can request research support as long as they cover all involved costs.

FHIA has developed a good track record in traditional export crops (bananas) in particular, but also is making contributions in other fields such as cocoa, citrus and other fruits and vegetables, as well as in the post-harvest area. It operates a well-equipped training and communications center, and a pesticide residue control laboratory.

* In April 1993, 1 US$=5.88 lempiras

Source: Fundación Hondureña de Investigación Agrícola 1986, 1991.

Box 1.6. The Foundation for the Development of Agriculture of Peru (FUNDEAGRO)

The FUNDEAGRO, created in 1988, is a joint effort of Peruvian public and private entities directed to promote the modernization, increased efficiency and competitiveness, and natural resource conservation in the country's agricultural sector. To this end, FUNDEAGRO promotes and implements projects in agricultural research and technology transfer, the training and entrepreneurial development of agricultural producers and organizations, and supports agricultural policy decision makers. In its activities, the Foundation emphasizes a market orientation and also gives special priority to projects related to agroindustry and the promotion of agricultural exports.

Operationally FUNDEAGRO works through the institutions that comprise the national agricultural research and technology transfer system, which includes the National Agricultural and Agroindustrial Research Institute (INIAA), the universities, and the agricultural experimental stations run by the private sector. Its main role is channeling and administering resources from international sources (USAID, IDRC of Canada, AECI of Spain, and others) to and for the institutions in the system. Projects under implementation include efforts with INIAA, the Agrarian University "La Molina" and the University of San Agustin, among others.

Program decisions are made by a Board of Directors, made up of ten members, seven of whom are from the private sector, two represent public sector institutions, and one represents an international organization , CIP. FUNDEAGRO maintains close working relationships with all the International Centers of the CGIAR system working in the region, and with other international technical and financial cooperation agencies such as IICA, The World Bank, IDB, CIDA, and the CEE. Although until now funding from international cooperation has constituted the largest share of FUNDEAGRO's resources, in December 1992 an endowment fund was constituted to assure stability and institutional continuity. The fund was constituted by a "seed" contribution from FUNDEAGRO's own resources (overheads from projects and other sources of income), and it is expected to grow through additional donations from national private entities and other international sources.

Source: Toledo 1993. Personal communication.

However, there are limitations inherent in such initiatives, more for NGOs working in the technological field than private foundations. They concern: a) institutional instability, often related to the lack of long-term funding sources, and b) limited technical capacity. But both are still competitive with public sector institutions, contributing to the weakening of the NARS as a whole. In the long run, the transformation of NGOs into stable, competent participants in agricultural technology systems will require closer relations with public sector research and extension institutions and public and private universities, ideally without losing a concern for farmer participation in the process.

Development of Markets for Technological Inputs

Agricultural modernization implies a substantial modification of market incentives for private participation in technology

generation and transfer. The most important modification is the opening of previously nonexistent or very limited markets for technological inputs. Several factors are interrelated. First, there is the tendency for seeds, agrochemicals, and machinery to become more important in relation to agronomic practices as sources of productivity growth. Then there is the rapid growth of commercial agriculture as compared to the traditional sector, probably as a consequence of its better access to credit and technical assistance. Together with the growth of the commercial sector, modernization also develops the communication and service infrastructure necessary for getting new inputs to farms, thus expanding the markets for these inputs even further.

The incentives for private participation in R & D activities are market growth and lower input distribution costs (lower level of invest-ments and shorter payback period). This is further reinforced by intellectual property protection, which the passage of plant breeders' rights legislation in a number of countries has extended to seeds, while agrochemicals, machinery, and veterinary products are protected by the patenting laws regulating the industrial and pharmaceutical sectors. Under these circumstances, there has been rapid growth in these industries[8/].

This is neither new nor unique to Latin America. The experience of the United States indicates a similar trend in the change from what was initially a primarily public system, implemented through the creation of the land-grant colleges and the U.S. Department of Agriculture experiment stations, to the present situation, where about half of all agricultural research is funded by private firms.

In Latin America, and probably in other less-developed regions, this process has gone beyond what regional and national conditions warrant. This is largely due to the increased importance of multinational firms. Their multinational character has relaxed some market constraints because technological knowledge and innovations developed in one country can be used in another. The integration of national firms into multinationals also implies differential access to technological potential —the larger scale of operations permits their direct participation in the generation of new basic knowledge (Trigo and Piñeiro 1981).

The increasing importance of the markets for technological inputs is giving rise to a particular form of interaction between the research institutions and private firms in the agricultural inputs industry. The former have a clear advantage for the creation of "technological potential" (advanced genetic lines, for example), but are not well equipped for the production and distribution of "finished technologies" of the embodied type, as they lack the production and market capabilities. In this context, there are plenty of opportunities for "joint ventures" in which public institutions contribute their scientific and technological capabilities and the private sector its funding resources and marketing talents. In the seed industry, interactions have a long history, as the cases of maize in a number of countries and wheat and soybeans in Argentina and Brazil show, because the public breeding programs constituted the critical element for the development of the local seed industry. But relations have been essentially non-specific, i.e., the public breeding program making available materials to all firms. In more recent times, there has been an evolution to "bilateral" relations, with a contractual agreement for the joint development of a given technology between the public research institution and private sector firms.

This alternative is of critical importance because it broadens the funding base of public institutions and at the same time strengthens the competitive position of local firms otherwise without access to R & D facilities, because of their limited scale of operations.

This model is perhaps best exemplified in the case of INTA in Argentina, which already has more than 90 joint ventures with national and multinational firms, covering areas from seed production to farm machinery (Cirio and Castronovo 1992).

Box 1.7. Public-private Joint Ventures as Instruments to Link Technological and Production-Marketing Capacities: The National Agricultural Technology Institute (INTA) of Argentina

R&D organizations in general, and those in the agricultural sector in particular, usually lack the capacities needed to mass-produce and distribute the production inputs that embody the technologies generated by them. The lack of these capacities has been frequently recognized as one of the main limitations on technology diffusion.

In an attempt to solve this problem, INTA of Argentina in 1987 started a policy of formal operational linkages with private sector entities in the agricultural inputs industry. Two types of mechanisms developed within this framework. The first are of technological agreements for the exploitation of technologies already developed by the INTA; the focus here is moving the knowledge generated by the organization. The second mechanism is formed by joint ventures and risk-sharing agreements for the development of innovations on the basis of given demands or market opportunities; the focus in this case is on better utilization of existing scientific and technological capacities. In either case, contractual agreements establish both INTA's and the private firms' technical and financial contributions, and the intellectual property arrangements for the resulting knowledge and technologies. The resources generated are used not only to cover the R&D costs of the specific projects, but also to provide salary "topping" for the researchers involved.

Since the inception of this policy, more than 90 agreements or joint ventures have been operationalized, and the system has produced 45 patents in areas such as new plant varieties, vaccine development, and agricultural machinery, among others. INTA income from these operations is about US$2 million a year.

Source: Cirio and Castronovo 1992.

Emerging Issues for the Policy Agenda

The current trend is increased private sector involvement in agricultural R & D activities. Institutional and market-force dynamics associated with the modernization process, as well as biotechnology and new patenting criteria, have reinforced the trend. All these factors have consequences for the structure and policies of national agricultural research and technology transfer. Some of the issues affecting public-private relations in R & D activities are discussed below, but the process is still underway, and its course cannot yet be predicted with any certainty.

Biotechnology and the Privatization of Agricultural R & D Activities

Biotechnology is significantly changing the scientific and institutional bases of agricultural

technology generation and transfer[9]. Several aspects are important for developing countries. The first is that biotechnology is radically different from previous technologies; for the first time, commercially relevant technical information is close to the frontiers of basic research in molecular and cell biology.

This is changing the traditional dichotomy between basic and applied research, altering linkages in the flow of scientific information. Work relevant to agriculture is now being done by universities and research centers with no previous experience in agriculture[10]. Such a shift poses a significant problem for national research institutions in Latin America and the Caribbean, which have no links with these new centers of valuable technological information. A related problem is that biotechnology requires scientific talents different from those available at the traditional agricultural institutions. Eventually, the greatest obstacle preventing developing-country research institutions from utilizing state-of-the-art biotechnology may be that few staff will be trained in molecular and cell biology, virology, and immunology (de Janvry *et al.* 1987; IICA 1987).

Another important facet of biotechnology is its relationship with the private sector (de Janvry *et al.* 1987). During the Green Revolution, most essential components were handled through public institutions (international or national), whereas today biotechnological advances are spearheaded by the private sector, prompted by the proprietary nature of resulting technologies.

A complex system of public and private sector interactions has evolved from the initial work in universities; the system is centered on multinational corporations but includes academic research centers and smaller start-up companies. This "concentrated, decentralized" system, as it was called in an OECD report (OECD 1989), takes advantage of the strength of each of its components: the basic research capabilities of the academic sector, the entrepreneurial advantages for product development of the start-up firms, and the manufacturing and marketing strength of the multinational corporation. These last access the needed resources for innovation through contracts with academic and start-up institutions, outright take over of smaller firms, and the development of in-house R & D capabilities in a new field (Arora and Gambardella 1990).

While no exact data on total investment in agricultural biotechnology R & D for OECD countries are available, it is clear that the private sector has an important, perhaps dominant role in it. For the USA, it has been estimated that 10% of total agricultural research is in biotechnology, and that 50% of this is by industry (Barker and Plucknett 1991). The total expenditure on agricultural research by the public and private sectors has been estimated to be about US$ 2 and 2.1 billion, respectively, for 1987 (OTA 1988). This permits a rough estimate of total investment in agricultural biotechnology R & D in the USA of some $ 410 million (Jaffé 1992). Another estimate puts the private sector share of agricultural biotechnology R & D worldwide at 60% through 1985 (Persley 1990).

Table 1.1 highlights an additional characteristic of biotechnology that sets it apart from the traditional agricultural research: it is not product-specific. Biotechnology, on the other hand, is process-based, cutting across products.

This tends to strengthen private participation in agricultural R & D, as numerous factors change the industrial organization of the agricultural input business, with greater participation by transnational corporations. This has important ramifications for the development of national strategies in this field (de Janvry *et al.* 1987; IICA 1987).

Box 1.8. The Importance of Informal Technical Relations With Public Sector Institutions for Small-scale, High-tech Companies: The Case of Laboratorios Santa Elena S.A. in Uruguay

Laboratorios Santa Elena S.A. was founded in 1957 as a family-owned corporation in the veterinary products area. In the early 1960s, its main product was a foot-and-mouth disease vaccine, and it was the country's leading firm in this area. Even though changes in legislation and sanitary regulations forced discontinuation of this vaccine, the firm continued to produce other products for bovine and ovine livestock. The participation of the firm's technical staff in veterinary research projects in the universities was an important factor in its capacity to adapt its product line to new market conditions.

In the early 1980s, a group of researchers just returned from studies abroad joined the firm, and a new development phase was initiated. The critical aspect of this phase was "technology transfer thorough individuals," as several researchers working in the public institutions in Uruguay and abroad collaborated in new product development. Collaborations generally took the form of formal profit sharing agreements in which researchers assumed the responsibility for product development and the firm took charge of commercial-scale production and marketing. Through this process, the firm gained access to high-level scientific and technological capacities, usually located in the public sector, at a reasonable cost. During this period, the firm complemented its strategy of accessing innovations through the exploitation of a sort of "technical periphery," with a very aggressive policy of reinvestment in infrastructure and new technology development.

In 1987, the process was taken one step further with a project to mass-produce a new foot- and-mouth disease vaccine which was developed at the experimental level by the Foot and Mouth Disease Center of the Pan American Health Organization. This initiative led in 1989 to the creation of a subsidiary firm for the research, development and production of biotechnological veterinary and industrial products.

Source: Snoeck *et al.* 1991.

The increasing participation of the private sector in R & D activities and the emergence of biotechnology have important consequences for the organization of research and the free flow of scientific knowledge. As the development of commercially relevant technical information comes closer to basic research, the traditional dichotomy between basic and applied research is significantly altered, and with it the linkages for the flow of scientific information. Furthermore, the opportunity for patenting research results means that an increasing portion of scientific knowledge will be withdrawn from the public domain[11/].

Table 1.1. Markets and Biotechnologies Relevant to Food Systems.

Technologies	AG	BL	BM	CM	DG	EN	FP	FU	MN	PS	PH	TW	VT
Bioprocessing		X	X	X		X	X	X	X	X	X	X	
Genetic engineering	X	X	X	X	X	X	X	X	X	X	X	X	X
Ecological engineering	X		X								X		

Source: Riggs (1985), as cited in de Janvry *et al.* (1987).

AG = agriculture; BL = biologicals; BM = biomass; CM = chemicals; DG = diagnostics; EN = energy; FP = food processing; FU = fuels; MN = minerals; PS = pesticides; PH = pharmaceuticals; TW = toxic waste processing; VT = veterinary.

Technological institutions in developing countries are being affected by these trends. Such institutions once looked to the universities in developed countries (most notably, those of the U.S. land-grant system) and to the international agricultural research centers for basic and strategic research results. They now find that the information they need is controlled by private companies or basic science laboratories, which, all too often, have significant connections with private industry. The information is either protected by patents or subject to "industrial secret" treatment because of its potential commercial value. In many cases developing countries have little or no access to these companies. This new "academic/industrial complex" represents a significant change in the organizational structure of the systems of agricultural science and technology in the developing world (Kenney 1986). Without easy and free access to basic, strategic scientific information, it is not clear how the NARS can continue to perform their functions.

Access to new knowledge and specific technologies will doubtless become even more restricted, and there will be an increased bias in terms of input use and relevance for local conditions. This latter problem has impacted tropical and subtropical areas more severely (Moscardi 1988). Knowledge flows and exchanges will likely become increasingly dependent on intellectual property protection arrangements. Few developing countries have definitive policies in this area, and it is key if public-private interactions in R & D are to be more fruitful.

The trend towards the privatization of knowledge is clear in the policies of several OECD countries, which seek to strengthen intellectual property in general, and for agriculture in particular. LAC countries have been submitted to intense pressure by the U.S. government in this regard. This has led to revised patent laws in several countries (Mexico, Chile, Andean Pact, Argentina, Brazil), all of which address the biotechnology issue (Correa 1992). Simultaneously, countries are introducing special IPP systems for plant breeding (Brazil, Andean Pact), as well as making systems introduced several years ago operative (Uruguay, Argentina, Chile).

From an Agricultural to an Agroindustrial Sector

Dependence on nature has always been a key feature of agriculture, as physical

biological processes transform solar energy into agricultural products. Agricultural development has revolved around efforts to better control these processes and limit natural constraints on agricultural production. Population growth and urbanization have made these efforts more urgent, creating demands for increased food production (better genetic materials, mechanization, chemical fertilizers, pesticides) and also the need to transform primary products to meet the modern urban consumer's demands. The dramatic decline of the farmer's share in the final prices of food and other agricultural products is in reality the culmination of a long-term transformation, in which better production technologies alone will not be enough; improved agricultural performance will increasingly depend on better preservation and processing technologies, as well as on an improved capacity to respond to changing market conditions. The case of cassava in Colombia, Ecuador and Brazil, and a number of experiences with non-traditional export crops such as ornamentals, fruits and vegetables in Central America and the Caribbean have illustrated how farm level technologies are highly dependent on what happens to the products further down the agri-food chain.

Biotechnology is having a critical impact, speeding up this process as it facilitates the development of "designer" foods produced not as traditional vegetable or livestock raw material, but recombining the component elements to produce new products. Micro-electronics and informatics will also play an increasing role in improving production efficiency and reducing commercial and climatic risks with the introduction of information networks, expert systems, training supported by telecommunications, and greater access to market information and telemetry.

Increased agricultural-agroindustrial linkages bring about the need for R & D in new fields not previously covered by agricultural research institutions, in many of which there is already substantial private sector involvement, and where close public-private sector collaborations could be extremely beneficial in terms of the efficiency and effectiveness of resource use. Aspects such as the range of products, regions, types of technologies, producers to be catered to, funding schemes and mechanisms for public-private interactions, should be reassessed in the light of the technological imperatives of a broader agricultural-agroindustrial complex.

Activities of Transnational Corporations and National Technological Development

The modernization process and the opening of developing country markets for technological inputs has not only brought private sector involvement into R & D, but also an increasing participation by multinational corporations in agriculture and agricultural supply industries. The growth of biotechnology has reinforced this tendency. New plant breeding technologies and changing patent legislation are leading to a restructuring of the industry, integrating previously independent segments (seeds, agrochemicals) into highly concentrated multinational conglomerates.

Until the 1970s, inputs for crop and animal production were generally marketed by separate firms for each product area: seeds, chemicals, pharmaceuticals, machinery, and petroleum products. However, these input industries have been restructured, and the research process has been realigned.

The first step in the transnationalization of the original seed companies coincided with the opening of profitable markets in the developing world. This occurred both through the creation of subsidiaries and the takeover of existing developing country seed firms. A second, more important factor was the acquisition of these firms by larger ones, mainly agrochemical, oil, grain trading, and pharmaceutical companies. According to de

Janvry *et al.* (1987), this was the result of two separate, but related forces.

One of these was the decline in the profitability of the chemical industry when energy costs and environmental controls increased during the mid-1970s. This led many of the large chemical companies to diversify and enter specialty end-product markets (Kenney 1986). Then came the passage in Europe of legislation to secure rights for plant breeders in the early 1960s, along with the Plant Variety Protection Act in the United States in 1970. The possibility of establishing proprietary protection on genetic materials and the natural complementarities between seeds and agrochemicals at the marketing stage made seeds an obvious and optimal road for diversification for these companies (Mooney 1979). It now seems likely that virtually all seed companies will become centerpieces of transnational corporations (TNCs) [12].

In more recent times, these companies, seeing the tremendous growth of the biotechnology industry, have begun to finance biotechnology research on a contractual basis from universities and smaller start-up firms, and to invest relatively large sums in-house R & D units.

From a general perspective, the growing importance of TNCs in agricultural technology supply industries might be seen as positive. To the extent that they are truly international corporations with research facilities around the world, the privatization of applied research may actually benefit developing countries, particularly in export markets, by giving them rapid access to state-of-the-art technology at the same time and price as everyone else. This would remove part of the advantage that developed countries have in early access to new technologies. The newly created International Service for the Acquisition of Agribiotechnology Applications (ISAAA) also represents an important step for facilitating technology transfer in strategic areas through increased private-public sector interactions (Knudsen 1993).

However, the increased importance of TNCs in the agri-technology field points to a number of problems for the developing countries (de Janvry *et al.* 1987). First is a possible bias in research priorities toward the development and promotion of technological packages which reflect a global corporate strategy to integrate seeds with a company's own chemicals, rather than breeding for genetic resistance to abiotic stresses, insect pests, and diseases. This will increase the dependence of agriculture on purchased inputs, favoring larger commercial agriculture over smallholders. Second, the expansion of the TNC seed business could further narrow the genetic base of important staple crops such as maize, wheat, and sorghum, thereby increasing the risks of widespread crop failure in many parts of the world.

Finally, there are broader implications of economic and food security that would result from increased dependence on TNC marketing networks for strategic technological supplies. Capital-intensive technologies may conflict with economies prevailing in developing countries, where natural resources and/or labor are relatively abundant compared to capital resources. At the same time, many countries will create a high "political adjustment" factor to maintain national control of the strategic factors that affect food production and agricultural exports. Furthermore, TNCs concentrate their efforts on cultivars and related technologies for which there are markets of significant size, so many local crops and their problems will not be included in TNCs R & D strategies. All these elements point out the importance of continued development of national R & D capabilities, together with clear policy definitions concerning TNC participation in national markets for agricultural supplies.

Box 1.9. International Service for the Acquisition of Agribiotechology Applications (ISAAA)

ISAAA is a non-profit international organization with the aim of facilitating the acquisition and transfer of agricultural biotechnology applications from the industrial countries, particularly proprietary technology from the private sector, for the benefits of the developing world. In the past, developing countries had free access to basic agricultural (germ plasm-based) technologies, as these were mainly in the public domain. Most technologies today, however, are of proprietary nature and are owned by private companies.

The Service has initiated a 5-year pilot program that initially focuses on 10 developing countries. It will concentrate on near-term applications involving tissue culture diagnostics and transgenic plant technologies on food crops, horticulture and forestry, which have already been tested in developed countries.

ISAAA's prime sponsor is the McKnight Foundation, which awarded a US$1 million grant. Other donors include the Hitachi Foundation, MacArthur Foundation and the Rockefeller Foundation. In addition, a number of large companies, such as Monsanto, Pioneer Hi-Bred and Sandoz Seeds contribute to the initiative by donating technologies.

Operationally, ISAAA acts as a broker between companies owning technologies and public institutions in developing countries having the basic capacities to adopt and apply them in their environments. The companies donate, on a limited basis, the rights to the technologies and ISAAA provides the funding for the transference process (training, local research and testing, etc.).

To date, ISAAA is involved in four projects: 1.- Development of virus resistance in potatoes through coat protein technologies, involving the Monsanto Company and the Centro de Investigación y Estudios Avanzados (CINVESTAV) in Mexico. 2.- Development of a cold DNA diagnostic probe by Washington State University and the Asian Vegetable Research and Development Center. 3.- Development of non-conventional virus resistance (NCVR) to the cucumber mosaic virus of criollo melon in Costa Rica, involving the Asgrow Seed Company and the University of Costa Rica. 4.- Development of NCVR of tomato by the John Innes Institute (UK) and Egypt's National Agricultural Genetic Engineering Laboratory.

Source: Knudsen 1993.

From a Science and Technology Policy to an Innovation Policy

The transformations discussed so far have major implications for the design of technology policies for the agricultural sector. Agricultural modernization, with its concomitant industrialization processes, converts on-farm production into an ever-smaller component of the sector. Backward (input) and forward (processing/marketing) linkages assume greater importance. The specific nature of the modernization process may differ between venues and commodities, but the general trend is usually the same: as agriculture and industry grow increasingly interdependent, agricultural production should be viewed as one phase of the agroindustrial production chain, and it becomes necessary to consider the policies that govern agriculture and technology in the context of policies that govern industry and other sectors. More generally, a transition must be made from a "science and technology" policy, centered on the dominant role of the public sector and of technology generation, to an "innovation" policy, centered on the development of innovation capabilities in firms (Avalos 1993).

The tendency toward increased private-sector participation in agricultural R & D activities also implies a passage from a relatively centralized system to a highly diversified one. This raises the issue of how to integrate the diverse efforts into a coherent whole, making optimal use of opportunities and available resources. The new biotechnologies also affect policies that govern agricultural technology. As technological development grows closer to basic science, innovations in agricultural technology must fall within overall policies for science and technology in a country. Policymakers must consider agricultural research centers along with the whole complex of scientific and educational institutions.

Policies for technology in the agricultural sector have traditionally amounted to little more than decisions on resource allocation for research within the national public research institutions, with small concern for the broader context. In the early stages of the system, the monopoly enjoyed by national research institutes allowed them to effectively allocate resources and establish priorities. As their role diminishes and they become an alternative source of new technologies, the direction of technological change will depend increasingly on market forces.

The role of the public sector becomes one of creating and managing an appropriate macroeconomic, regulatory and scientific environment, stimulating and facilitating technological innovation in the private sector, principally at the firm level. The goal of this new science and technology policy is to create the "technology infrastructure" needed in every internationally competitive economy (Tassey 1991).

The potential contribution of technology to agricultural development and economic growth can be fully tapped only if full consideration is given to the interdependence of different sectors and the impact that macro-economic policies have on technological behavior in the agricultural sector.

How do these interactions take place? In some cases, changes have to be made in policy decisions, so that research priorities and resource allocations will be consistent with economic and agricultural policy. It can be done if forward-looking economic planners and private sector suppliers of modern inputs, as well as the different research clientele groups, are incorporated into the policy-making process.

The Role of Public-Sector Institutions

With the emergence of new private sources of technological knowledge, we are witnessing a progressive deterioration of public sector research institutions. This situation is partly a consequence of the budgetary restrictions derived from the debt crisis in the developing world. But it is also the result of what is perceived as the ineffectiveness of public organizations in reaching farmers, particularly small-scale producers, and meeting their technological needs. If the technological process follows the principles of market behavior, the deterioration of public research institutions will continue and probably worsen, in a vicious circle of lack of impact and effectiveness, operational budget restrictions, and reduced external support.

This scenario is critical for the developing world because the agricultural sector is made up of productive sectors at different stages of modernization. Increasing participation in the supply of technological services by private and semi-public sources, together with the deterioration of public institutions, bodes for the widening of existing differences. Private producers of technology will tend to service only those in the more advanced productive sectors, with technological demands oriented to the capital inputs they offer. This is ominous for small-producer and peasant economies in general. With highly diverse

farm types and environments, they seldom represent profitable alternatives for the private sector. Moreover, the basic structural conditions necessary to facilitate producer organizations rarely exist.

In this context, there is a clear need to revise the role of the public sector in the technology development process, so that it can function effectively in the new institutional and economic situation and continue to perform its service function for the non-modernized sector. An appropriate division of labor might focus public-sector institutions primarily on the generation and transfer of technologies for the small-farm sector, in those areas where either the small size of the markets or the nature of the technologies (agronomic techniques, resource management research) offer no possibility to recover R & D costs. On the other hand, the private sector should be encouraged to adopt or develop technologies whose proprietary nature permits cost recovery. Public-sector institutions have a crucial role to play in facilitating this technology transfer process, by monitoring scientific and technological development and by back-stopping the negotiation and adaptation process of the transferred technologies (Trigo and Kaimowitz 1993). This broad division of labor, however, does not imply that the public sector should not continue working on basic or strategic research to assure a minimum level of technological independence at the national level[13].

The Funding of R & D Activities

A reformulated relationship between public and private generators of technology may expand funding opportunities for agricultural R & D activities. New private resources can help widen the financial support base and free up public resources. Furthermore, in the case of heavily indebted countries, attracting private resources for technology generation and transfer is one way to mitigate the impact of the budgetary crisis on public research institutions. But, in spite of potentially promising public-private synergy, it must be stressed that the relationship is still an uneasy one.

Many countries lack a tradition of interaction with private sector research and development and need new institutional mechanisms for such cooperation. As a result, the private sector often finds it difficult to finance research projects in public research institutions. In turn, public sector scientists are often prevented from participating in private-sector research and development. The pace of change in this area has been slow, in part because of a long history of mutual suspicion, but also because private firms in the developing world have not traditionally been willing to spend on R & D. To a certain extent, this is because TNCs dominate and, in many research-intensive industries, do their research elsewhere. Local firms usually lack experience in translating research results into production activities (Waissbluth *et al.* 1985). A history of direct transfer of technology from abroad has also tended to discourage innovation in this area.

But there is evidence that the pace of public-private cooperation is quickening. Producer associations and research foundations in a number of countries are one example. More complex mechanisms, however, are needed to deal with the increasingly proprietary nature of agricultural technology. INTA in Argentina is a good example of the types of transformations which are needed. Still, further innovations are needed to modernize the prevailing top-down planning mode and make it more responsive to final users, as well as creating the management capacities and flexibility needed in a more decentralized and interactive system.

It is not so much a question of who does the needed research, but rather the efficiency of resource use and who pays for it. Unfortunately, in many cases it has become

fashionable to advocate privatizing the implementation of research activities in situations where there is no real possibility of this happening. R & D activities require a minimum market size to be profitable, and a level of organizational and management development that many countries still lack. Also, in certain types of technologies (open-pollinated varieties, management practices), investments are difficult, if not impossible, to protect. In these cases, the issue should not be to "privatize" the implementation of research, but to bring the private sector (private firms, NGOs, producer organizations) into the decision-making and funding processes, while keeping research activities within the public domain, where they can benefit from economies of scale and a more efficient use of scarce strategic resources (highly specialized human resources, laboratories) which the country cannot afford to maintain in more than one institution. The challenge is to produce the institutional and managerial reforms needed for public institutions to interact effectively with other parties.

The importance of increased cooperation between the public and private sectors goes well beyond the funding issue. It will have a great impact on a country's ability to exploit new scientific developments, particularly biotechnology, in the field of agricultural inputs and new market opportunities related to export diversification. Recent research by IICA has shown the crucial role played by the public sector in the development of local biotechnology industry. This support may take the form of providing risk capital for the creation of new firms or financing R & D, or permitting the development of crucial skills and experiences in relevant technologies which can be then exploited by entrepreneurs-researchers. For instance, a pool of laboratory-level developments might be provided, which could be rapidly scaled up by private firms.

In many countries, especially the smaller ones, TNCs already control input industries, and local firms are merely distributors of TNC products. The transition to biotechnology may not bring great change. Even so, independent or state-run suppliers of seed, chemicals, and fertilizer will not be able to compete unless the R & D capacity already existing in the public sector can be used to sustain their competitiveness in local and regional markets (de Janvry *et al.* 1987; IICA 1987).

Effective R & D support is also the key for new export markets. Many opportunities already exist, but they could be identified and made more accessible by government activity. Without greater coordination between the public and private sectors, these opportunities will be lost or undertaken as part of TNC R & D efforts, and developing countries will miss the opportunity to access critical private funds for research and to exploit national innovations.

Some Concluding Comments

Over the last quarter of a century, institutions in the developing world that generate and transfer technology have grown dramatically and have had a tremendous impact on agricultural improvement and economic growth. A number of specific cases —grains in Argentina, soybeans and wheat in Brazil, potatoes in Ecuador, rice in Colombia and the Dominican Republic, and wheat in Mexico— attest to this process. It is also clear that, in Latin America and the Caribbean, those countries that invested more on research and development are the ones that show a better agricultural performance overall today (Scobie 1977; Moscardi 1988).

Public agricultural research organizations have been at the center of successful technology generation effort. At the same time, they have been involved in creating conditions that allow nonpublic organizations to become active participants in the technological process. Scientific developments, particularly biotechnology, have precipitated

situations in which public institutions are no longer the sole suppliers of new technological knowledge, but rather share the stage with a increasing number of other actors, particularly private industry. It has also become clear that key technologies are not restricted to the primary production sector, but are those important in the broader context of "agri-food chains," more relevant to the non-farm stages increasingly dictate the "innovation requirements" for farm-level activities.

Changes and adjustments must be made in the prevailing institutional model, so that it can continue to meet each society's demands for agricultural technology. As a basic concept, the "agricultural sector" must be replaced by the "agri-food system" as the institutional locus for the technological process. These changes imply a redefinition of the role that public-sector institutions should play in setting technology policy. Specific mechanisms must be found to cope with the new interactions between public and private sectors, as well as the effects of biotechnology on the workings of national systems. The issue is how to adapt the public national research organizations, still the centerpieces today, to exploit the rapid modernization process and the diverse new participants. Increased availability of international technical knowledge must be utilized while retaining the capacity to direct R & D toward national development priorities and maintain a reasonable degree of social control of the innovative process. The discussion of policies and alternatives for specific situations will require consideration of the particular agroecological and socioeconomic characteristics of each country.

Bibliography

ARORA, A. and GAMBARDELLA, A. 1990. Complementarity and external linkages: The strategies of the large firms in biotechnology. Journal of Industrial Economics 38(4): 361-379.

AVALOS, I. 1993. Política tecnológica y agricultura en América Latina y el Caribe: del Concepto de sector agrícola al de cadena agroindustrial. Unpublished manuscript.

_____ and PINANGO, R. 1986. La Fundación Servicio para el Agricultor en el Sistema Agrícola Venezolano. Serie PROAGRO No. 7. Servicio Internacional para la Investigación Agrícola Nacional, La Haya, Países Bajos.

BARSKY, O. 1985. El sector privado en los cambios tecnológicos del agro ecuatoriano. Quito, FLACSO.

BARKER, R. and PLUCKNETT, D. 1991. Agricultural biotechnology: Global perspective. In Agricultural Biotechnology: Issues and choices. B.R. Baumgardt and M.A. Martin (eds), (Purdue University Station, West Lafayette, Indiana)

BEBBINGTON, A. 1991. Share cropping agricultural development: The potential for GSO government cooperation. Grassroots Development 51 (2): 21-20.

BERDEGUE, J. 1990. NGOs and farmer's organizations in research and extension in Chile. Agricultural Administration (Research and Extension) Network Paper 19. London. Overseas Development Institute.

CIRIO, F. and CASTRONOVO, A. 1992. Papel del estado en la innovación tecnológica en el sector agrícola, con énfasis en las organizaciones del I & D. Taller sobre Política Tecnológica y Competitividad Agrícola, Montevideo. 49 p.

CORREA, C.M. 1992. Políticas de desarrollo biotecnológico en América Latina. In Formulación de políticas para el desarrollo de la biotecnología en América Latina y el Caribe. W.R. Jaffé and M.E. Zaldívar (eds). San Jose, C.R. IICA. p. 123-146.

CHAVES, M. A. 1993. Public-private collaboration in research priority setting: The case of the Directorate for Sugar Cane Research and Extension Services (DIECA). Personal comunicación.

DE LA FUENTE, J. 1992. Institucionalidad y metodologías del programa de transferencia de tecnología del Estado de Chile. Seminario Transferencia de Tecnología y Desarrollo Rural. Unpublished. Brasilia, Brasil 25 p.

DE JANVRY, A., RUNSTEN, D. and SADOULET, E. 1987. Technological innovations in Latin American agriculture. Program Papers Series No. 4. San Jose, Costa Rica. IICA.

FALCONI, C.A. 1993. Interacciones en el sector público y privado en la investigación agrícola: El caso de Colombia. Presentado en Seminario La Modernización del ICA. (1993: Santafé de Bogotá, Col.)

FAO. 1980-1987. Fertilizer yearbook. Vol. 29-36. Rome: FAO (Food and Agriculture Organization of the United Nations).

FUNDACION HONDUREÑA DE INVESTIGACION AGRICOLA. 1986. Informe anual 1986. La Lima. 128 p.

_____. 1991. Informe anual 1991. La Lima. 82 p.

GROOSEMAN, T. 1987. Seed industry development in North-South perspective. Development No. 4.

HOBBS, H. 1989. Patronato: The agricultural Research and Experimentation Board of the State of Sonora, Mexico. In Management Perspectives for Agricultural Research. E.E. Felton, H. Hobbs (eds) ISNAR, p. 9-33 Training Series No. 1.

IICA. 1987. Technological innovation for agriculture in Latin America and the Caribbean: Problems, opportunities and issues. In Reactivating agriculture: A strategy for development. Ninth Inter-American Conference of Ministers of Agriculture. San Jose, Costa Rica. IICA.

ISNAR. 1983. El sistema de investigación en la República Dominicana. The Hague, ISNAR.

JAFFE, W.R. 1992. Agricultural biotechnology research and development investment in some Latin American countries. Science and Public Policy. 19(4):229-240

_____. 1993. Industrial agricultural biotechnology in Latin America. Submitted to BIO/TECHNOLOGY.

_____ and ZALDIVAR, M.E. 1993. The development of agricultural biotechnology R&D capabilities in Latin America and the Caribbean: A bibliometric analysis. Submitted to Research Policy.

KAIMOWITZ, David. 1992. El apoyo tecnológico necesario para promover las exportaciones agrícolas no tradicionales en América Central. Program Papers Series No. 30. San José, Costa Rica, IICA. 102 p.

KENNEY, M. 1986. Biotechnology: The university-industrial complex. New Haven, Connecticut, Yale University Press.

KLOPPENBURG Jr., J. and OTERO, G. 1985. Social impacts of biotechnology in the U.S. and the Third World. Paper presented at the Planning Workshop: Biotechnology and Food Systems in Latin America. San Diego, California: University of California, Center for U.S.-Mexican Studies.

KNUDSEN, H. 1993. ISAAA: Proprietary biotechnology for small farmers? Biotechnology and Development Monitor (14):12-13.

LINDARTE, E. 1986. Research foundations in Latin America: An institutionalization approach. Mimeo. The Hague, ISNAR.

MARTINEZ NOGUEIRA, R. 1985. Los consorcios rurales de experimentación agrícola: Evolución e impacto. PROAGRO. Paper No. 2. The Hague, ISNAR.

MOONEY, P. R. 1979. Seeds of the earth: A private or public resource? Ottawa, Inter Pares.

MOSCARDI, E. 1988. Reflexiones acerca de rumbos para la investigación agrícola en ALC frente a algunos factores que pueden limitar su contribución. Seminario del Alto Nivel sobre Políticas y Movilización de Recursos para la Innovación Tecnológica en America Latina y el Caribe. Montevideo, IICA/EDI.

OECD, 1989. Biotechnology, agriculture and food. (OECD, Paris). p. 99-112.

OFFICE OF TECHNOLOGY ASSESSMENT Congress of the United States (1988), New developments in biotechnology: U.S. investment in biotechnology. Special report (OTA-BA-360, Washington D.C.)

PARDEY, P. G. and ROSEBOOM, J. 1991. National agricultural research from a regional and agroecological perspective. ISNAR Working Paper No. 40. The Hague, ISNAR.

PAZ, L. and PLANAS, P. 1985. Potencial y posibilidades de la investigación y extensión agropecuaria privada. Unpublished manuscript. Lima, Peru.

PERSLEY, G.J. 1990. Beyond Mendel's garden: Biotechnology in the service of world agriculture. C.A.B. International, Wallingford, UK.

PRAY, C. E. and ECHEVERRIA, R. G. 1991. Private-sector agricultural research in less-developed countries. In Agricultural research policy: International quantitative perspectives. P. G. Pardey, F. Roseboom, J. R. Anderson (eds) Great Britain, Cambridge University Press.

PIÑEIRO, M. and TRIGO, E. J. 1985. Agricultural research in the public sector of Latin America: Problems and perspectives. ISNAR Working Paper No. 1. The Hague, ISNAR.

POSADA, R. 1993. FEDEARROZ: Rice improvement in Colombia. Personal communication.

RIGGS, L. A. 1985. The biotechnology industry in California and the U.S.: Characteristics and progress. Paper presented at the Planning Workshop: Biotechnology and Food Systems in Latin America. San Diego, California, University of California, Center for U.S.-Mexican Studies.

SAMPER, A. 1982. La investigación privada en Colombia. Serie Informativa 12. Cali, Colombia, CENICAÑA.

SCOBIE, G. M. 1987. Partners in research: The CGIAR in Latin America. Study Paper No. 24. Washington, D. C., CGIAR.

SNOECK, M., SUTZ, J. and VIGORITO, A. 1991. Políticas y estrategias gerenciales de empresas agrobiotecnológicas en Uruguay. IICA.

TASSEY, G. 1991. The functions of technology infrastructure in a competitive economy. Research Policy 20: 345-361.

TOLEDO, J. 1993. La Fundación para el Desarrollo del Agro de Perú. Personal comunicación.

TRIGO, E. J. 1986. Agricultural research organization in the developing world: Diversity and Evolution. Working Paper No. 4. The Hague, ISNAR.

_____ and KAIMOWITZ, D. 1993. The role of non-governmental organizations in agricultural research and technology transfer in Latin America. Unpublished manuscript. IICA.

_____ and PIÑEIRO, M. E. 1981. The dynamics of agricultural research organizations in Latin America. Food Policy 6:2-10. February.

_____, PIÑEIRO, M. E. and ARDILA, J. 1982. Organización de la investigación agropecuaria en América Latina: Reflexiones e instrumentos para su análisis. San José, Costa Rica, IICA.

UMALI, D.L. 1992. Public and private sector roles in agricultural research: Theory and experience. World Bank discussion paper, Washington, D.C. World Bank. (World Bank Discussion Papers, No. 176). 102 p.

WAISSBLUTH, M., CADENA, G. and SOLLEIRO, J. L. 1985. La vinculación universidad-industria: Una experiencia organizacional en México. Paper presented at the Planning Workshop: Biotechnology and Food Systems in Latin America. San Diego, California; University of California, Center for U.S.-Mexican Studies.

Additional reading

BUTTEL, F. H., KENNEY, M. and KLOPPENBURG Jr., J. 1985. From Green Revolution to biorevolution: Some observations on the changing technological bases of economic transformation in the Third World. Economic Development and Cultural Change 24(1). October.

EICHERS, T. R. 1980. The farm pesticide industry. Agricultural Economics Report No. 461. Washington, D.C., USDA Economics, Statistics, and Cooperative Service.

FUNDACION CHILE. 1987. Memoria anual 1987. Santiago de Chile.

FUNDAGRO. 1987. Informe anual. Quito, Ecuador, FUNDAGRO.

GOLDSTEIN, D. J. 1985. New patents in biotechnology and food systems in Latin America. San Diego, California, University of California, Center for U.S.-Mexican Studies.

GUTIERREZ, M. 1985. Las funciones del sector público en el mejoramiento genético de los principales cultivos de la región pampeana en Argentina. PROAGRO Paper NO. 3. The Hague, ISNAR.

HAYAMI, Y. and RUTTAN, V. 1985. Agricultural development: An international perspective. Baltimore, Maryland, Johns Hopkins University Press.

HOBBELINK, H. 1987. New hope or false promise? In Biotechnology and Third World agriculture. Brussels.

OTERO, G. 1987. From Green Revolution to biotechnology: Impacts on U.S. and Mexican social structure. Research proposal. San Diego, California, University of California, Center for US-Mexican Studies.

PENANGO, R. and AVALOS, I. 1986. La Fundación Servicio para el Agricultor en el sistema agrícola venezolano. PROAGRO Paper No. 7. The Hague, ISNAR.

PIÑEIRO, M. 1985. Agricultural research in the private sector: Issues and analytical perspectives. PROAGRO Paper No. 1. The Hague, ISNAR.

PIÑEIRO, M. 1986. The development of the private sector in agricultural research: Implications for public research institutions. PROAGRO Paper No. 10. The Hague, ISNAR.

TRIGO, E. J., PIÑEIRO, M. E. and SABATO, J. F. 1983. La cuestión tecnológica y la organización de la investigación agropecuaria en América Latina. Desarrollo Económico 23(89). April-June.

1/ The ideas and issues presented in this paper were partially outlined in an earlier paper entitled "Private-Sector Participation in Agricultural Research and Development: Notes on Issues and Concerns," in The Changing Dynamics of Global Agriculture. A Seminar/Workshop on Research Policy Implications for National Agricultural Research Systems. E. Javier, V. Remborg (eds). 1988.

2/ In the Latin American context, this process created a number of research institutions that today constitute one of the region's most important assets for agricultural development. They include the National Institute of Agricultural Technology (INTA) of Argentina, founded in 1957; the National Institute of Agricultural Research (INIAP) of Ecuador, founded in 1959; the CONIA/FONAIAP complex in Venezuela, which began operations from 1959 to 1961; the National Agricultural Research Institute (INIA) in Mexico, circa 1960; the Agricultural Research and Outreach Service (SIPA) in Peru, which, after successive modifications, became the National Institute of Agricultural Research and Outreach (INIAA) in 1984; the Colombian Agricultural Research Institute (ICA), founded in 1963; and the Agricultural Research Institute (INIA) of Chile, founded in 1964. The 1970s saw the establishment of the Empresa Brasileira de Pesquisas Agropecuarias (EMBRAPA) in Brazil, the Bolivian Institute of Agricultural Technology (IBTA), the Institute of Agricultural Science and Technology (ICTA) in Guatemala, and the Agricultural Research and Development Institute (IDIAP) of Panama. Efforts to create similar institutions are under way in Uruguay and the Dominican Republic (Piñeiro and Trigo 1985).

3/ Between 1960 and 1984, the human resource base for agricultural research in Latin America grew at an annual rate of about 6.5% per year, increasing from about 1000 researchers in 1950 to over 8500 in 1984. In specific countries, the evolution followed approximately the same trend as in the region:

- At EMBRAPA in Brazil, the total number of researchers between 1974 and 1985 grew from 872 to 1650 (an annual rate of almost 6%).
- At ICA in Colombia, the number of researchers between 1962 and 1988 went from 137 to 603 (an annual rate of 5.9%).
- At INTA in Argentina, the increase was from 640 researchers in 1958 to 1467 in 1978 (an annual rate of 4.2%).
- At INIFAP in Mexico, the growth rate between 1977 and 1985 was 9.7%, when the number of researchers went from 929 to 1949.

These figures are based on the author' personal experiences and data from IICA and ISNAR publications.

4/ For an extensive discussion of this process in Argentina, Peru, and Colombia, see Trigo *et al.* (1982).

5/ The apparent difficulties for traditional institutional actors in meeting the challenges of creating a more sustainable and equitable pattern of agricultural development have led policy makers and social activists to promote new institutional actors and configurations designed to achieve these goals. Among these actors are the so-called non-governmental organizations (NGOs), which include any national or international private non-profit institution, with development objectives, which is not a membership organization. Few NGOs have been founded with the main objective of working in agricultural research and technological issues. Even so, there are hundreds of NGOs with some related activities. In Chile, there are at least 61 NGOs with agricultural projects (Gómez and Echenique 1988); in Bolivia there are said to be 150 (Bebbington 1991) and Central America has some 200.

6/ For a more complete discussion of the case of the research foundations, see Lindarte (1986).

7/ For a detailed discussion of the case of FUSAGRI, see Avalos and Pinango (1986).

8/ An idea of the quantitative importance of market incentives can be seen from the evolution of modern input consumption. For the whole of Latin America, the proportion of the area sown to modern varieties grew from 11% to 83% for wheat and from 4% to 28% for rice between 1970 and 1983 (Scobie 1987). The fertilizer consumption index between 1979 and 1985 grew at about 13% per year for nitrogen, overall fertilizer use grew from 9.7 kg per hectare in 1961-65 to 43.7 kg per hectare in 1981-85 while the number of tractors per unit of land almost tripled (Pardey and Roseboom 1991), 7% for phosphate, and 13% for potassium (FAO 1986-1987). The net trade of pesticides increased fourfold between 1970 and 1975 (de Janvry *et al.* 1987).

9/ The principal techniques identified as biotechnologies are cell/tissue culture, cell fusion/hybridoma production, recombinant DNA techniques, gene synthesis, separation, fermentation, enzymology, purification, large-scale purification, sequencing, and process-monitoring control (Riggs 1985). Only cell fusion, recombinant DNA, and gene synthesis are considered genetic engineering; the rest can be termed bioprocessing technologies.

10/ Research done by IICA clearly demonstrates this fact. Agricultural biotechnology R & D expenditure in Argentina, Costa Rica and Venezuela in 1989 was concentrated in academic organizations (48%, 78%, and 64%, respectively) (Jaffé 1992). Non-agricultural universities and other research institutes had 62.6% of the total papers reporting the use of traditional biotechnologies in the period 1978-87 in LAC. In the case of modern biotechnologies (principally genetic engineering and hybridonas), this goes up to 88.6% (Jaffé and Zaldivar, forthcoming).

11/ This table provides an indication of the extent of TNC involvement in the seed industry, and by extension, the level of integration with crop inputs supplied by agroindustries:

INDUSTRY	COUNTRY	ESTIMATED TURNOVER (millions US$)
Pioneer Hi-Bred*	U.S.A.	520
Royal Shell (oil)	U.K Netherlands	200-300
Sandoz (pharmaceuticals)	Switzerlands	290
LaFarge Coppee/ORSAN Semences	France	200
Volvo Provendor (automotive) (Hilleshop/Weibull)	Sweden	170
Pfizer/Dekalb* (pharmaceuticals/seeds)	U.S.A.	150
Upjohn/Asgro* (pharmaceuticals/seeds)	U.S.A.	140
Ciba Geigy/Funk (chemicals/biotechnology)	U.S.A.	130
Lubrisol/Agrigenetics (chemicals/biotechnology)	U.S.A.	110
Cargill (agribusiness)	U.S.A.	80-110
Elf Aquitaine/Sanofi (oil/seeds)	France	90
Rhone Poulenc (chemicals)	France	n.a.
Monsanto (chemicals)	U.S.A.	n.a.
Occidental Oil (oil)	U.S.A.	n.a.
ARCO Seeds (oil/seeds)	U.S.A.	n.a.
Continental Grain/Pacific Seeds (agribusiness/seeds)	U.S.A.	n.a.

Source: Grooseman (1987)
* Traditional seed company
n.a. Not available

12/ Basic research results, if not completely withdrawn from the public domain, could at least be delayed until there is a certainty that making them freely available does not diminish the possibilities for their commercial exploitation, but still there is no hard evidence at this happening. Genetic biotechnologies, that is, basic techniques with broad applications like genetic engineering and PCR, for example, have diffused to LAC quite rapidly, in spite of their being patented (Jaffé, forthcoming). The 1981 US Supreme Court decision Diamond vs. Chakrabarty made it possible to patent novel living organisms and opened the way to protect and commercially exploit basic knowledge. To date, few countries have accepted the possibility of patenting living organisms or seeds (agrochemicals and fertilizers are already included in existing patent laws), but there is on-going discussion about this in the International Union for the Protection of Industrial Property. The consequences of patent laws for seeds could be very far-reaching. Plant breeders' rights legislation does not prevent other breeders from using protected varieties for further breeding

purposes. Patent protection by taxing use would even make breeders pay for the use of protected seeds in their research. The consequences of such a situation need not be elaborated (for a further discussion of this topic, see Kloppenburg and Otero 1985).

13/ In the seed industry, which is increasingly dominated by TNCs, many countries will want to have crop improvement programs capable of supporting the local production of improved seeds to safeguard against oligopolistic behavior, excessive dependence on other countries, and a bias toward the development of improved varieties with undesirable traits, such as excessive dependence on the use of agrochemicals.

HOW CAN THE ROLE OF PUBLIC-SECTOR AGRICULTURAL RESEARCH BE DEFINED?

H. Carsalade [1/]
M. Griffon [2/]
M. de Lattre [3/]

The financial crisis being experienced by numerous public sector agricultural research organizations in Africa and Latin America means that CIRAD now has to reconsider its cooperation activities with partners who unfortunately have difficulties fulfilling their obligations. Like the other public research sectors that are now in deficit, these research organizations are being restructured and sometimes even privatized. This change in status should be backed up by a theoretical framework defining the respective roles of the public and private sectors, but this framework is as yet unclear.

The stakes for the efficiency of organizations mandated to create technical progress (research and extension structures) are high. Agricultural production in Africa and Latin America will have to increase more in the next forty years than ever before; this is the type of growth seen in Asia alone for more than twenty years now, as a result of the Green Revolution [1/]. Furthermore, this growth will have to be achieved without causing irreversible environmental changes.

Work by the World Bank and the International Service for National Agricultural Research (ISNAR) has already given a glimpse of the balance to be sought between private and public research. The main conclusion is that the private sector develops in those fields where there are potential economic returns and where the sector is sure of the appropriability of those returns and of being able to control them. For its part, the public sector is required to create a context favoring the development of private research and possibly to take charge of orphan activities and products. Public systems, non-profit-making organizations (such as research foundations) and international organizations would fill the gap between the private sector and public requirements [2/].

As this is a major strategic question for national research, the international agricultural research system and international cooperation organizations, it is essential to take the time to hammer out the issue.

At CIRAD, a working group is considering long-term issues and the CIRAD strategy. This document discusses the criteria for allocating research activities to a given institution. We will begin by showing the diversity of agricultural research activities, hence the multiplicity of possible approaches. We will go on the show that there are a great number of institutions capable of implementing research projects, and then look at a few criteria that can be used to determine the type of institution best qualified to carry out a given research project, as well as attempting to judge what role public research might play.

1/ Director General of CIRAD.

2/ Director of the Research Unit on Agricultural Policies and Prospectives (URPA) and Head of Mission for Economics and Sociology.

3/ Responsible for linkages with international institutions. Directorate of External Relations of CIRAD.

Agricultural Research Covers a Wide Range of Activities

There is a definite danger in considering agricultural research as a single entity. Research aims are many and varied; they correspond to an extraordinarily complex situation.

First, agricultural research covers an extremely wide field of investigation. Research looks into industrial systems upstream of agriculture (seeds, chemicals, agricultural machinery and rural equipment), in addition to those downstream (food processing, textiles, energy, etc.). Agricultural activities cover a whole range of technological and productivity levels, from techniques already used in the Neolithic Age to highly artificial forms.

Furthermore, research aims and activities, scientific disciplines and the ways of organizing research are many and varied. Research can look into plant and animal production[3/]. Researchers work on diagnosis and analysis, defining procedures, experimentation, building up data banks, product utilization (capitalizations) and producing results.

These activities call for resource management methods (human resources, laboratory management, scientific and technical information management, financial management). Several scientific disciplines can be brought into play (crop projection, agronomy, genetics, industrial technology, social sciences, etc.[4/]. Organizational methods also vary. Table 1.2 shows this variety and gives an idea of the vast range of expertise to be found in agronomic research institutions.

It should also be remembered that research institutions are complex sets of multi-purpose activivities, as each research procedure can be seen as a small, often short-lived business that mobilizes human resources, uses scientific information, inputs and one or more scientific procedures, produces outputs and scientific products and constantly has to revise its strategy (see Figure 1).

Any debate on the status of research institutions has then to take into account the diversity and multiplicity of agricultural research activities. Not all activities can be tackled in the same way. Certain research activities might well be suitable for privatization, while others should remain public. However, it is clear that segregation is not a viable option. Certain activities are closely linked, and segregating them by entrusting them to several companies can increase transaction costs. For example, separating crop protection and plant breeding activities that use the same genetic techniques would be costly. As well as the increase in transaction costs, it is also important to take into account the economies of scale that can be made when a research organization covers a wide range of activities.

Many Kinds of Organizations are Capable of Carrying Out Research Activities

Each country or region has one or more research institutions, either purely public or a mixture of public and private establishments[5/]. Ideally, these institutions should be grouped together in a national (or regional) agricultural research system (NARS). Their activities should be coordinated; complementarity and work sharing should be a target. All this should not exclude scientific competition. In reality, the institutions are often in juxtaposition, with few or no links with one another.

It is important to note that research is not only carried out in institutions. Agricultural producers also have research activities. They innovate, and transform their products to fit consumer demand and adapt to the prevailing conditions. However, their work is on a small scale and it not capitalized upon or valorized.

Alongside producers, institutions working on a national or regional scale devote all or part of their time to agricultural research. They can be split into eight ideotypes:

Public or semi-public institutions

1. Public research institutions (research institutes, research councils, ministerial departments).
2. Universities and faculties of agriculture.
3. Development companies which are also involved in adaptive research.
4. Regional research organizations.

Private institutions

5. Collective private associations, either profit-making or not, i.e., non-governmental organizations (NGOs), cooperatives and farmers' associations, institutions controlled and funded by producers, commodity boards.
6. Commercial companies in the agricultural or food industry field, large farms and plantations.

International institutions

7. Research institutions in another country whose researchers work with researchers from national institutions.
8. Research institutions from another country working alongside national institutions.

Lastly, several institutions working in the same field often combine to form a research network. There are several types of networks: information exchange networks, scientific consultation networks and collaborative research networks.

It is important to remember that not all public or semi-public institutions are state-owned. The difference between the public and private sectors can be determined by analyzing the institutional origin of the main decision-makers, particularly members of Boards of Trustees and/or Scientific Advisory Committees. The source of funding or the fact that commercial activities are carried out are not sufficient criteria for distinguishing between the public and private sectors. Private institutions receive public funding and vice versa. Public institutions sometimes sell their products or services.

What are the Criteria for Allocating Research Projects to the Public or the Private Sector?

Faced with this multiplicity of research institutions, how is one to determine what type of institution is best placed to carry out a given research project? Several criteria can be applied: the type of research output, the size of the market, the source of funds, the type of work involved, and lastly the notion of public utility. These will be looked at in succession.

Types of research outputs: Public or private good?

Using the typology of goods proposed by V. and E. Ostrom[6/], research outputs can be classified according to the possibility of preventing third-party access (open or exclusive access) and of separating the goods from their use (joint or rivalrous use).

In addition to public goods (open access, joint use) and private goods (exclusive access and rivalrous use), its is worth distinguishing between common goods and toll goods. Common goods are openly accessible —at least for the group controlling them— but there is competition for their use. This can be the case with "trade secrets" divulged only to members of specific associations or known only by a group of craftsmen. Toll goods are open to

joint use, but access can be controlled, for example by paying a fee to the patent owner. This can be the case with scientific analysis and diagnosis equipment or private teaching of agricultural technical know-how: knowledge is open to joint use but teaching is a compulsory stage for which a charge can be made.

It is extremely useful to be able to determine the status of research outputs. In effect, it is clear that purely public products cannot be sold and are therefore of no interest to private companies. However, such companies will be interested in "fee-paying" goods and private type goods. Unfortunately, it is not always easy to determine the status of research outputs.

The first difficulty lies in the fact that research outputs are often a combination of information and concrete achievements. For example, a soil tilling technique is defined by the data describing it (characteristics of the tool, conditions for use, environmental conditions) and the tool itself, which incorporates different techniques (plough, chisel, etc.). The tool can itself be a product of research or innovation (or be made commonplace) and the technique it contains is also a research output; it is an item of information —or of knowledge— and as knowledge, it can be seen as a purely public product[7].

In effect, written or oral information can circulate easily, and the cost of access to this information is theoretically low[8].

Another difficulty lies in the fact that certain innovations can be incorporated into a commonplace product without anyone having access to the information involved, as it is not detectable. For example, a hybrid plant or disease-resistant variety contains genetic information, but this can be kept secret. The information-product combination is common in research outputs, many of which have this dual nature: if the physical product is private, for example a resistant variety obtained by genetic engineering, the corresponding information will be protected (trade secrecy contract) or patented. If the physical product is easily copied, for example, an animal-drawn tool, the information it contains is public and patenting will not provide effective protection.

Two major conclusions can be drawn from these considerations:

- First, every research product, even if it is a composite, by its very nature has a "potential" status (public, private, common, fee-paying) as regards the way it can be used[9].

- If scientific and technical information is not kept secret in the legal sense of the word (protection by patenting or trade secrecy contracts) or is inaccessible (analysis of the product does not provide any information as to how it was produced, except at very high cost), it can be seen as public property. This does not mean that companies cannot sell a service (teaching, educational material) in order to facilitate access to the information, in which case the information can be likened to product "packaging." For example, this is the case with the extension of research outputs, which can be a private service.

Following this reasoning, it is tempting to think that public goods should be produced by public organizations and private goods should be produced by private companies. In practice, there are different kinds of examples, particularly public research organizations producing seeds, for example (private product), or private companies marketing goods with a public component by selling the means of access (for example, training). In the former case, the public agencies are paid by the market, while the latter can be public service concessions or purely private

undertakings. The idea of an agency offers a theoretical framework for proposing various types of relationship between the state and the private sector: public agencies, subsidiaries, sub-contracting, decentralized establishments, etc.[10/]

The type of research product (public or private) alone is not equal to allocating research activities to the public or private sector.

Market size and characteristics

One often has the impression that private institutions invest in a generation of research outputs that are widely applicable and will therefore have a larger market (for example biotechnology, varietal improvement, fertilizer and pesticide studies) or which will enable them to be more competitive on their particular market. It is tempting to assume that public-sector institutions must concentrate on outputs destined for more limited or less profitable markets, and that private institutions work toward more substantial, profitable markets. This is not necessarily the case in practice.

On the one hand, private institutions (for example NGOs) may carry out research for a limited number of users and on outputs that will not necessarily be competitive. The work can be geared towards improving living and production conditions and be implemented by private institutions. On the other hand, public institutions are capable, with private (and public) funding, of effectively carrying out research work destined for major, profitable markets.

Source of funds

Should assigning a given research project to a given institution be linked to the source of its funding? If so, this would be tantamount of saying that what can be funded by contracts would correspond to the private research sector, while public needs, hence public funding, would be directed toward public research or international institutions, and possibly that research corresponding to common needs —for example, those of an agricultural cooperative— would be carried out by organizations of equivalent status, i.e., associative or cooperative bodies.

This is not the case in practice. However, this approach integrates the interesting idea that certain research can be funded jointly by groups of companies, or groups of producers, and that private research organizations can be set up in response to the common needs of certain user categories. These may be research cooperatives, associations, or foundations. In France, almost all applied and adaptive agricultural research is carried out in research centers devoted to specific products funded by para-fiscal taxes, cooperatives and mutual benefit societies and producer groups. This type of institutional structure corresponds to a true, well-established "rural culture"[11/], hence to a set of stable professional institutions.

Type of research work

Can it be assumed that public institutions should be devoted to carrying out "basic" research, while private should stick to applied and adaptive research[12/]? This idea prompts another relating to sharing the economic and financial risks involved in research and innovation. The further upstream the research, the greater the risks of not covering research expenditure with economic returns, while the further downstream, the lower the risk. Companies can therefore take the responsibility for research.

In practice, the opposite situation is often found: major companies in the food or chemical industries carry out basic research with long-term targets as regards outputs; furthermore, public research often conducts

highly applied research that companies could carry out, but do not if the potential market is too limited.

However, it can be considered that in order to cover the risks involved, it would be more appropriate for public organizations to carry out upstream research at the request of companies themselves carrying out directly linked downstream research. But, this is obviously not the only principle.

The idea of public utility

The idea of public utility refers back to that of external effects[13]. A product can be considered to be of public utility —even if by its very nature, it is a private product— if it has "external effects." For example, a high-yielding food crop variety can have the direct effect of increasing agricultural income and improving the trade balance and balance of payments of the country concerned, but also have "external" effects on improving nutrition and health, hence work productivity, and possibly on calming political tension linked to food shortages. The external effects of a research output and an innovation can be positive, but also negative, for example when using polluting chemicals or techniques that damage ecosystems and their sustainability.

However, the existence of "externalities" does not necessarily means that the public sector has to be involved. It is quite possible that the economic protagonists concerned might themselves develop the institutions, regulations and economic internalization methods without public intervention. For example, a cereal cooperative could carry out research to improve the forage quality of certain cereals and negotiate regulations with livestock farmers' representatives in order to recover a reasonable proportion of the gains in productivity. Admittedly, this is not a common occurrence. In general, the authorities intervene to arbitrate or legislate. Nevertheless, their intervention is unquestionably warranted if the external effects in question are purely public goods or public "bads."

Public utility can also be invoked if the market itself creates negative external effects. Markets are designed to allocate, not to share out. However, research and innovation lead to gains in productivity that are evenly split between economic sectors and protagonists. Research is one of the key elements in modifying income distribution. Certain innovations can also have significant external effects; they are strategic in character. This can be the case with anything linked to a country's food dependence, or the state of its renewable natural resources. The state can take steps to control research of strategic importance, in the public interest. For example, the state could conduct research on mechanizing small-scale farming to ensure that not only large farms benefit from the gains in productivity made possible by the agricultural machinery marketed by firms.

Lastly, the state can consider that a forecasting sector is necessary, in order to anticipate the negative external effects that might be produced in societies.

What is the Role of Public Research?

All the principles cited for determining the role of public, semi-public and private institutions have limited scope. None of them is universal, but they are all valuable. Their application case by case has the advantage of showing that there is a large number of possible institutional situations, which we have merely touched upon. It is highly likely that among all the possible choices, the decision to steer a given research sector toward a particular legal form essentially depends on the history and institutional culture of the country in question. It goes without saying that the choice will be difficult in countries whose state institutions are in turmoil.

For research considered to belong to the public sector, for the reasons discussed above, there is also a wide range of institutional solutions, particularly if one considers that the public sector is not necessarily the exclusive preserve of the state; the organizations involved may be public on the scale of a zone within the country or on a regional or a wider international scale (several countries affected by the same agro-ecological or economic problems).

For their part, the leading firms in the agricultural and food industry field work on the international market scale, and the consequences of their activities extend beyond national boundaries. Alongside the spheres of influence of research carried out by these firms, it would be useful to develop spheres of influence for public research.

Prospective studies of the overall architecture of public systems is still a difficult undertaking, although it is essential and urgent to propose guidelines if the current institutional crises are to be overcome.

Bibliography

ANDERSON, J.R. and DE HAAN, C. (eds). 1992. Public and private roles in agricultural development. Proceedings of the Twelfth Agricultural Sector Symposium· The World Bank.

BINSWANGER, H.P. et. al. 1978. Induced innovation: Technology, institutions, and development. Baltimore: Johns Hopkins University Press.

BRAGA, C.A.P. 1990. Guidance from economic theory. In Strengthening protection of intellectual property in developing countries. World Bank Discussion Paper No. 112. W.E. Siebeck (ed). Washington, The World Bank. p. 17-32.

CIRAD (Hanak-Freud, E., de Lattre, M., Bachelier, B., Faye, J., Matheron, G., Omont, H., Seydoux, L., Nucé de Lamothe, M., and Picard, D.) 1993. La recherche agronomique en Afrique: Activités structures et gestion-document provisoire. Paris. CIRAD.

ECHEVERRIA, R.G. 1990. Assessing the impact of agricultural research. In Methods for diagnosing research system constraints and assessing the impact of agricultural research. Vol. II. The Hague: International Service for National Agricultural Research. p. 1-31.

EVENSON, R.E. and PUTNAM, J. 1990. Intellectual property management. In Agricultural biotechnology: Opportunities for international development. G.B. Persley (ed). Oxon, United Kingdom: C.A.B. International. p. 332-366.

GRIFFON, M. 1992a. Décentralisation de la gestion des biens publics et des bienes communs en Afrique de l'Ouest. CIRAD/GERDAT/URPA. Document de travail no. 14. Paris-CIRAD. Document présenté au Séminaire AEAE-Hohenheim. Stuttgart. September 1992.

_____. 1992b. La contribution francaise au développement agricole des tropiques. CIRAD/GERDAT/URPA. Document de travail No. 15. Paris-CIRAD.

HANAK-FREUD, E. 1992. Les défis économiques pour le recherche agricole dans les zones humides et sub-humdes de l'Afrique de l'Ouest et Centrale. CIRAD/GERDAT/URPA. Document de travail No. 8. Paris. CIRAD.

JAFFEE, S. and STRIVASTAVA, J. 1992. Seed system development: The appropriate roles of the private and public sectors. World Bank Discussion Paper No. 167. Washington. The World Bank.

LATTRE (DE), M. 1990. La gestion stratégique des relations des institute de recherche avec leur environnement. Thése, Paris I. Paris.

ORGANIZATION FOR ECONOMIC COOPERATION AND DEVELOPMENT. 1981. The measurement of scientific and technical activities, Frascati Manual 1980. Paris, France, OECD.

PHIPPS, T.T. 1989. Externalities and the returns to agricultural research discussion. American Journal of Agricultural Economics 71(2):466-467.

PIÑEIRO, M. 1985. Agricultural Research in the private sector: Issues and analytical perspectives. The Hague, ISNAR.

PRAY C. 1991. Private-sector agricultural research in less-developed countries. In Agricultural Policy, International Quantitative perspectives. P.G. Pardey, J. Roseboom, and J.R. Anderson (eds). Cambridge, Cambridge University Press, p. 342-396.

SMITH, L.D. and THOMPSON, A.M. 1991. Achieving a reasonable balance between the public and private sectors in agriculture. Papers of the Plenary and Invited Papers Session. Twenty-first International Conference of Agricultural Economists, August 22-29. Tokyo, Japan.

UMALI, D.L. 1992. Public and private sector roles in agricultural research: Theory and experience. World Bank Discussion Paper No. 176.

UMALI, D.L., FEDER, G., DE HANN, C. 1992. The balance between public and private sector activities in the delivery of livestock services. World Bank Discussion Paper No. 163. Washington, The World Bank.

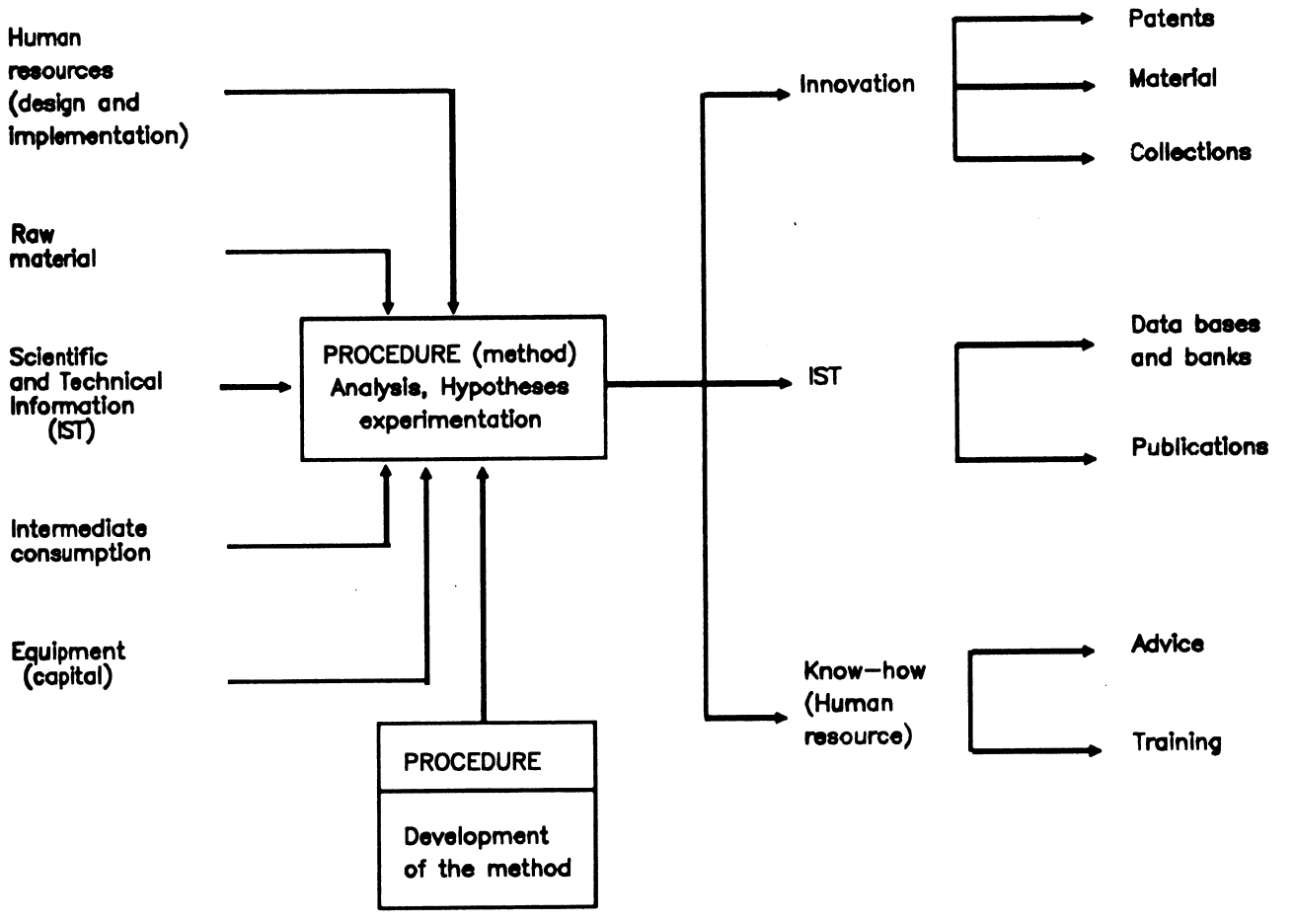

Figure 1.1. Elementary Research Procedure

Source: Lattre (de), M. (1990).

Table 1.2. Summary Table of the Expertise Found in an Agricultural Research Organization.

Research aims		Ecological environment	Plants and animal as material	Pathosystem	Technical approach	Farming and livestock-rearing systems	Production system	Agricultural production unit and households	Village units and commons	Processing industry	Subsector channel	State policy and sector as a whole
ACTIVITIES	Capitalization	Data Bank	Collection Surveys	Collections	Frame of reference	Classification Data Bank	Classification Data Bank	Data Bank Typologies	Case Bank	Case Bank	Data Bank Observatory	Data Bank Observatory
	Analysis	Detection survey	Laboratory techniques	Protection Identification	Surveys	Surveys	Surveys	Surveys	Surveys	Surveys	Surveys	Surveys
	Experimentation	/	Station	Laboratory Plots	Station Plots	R - D*	R - D*	R - D*	R - D*	ED**	/	/
	Advice	Knowledge	/	Methods	References	References	References	Methods	Methods	Techniques	Competitiveness	Models
	Production	/	Seeds Genes Seedlings	Methods Techniques	Development	Development	Development	Products	/	Product	Information	Models
Scientific disciplines		Ecology	Genetics Physiology	Crop protection	Agronomy and mechanization	Systems agronomy		Social sciences and economics		Technology		
		Remote sensing, image analysis, biometry, modelling, methodology, R-D, analyses, scientific and technical information.										
Organizational fields		By ecological zone	By product type			By agro-ecological zone		By major economic region and agribusiness system				

* Research-Development
** Experimental development

1/ This topic has been covered by much futurology work, particularly:

- Harrison, P. - Terres, vivres et populations. FAO. ROME 1984
- World Bank - l'Afrique subsaharienne. De la crise a une croissance durable - 1989. IBRD Washington D.C.
- CIRAD. Le projet d'enterprise - 1991 - Paris.

2/ Michel Petit, Foreword to Umali (1992)

3/ In the tropical field, around ten main animal species and another ten or so secondary species; around forty main plant species and over fifty secondary species, not to mention all the species not destined for exploitation.

4/ At CIRAD, there are 10 major and 29 secondary disciplines (themselves broken down to avoid their titles becoming too wide-ranging). The main fields (genetics, crop protection, agronomy in its widest sense and natural resource management, animal biology, industrial technology, social sciences, biometry, remote sensing) only partly correspond to the succinct typology given by Evenson and Putnam (1990).

5/ Lefort, J. and Moreno, A. 1990. Systemes nationaux de recherche agricole en Afrique: Quelques réflexions sur les difficultés actuelles et quelques propositions pour l'avenir. CIRAD-DSA.

6/ Ostrom, E., and Ostrom, V. 1977. Public goods and public choices. In Alternatives for delivering public services. E.S. Savas (ed). Boulder, Colorado, Westview Press.

7/ Ostrom, E. - Personal communication to the authors.

8/ However, this point is debatable. Numerous field researchers or those from organizations with few resources only gain access to scientific and technical information by paying extremely high charges in relation to their resources.

9/ An analysis of a wide-ranging list of research projects is under way.

10/ The agency theory claims that the state can "lay down the rules of the game which, along with the market, form an institutional context in which the links between agents in the private sector more easily ensure growth that is beneficial to all ... This concept is based on the model of the agency relationship between the State and the market ..." in Herbert Gintis' "New economic rules of the game: Challenge," 1992, Armonk, New York.

11/ Cerf, M. and Lenoir, D. 1987. Le développement agricole en France. Presses Universitaires de France. p. 96.

12/ According to the terminology used by ISNAR, based on the Frascati Manual - OECD - 0981. The measurement of Scientific and Technical Activities. Frascati Manual, 1980, Paris.

13/ "External effects" or "externalities" means all the effects resulting from the activity of one agent on economic agents not linked by a commercial relationship.

PANEL MEMBERS' COMMENTS

Carlos Torres

In **Argentina**, new decision-making structures in which farmers participated fully have been established as part of a process of institutional restructuring and decentralization. The Agricultural Technology Institute of Argentina (INTA) was organizationally integrated into private-sector technical assistance schemes which provide the required research support. Recently, INTA set up a foundation to facilitate the receipt of research funds, and since 1987 has followed a policy of joint undertakings with industry to develop specific products. Such technological linkage agreements were limited by the juridical structure of the state, and the next stage therefore envisages the establishment of companies with INTA as the principal stockholder. The need for a technology pool has also been suggested as a more advanced form of integration and linkage between the Institute and private companies.

Zafar Altaf

Pakistan was characterized by a highly agricultural economy whose structure was based on peasant farmers. The following topics were therefore important in the recent development of agricultural research in that country: The need to conceive public-private sector relations as an association; the importance of working with younger and more innovative entrepreneurs; and the incorporation of nongovernmental organizations. These aspects were important to consider in identifying possible opportunities for collaboration and linkage between the two sectors. Success in that regard required the creation of a new commercial approach and the establishment of personal relationships among those involved.

Quayogode Bakary

In **Cote d'Ivoire**, whose situation could also be representative of the rest of Francophone, the existing research systems, which were a carry-over from the colonial experience and still maintained close relations with France, were facing major economic difficulties and structural constraints owing to the size of domestic market and to price policies. One basic constraint was the absence of a processing sector for the country's —and the region's— raw materials, which were generally exported. Thus, an essential link in the agroindustrial chain was missing, which hampered research funding and even the focus of research in terms of market needs. Consequently, private-sector involvement in agricultural research was still very limited. To overcome these constraints, one solution that had been suggested as being important was regional integration, in order to take advantage of economies of scale.

Discussion

The participants' remarks centered on the presentation of specific experiences, requests for additional information and comments on earlier papers. Thus, representatives from Brazil, Bangladesh, India and Hungary presented some of their countries' experiences with regard to the topic under discussion. The representative of Hungary, in particular, gave a summary of his country's experience of four years of privatization, which had placed the survival of a large part of the existing research structure at risk, as well as leaving a major sector of small- and medium-scale farmers without adequate support. These presentations, together with those of the panel members, underscored the diversity of national situations and the substantial differences in the level of development of research systems,

which were necessarily reflected in the relations between the public and private sectors.

The suggestion that national research institutes should concentrate their efforts on support for small- and medium-scale farmers was questioned. In replying, Dr. Trigo underscored the need for a clear definition of the public sector's role in agricultural research.

In conclusion, the representatives of Colombia and Panama suggested that it was necessary for multilateral financial agencies to recognize the emergence of new private-sector research organizations as a feature of their funding and technical assistance policies. Finally, the experience of research foundations in Latin America generated an interest in obtaining further information.

SEEDS AND GENETIC MATERIAL

THE DEVELOPMENT, PRODUCTION AND MARKETING OF IMPROVED SEEDS: FARMER, PRIVATE, AND PUBLIC SECTOR ROLES

Steven Jaffee
Jitendra Srivastava [1/]

Summary

Seeds are crop-based agriculture's most important input. They carry the genetic potential of the crop, determining the upper limit on yield, and therefore the ultimate productivity of other inputs. In the future, the importance of seed will increase, not diminish. Seeds will be the primary delivery agents for many innovative products and technologies from plant biotechnology and may well be the most efficient and environmentally safe carriers of plant protection chemicals and growth regulators. Seeds will play major roles in programs and strategies geared toward agricultural diversification, natural resource management, and the preservation of genetic diversity.

Past experience in developing and diffusing (genetically or physiologically) improved seeds has been mixed, with most of the potential benefits being unfulfilled in many developing countries. There has been considerable success in introducing and spreading improved cereal and horticultural crop seeds in the now industrialized countries, high-yielding varieties of rice and wheat in the irrigated areas of Asia and Latin America, and improved planting materials for major export crops (e.g., oil palm, rubber, tea) in several developing countries. However, in many developing countries, the development or adaptation of improved varieties of many important food and cash crops has been very limited, particularly for use in rainfed or upland areas. Even where national or international research centers have made plant breeding breakthroughs, ineffective seed multiplication and distribution systems in many developing countries have limited the spread of improved seeds at the farm level, especially among small-scale farmers.

Part of the problem has been institutional. In many developing countries, the strategy adopted by government (and assisting develop ment agencies) was to establish large-scale national or provincial seed corporations and public seed farms to multiply and distribute improved seeds of selected crops. While these public supply systems have generally expanded domestic seed output and while some public seed enterprises have played important roles in the initial spread of high-yielding varieties (or hybrids) of rice, wheat, and maize, most such enterprises have operated at well below their capacity, have been a major financial liability for their governments, have produced only a narrow range of sub-standard quality products, and have directly or indirectly crowded out commercial private sector seed ventures. Influenced more by political pressures then by competitive or customer pressures, and

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1/ Agriculture and Natural Resources Department of the World Bank. The views expressed are those of the authors and do not necessarily represent those of the World Bank.

experiencing major technical, managerial, and/or financial constraints, most if not all public seed enterprises have failed to meet the diverse crop and varietal needs of different categories of seed users in their countries.

Until recently, little attention was given to the potentially important roles which private firms, cooperatives, other non-governmental organizations, and farmers themselves might play in seed supply systems, with private sector participation actually being barred in some countries. However, budgetary pressures, together with concern about the inefficiency and ineffectiveness of public seed enterprises, the increasing demand for high-quality seed, and a growing awareness of the opportunities and challenges associated with the emerging biotechnology, are leading many developing country governments (and international development agencies) to reconsider the roles for both the public and private sectors in seed supply systems.

This paper analyzes the appropriate roles for the private and public sectors in seed supply systems. It examines the technical and economic characteristics of seed and of the wide range of varietal development and seed production and marketing functions which are required to produce and disseminate improved seeds. This analysis serves to define the scope for private sector (and farmer) involvement to identify the critical and complementary roles which the public sector must play in support of an efficient, yet socially responsible seed system.

The paper also examines global trends in seed supply (including the current mix of public and private sector roles) and reviews selected experiences in the development of private sector and farmer-based seed production and marketing activities. The lessons from such experience as well as the policy tools for encouraging a broadly based and efficient seed system are highlighted.

Introduction

Seeds are crop-based agriculture's most important input. They carry the genetic potential of the crop, determining the upper limit on yield, and therefore the ultimate productivity of fertilizers, agro-chemicals, and other inputs. Seeds which are improved —in terms of their genetic make-up or their physical and physiological properties— can frequently make a substantial contribution to agricultural productivity and sustainability, at relatively little cost, independent of these other inputs. As seen in the Green Revolution, improved seeds which embody the results of new research can be an important agent of change in rural economies. In the future, the importance of seed will increase, not diminish. Seeds will be the primary delivery agents for many innovative products and technologies from plant biotechnology and may well be the most efficient and environmentally safe carriers of plant protection chemicals and growth regulators.

The potential benefits deriving from the spread and use of improved seed are enormous, yet much of this potential remains underutilized in many developing countries. Despite the critical importance of seed, the investments which have been made in seed multiplication, processing, distribution, and quality control have been small compared with developing country expenditures on fertilizers, agro-chemicals, tractors, and other inputs which are typically imported and subsequently consumed in the production process. While noting this pattern of resource allocation, we do acknowledge the progress which has resulted from certain international and national-level investments in seed-related activities. High-yielding varieties of rice and wheat, initially developed at IRRI and CIMMYT, have brought substantial yield increases in much of the irrigated areas of Asia and Latin America. Hybrid maize is being adopted by growing numbers of commercial and smallholder farmers in many developing countries. Improved planting materials for

major export crops (including tea, oil palm, and rubber) have enhanced the competitiveness of agro-industries in certain countries.

Still, the development or adaptation of improved varieties of sorghum, millet, cassava, (open-pollinated) maize, food legumes, vegetable crops, and fodder crops has been very limited in many developing countries, particularly for use in rainfed and upland areas (Dalrymple (1986a and 1986b); McMullen (1987); Kloppenberg (1988). Even where national or international research centers have made plant breeding breakthroughs, ineffective seed multiplication and distribution systems in many countries have limited the spread of improved seeds at the farm level, especially among small-scale farmers (CIMMYT (1987); Lipton and Longhurst (1988); Cromwell (1990). While seed system development has reached fairly advanced stages in several Latin American and Asian countries, in much of sub-Saharan Africa and amongst the poorest developing countries in other regions, progress in seed supply systems has been very limited, despite periodic or even sustained development assistance efforts.

In the past, the seed development strategy adopted by many governments (and international development agencies) was to establish large-scale national and provincial seed corporations and public seed farms to multiply and distribute improved seeds of selected crops. National seed programs set seed production targets, which were pursued by public corporations frequently with inadequate regard to product quality and in the absence of any realistic assessment of current or future demand. While some of these public seed corporations have expanded seed output and did contribute to the initial spread of high-yielding varieties (or hybrids) of rice, wheat, and maize, most such enterprises have operated at well below their capacity, have been a major financial liability for their governments, and have directly or indirectly crowded out commercial private sector seed ventures. Influenced more by political pressures than by competitive pressures or consumer preferences, and having limited technical, financial, and other resources, none of the public seed enterprises have been able to meet the diverse crop and varietal needs of different categories of seed users in their countries.

Until recently, little attention was given to the potentially important roles which private firms, cooperatives, other non-governmental organizations, and farmers themselves might play in seed supply systems. However, budgetary pressures, together with concern about the inefficiency and ineffectiveness of public seed enterprises, the increasing demand for high-quality seed, and a growing awareness of the opportunities and challenges associated with the emerging biotechnology, are leading many developing country governments and international development agencies to reconsider their approach to seed system development and the appropriate roles for the pubic and private sectors, including farmers themselves. By defining the scope for private sector involvement in seed supply activities, by identifying the critical and complementary roles for the public sector, and by reviewing past experiences in seed system development, this paper seeks to contribute to the design of improved strategies for seed system development in developing countries and among centrally planned countries.

Seed System Functions

Improved seed represents the outcome of a multiple and sequential series of activities and decisions; the outcome of a process which begins with the initial manipulation of germplasm and identification of a suitable variety or hybrid, continues through the multiplication, processing, and distribution of seed, and ends with farmer up-take and use of this seed.[1/] Major functions in this process include:

1. *Varietal development and release*: whereby new varieties are developed through selection, mutation, hybridization, or genetic engineering processes, are evaluated for yield and/or other performance characteristics, and are released for specific agro-ecological areas.

2. *Seed multiplication*: whereby genetically pure "breeder seed" (or in the case of hybrids, inbred lines) is produced and then multiplied, first to generate a larger supply of "foundation seed" and subsequently again to produce "certified seed" in quantities sufficient for general marketing. Seed that is marketed without certification is called "commercial seed," usually grown from "foundation seed" or similar stock. "Commercial seed" may also derive from a further multiplication of "certified seed".

3. *Seed processing*: involving seed drying, shelling, and sizing, the removal of inert material and alien seed, and various types of chemical treatment to protect seed health and combat against insects, fungi, and bacteria.

4. *Seed storage*: including long-term storage of breeder seed of released varieties, the maintenance of reserve stocks of seeds for staple food crops, carry-over seed stocks between crop harvests and subsequent planting seasons, and seed stocks to meet short-term sales requirements.

5. *Seed marketing and distribution*: involving seed handling and transport, market research, field demonstrations and advertising, wholesale and retail buying and selling operations, and the related facilitating functions of risk-bearing and financing.

6. *Quality control*: including seed crop inspection, seed testing, and seed certification.

The above operational functions are highly interdependent, both technically and economically. The outputs from each activity serve as primary inputs into the subsequent activities; the economic returns to each activity are dependent upon the effective performance of the other activities. The interdependent set of seed-related physical activities, the firms and individuals which perform such activities, and the network of trading and other institutional arrangements which facilitate coordination among such activities and participants can be regarded as constituent elements of **national seed systems**.

Seeds can be a major lever for bolstering productivity and for rendering agricultural production systems more flexible and environmentally sustainable. To be that lever, seed must be accessible and affordable to farmers and be effective in addressing farmers' constraints, such as poor yield, limited labor resources, pests, or diseases. The seed must also yield a crop which has the quality and storage attributes preferred by farmers, other consumers, and/or agricultural processors. To meet these objectives, national seed systems need to be effective not only in inducing **varietal replacement** (e.g., the development and dissemination of new, genetically improved varieties and hybrids), but also in the efficient **resupply of high-quality seeds** (of well-known and used varieties) on a periodic or seasonal basis.

Major Actors in the Seed System

To meet the varied seed needs of different categories of farmers, a multi-pronged strategy is needed which gives due regard to the comparative advantage of different actors and institutions across the public sector - private sector spectrum. A multiplicity of actors, operational modes, and public support measures are required. In the past, such a

holistic perspective was not taken in many developing countries, with most resources being directed to large-scale, centralized, parastatal seed corporations. Table 2.1 lists different types of actors who participate in many national seed systems, indicating their most common forms of participation.

An important characteristic of seed which distinguishes it from most other agricultural inputs is its ability to reproduce itself. This property enables farmers to serve as their own suppliers, thus setting certain limits on the development of a commercial seed market. While it may not be cost-effective or technically feasible for farmers to save seeds for certain types of crops and under certain agro-ecological conditions (see Box 2.1), any analysis of the appropriate roles of the private and public sectors in seed supply systems must take into account what seed-related functions farmers can and cannot perform efficiently (Pray and Ramaswami 1991; Cromwell *et al.* 1992). Farmers should not be viewed as simply the consumers of seed produced and distributed by formal private and public enterprises. As we will demonstrate below, farmer-saved seed continues to account for the bulk of seeds planted in many developing countries.

Appropriate Private and Public Sector Roles in Different Seed System Components

The major functions of seed supply systems have different economic and technical characteristics. In examining the incentives for private sector involvement and the justification, if any, for public sector intervention, we should examine each activity separately. The primary characteristics of the activities which we focus on here are the following:

1. *Excludability*: Can the performer of the function exclude non-paying parties from making use of the good or service? If not, then the private return on investment in that activity may be quite low, deterring at least certain types of private entities from undertaking the activity. Where such investment falls below the social optimum, some form of government intervention will be required either to induce greater private investment or to undertake the activity itself.

2. *Economies of Scale*: Are there large initial costs in entering the activity or do major advantages accrue to those who can operate on a relatively large scale? If so, then private entry may be constrained at least in the early stages of seed system development. This may result in a lack of private investment altogether or in a non-competitive market. Economies of scale in certain activities might also result in certain areas or segments of the market being poorly served. Hence for either efficiency or equity reasons, some form of public action may be warranted.

Table 2.1. Major Participants in Seed Systems.

TYPE OF PARTICIPANT	TYPICAL ACTIVITIES	LOCATION OF OPERATION
Individual Farmers	Save Own Seed Farmer-to-Farmer Exchange Involvement in On-farm Trials	Local
Farmer Seed Producers	Seed Multiplication for Sale Under Contract or Direct to Farmers (One or Few Crops)	Local
Small Companies	Multiplication and Distribution of Public and Private Varieties (Limited Crop Range) Retailing of Seed/Other Inputs Seed Importation	Local/ Regional
Non-governmental Organizations (NGOs)	Organize Community-Level Seed Multiplication/Supply Relief Program Seed Supply Seed Extension Work	Local/ Regional
Cooperatives	Seed multiplication (Members) Seed Processing/Distribution Possibly Breeding Research and/or Trials	Local/ Regional/ National
Large Domestic Private Enterprises	Seed Multiplication, Processing, and Distribution (Wide Range of Crops) Plant Breeding Research Seed Importation Seed Extension/Promotion Commodity Processing and Marketing	National
Multinational Corporations	Plant Breeding/Varietal Testing Seed Multiplication, Processing, and Distribution (For Hybrids) Seed Importation Seed Extension/Promotion	National and Global
Seed Associations	Define and/or Enforce Quality Standards Influence Seed-Related Public Policies	National
Agricultural Banks	Credit for Seed Purchases Seed Distribution	National
Public Seed Corporations	Foundation and Certified Seed Production Seed Processing/Distribution	Provincial or National
Public Research Institutes and Universities	Plant Breeding/Varietal Testing Training Breeder Seed Production	Local/ Regional/ National
Public Extension Service	Seed Trials/Extension/Promotion	National
Public Regulatory Agencies	Seed Field Inspection Seed Certification Quarantine	National

Box 2.1. Factors Influencing Farmer Choice Between Saved Seed and Seed Procured from Other Sources

Farmers will compare the costs and benefits of saving their own seeds versus those associated with obtaining seeds from external sources, whether through purchase or barter. Relevant costs include direct seed production and storage costs, transaction costs, seed purchase costs, and any opportunity costs associated with reduced consumption and/or market sale of a crop due to the saving of seed. The relevant benefits relate to the physical quality characteristics and (predictable) performance of the seed, seed accessibility, and the reliability of supply.

In addition to the farmer's own technical know-how and experience, other important factors affecting the cost-benefit ratio for farmer seed retention are the prevailing agro-technical and environmental conditions, and the type of crop or variety. Farmers retaining their own seeds are vulnerable to total seed loss in the event of drought or other adverse natural event. Risks of farmer production and seed storage are higher under rainfed than irrigated conditions and when seed harvests are made in humid rather than dry weather. Risks will be higher for crops for which the edible/usable form of the crop is but a precursor to the seed (eg., vegetables, fodder crops) than for crops whose seed is the mature grain (eg., wheat, maize, rice, grain legumes) given the extended production cycle involved for the former.

Farmers risk declining productivity if the genetic and physical purity of the seed is not maintained and as varieties become susceptible to new types of diseases and insects. Varietal deterioration in farmer-retained seed is generally very low in the case of self-pollinated crops, moderate for cross-pollinated crops (because they may become genetically mixed with other varieties in nearby fields), and very high in the case of hybrids which tend to progressively lose their hybrid vigor with each multiplication. Different crops also vary in their susceptibility to disease and pests and in their storage properties. It is generally more difficult for farmers to retain seeds for crops which are vegetatively propagated (eg., cassava, sugar cane) because of a high risk of disease development and spread.

Farmers will substitute for or supplement their own seeds by purchasing seed from others in circumstances where a superior or alternative variety is available, the previous standing crop was sold, the purity (or resistance to diseases and insects) of farmer seed stocks has deteriorated, or it is easier or less costly for the farmer to obtain seed from external sources rather than undertake production and storage him/herself. External suppliers may be in a position to produce higher quality seed or produce seed at lower cost due to economies of scale and by utilizing specialized knowledge in plant breeding or seed production, better operating conditions (eg., irrigation), and/or better facilities for seed processing and storage.

3. *Information or Quality Problems* (otherwise referred to as moral hazard in economics jargon): Is there uncertainty about the quality of the product or service and might such uncertainty undermine the functioning of the market? If so, then certain measures will be needed to achieve effective quality management and to protect consumers of the product or service. As noted earlier, this is likely to be an important problem in the case of seed supply.

4. *Externality*: Does the activity give rise to either positive or negative spillover

effects which the supplier may not take into account when considering his level of investment and effort? If so, then the private delivery of the service may be at levels less than or greater than the social optimum. Again, some form of public action may be warranted.

Varietal Development

The analysis first considers varietal development which is a crucial starting point in the production and dissemination of improved seeds. Table 2.2 provides a summary of this analysis. There, a distinction is made between varietal development for self-pollinated crops (e.g., wheat, rice, barley) and hybrids. The table indicates whether or not the above-noted economic characteristics apply and whether private and public sector participation can be economically justified.

The development of new varieties and hybrids can be a profitable activity for private firms, either specialized R&D firms or firms which also engage in seed production and distribution. However, for several reasons, the amount of investment in these activities by the private sector may not reach socially optimal levels.

First, private firm investment in plant breeding may be constrained by the high fixed entry cost in this activity. A critical mass of scientists, physical facilities, and germplasm is needed to undertake an effective varietal development program. There are thus certain economies of scale. In very small markets, this might deter private investment in plant breeding or result in one firm monopolizing this activity.

Table 2.2. Economic Characteristics of Varietal Development: Appropriate Private and Public Sector Roles.

		VARIETAL DEVELOPMENT	
		Self-Pollinated Crops	**Hybrids**
Economic Characteristics	Economies of Scale	Some	Some
	Quality/Inform. Problems		
	Externality	Yes	Yes
	Problems of Exclusion	Yes	
Appropriate Sectoral Roles	Private Sector	Y	YY
	Direct Public Sector	YY	Y
	Public Sector Finance/ Tech. Assistance	YY	YY

YY Strong Economic Justification
Y Economically Justified Under Special Circumstances (Such as "infant industry," cases of minor crops or particular market niches)

Second, there are potentially significant externalities associated with plant breeding work with benefits accruing to researchers or producers of other crops or in different regions. The breeder may capture little or none of these benefits and therefore from the social point of view underinvest in varietal development.

Third, many outputs from plant breeding R&D have the public good properties of non-exclusivity and non-rivalry —it is often difficult or costly to prevent non-paying competitors or farmers from benefiting from the knowledge embodied in new varieties of seed and many such individuals can simultaneously use this knowledge without depleting it (Umali 1992).

The significance of these factors varies among types of crops. The most important distinction relates to the ability to exclude "free riders" and thus earn a sufficient return on one's investment. Plant breeding of hybrids can be commercially attractive to the private sector given the biological protection which the breeder obtains over its R&D output by maintaining control over the inbred lines. Hybrids give their developers the ability to preclude others from easy duplication and help ensure a market because farmers must buy seed every year to get maximum yields.

In contrast, the breeder of self-pollinated varieties may capture little of the benefits from his work as his output —an improved variety— can be easily duplicated by others (including farmers themselves) who may not pay for the variety. Hence, private investment in varietal development work for self-pollinated crops is likely to remain below socially optimal levels. Private investment would be expected only under special circumstances, such as when proprietary rights can be enforced, when a particular market niche can be targeted, or when such research is at least partially funded by the public sector. Given this and the externalities involved, there is strong justification for public sector involvement here, both directly (by government research stations or public universities) and indirectly (through providing financing, training, etc. to stimulate private sector investment areas).

For hybrids (and also for specialty crops such as vegetables and plantation crops), the direct involvement of public institutions in varietal development can be justified under two sets of circumstances. One, in the early stages of seed system development when there are relatively few trained local scientists, very limited resources, and very uncertain demand for seeds of these types; and two, in very small markets for which private investment is not taking place. In either case, however, the public sector can reduce the costs of private investment by conducting effective basic research and germplasm enhancement, by sharing inbred lines with private researchers, by providing support in accessing germplasm from international sources, by training plant breeders, and by not restricting investor importation of equipment, where necessary.

Seed Production and Processing

Table 2.3 examines the economic characteristics of seed multiplication and processing for self-pollinated crops, hybrids, and specialty crops (e.g., vegetables, plantation crops). The skill requirements and technical and commercial risks associated with seed multiplication are considerably lower than for varietal development work. Hence, the economic and technical barriers to entry by the private sector will be relatively lower. While individual farmers may find it cost-effective to produce and save their own seed for certain crops, there is ample scope for private companies to find profitable niches in the production of hybrids, specialty crop seeds, and replacement seed for self-pollinated crops.

For seed multiplication, a common problem across different types of crops is quality uncertainty and quality management. In the course of production, care must be taken to maintain both genetic and physical purity.

This can be done through a combination of measures internal to the producer (such as supervision and incentives for laborers and contract farmers) and external measures such as seed field inspection and seed certification.

In the case of self-pollinated crops, a breakdown in quality in the multiplication of foundation or certified seed can generate negative externalities since the impure or otherwise low-quality seed may be subsequently multiplied, used, and re-multiplied by many farmers. Where this occurs for a staple food crop, food security may be adversely affected. Such negative multiplier affects will generally not occur for hybrids and could be avoided for specialty crops other than those from which clonal materials are used for planting (sugarcane).

Table 2.3. Economic Characteristics of Seed Multiplication and Processing Appropriate Private and Public Sector Roles.

		SEED MULTIPLICATION			Seed Processing
		Self-Pollinated Crops	Hybrids	Specialty Crops	
Economic Characteristics	Economies of Scale	Some			Some
	Quality/Inf. Problems	Yes	Yes	Yes	
	Externality	Yes			
	Problems of Exclusion	Yes			
Appropriate Sectoral Roles	Private Sector	YY	YY	YY	YY
	Direct Public Sector	Y	Y	Y	Y
	Public Sector Finance/Tech. Assistance	Y	Y	Y	Y

YY Strong Economic Justification
Y Economically Justified Under Special Circumstances (Such as "infant industry," cases of minor crops or particular market niches)

For self-pollinated crops, the profitability of commercial seed multiplication is greatly constrained by the fact that the harvested grain is close in character to that of commercial seed, making it relatively easy for farmers or competing firms to reproduce the seeds without significant loss of quality. Exclusion is thus a serious problem plus the price that one can charge for a well-established variety can only be modestly above that of commercial grain.

Multiplication of hybrids and of seed of specialty crops is far more costly and technically demanding, while the saving of seed from hybrids generally results in significant

declines in productivity in subsequent plantings. Hence, replacement will be done annually and there is far less scope for unauthorized or unlicensed seed multiplication. Profit margins can also be significantly higher than for seeds of self-pollinated crops.

Thus, there can be very strong incentives for the private sector to engage in seed multiplication, although its actual character would be expected to differ across different types of crops. For self-pollinated crops, under suitable agro-ecological conditions, farmers themselves are likely to be major seed producers. The only other parties who might profit from this activity will be small seed companies which carry low overheads, yet can produce very high quality replacement seed or seed of new improved varieties for farmers. Where demand has been established, there is potentially a strong incentive for larger or more specialized private seed companies to organize the production of hybrids and specialty crop seeds.

There is an economic rationale for public sector involvement under several circumstances and in several capacities. In the case of self-pollinated crops, direct production of foundation seed may be warranted either in the early stages of seed system development or when a new variety is being introduced and there is very limited breeder seed available. For equity reasons, there may be justification for public sector intervention in the multiplication of seeds for very minor crops or for narrow agro-ecological areas for which demand is inadequate for private investment. This need not be done directly on a public seed farm —the government can support such production by private firms, cooperatives, or other non-governmental agencies. There is also a potentially important role for the public sector through the extension service: providing technical support to farmers to enable them to improve their techniques of seed selection and retention.

Direct public sector production of hybrids and specialty crop seeds can be justified only in the early stages of seed system or agro-industrial development when the private sector is still very weak and demand not yet established. Once private production has taken off, the public sector should support and promote it, rather than compete with it.

Seed processing is frequently the component of the process which requires the largest capital investment. This is because some seed drying, cleaning, chemical treatment, and packaging activities either require or are more efficiently performed with mechanized equipment. Seed processing is technically demanding for some crops (e.g., vegetable, oilseed and forage crops) and less problematic for field crops. Generally, seed processing can be a value-adding activity for private seed producers or traders or a profitable activity for private enterprises providing custom processing services. There is little economic justification for public sector involvement except where the technical skills and investment requirements for processing a particular seed crop are not readily available in the private sector or where transport costs can be saved by integrating processing activities with existing public sector seed multiplication operations. In more advanced seed systems, neither of these conditions would be applicable.

Seed Marketing, Distribution and Quality Control

Table 2.4 below examines the economic characteristics of a cluster of major seed marketing and distribution functions and denotes whether or not private and public sector participation can be justified on economic grounds. It is particularly in this line of activities, where flexibility of action and responsiveness to farmer requirements are important criteria for success, that the private sector has its greatest potential advantages over the public sector. Nevertheless, seed

marketing functions do have certain properties which might lead private sector provision to remain below the social optimum or result in problems of equity in seed distribution.

For example, some **economies of scale** can be realized in market research, and in seed storage and distribution. This condition can lead to competitive disadvantages for small-scale enterprises and may also deter private firms from serving relatively small or isolated market areas. Hence, some farmers may be poorly served by private seed distribution channels or face localized supply monopolies charging above competitive prices. It is especially in remote areas where governments and non-governmental organizations should support farmer-based seed multiplication and dissemination schemes (see Box 2.3).

Box 2.2. Decentralized Seed Processing in the Philippines

Transport costs have an important bearing on the economics of seed processing. This is illustrated in the case of the Philippines, where farmers have played a major role in organizing seed production and processing. After the introduction of high-yielding rice varieties in the 1960s, medium-scale farmers formed Seed Growers Associations which now produce the bulk of certified rice seed. Although fifteen large-scale processing centers were provided under a bilateral aid program in the 1970s, these have remained underutilized as it is uneconomic for farmers to transport seed to and from these centers. Farmers have been able to produce seed of adequate quality by using small-scale, on-farm processing devices, supplemented by mobile seed cleaning units. The processing units require minimum capital investment and involve labor-intensive methods.

Source: Cromwell *et al.* (1992).

Seed promotion is associated with **information (or "moral hazard") problems** and with possible **externalities**. As some seed quality characteristics are un-observable, the promoter (and also the seed distributor) may make false or incomplete quality claims which result in unnecessary costs or low productivity for farmers and perhaps an overall reduction in farmer confidence in the value of commercially-supplied seed. While competitive pressures will contribute to the improvement of seed quality, market development can be strengthened by the establishment and enforcement of quality standards and rules regarding seed labelling and by the development of systems for seed evaluation and certification.

On the other hand, promotion may have positive spillover effects on others which the firm will not take into account when considering its level of investment in promotion. Those benefiting from such promotion may include competing seed companies who benefit from farmers gaining greater awareness of the advantages of purchasing improved seed, local agro-processors who benefit if the improved seed results in larger supplies of local agricultural raw materials, and distributors of other farm inputs as the demand for their products may increase with additional seed purchases. Such externalities can be at least partly internalized through seed promotion activities by seed associations and through the integration of seed supply with the marketing of other inputs or of agricultural commodities.

Table 2.4. Economic Characteristics of Seed Marketing and Distribution Appropriate Private and Public Sector Roles.

		Storage	Market Research	Seed Promotion	Distribution	Importing
Economic Characteristics	Economies of Scale	Some	Some		Some	
	Quality/ Inform. Problems			Yes	Yes	Yes
	Externality			Yes		Yes
	Problems of Exclusion				Yes	
Appropriate Sectoral Roles	Private Sector	YY	YY	YY	YY	YY
	Direct Public Sector		Y	YY	Y	Y
	Public Sector Finance/ Technology Assistance	Y	Y		Y	

YY Strong Economic Justification
Y Economically Justified Under Special Circumstances (Such as "infant industry," cases of minor crops or particular market niches)

With seed distribution, there is not only the quality information issue, but also some **problem of exclusion** in the case of self-pollinated varieties since competing distributors and farmers can multiply the seeds for their own sales. Your marketing success this season may not be repeated next season. Private solutions to these problems include brand name promotion and the supply of additional inputs and/or services.

With seed imports, not only is there the quality uncertainty problem, but there are potential **negative externalities** with the imported seed bringing with it pests, diseases, or weed seed which could adverse affect production for the targeted or other crops. Prudent, yet not unduly obstructive rules for seed import, testing, and temporary quarantine (administered by public or private institutions) can minimize these hazards.

Box 2.3. Informal Seed Distribution in Remote Regions and Narrow Agro-Ecological Zones

Informal seed distribution systems are typically based on localized farmer-to-farmer or community-to-community exchanges. These systems are typically quite flexible, involving a variety of different exchange mechanisms. Informal seed systems are most appropriate and often dominant in circumstances where: 1) the farming community is located in a remote location (inhibiting farmer access to markets and seed distributor access to the area), 2) production is undertaken within a narrow agro-ecological zone (limiting seed market size and the suitability of widely marketed varieties), and 3) the major crop(s) have very high seeding rates (implying high transport costs for seeds moved over considerable distances).

All of these conditions prevail in the Peruvian highlands where potatoes are the primary food crop as well as the most important cash crop for some 60% of the smallholder farm households. Because of the narrow agro-ecological niches within the highlands, the considerable risk of production due to drought and frost, and the varied culinary tastes of farmers and consumers, several hundred indigenous potato varieties are grown. Within the highland areas, the road network is poor and some production areas are completely cut off from vehicular access.

Until the early 1980s, seed potato programs in Peru had focused on supplying improved seeds to large-scale commercial seed growers (located in the coastal area or in the Central Highlands), with the expectation that this improved seed would spread into the production systems of small-scale hill farmers. This, however, generally did not occur and smallholders tended to save their own seeds or exchange seeds amongst themselves. In order to strengthen the links between formal research and the informal highlands seed distribution system, a special program was launched in 1983, with the participation of the National Institute for Agricultural Research, the International Potato Center, and the Swiss Development Corporation.

As part of the program, laboratories and research stations were set up in five locations in the highlands to produce pathogen-free foundation seed of the twenty most popular modern varieties and sixteen most popular native varieties. This foundation seed was sold by the extension service or by non-governmental organizations to farmers or farmer communities for them to multiply and distribute. Individual communities made their own arrangements for such multiplication and distribution. The program has been successful. A follow-up study undertaken after two years of the program found that the volume of seed production had expanded rapidly, that seed quality had been maintained, and that improved seed had been widely diffused among many farmers and nearby communities.

Source: Scheidegger *et al.* (1989).

Thus, in an environment where the prices of seeds are largely market determined, most of the functions which constitute seed marketing can be profitably performed by the private sector. Many of the noted features of scale economies, externality, and quality uncertainty can be dealt with via market or collective solutions. The public sector should act to supplement and support private activity, encourage competition, provide additional information, provide consumer protection, and protect against negative externalities. Direct public distribution activities can be justified only in the early stages of seed system development when private distribution channels are weak or undeveloped in particular areas. Potentially important support and regulatory roles might include: 1) support

for the distribution of seed of minor crops, 2) support for seed distribution in remote areas, 3) seed testing and disemmination of test results, 4) promotion of new varieties, and 5) enforcement of quality standards and truth-in-advertising provisions.

Hence, the analysis thus far suggests that as seed systems develop, the private sector should assume the primary or exclusive responsibility for the "business" of seed production, processing, and trade. The public sector, on the other hand, has a major role in the scientific elements of the seed system —through research, training, and seed testing. The public sector should supplement or fill gaps in areas where private activity is weak as for minor crops, narrow agro-ecological zones, serving remote farmers, and in foundation seed production for newly released public varieties. The public sector should act as a quality watchdog to supplement the commercial quality activities of the private sector and protect consumers.

Global Patterns of Seed System Development and Commercialization

During the mid-1980s, the annual value of all agricultural seeds used worldwide was estimated at $50 billion. Of this total, commercial sales by private firms and cooperatives were about $15 billion (or 30%) and sales by public sector enterprises and institutes had an estimated value of $17 billion. The remaining $18 billion (e.g., 35%) is the estimated value of farmer-saved (or local community supplied) seed used worldwide (Cultivar 1991; Groosman 1991).

While the planted area for many important food and industrial crops is larger among developing countries as a whole than among industrialized countries, it is the latter countries which account for the dominant share of the value of seeds sold commercially. It is estimated that the value of seed sold commercially in developing countries was $3.8 billion in 1988, representing only 10-12% of global commercial sales at that time (Pray and Ramaswami 1991). Several factors account for the relatively small commercial market share of developing countries, including: 1) the very high proportion of planted seed in developing countries which is farmer-saved (Box 2.4); 2) the limited development of the higher value segments of the seed industry in developing countries, including those comprising hybrids for foodgrain and industrial crops and improved varieties of horticultural and forage crops[2/]; and 3) the slow development and release of improved varieties of foodgrains in many developing countries (Delouche 1982; Dalrymple 1986a, 1986b; Timothy *et al.* 1988; Groosman 1991).

In 1985, the FAO conducted a global survey of seed industries related to food, industrial, vegetable, and other types of crops. The survey found that varietal development work and seed production and distribution are generally more advanced for food crops than for industrial crops and that very few developing countries have advanced seed systems for vegetable crops. The survey also found that in many of the cases where countries have attained relatively advanced systems of varietal R&D, systems of seed production and distribution have lagged behind. These patterns are a reflection of the overall structure of agricultural production in developing countries, the emphases given to food security and import-substituting agro-industrial development by many governments, the research emphases and influence of international agricultural research centers, the emphasis on foodgrains in most national seed programs supported by donor agencies, and the limited resources which have gone toward the support for seed production and marketing compared to investments in agricultural research.

Box 2.4. Limited Proportion of Seeds Supplied by the Formal Sector in Many Developing Countries

According to Delouche (1982), some 80% of the seeds planted in developing countries are farmer-selected and -saved. While this proportion has probably declined since then, formal sources of seed (whether public or private sector) remain supplemental rather than dominant for important food crops. This is illustrated in the table below. Estimated seed source patterns for the United States and Japan are included for comparison.

Proportion of Seeds Used Supplied by Formal Seed Sources (Private + Public Sectors)
(All Figures are % of Planted Seed)

Crops	India	Mexico	Egypt	Nigeria	Ethiopia	Zimbabwe	USA	Japan
Maize	9	24	27	7	12	98	100	100
Wheat	8	100	79	<1	10	58	24	65
Rice	13	100	59	1	N.A.	N.A.	80	72
Sorghum	3	100	N.A.	1	17	35	100	100
Bean/ Cowpea	3	27	<1	<1	1	<1	90	80

Sources: Agrisystems (1990); Pray (1990); Friis-Hansen (1991); Seed Technology Laboratory (1991); Cultivar (1991); Venkatesan and Jaffee (1992); and private commercial seed sources.

The table shows that even in India where the national seed system has advanced considerably, the vast majority of seeds planted are farmer-saved or derived from local, informal sources. Replacement seeds from commercial sources are apparently purchased only once in eight or more years. Seed procurement from commercial sources is extremely low in Nigeria, Ethiopia, and many other sub-Saharan African countries, with less than 5% of the seed planted by smallholders deriving from such sources. Commercial seed purchases are comparatively higher in Mexico, Egypt, and Zimbabwe due to the greater spread of hybrids and their relatively more developed seed supply systems. Still, only one-fourth of the seed planted for Mexico's two leading crops--maize and beans--derives from commercial sources. In contrast, commercial sources of seeds are predominant in Japan and the United States, although in the latter, some two-thirds of the seed for small grains (e.g. wheat, barley, oats) is farmer-saved.

Considerable differences in seed system development are also apparent between regions. Formal seed systems are least developed in Sub-Saharan Africa and Central America, although countries such as Kenya, Zimbabwe, Mexico, Guatemala, and El Salvador have somewhat more developed and diversified seed systems. Seed development patterns within Asia are quite varied with China, India, and Thailand having much more

developed systems than the other countries. Seed industries in South America are generally more developed, with a large majority of such countries having relatively advanced systems for food and industrial crops. The seed industries of Argentina, Brazil, and Chile are among the most advanced of developing countries. Given these patterns, one would expect to find considerably less private sector participation in African and Central American seed systems compared with Asia and especially South America.

Actual Private and Public Sector Involvement in Seed Systems

In order to examine the actual mix of the private and public sectors in the conduct of formal varietal development, seed production, and seed marketing activities a survey of seed and agricultural specialists at the World Bank and within the CGIAR network, private sector, and academic community was conducted and a seed industry literature review was undertaken. Distinctions in institutional patterns were made for different crops, including selected food, forage, industrial, and horticultural crops. The survey found that in the seed industries of advanced market economies, the present mix of public and private sector activities is largely consistent with the guidance or predictions of economic theory. In contrast, in many developing countries, the public sector remains heavily involved in direct seed production and distribution, sometimes in the place of or in competition with the private sector. The discussion below and Appendix Tables 2.1 - 2.4 center around the institutional patterns found for seed supply for wheat, rice, maize, and vegetables.

Varietal Development

The survey indicates that varietal development work is undertaken by the public sector (e.g., research institutes and universities) throughout the world. The public sector (sometimes including international agricultural research centers) plays a dominant or exclusive role in plant breeding R&D for wheat, rice, and other self-pollinated crops in most countries. The major exceptions to this pattern are in Argentina, Chile, and several industrialized countries where the private sector has undertaken plant breeding work geared toward the hybridization of wheat or rice and the generation of varieties suitable for very specific agro-ecological areas. These are also countries where plant breeders' rights are enforced, providing breeders with protection against the unauthorized use of their varieties by competing firms. The public sector is also widely involved in basic research and germplasm collection, evaluation, and enhancement: the building blocks for commercial varietal and hybrid development. Even in the United States where there is substantial private investment in R&D, more than 50% of wheat and soybean seed, 90% of barley and dry bean seed, and 95% of rice seed planted is of publicly-bred varieties (Knudson 1990).

Both in industrialized and developing countries, private sector plant breeding R&D has been heavily concentrated on hybrids for major food, industrial, and horticultural crops, with the development of hybrids for maize receiving the greatest attention and resources from the private sector. In the United States, in 1989 there were over 250 full-time plant breeders/geneticists working on maize breeding within the private sector, compared with between 15 and 40 such scientists working on the breeding of alfalfa, wheat, cotton, sorghum, and sugar beets (James 1990). In many industrialized and developing countries, private research on hybrid crops has depended upon support from the public sector, particularly in the supply of germ plasm and inbred lines and in the training of scientists, and sometimes in financial support or tax incentives (see Box 2.5).

Box 2.5. Use of Public Varieties and Hybrids in Private R&D and Seed Production

In many countries, private plant breeding and seed production has been dependent upon prior or parallel public sector plant breeding R&D. For example, in India, public plant breeding breakthroughs in the 1960s created the demand as well as the products for the private commercial seed industry. The activities of international and national public research institutes in introducing high-yielding varieties of wheat and rice and in developing hybrids for maize, sorghum, pearl millet, and cotton suitable for Indian conditions provided the basis for the subsequent development of local private seed companies. Private Indian companies continue to rely on public institutions for much of the genetic material, self- and open-pollinated varieties, and inbred lines for several major food crop seeds.

In Zimbabwe, for most crops the government has entered into long-term agreements with farmer cooperatives and associations, providing the latter with exclusive control over publicly-released varieties and licenses to multiply and distribute seeds of such varieties. While the government Crop Breeding Institute (CBI) retains the ownership rights to the varieties, the associations are not required to pay royalties. Seed Coop, Zimbabwe's largest seed producer, has held an exclusive license to produce and distribute publicly-bred maize hybrids. Seed Coop conducts extensive trials of government-bred hybrids and varieties on its own farms.

In Brazil, the public research institute, EMBRAPA, sells parent lines to private national companies which then produce double hybrids for sale to farmers. This process has given new life to small to medium-scale firms who do little or no research and who were previously dependent on aging lines from the public sector.

In the United States, small seed companies have long relied upon publicly-bred varieties for their production and distribution of wheat, rice, and other seeds of self-pollinated crops. Historically, universities and other public research institutes also played a major role in the development of hybrid maize, the largest commercial product of the private sector seed industry. As late as 1979, some 72% of maize hybrids in use had at least one inbred line of public sector origin. With a decline in public research and a parallel expansion in private sector research, by 1984, the proportion of maize hybrids with at least one public line had declined to 38%.

Sources: Pray *et al.* (1989); Sorj and Wilkinson (1990); Friis-Hansen (1991); Butler and Marion (1985).

As a result of the high costs and technical demands of plant breeding work, most of the private firms active in this work are large in scale and also active in downstream seed production and sales. In many developing countries, private sector breeding activity in undertaken primarily by multinational corporations, joint venture companies, or large local firms with diverse agricultural and industrial interests. With the exception of China, each of the Asian and Latin American countries which have developed relatively advanced seed systems for food and/or other crops have attracted considerable private foreign investment over the past decade (See Appendix Table 2.5). Such investment has been stimulated by the potentially large commercial seed market in these countries and by policy changes pertaining to imports and exports of seed and germ plasm, private sector access to publicly-bred varieties, domestic seed marketing and pricing, and the repatriation of investor profits. Most international companies have focused their varietal development and

seed production and marketing work on a narrow range of hybrids and specialty crops.

Seed Production and Processing

Private sector involvement in seed production and processing is more extensive and features firms with more varied size and ownership characteristics. In the advanced seed systems of North America, Western Europe, and Japan, the private sector, comprising large companies, cooperatives, and small, localized companies, dominates foundation and commercial/certified seed production and seed processing for the full range of crops. In the United States, there are specialized foundation seed producers, while in Japan, cooperatives are given exclusive rights to multiply the breeder seed provided by public research institutions. For commercial seeds, medium- to large-scale companies have focused production on hybrids and specialty crops, for which profit margins are relatively high and these firms can utilize their technical skills for competitive advantage. Seed multiplication for (publicly-bred) self-pollinated varieties is undertaken by a combination of cooperatives, small companies, and specialized seedsmen, targeting particular locations or agro-ecological zones.

While in a few developing countries, certified seed production and processing is undertaken almost exclusively by either the private sector (e.g., in Argentina and Chile) or the public sector (e.g., in China), the typical institutional pattern is one of a mixture of public and private sector activities. Public sector involvement is most widespread and intensive in the production and processing of seed for high-volume self-pollinated crops, such as rice, wheat, barley, and various legumes, and of cross-pollinated varieties of maize. Since such seed accounts for a large majority of the volume of formal seed production in most developing countries, public seed enterprises continue to account for a majority of total seed production among developing countries.

In many developing countries, public seed enterprises or research institutes directly produce foundation seeds on their own farms. In some countries, only public seed enterprises have been provided access to the breeder seed supplied by (national and international) public research institutions. Until very recently, this situation prevailed in such major seed markets as India and Mexico. This situation is now changing, with foundation seed production being increasingly contracted out to medium- to large-scale farmers. Contracted production is now the norm for certified seed production (for self- and cross-pollinated crops). While public agencies continue to bear the market risk for such seed, supervise its production, and frequently provide some financial and/or technical backing, the actual seed multiplication is done by farmers (see Box 2.6).

In several developing countries, public seed enterprises have also entered into the production of selected hybrid and specialty crop seeds, sometimes in competition with the private sector. Public sector entry into such activities has been driven by various factors, including government concern about the development of "strategic" export or agro-industrial sectors, an objective of cross-subsidizing losses from the production of low-value seeds of self-pollinated varieties, and a perception that the nascent private sector is developing too slowly to effectively spread hybrids and improved varieties. However, in the majority of cases where commercial markets for such seed have developed and where public sector monopolies were not imposed (or maintained), it has been the private sector or joint venture enterprises which have emerged to account for dominant shares of local production. In the case of maize, the share of the private sector in 1985-86 commercial sales of hybrid and improved open-pollinated varieties was 94% in Latin America, 80% in Africa, 62% in non-Communist Asia, and 39% in the Middle East (CIMMYT 1987). Private sector shares are probably even higher for vegetable seed (see Box 2.7).

Box 2.6. Contracting Out Public Sector Certified Seed Production

Until recent years, a large proportion of the certified seed for rice, wheat, grain legumes, and cross-pollinated maize produced in developing countries was produced on large state farms. This was the pattern in many of the largest developing countries, including China, India, Indonesia, Bangladesh, Pakistan, Egypt, Turkey, Nigeria, and Ethiopia. Encountering low yields, quality problems, and high operating costs on many state seed farms, attention has turned to phasing out direct production in favor of contract growers.

In some countries, production has been delegated to a relatively small number of large-scale farmers, located in close proximity to government seed processing facilities. This, for example, is the pattern in Nigeria, where contract growers generally have landholdings exceeding 100 hectares and produce rice, maize, and/or cowpea seeds on 10 ha. or more. While the contracting of certified seed production in Nigeria is relatively new, it is expected that the contract growers will eventually become small seed enterprises, processing and distributing seed under their own names or using government facilities for custom seed processing services. In other countries, contracted production is done by a larger number of small- to medium-scale farmers. For example, in Sri Lanka there are some 3000-4000 contract growers of rice seed every season. It is common for small-scale contract growers to retain some of the seed production for their own use and for sale or supply to neighboring farmers. Hence, contracted production frequently serves as a means for rapid seed dissemination.

Experience has shown that a critical factor in the effectiveness of contract seed production is the incentive structure provided to farmers. Unless farmers are paid prices sufficiently above the market price for grain, they will not devote the extra labor and other resources to generate high-quality seed, will use the seed as grain, or will sell the seed outside of the contract. Price premiums of 25% or more above the grain price are often required. In the case of Egypt, due to inadequate seed-grain price differentials, seed delivery rates ranged from 37-57% for wheat and 58-63% for rice during the late 1980s (Seed Technology Laboratory.

Sources: Venkatesan and Jaffee (1992); Reusche (1990); Seed Technology Laboratory (1991).

Seed Marketing

The private sector plays a dominant role in seed marketing within advanced market economies, with government intervention being confined to the enforcement of standards and truth-in-labeling (see Box 2.8). In contrast, in most developing countries seed marketing and distribution features a mixture of public and private sector participation. For self-pollinated staple food crops, public seed corporations continue to play major roles in seed storage and wholesaling and in seed promotion in many countries. In some countries (including Mexico, Egypt, Nigeria, Syria, Ethiopia, and China), public institutions also supply such seeds directly to farmers, either through credit agencies or special agricultural projects. This seed is usually subsidized by the government, and in some cases the supply of credit is contingent upon the farmer purchasing seeds of high-yielding varieties ("no seed, no credit").

Nevertheless, in most countries, small private firms and cooperatives have been able to compete with public seed distribution as a result of their willingness to earn low margins, their access to both public and private varieties, their provision of additional services, and the uneven or low quality of seeds supplied by some public seed companies. Once

improved seed of self-pollinating varieties is made available to farmers, it is commonly reproduced and distributed widely throughout rural communities via informal supply arrangements (Garay *et al.* (n.d.); Tetley *et al.* 1990; Crissman 1989).

Box 2.7. Export-oriented Horticultural Seed Production in the Private Sector

In parallel with the rapid expansion in world trade in fresh and processed horticultural products which has taken place over the past two decades, a similarly rapid growth has been seen in trade in horticultural seeds. While the United States and the Netherlands have been by far the leading exporters of such seeds, several developing countries, including Chile, Thailand, India, Turkey, Taiwan, and Kenya have developed successful trades in this area. This export trade has been undertaken almost exclusively by the private sector, using different production systems and involving different combinations of multinational corporations, indigenous private firms, and/or farmer cooperatives.

One especially interesting case is the development of horticultural seed production and exports in Northeast Thailand during the 1980s. The basis for this development was a government and aid-financed irrigation project at Lam Nam Oon. Following a failed government effort to promote expanded groundnut production in the area, a program of public research, extension, and market assessment was developed to support the production and marketing of non-traditional horticultural crops. Under a USAID-funded Agro-Production and Marketing Program (APMP), pre-feasibility studies were conducted and private firms were invited into the area. APMP staff were seconded to these firms.

The operating environment proved to be especially attractive to seed enterprises, both multinational and local, who contracted smallholder farmers to produce vegetable and flower seeds. Farmers have been provided with parent seed and with technical support by the companies, with production credit coming from the Bank for Agriculture and Agricultural Cooperatives. While initially each company was given exclusive zones in which to recruit and support contracted farmers, this gave way to a more competitive system involving half a dozen companies and up to 3000 farmers. Farmer incomes have been considerably higher than for traditional crops. In 1991, judging that the contract-based seed industry in the region was now self-sustainable, the Thai Government disbanded the APMP support units.

Source: Dolinsky (1992); Jaffee and Srivastava (1992).

The distribution of hybrid, horticultural, and other specialty seeds also features a mix of public and private sector activities in most developing countries, although the private sector frequently accounts for dominant market shares. In many developing countries, seeds (or other planting materials) for industrial and export crops are distributed in part or solely by the major processing or commodity trading firms. Continued direct public sector involvement in seed distribution for such crops even after the private sector has developed has been frequently due to a strategy to cross-subsidize

public enterprise losses from distributing high volume/low value self-pollinated seeds. The seed system of India provides a striking example of public seed corporations entering product lines in which the private sector has demonstrated strong interest and potential. Such public sector involvement in high-value seed markets reduces demand for private seed, thus slowing the pace of private sector development.

Box 2.8. Japan and the United States: Contrasts in Private Seed Distribution Arrangements

While seed distribution is done virtually exclusively by the private sector in both Japan and the United States, the institutional arrangements for distribution differ considerably. In Japan, more than 75% of all seed, including virtually all rice and soybean seed, reaches farmers via cooperatives, operating at national, prefectural, and local levels. In the case of rice, the cooperative sector has exclusive seed multiplication and distribution rights. The cooperative's role in seed distribution also arises from the very small average size of farms and the significant role of cooperatives in farm product marketing. The costs for delivered seed are normally deducted from the cooperative member's receipts from commodity sales. Private seed companies (through direct mail) and retailers have a more important distribution role for vegetable and fodder crop seeds.

In the United States, while there are several thousand local cooperatives which do retail seeds, this is not a major distribution channel. The primary distribution system for maize, soybean, and alfalfa seed features farmer-dealers. Farmer-dealers generally purchase seed on their own account and then sell it in localized market areas. This marketing method utilizes local farm networks and provides effective channels to transmit market and other information from farmers to the seed-producing companies. In the case of rice seed, distribution is done directly by localized certified growers. For major industrial crops, including cotton, sugar beet and tobacco, agricultural processors play a major role in seed distribution within the context of contractual or other crop buying operations. In the important markets for vegetable and turf seeds, distribution takes place via mail order or through supermarkets and garden and hardware stores.

Policy Environment for Private Sector Development

In many developing countries, the policy environment for many years was not supportive of commercial private sector participation in seed production and trade. Heavy restrictions on seed imports and exports, restrictions on private access to public germplasm and varieties, major hurdles and delays in varietal registration and seed certification, subsidies on public sector seed, and various types of investment restrictions were among the common barriers. Over the past decade, a number of developing countries have implemented seed-related policy reforms which have contributed to a major increase in private investment in varietal development, and seed production and distribution (see Box 2.9). Policy changes which have had a stimulating effect have included:

- the liberalization of entry and utilization of breeding lines and improved seed of foreign origin;
- the removal of restrictions on private access to breeding lines and improved seed from public research institutions;

- the liberalization of variety registration procedures and requirements;
- the removal of government subsidies on public sector seeds;
- the phasing out of direct public sector seed multiplication and distribution activities in favor of contract growers and private and cooperative distributors;
- the adoption of investment codes which encourage foreign and joint venture investments;
- the removal of restrictions on the export of seeds.

Box 2.9. Private Sector Response to Policy Reforms in India

The recent experience in India illustrates the potential impact which policy reforms can have on private sector participation in seed production and distribution. In India, prior to the 1980s, private sector seed activities were limited by restrictions on landholdings, germplasm and technology imports, foreign ownership, and the size of domestic companies permitted to participate in the seed industry. Most of the private companies which operated lacked the financial resources to undertake their own research and concentrated on multiplying and distributing either public varieties and hybrids for staple food crops or vegetable crop seeds.

In the early 1980s, a policy change allowed private firms to obtain breeder seed directly from ICRISAT and from Indian public research institutes. This and subsequent changes in industrial licensing policies, foreign investment regulations, and policies on seed imports have contributed to a boom in private sector seed activities. By 1990, the estimated share of the private sector in the value of commercial seed sales reached 70%, with private sector growth occurring most rapidly for sorghum, pearl millet, cotton and vegetables. While there has been a substantial increase in foreign investment in the sector, the larger Indian companies have proven that they can compete with the multinationals, both in their breeding programs and in the market. Many new companies have emerged as spin-offs from other companies. One firm alone, Maharashstra Hybrids, has given birth to at least eight additional private companies since the mid-1970s.

Source: Pray and Ribeiro (1990).

Conclusions

There is no ideal institutional structure for a seed system. The most efficient mix of public and private activities varies among countries, types of crops, and stages of seed system development. Both the public and private sectors have important roles, yet there are substantial limitations on what each can do separately. The critical challenge is to design policies and undertake investments which lead the two sectors to complement one another in the provision of the entire set of services related to seed development, production, quality control, and distribution.

Experience indicates that no single enterprise or type of enterprise can cater to the diverse seed needs of different categories of farmers. This pertains to both the public and private sectors. Most public seed corporations have had their activities restricted to a limited range of crops and have had their priorities determined more by political than by market considerations. On the other hand, commercial private companies have, at least initially, focus

their attention on hybrids or on seeds of specialty, high-value crops. Other actors, including cooperatives, NGOs, small local companies, and farmers themselves, should be supported in their efforts to multiply, save, and distribute seed of self-pollinated food crops.

Prior experience does suggest that the public sector should withdrawal from the "business" of seed importation, production, processing, and marketing. Where not already in private hands, seed trading activities should be the first area where public institutions should phase out their direct participation. Certified seed production would be the next candidate for privatization, beginning with hybrids and specialty crops and subsequently moving toward self- (and open-) pollinated crops. Creative solutions, some falling short of the ideal of free and competitive markets, may be required. Examples might include: exclusive release of public varieties to particular private or cooperative firms; or guaranteed government purchases of contracted seed.

The privatization process might then move to foundation seed production for self- and open-pollinated crops and toward the complete withdrawal of the public sector from the market for hybrid seeds. This can be done within the next few years in countries with relatively advanced seed systems; elsewhere, the process will be slower. For some minor crops or for seeds suitable for narrow agro-ecological zones, the public sector may need to retain a longer term involvement in seed production and distribution, although this need not be direct and could involve sponsoring (i.e., subsidizing) other parties. Given the relatively high investment requirements, privatizing processing facilities might need to be phased over many years, although intermediate solutions such as custom seed processing services, facility-leasing, management contracts, etc. are possible.

Even as the public sector withdraws from the "business" of seed production and trade in favor of private firms, cooperatives, non-governmental organizations, and farmers, very important roles in efficient seed system development will remain for the public sector. These include: basic scientific research, the funding or direct performance of plant breeding work for self-pollinated and minor crops, support for private R&D, the training of seed technicians, variety testing and registration, planting material inspection and quarantine, germplasm and varietal maintenance, seed standard legislation and enforcement, enforcement of fair business practices and truth-in-advertising, enforcement of phytosanitary regulations, support for seed associations, and support for farmer- or community-based seed programs.

Bibliography

AGRISYSTEMS (Overseas) Ltd. 1990. Ethiopia Seed Corporation Seed Marketing Study, Final Report.

BUTLER, L. AND MARION, B. 1985. The Impact of Patent Protection on the U.S. Seed Industry and Public Plant Breeding. Madison, Wisconsin. North Central Regional Research Publication 304.

CIMMYT 1987. 1986 CIMMYT world maize facts and trends: The economics of commercial maize seed production in developing countries. Mexico City, CIMMYT.

CROMWELL, E. 1990. Seed diffusion mechanisms in small-farmer communities: Lessons from Asia, Africa, and Latin America. ODI Agricultural Administration Network Paper 21. London, ODI.

CROMWELL, E., FRIIS-HANSEN, E. and TURNER, M. 1992. The seed sector in developing countries: A framework for performance analysis. ODI Working Paper. London, ODI.

CRISSMAN, C. 1989. Seed potato systems in the Philippines: A case study. Lima, International Potato Center.

CULTIVAR. 1991. Seed Business. Groupe Liaisons Agriculture. June.

DALRYMPLE, D. 1986a. Development and spread of high-yielding wheat varieties in developing countries. Washington, USAID.

_____. 1986b. Development and spread of high-yielding rice varieties in developing countries. Washington, USAID.

DELOUCHE, J. 1982. Seed quality guidelines for the small farmer. Paper prepared for Centro Internacional de Agricultura Tropical Seed Unit Workshop, Colombia.

DOLINSKY, D. 1992. Contract farming at Lam Nam Oon: An operational model for rural development. Columbia University, East Asian Institute Report.

ECHEVERRIA, R. 1990. Public and private investments in maize research in Mexico and Guatemala. CIMMYT Economics Working Paper 90/03. Mexico City: CIMMYT.

FAO. 1987. FAO seed review. Rome: FAO.

FRIIS-HANSEN, E. 1991. The Zimbabwe seed industry. Background study for the World Bank Agricultural Sector Memorandum for Zimbabwe.

GARAY, A., PATTIE, P., LANDIVAR, J. and ROSALES, J. (n.d.) Setting a seed industry in motion: A nonconventional successful approach in a developing country. Working Document 57. Cali, Colombia CIAT.

GROOSMAN, T. 1991. Seed industry development in a North/South perspective. Wageningen, Pudoc.

JAFFEE, S. AND SRIVASTAVA, J. 1992. Seed system development: The appropriate roles of the private and public sectors. World Bank Discussion Paper 167. Washington, World Bank.

JAMES, N. 1990. A survey of public plant breeding programs in the United States, 1989. Diversity 6(2):32-33.

KLOPPENBERG, J. 1988. First the Seed. New York, Cambridge University Press.

KNUDSON, M. 1990. The role of the public sector in applied breeding R&D. Food Policy. 209-217.

LIPTON, M. and LONGHURST, R. 1985. Modern varieties, international agricultural research, and the Poor. Washington, The World Bank.

MCMULLEN, N. 1987. Seeds and world agricultural progress. Washington, National Planning Association.

PRAY, C. and RAMASWAMI, B. 1991. A framework for seed policy analysis in developing countries. Washington, IFPRI.

_____ and Ribeiro, S. 1990. Government seed policy, the development of the private seed industry and the impact of private R&D in India. USAID, New Dehli.

_____, RIBEIRO, S., MUELLER, R. and RAO, P. 1989. Private research and public benefit: The private seed industry for sorghum and pearl millet in India. Economics Group Progress Report 89. Hyderabad, India, ICRISAT.

REUSCHE, G. 1990. Rice seed supply in Sri Lanka: A case history. In Seed System Development: Developing countries' experiences in different crops. T. Groosman (ed), The Hague, IVO.

SCHEIDEGGER, U., PRAIN, G. EZETA, F. and VITTORELLI, C. 1989. Linking Formal R&D to Indigenous Systems: A user-oriented potato seed programme for Peru. Agricultural Administration (Research and Extension) Network Paper 10. London: ODI.

SEED TECHNOLOGY LABORATORY. 1991. Egyptian seed sector: Description and analysis. Mississippi State University.

TETLEY, K., HEISEY, P., AHMED, Z. and AHMAD, M. 1990. Farmers' seed sources and seed management. In Transferring the gains from wheat breeding research and preventing rust losses in Pakistan. Mexico City, CIMMYT.

TIMOTHY, D., HARVEY, P. and DOSWELL, C. 1988. Development and spread of improved maize varieties and hybrids in developing countries. Washington, USAID.

UMALI, D. 1992. Public and private sector roles in agricultural research: Theory and experience. World Bank Discussion Paper 176. Washington, World Bank.

VENKATESAN, V. and JAFFEE, S. 1992. Nigeria: National seed and quarantine project. Draft World Bank Project Supervision Report.

Appendix Table 2.1. Rice Seed Systems in Major Asian Producing Countries.

	Variety Sourcing/ Development		Seed Production/Processing			Seed Marketing/Distribution			
Country	Direct seed import	Variety Development	Foundation/ Basic Seed	Commercial/C ertified Seed	Seed Processing	Wholesale/ logistics	Promotion	Retail sales	Price determination
China	NA	G + IRRI	G	G	G	G	G	G	Fixed by Government
India	NA	G	M	CON + P	M	M	M	M	Partly Subsidized*
Indonesia	NA	G + IRRI	G + CON	M	M	M	M	M	Market Determined
Thailand	P	G + IRRI	G	CON + P	M	M	M	M	Partly Subsidized*
Bangledesh	G	G + IRRI	G	G + CON	G	G	G	M	Partly Subsidized*
Japan	NA	M	Coop	Coop	Coop	Coop	G + Coop	Coop	Regulated and Subsidized
Philippines	G	G + IRRI	G	CON + P	M	M	M	M	Market Determined

Codes: G= Predominantly Government (Public) Enterprises, Agencies, Universities, and Institutes (90% or more)
P= Predominantly Private Enterprises, Individuals, and Institutes (90% or more)
M= Mixed Government and Private Involvement (Significant but separate roles for each)
Coop= Seed or producer cooperative.
CON= Government contracting out to private firms or farmers.
* Public sector seed is subsidized

Sources: Author's seed survey; FAO/World Bank (1991); Ribeiro (1991); Pray (1991)

Appendix Table 2.2. The Organization of Wheat Seed Industries.

	Variety Sourcing/Development		Seed Production/Processing			Seed Marketing/Distribution			
Country	Direct seed import	Variety Development	Foundation Seed	Commercial Seed	Seed Processing	Wholesale/ logistics	Promotion	Retail sales	Price Formation
U.S.A.	P	M	P	P	P	P	P	P	Market
United Kingdom	N.A.	M	P + Coop	P + Coop	P + Coop	P + Coop	P + Coop	P + Coop	Market
France	N.A.	P + Coop	P + Coop	P + Coop	P + Coop	P + Coop	P + Coop	P + Coop	Market
Mexico	N.A.	G + Donor	G + Con	Con	G + Coop	G + Coop	G+ Coop	G + Coop	Subsidized
Argentina	N.A.	G	G	Coop	Coop	P + Coop	P + Coop	P + Coop	Market
India	N.A.	G	M	Con	M	M	M	M	Subsidized
Turkey	N.A.	G	G	M	M	G	M	M	Market
Egypt	N.A.	G	G	G + Con	G	G	G	G + Coop	Regulated
Zimbabwe	N.A.	M	M	P + Coop	P + Coop	P + Coop	P + Coop	P + Coop	Regulated
Kenya	N.A.	G	M	P	P	Coop	M	P + Coop	Market
Nigeria	G	G + Donor	G	G + Con	G	G	G	G	Regulated

Codes: G= Predominantly Government Enterprises, Agencies, and Institutes (90% or more)
P= Predominantly Private Enterprises, Individuals, and Institutes (90% or more)
JV= Joint Venture between Government and Private
M= Mixed Government and Private Involvement (significant but separate roles for each)
Coop= Seed or Producer Cooperative
Con= Government contracting out to private firms or farmers.
N.A.= No formal activity.
N.I.= No information available on existing formal activity.

Appendix Table 2.3. Maize Seed Values and Private Sector, Public Sector, and Farmer-Saved Shares (1985-86).

Region/ Country (A)	Value of Farmer-Saved Seed ($ Mill.) (B)	Value of Commercial OPV Seed ($Mill) (C)	Value of Commercial Hybrid Seed ($Mill) (D)	Private Sector Share of OPV Sales (%) (E)	Private Sector Share of Hybrid Sales (%) (F)	Farmer Share of Total Seed Value (%) (G)	Private Sector Share of Total Seed Value (%) (H)	Public Sector Share of Total Seed Value (%) (I)
Mexico	20.5	5.9	13.0	62	47	52	27	21
Argentina	0	0	82.3	N.A.	100	0	100	0
Colombia	4.0	0.4	2.5	15	50	58	18	24
Ecuador	0.9	0.5	0.1	75	100	60	31	9
Brazil	10.0	7.3	115.6	80	97	8	89	3
Chile	0.1	0.4	4.5	100	100	2	98	0
Bolivia	14.1	1.2	0	NI	NA	NI	NI	NI
All Latin America	61.0	19.0	236.0	70	96	19	74	7
India	21.2	2.4	7.3	67	63	69	20	11
Philippines	11.6	6.6	1.8	25	100	58	13	29
China	13.3	0	145.9	0	0	8	0	92
Indonesia	50.5	1.8	0.8	81	100	95	4	1
Thailand	2.2	10.8	4.7	89	98	12	79	9
All Asia	113	26	176	60	10	36	11	53
Asia Non-communist	96	24	28	62	62	65	22	13
Turkey	1.7	0.7	7.4	0	55	17	38	45
Afghanistan	1.8	0.9	0	0	N.A.	67	0	33
Egypt	3.3	1.6	0.5	73	100	61	30	9
Syria	0	0.2	2.2	0	0	0	0	100
All M.E.	6	4	11	29	42	29	27	44
Zimbabwe	1.1	0.1	12.6	100	100	8	92	0
Ethiopia	3.6	1.3	0	0	0	67	0	33
Tanzania	15.3	1.8	2.7	NI	NI	78	NI	NI
Ghana	4.7	1.2	0	0	0	80	0	20
Nigeria	32.3	7.5	3.0	74	100	75	19	6
All Africa	88	22	35	57	95	61	33	6

Source: CIMMYT Maize Survey Data Base.

Appendix Table 2.4. The Organization of Vegetable Seed Industries.

	Variety Sourcing/ Development		Seed Production/Processing			Seed Marketing/Distribution			
Country	Direct seed import	Variety Development	Foundation Seed	Commercial Seed	Seed Processing	Wholesale/ Logistics	Promotion	Retail sales	Price Formation
U.S.A.	P	M	P	P	P	P	P	P	Market
France	P	M	P	P	P	P	P	P	Market
Japan	P	M	P	P	P	P + Coop	P + Coop	P + Coop	Market
Mexico	P	G	P	P	P	P	P	P	Market
Argentina	P	P	P	P	P	P	P	P	Market
India	P	M	M	M	M	P	M	P	Market
Philippines	P	M	M	P	P	P	P	P	Market
Thailand	P	M	M	M	M	M	M	M	Market
Turkey	P	P	P	P	P	P	P	P	Market
Egypt	M	G	M	M	M	M	M	M	Market
Zimbabwe	P + Coop	G	M	M	M	P + Coop	P + Coop	P + Coop	Market
Kenya	P	G	M	P + Con	M	M	M	P + Coop	Market

Codes: G= Predominantly **Government** Enterprises, Agencies, and Institutes (90% or more)
P= Predominantly **Private** Enterprises, Individuals, and Institutes (90% or more)
JV= **Joint Venture** between Government and Private
M= **Mixed** Government and Private Involvement (Significant but separate roles for each)
Coop= Seed or Producer Cooperative
Con= Government contracting out to private firms or farmers.
N.A.= No formal activity.
N.I.= No information available on existing formal activity.

Appendix Table 2.5. Major International Companies and Investments in Relatively. Advanced Latin American and Asian Seed Industries.

COUNTRY	COMPANY	SEED CROPS
Argentina	Agrigenetics	Maize, Sunflower
	Asgrow	Maize
	Cargill	Maize, Sunflower
	Continental Grain	Maize
	Dekalb Genetics	Maize, Sunflower
	ICI	Maize
	Pioneer	Maize, Sunflower, Sorghum
	Sandoz	Maize, Wheat
Brazil	Anderson Clayton	Soyabean
	Asgrow	Maize, Vegetables
	Cargill	Maize
	Ciba Geigy	Maize, Sorghum
	Continental Grain	Maize
	Dekalb Genetics	Maize, Sunflower
	ICI	Maize
	KWS	Sugarbeet
	Pioneer	Maize
	Sakata	Vegetables
	Takii	Vegetables
Mexico	Asgrow	Maize, Vegetables
	Cargill	Maize, Sorghum
	Ciba Geigy	Maize, Sorghum
	Dekalb Genetics	Maize, Sorghum
	Petoseed	Vegetables
	Pioneer	Maize, Sorghum
	Sandoz	Maize, Vegetables
India	BAT	Tobacco
	Cargill	Maize, Sorghum
	Ciba Geigy	Maize, Sorghum
	Hoeschst	Vegetables
	Pioneer	Maize, Sorghum, Sunflower
	Royal Sluis	Vegetables
	Sandoz	Vegetables
	Unilever	Vegetables, Plantation Crops
Thailand	Asgrow	Vegetables
	Cargill	Maize, Sorghum, Sunflower
	Ciba Geigy	Maize, Sorghum, Sunflower
	Continental Grain	Maize, Sorghum
	Dekalb Genetics	Maize, Sorghum
	ICI	Maize, Sorghum
	Pioneer	Maize, Sorghum, Sunflower
	Royal Sluis	Vegetables
	Unilever	Plantation Crops

1/ An alternative to collecting and manipulating germ plasm to breed improved varieties is to import seed from a foreign supplier. Such imported seed may be a finished product, suitably conditioned and packaged for direct distribution to farmers or it may be "foundation seed" requiring further multiplication and subsequent treatment before distribution. Local field evaluation of an imported new variety/hybrid is necessary before seed can be distributed to farmers. Imported seeds may also be subjected to quarantine regulations to prevent the simultaneous importation of pests and plant diseases.

2/ In Japan, North America, and the EEC, a large majority of commercial seed sales consist of hybrids of food, forage, vegetable, and industrial crops. In contrast, the contribution of hybrids to commercial seed sales are less than 10% in most developing countries. Major exceptions to this pattern are in Argentina, Brazil, Chile, El Salvador, Guatemala, Kenya, Zimbabwe, and Thailand, where significant sales of hybrid maize occur; in China, where large quantities of hybrid rice and maize are sold; and in India and Mexico, where hybrids for a range of food and other crops have spread.

PANEL MEMBERS' COMMENTS

The presentation was based on three propositions; first, private-sector participation "is not a panacea" and should complement that of the public sector; second, it was important to define a policy of sustainable development in which seeds played a role; and third, it should be established that "seeds are the property of humanity, not of a particular group." On that basis, it was essential to update legislation on seeds, since much of it was now obsolete, and generally speaking, the public sector acted as both judge and party.

Orlando Ramirez

In **Costa Rica**, there was significant private-sector participation in the seed sector, as a result of its enlightened legislation. The private sector currently accounted for approximately 75% of the certified seed market. The country's standards in that regard were compatible with international standards, which gave it access to the world seed and plant materials market.

Ali Erylmaz

In **Turkey**, the seed sector underwent significant changes during the 1980s. The private sector reoriented its participation towards varietal development, introduction of registered varieties and marketing, prior to registration and tests by a Varieties Committee. Prices were market-determined.

Support for the seed sector was provided by means of loans to companies; the implementation of a program to foster seed use; and the elimination of import taxes. As a result, after 10 years, the companies in that line of business, both domestic and transnational, grew from 5 to 50. Privatization, however, did not involve handing everything over, but rather creating the conditions to favor private-sector participation in benefit of the country.

M. Sujayet Ullah Chowdury

In **Bangladesh**, emphasis was placed on seed distribution in the country, underscoring public- and private-sector participation. Currently, the state's involvement was greater, through a national agency which owned, among other concerns, 16 seed processing centers, in which farmer organizations participated in seed reproduction. A National Seed Council chaired by the Minister of Agriculture programmed and regulated seed production.

The private sector's contribution was low. As of 1993, efforts were being made to encourage greater private-sector involvement. Although promotion was limited, there was an increasing demand for certified seeds. A review of the role of international agencies in the supply of germ plasm and the availability of materials for the country's principal crops was also made.

Discussion

The moderator suggested orienting the discussion towards three topics: What was the point of balance between the public and private sectors? Did we have the range or the number of criteria to define the degree of participation by the different sectors? Was it possible to delimit each sector's responsibilities?

The participant from **Bangladesh** explained that the low seed-use indicators in certain countries were due to the exchanges that took place between farmers, which required defining policies of support for farmers rather than for the development of a

seed industry. The basic premises for promoting privatization of seed production as a general rule for all countries was questioned, in view of the fact that different conditions existed in each region.

Emphasis was placed on the importance of enforcing seed quality control regulations, as well as on the development of the seed industry. On the other hand, mention was made of the importance that **Pakistan** and **India** placed on intellectual property of the genetic materials obtained in national seed production systems.

The experience of the Sahel (**Cameroon**) was presented. There, farmers received seeds from the state in order to produce them on their own lands, and the ministry supervised their quality. That procedure favored local supplies of improved seeds. The cost was low, the number of farmers participating was greater, the problem of storage was eliminated, the seeds were marketed locally and their use was increased.

Reference was made to the importance of the private sector in the development of the seed sector, by means of agreements between cooperatives and the private sector on technological innovation for seed reproduction. It was mentioned that, in **Argentina**, INTA obtained the basic seed, and work was currently in progress on 15 species, among them wheat, maize and potatoes. International centers provided support for the promotion of such agreements.

A request for information on the propagation of plant material and the roles of the private and public sectors in that area was answered as follows:

With regard to property rights, it was important for national legislation to make a distinction for varieties that pollinated freely. Here it would be interesting to review the cases of **Argentina** and **Chile**. Regarding the cost of transportation, a point raised by some participants, it was pointed out that it had not been taken into account, but that it should be a key factor in working with small farmers (potatoes and yucca, among other crops). Furthermore, local production systems should be borne in mind when designing seed-introduction programs. Economic criteria were not the only ones, as evidenced by the situation in **India**.

In **Costa Rica**, plant propagation was carried out on a small scale, but pathogen-free materials were generated. On the other hand, importance was placed on gradually adapting legislation so as to regulate transgenic materials.

Two topics that should be considered as part of the seeds aspect were proposed: development of the farmer's capacity and technical ability to use improved materials, and the need to have appropriate lands for seed production (potatoes, for example, only in specific areas). The experience of **Colombia** was mentioned in relation to the adoption of certified seeds, owing not to the size of the farm but to the attitude or situation of the farmer as regards land use or landholding. Programs for the introduction of seeds should consider the landholding structure. In general, were farmers landowners or not?

Mention was also made of the need to review the concept of intellectual property with regard to the interface between crop betterment and biotechnological products.

To sum up, moderator Donald L. Winkelmann (CIMMYT) stated that the criteria or aspects to be considered in developing the seed sector were: to recover the importance of seeds in agriculture; consider the aspect of property rights over materials and the role of farmers in their task of selecting and conserving genetic plant resources. The State should participate in financing enterprises of a social nature when the materials were not appropriate; government participation depended on the flexibility of private

companies, their capacity for response and their opportunity costs; the private sector could participate without affecting the state's human resources; it seemed that there were no mechanisms for self-regulation; industry was not the panacea —innovation required imagination.

The state provided support by means of quarantines, rules, and regulations on intellectual property. The state should find a balance in its involvement and play a clearly defined role; participation by all sectors, including farmers, should be promoted.

AGRICULTURAL EXTENSION AND INFORMATION

PUBLIC AND PRIVATE ROLES IN THE DELIVERY OF EXTENSION SERVICES

Lisa A. Schwartz[1/]
Willem Zijp[2/]

Summary

Agricultural extension is traditionally the work of a professional body of agricultural experts, often government employees, who teach improved farming methods, demonstrate innovations, diagnose problems and opportunities, and help farmers to organize and solve their problems. Extension has also served as a link to transfer the "best practices" of one farmer to another, and as a channel to introduce —and sometimes enforce— agricultural policies.

Provision of extension services by the private sector has been little-studied compared to the wealth of practical knowledge and literature available on public sector extension. Extension activities, however, are carried out by a wide range of organizations in the private business and not-for-profit sectors, including farmer's organizations. This study first examines extension from a welfare economics perspective, and then uses case study analyses to develop conclusions about the circumstances under which private extension is likely to succeed, and in what form. The role of private extension in an agricultural development strategy (especially in terms of how public and private extension can be complementary) is also discussed.

The authors believe that the existence of multiple (sometimes conflicting) information sources is an advantage for farmers in that they will decide for themselves which information is most suited to their goals as producers, and which is the most reliable. Private firms provide services in accordance with their specialized incentives and farmers respond in terms of what they see as most beneficial to them. Because each type of extension (public and private) has limitations, the objective for farmers and agricultural development organizations of all types (local and international) is to attain the best mixture of public, private, and NGO/NFP (non-governmental organization/not-for-profit) services.

The public sector in general is overly burdened with numerous activities, and moving some of them to the private sector might allow more effective implementation of essential services. While extension services cannot be totally privatized, the public sector can more actively promote private and NGO efforts to improve the overall availability and quality of extension services. Government has a crucial role is setting guidelines and offering incentives to private providers of extension services; however, such leadership and policymaking expertise is often lacking in the appropriate government entity.

1/ Consultant to the Agriculture Policy Division of the World Bank.

2/ Senior Extension Especialist, Agricultural Technology and Services Division of the World Bank.

Private sector extension services generally focus on cash crops or on sale of inputs (seed, chemicals, fertilizer, animal feeds, and machinery). Private agribusiness firms in developed and developing countries sometimes hire extension specialists to manage field activities with multiple functions such as education and promotion, input supply, instruction on production, and enforcement of output delivery.

The combination of all types of extension activities in a given country constitutes an extension system. This system encompasses both public and private extension activities and their relationships with surrounding organizations and institutions, but the distinction between these categories (public, private, not-for-profit) can often blur in practice. For example, public extension services may be commercialized: a privatized-extension staff may be paid by farmers for special services or they may routinely exchange their services for food, free housing, money, and other goods.

Although the structure of extension systems around the world is diverse and often complex, there are five key variables which apply to them all: objective(s), organization, mode of interaction, content of interaction, and target. This model focuses on the providers of extension versus the users, leaves little room for two-way interaction, and is thus imperfect. However, it effectively illustrates the diverse types of extension and provides a good base for analyzing different types of private extension and how they differ from public extension.

The case studies examine two broad questions:

- Under what circumstances is private extension most likely to succeed, and in what form?
- What is the role of private extension in an agricultural development strategy, and how can it complement public sector extension activities?

The evidence from the cases is not quantitatively rigorous but provides illustrations of several key topics:

- Private extension and the technical complexity of agriculture.
- Private extension as part of commercial firm activities.
- Private extension and farmer's associations.
- Complementarity between public and private extension.
- Assessing the performance of private extension.
- Assessing the government role in extension.

The paper completes the discussion of the role of private extension in agricultural development by looking at policy implications, practical recommendations, and areas for future research. The recommendations are intended as practical ideas for both government extension planners and staff in development organizations.

Introduction

Farmers need land, labor, capital, and know-how to produce crops or livestock, but they need extension services only to the extent that such services provide relevant and timely information. Agricultural extension is traditionally the work of a professional body of agricultural experts, often government employees, who teach improved farming methods, demonstrate innovations, diagnose problems and opportunities, and help farmers to organize and solve their problems. Extension has also served as a link to transfer

the "best practices" of one farmer to another, and as a channel to introduce —and sometimes enforce— agricultural policies.

Agricultural extension encompasses a wide range of activities (in both the public and private sectors), but the exchange of information to and from farmers continues to be the primary focus[1/]. Provision of extension services by the private sector has not been studied very much compared to the wealth of practical knowledge and literature available on public sector extension. Extension activities, however, are carried out by a wide range of organizations in the private business and not-for-profit sectors, including farmer's organizations (Zijp 1992; Moris 1991; Hayward 1989; Lafourcade 1988). This study first examines extension from a welfare economics perspective and then uses case study analyses to develop conclusions about:

1. The circumstances under which private extension is likely to succeed, and in what form.

2. The role of private extension in an agricultural development strategy (especially in terms of how public and private extension can be complementary).

In this study, extension services are defined rather loosely to include all activities involved in the exchange of information with crop and livestock producers[2/]. For example, extension may include:

- instructions on how to use a product provided by a chemical company salesperson;

- information distributed by a seed company to promote a new variety;

- advice on plant spacing and use of fertilizer provided by a public sector extension field officer;

- information on market prices broadcast over the radio;

- farm management advice from farmers organizations;

- pamphlets on soil conservation prepared by an NGO (non-governmental organization); or

- advice on integrated pest management provided by a private consulting firm.

The authors believe that the existence of multiple (sometimes conflicting) information sources is an advantage for farmers in that they will decide for themselves which information is most suited to their goals as producers, and which is the most reliable. Private firms provide services in accordance with their specialized incentives and farmers respond in terms of what they see as most beneficial to them. Because each type of extension (public and private) has limitations, the objective for farmers and agricultural development organizations of all types (local and international) is to attain the best mixture of public, private, and NGO/NFP (not-for-profit) services. As Roth (1987) asserts, the public sector in general is overly burdened with numerous activities, and moving some of them to the private sector might allow more effective implementation of essential services. While extension services cannot be totally privatized, the public sector can more actively promote private and NGO efforts to improve the overall availability and quality of extension services.[3/] Government has a crucial role in setting guidelines and offering incentives to private providers of extension services; however, such leadership and policymaking expertise is often lacking in the appropriate government entity.

This study includes case studies, and is divided in four sections: iIntroduction, the application of fundamental economic principles —especially public goods theory— to agricultural extension, a discussion of the

case studies, and policy and project recommendations and suggestions for future research.

Overview of Extension Activities

Significant public funds have been invested in extension services by governments around the world (Swanson 1989; Evenson 1986; Judd, Boyce, and Evenson 1986). About half of the present extension services in the world were established in the last two decades. Global annual expenditures for extension rose from US$3.4 billion in 1980 to over US$6 billion in 1990, about 85 percent of which are public funds. About 0.5 percent of agricultural gross domestic product is spent on extension world-wide, including the employment of an estimated 600,000 people, of whom more than 90 percent are government employees. Four out of every five extension staff are field workers, and about 13 percent are women, with significant regional differences (Zijp 1992).

Over time there has been little shrinkage in the ranks of extension employees. In many countries this has led to a heavy budgetary burden for maintaining field staff. In addition, bloated bureaucracies have a vested interest in avoiding the privatization of traditionally public activities because civil service jobs and bureaucratic power may be lost. Maintaining a strong presence in the field, however, allows governments to gather agricultural statistics.

Public sector extension has gone through numerous transformations, and international donor agencies have tended to align themselves with one form of extension or another. FAO's primary support for extension is provided through field projects. "More than 500 such projects under implementation in 1980-1986 were concerned mainly or partially with extension" (FAO 1989:14). From 1975-84, USAID had 1065 projects involving extension and 266 focusing on extension (World Bank 1989). During the 1980s, AID moved away from support of public sector extension and began to focus on increased private sector involvement. The World Bank has focused its support for public sector extension through the T&V approach. Support for extension by bilateral donors has tended to

Box 3.1. Asia and the Middle East: Pockets of Extension Strength

The private sector in parts of Asia is very strong. For example, in the Philippines, more than 2000 private licensed dealers are operating competitively and efficiently to import, produce, and distribute fertilizers, pesticides, and veterinary supplies through retail outlets in every municipality of the country. Some dealers advance credit for farm inputs and others provide technical advice, including farm trial plots. The private sector also plays a major role in purchasing, processing, and distributing marketed farm products. Agribusiness in many countries — Korea, Philippines, Pakistan, and Turkey, among others — have implemented effective information transfer activities (Lowdermilk 1981).

In post-Green-Revolution areas, however, the private sector has been slow to adopt an increasing role in the generation and transfer of technology related to food crops, "despite the rapidly increasing use of purchased inputs and the associated demand for better information" (Byerlee 1987:40). This has been partly because information, inputs, and credit for crops such as rice and wheat were supplied by the public sector during the Green Revolution. Private companies have been more important providers of information and other services for cash commodities such as pineapple, asparagus, poultry, and silk.

follow the colonial models used by those nations before their independence (for example, the French support the commodity-based model in their former colonies). Increased farmer participation has often been tried, from *animation rurale* to extension through cooperatives. Farmer participation has been supported by NGOs, farmers associations, and certain donors and nations. However, farmer participation in the planning, implementation, and evaluation of extension has not yet been realized at a national level in most developing countries.

The returns to investment in public extension have been presented in several surveys of extension impact studies (Huffman 1978; Lockheed, Jamison, and Lau 1980; Jamison and Lau 1982; Orivel 1983; Evenson 1986; Judd, Boyce, and Evenson 1986; Birkhaeuser, Evenson, and Feder 1991).[4/]

Box 3.2. Africa: Private Sector Extension in Many Forms

Africa's private sector is very heterogeneous. There are well-established multinational firms at the top, a few wealthy traders in the middle, numerous small contractors and input supply firms, and small-scale family trading businesses dealing in livestock, exports, and retail goods. There are a few successful commercial agricultural services developed under colonial rule for relatively large-scale farms and then extended to smallholders. The crops involved were "either estate crops (tea, coffee, or sugar) or else mixed grain and livestock produced on favoured, highland soils. The initial commercial growth took place before currency and import controls were instituted, and the companies involved were seen after independence as protecting a valuable national asset (Moris 1991:67).

Agroindustrial development agencies — typically run as government parastatals, often in partnership with an off-shore buyer — are a common organizational type in Africa which provide private extension services. These are vertically-integrated operations typically focused on one commodity. In many cases, multiple basic functions are carried out by such organizations: production and processing (both potentially including some extension), packaging, transport, and financing (for example, with tea, cotton, and oil palm). Commodity-focused extension provided through a vertically integrated organization tends to be very intense with agent-to-farmer ratios rarely over 1:300, and in some cases as high as 1:50 (for example, BAT Kenya in the late 1980s).

Smaller firms in general may have a difficult time providing their own extension services due to the expense of training agents or supporting farmer training and supervision. In Africa in particular, there are fewer trained agronomists/extensionists available to work privately than are found in Asia and Latin America. When human resources and operating costs are not overwhelming obstacles, additional constraints to growth of private sector firms, and thus potential supply of private extension services in Africa, are rigid import controls, high transport costs, high storage losses, poor infrastructure for internal shipping or communications, unstable quality and volume of produce traded, scarcity of people with executive management training, excessive bureaucratic regulations and corruption, unstable political structures, and violence due to war or armed banditry. As more advanced farmers progress, however, demand increases for specialist advice from subject matter specialists, universities, and the private sector. Portions of the farming communities in many countries already make use of private extension (Kenya, Botswana, Zambia, Côte d'Ivoire, Gambia, Zimbabwe, Nigeria, and others).

Most available studies focus on public-sector extension, and a few look at parastatal-operated extension services. Birkhaueser, Evenson, and Feder (1991) report that a review of 36 studies (in both developed and developing countries) indicated relatively high returns to investment in extension for certain crops[5/]. While there is evidence that extension can have a significant effect on output under some conditions, there is limited evidence about the impact of investment in extension from a social welfare perspective (Birkhaueser, Evenson, and Feder 1991). The recent study in Kenya on returns to investment in extension estimated an extraordinary rate of return over 300 percent (Bindlish and Evenson 1993). Some extension practitioners argue, however, that cost effectiveness of extension is a more important criteria for cash-poor governments to consider than the rate of return.

Returns to extension vary by production system, and it is difficult to estimate if social welfare benefits have implications for a study of the incentives underlying how extension services are distributed across the public/private sector continuum. If the returns to investment in extension for certain crops or animals are likely to be low, private companies are unlikely to invest in such activities unless combining extension with other goods and services (such as input supply) can make it worthwhile in terms of appropriable benefits. The difficulty of quantifying the social welfare benefits means that governments and private suppliers of extension may under invest in terms of optimizing social welfare benefits.

Private sector extension services generally focus on cash crops or on sale of inputs (seed, chemicals, fertilizer, animal feeds, and machinery). Private agribusiness firms in developed and developing countries sometimes hire extension specialists to manage field activities with multiple functions such as education and promotion, input supply, instruction on production, and enforcement of output delivery.

The combination of all types of extension activities in a given country constitutes an extension system. This system encompasses both public and private extension activities and their relationships with surrounding organizations and institutions. Note that the distinction between these categories (public, private, not-for profit) can often blur in practice. For example, public extension services may be commercialized rather than privatized. Extension staff may be paid by farmers for special services or they may routinely exchange their services for food, free housing, and other goods.

Many economists and technicians have used a linear and sequential model of technological development in agriculture. This model claims that research generates new information[6/] or technology, extension passes it on, and farmers gratefully use it. Reality is of course more complex than that. Not only do many farmers generate knowledge, researchers are strong users of new findings, and extension does more than simply pass on messages. Technological development seems to follow more complex, cyclical, non-sequential models, which are no longer based on the reductionist approach to science, but more on the systemic perspective.

The reductionist approach has a comparative advantage if there are only one or two elements to be considered and weak links between them, and is efficient where there are only a few elements that share weak, linear links. In development work, however, particularly agriculture, there are usually many elements which have strong, non-linear links. A government staff which looks at development from a reductionist point of view, therefore, can be problematic.

Box 3.3. Latin America: Making the Shift to Private Extension

During the 1950s and 1960s, government intervention was endemic in many Latin American countries. Inefficient companies were subsidized and overtaxation was common. Privatization became a political objective, however, as the debt crisis led to the inability of many Latin American governments to fund public enterprises. Over the past decade, Latin American governments have outpaced the British in terms of privatization. The forces behind this transformation are "the need to reduce the drain of inefficient operations on federal treasuries; the desire to bolster the competitiveness of these enterprises to maintain their domestic markets and generate hard currency through international sales; and the opportunity to raise nontax revenues through the disposition of such enterprises" (BCI 1990:i). The countries where privatization has been most strongly pursued are Chile, Mexico, and Venezuela. Chile has been the leader in privatization in Latin America. During the early years of Augusto Pinochet's rule, the Chilean government reprivatized 240 firms nationalized under the socialist regime of Salvador Allende (1970-73) and sold off an additional 232 public sector firms — including traditionally public sector concerns such as telephone, water, and energy. Additionally, efforts to privatize some key holdings of the public sector are being made in Brazil, Argentina, Bolivia, Colombia, Costa Rica, El Salvador, Guatemala, Honduras, Nicaragua, Panama, Paraguay, Peru, and Uruguay.

Clearly a part of the economic transformation of Latin America will be increasing involvement in private agribusiness and increased demand for specialized services on the part of farmers. As technology increasingly takes the form of purchased inputs, the private sector will assume a more important role in developing and delivering agricultural technology in Latin America (de Janvry, Runsten, and Sadoulet 1987; Pineiro 1985). As Byrne (1991) reports, international agricultural research centers do not commonly work on non-traditional agricultural export (NTAE) crops, and public sector agricultural research systems in Latin American countries typically have limited experience with NTAE crops. The private sector has been the primary source of specialized, site-specific information on NTAE crops for farmers. As Latin American agriculture becomes specialized, a growing portion of information services will become commodities for sale.

Both reductionist and systemic traditions are legitimate, but each has its own strengths and weaknesses. By far the most pervasive and dominant is the reductionist (or analytical) approach, which centers on the elements themselves rather than on the interactions between them. It is based on precise details, reducing phenomena to ever-smaller constituents while modifying one variable at a time, but with ill-defined goals. Reductionist procedures that work today should work tomorrow, validated by experimental proof, and focus on single disciplines (de Rosnay 1975). This is a very respected tradition, and without it, for example, DNA would not have been discovered.

The World Bank's Training and Visit (T&V) approach to agricultural extension is strong on procedures: regular and controllable visits to farmers, monthly training sessions for staff, periodic meetings between research and extension, for example. In a country such as Pakistan, with a strong reductionist tradition, this approach fell on fertile ground, and staff would strictly follow farm visit schedules, but with very little to tell the farmer.

Box 3.4. Ecuador: Partnerships with Public Sector Extension

In Ecuador many public sector extension agents have a partnership with semi-commercial small farmers — providing inputs and technical assistance in return for a share of the crop. Public extension in the country has a classic top-down structure and emphasizes increased productivity of certain commodities. The primary public sector organization which provides extension services is part of the Ministry of Agriculture, known by its Spanish acronym PDTA. It is involved in research, extension, seed production, and training. In theory it focuses on subsistence farmers, but there are only 184 agriculture field officers for the entire country, with an additional 60 working on rural development.

The supply of land and inputs (including information) in exchange for labor has a long history in Ecuador. In addition, it is a way to maximize labor input, land productivity, and surplus in areas where land is limited and there are large numbers of peasants with little or no farmland of their own. In cases where technical information was an important factor, the sharecropping activity is a business partnership. The extension agents, or IAs (*ingenieros agronomos*) link up with small-scale farmers growing short-cycle commercial crops who need inputs and technical knowledge. The farmer provides land and/or labor, and the profits are split after harvest. The profits from sharecropping can significantly increase an IA's income.

The sharecropped plots are seen by some IAs as demonstration plots. Sharecropping with farmers increased agent credibility because the agents shared the risk with farmers, and those with urban backgrounds gained practical farming experience. The arrangement was attractive to many small farmers because their access to inputs and technical knowledge improved because of the IA's position. In addition, the shared risks and profits may be an incentive for extension agents to test new technologies in their area. In one case, for example, an IA and a farmer tried integrated pest management on a bean field to reduce pesticide applications. The continued presence of the IA on the farmer's fields led to information exchange on crops other than those being sharecropped.

On the negative side, the IAs often used resources allocated for extension work (vehicles, fuel) for their own farming activities, but in few cases did the IAs use seeds, inputs, or other items for their own farms because they would get fired if caught.

Box 3.5. Kenya: Extension for Export Commodities

Technology transfer from the private sector in Kenya involves mostly marketing, processing, and export activities. Private processors and marketers/exporters of commodities are the most involved in extension activities. All the top companies have their own farms, and also buy from farmers or middlemen on contract. They provide some extension services and inputs to contract farmers. Most technology transfer activities are closely related to the appropriate types of inputs required, how to use them, preventing pest damage, harvesting, and post-harvest handling.

Sunripe is a fresh vegetable exporter, and because technology transfer and input supply are necessary but too expensive for heavy investment, the company has evolved a system of buying from middlemen. These agents are responsible for providing a certain level of quality, and thus have the incentive to ensure that contract farmers are producing the required grade.

Sunripe conducts adaptive research on its own farm, and then distributes new varieties to its more reliable and loyal growers. Some technical workers — based on their farm — work with growers who regularly supply the firm.

Only a reductionist can see logic in calling the same people farmers, patients, cohorts, or taxpayers depending on whether one talks with managers from the ministries of agriculture, health, education, or finance. The needs and values of these same people cut across such artificial boundaries.

Keywords in the systemic approach to extension are: linkages, interactions, results, and global view. This approach leads to multidisciplinary and objective-oriented action. The private sector is much more systemic in its approach than the public sector. Peters and Waterman (1984) found a number of common factors among the —best performing U.S. businesses. These principles of excellence in management are essentially systemic.[7/]

Great efforts to rebalance the public and private sectors towards an open market economy are needed. An important part is the redistribution of roles and responsibilities in the economy. Such redistribution requires a

Box 3.6. Guatemala: Growing Vegetables on Contract

ALCOSA is a vegetable processor in Guatemala which operates a contract farming program, including extension services. ALCOSA focuses on a few labor-intensive vegetables for the North American market, including broccoli, cauliflower, and Brussels sprouts grown by small farmers in Guatemala's central highlands. This program contributed to a shift in the cropping pattern of farmers in the highlands, as well as major changes in their farming methods and management.

Through their relationship with ALCOSA, participating farmers have acquired information about new crops and new varieties of established crops; use of fertilizers and pesticides; quality requirements for processing; and the contractual, legal, and economic relationships between processor and growers. The information-dissemination activities of ALCOSA staff are combined with other services such as credit, input supply, and purchasing. The ALCOSA story is a complex example of agribusiness and social welfare effects which provides lessons about private sector extension.

One lesson is that when new technology was combined with credit, inputs, and a guaranteed market, crop production of broccoli and cauliflower by small farmers increased very rapidly, and soon exceeded plant capacity. Middle-sized farmers, the initial suppliers, were not considered suitable for several reasons: they are absentee farmers and these crops require close attention to meet quality standards, and commercial farmers were unsatisfied with the price ALCOSA paid, and often argued over quality requirements. The small farmers considered the ALCOSA offer highly desirable.

A second lesson is that once an operation encompasses many growers, it becomes difficult to control all field staff, which of course can also be a problem with public extension. In the ALCOSA case, two field staff were skimming a percentage of cauliflower deliveries. When the farmers made a unified protest about these two farmers from the area who had been hired as field assistants, they were fired.

systemic look at the dynamics of the whole economy, however, and at links within the system. Too much reductionist thinking will prevent borrowers from achieving a system-wide solution.

For complex technologies, the process of innovation and diffusion requires close cooperation among people so that they may learn from each other. The social and political context of those links is an important determinant of people's efficiency (Watkins 1991). A systemic look allows the use of more complicated, more real, and therefore more useful, models.

The popular British radio show The Archers, a soap opera about rural life, is essentially systemic. Facts and opinions about many aspects of agriculture are interwoven in the story of a farming family. The fact that such a show has never been successfully adapted in a borrowing country is an example of a strong bias towards reductionist thinking.

Some systems logic has been applied to agricultural research, as in farming systems research, and to integrated rural development, but not much to institutional development. The state is responsible for reorganizing public enterprises in order to modernize them, while maintaining its full control over capital and management. Restructuring may be seen as an attempt by a public authority to apply management criteria similar to those of private management (Bouin and Michalet n.d.). Civil servants, trained in the reductionist mold, find such management criteria hard to apply. Unless a specific effort is made, managers apply reductionist principles to problems that really need a systemic approach, and thus reductionism occurs by default.

Although the structure of extension systems around the world is diverse and often complex, there are five key variables which apply to them all. This model focuses on the providers of extension versus the users, leaves little room for two-way interaction, and is thus imperfect. However, it effectively illustrates the diverse types of extension and provides a good base for analyzing different types of private extension and how they differ from public extension.

There are five basic elements or variables to an extension system:

Objective. The central variable upon which all the others depend is the objective(s) of extension in a given situation. Multiple and perhaps conflicting objectives underlying extension activities are likely within the same system. This is especially true when considering extension provided by both the public and private sectors. For example, extension activities undertaken by government or NGOs may be designed to help farmers become more productive, while another concurrent objective of government extension may be to enforce agricultural policies designed to control prices of certain commodities. Other simultaneous extension activities (with the same farmers) by chemical input suppliers may seek to sell more products and perhaps educate farmers in their safe use; or a food processing firm may provide extension to ensure its supply of raw materials with characteristics required for processing. There are complex reasons motivating extension activities.

Organization. The type of organization or body carrying out an extension activity is a second variable. Organizations undertaking extension activities in various forms include government at several levels, quasi-public organizations, farmers themselves organized in different ways, private agribusiness firms, private consulting firms, and NGOs. Each organization has different incentives for providing extension services, and from a clientele perspective, each has different advantages and disadvantages.

Box 3.7. Mali: Village Associations and Veterinarians

There are several areas where private extension is active and likely to expand in the immediate future: private veterinary pharmacies, input suppliers, and farmers' associations. In the cotton zone of Mali, there is a significant amount of private extension activity under the more powerful *association villagois* (AV), and the AVs in the other zones have also taken on responsibility for input supply and marketing functions previously done by agents of parastatals. Public services will still be required, however, for less-advanced groups and for monitoring and regulatory activities for more-advanced groups.

Private sector technology transfer is also active in the livestock sector. About thirty-two private veterinary pharmacies started under an EEC project sell drugs and equipment, and also provide advice. All the pharmacies are run by fully licensed veterinarians with one or two assistants trained at the certificate or diploma level. Outreach activities focus on regular attendance at local weekly or bi-monthly markets where they sell products and also arrange for visits to farms to see sick animals. Clientele range from villagers to civil servants in town.

Box 3.8. Argentina: Private Extension in the Dairy Sector

Private sector institutions play a dominant role in Argentine agriculture. Farmers' associations of various kinds are widespread and carry out important functions such as technical assistance, input supply, marketing, and lobbying. The dairy sector benefits from private technical services provided by the milk processing industry.

Excess processing capacity led private companies to begin technical assistance programs to ensure an adequate milk supply because the industry was plagued by low productivity, seasonal production, and poor quality. When a 1976 recession caused many farmers to move out of the dairy industry, the two largest dairy plants took action. The dairy cooperative (SANCOR) provides technical assistance, and finances the purchase of inputs. A private dairy processor, La Serenisima, focuses on medium- and large-scale farmers. Both types of services are paid for by the producers.

The technical package disseminated by both organizations focuses on greater use of artificial insemination, more efficient use of concentrate feeding, and increased forage conservation to generate more milk during the traditionally low winter months. Between 1976 and 1985, SANCOR producers increased annual milk yields by 13 percent per cow and butterfat yields per hectare of pasture by 50 percent. The La Serenisima producers boosted milk yields by 65 percent per cow, and butterfat per hectare by 111 percent.

Mode. The mode or method of interaction between the implementors of extension and the users is the third variable. Note that both functions may be undertaken by farmers. This addresses the type of communication channels used —radio, individual or group visits, satellites, field demonstrations, computer programs, written materials, video productions, etc.

Content. The fourth variable is the content of the interaction with clientele. In the private sector, information may be largely promotional and combined with many other goods and services, while in the public sector the interaction may be mainly educational with few goods and services attached. Commodity-based organizations largely offer production recommendations, while NGOs often focus on local organization and alleviation of poverty.

Target. The fifth variable is the target group upon which a given extension activity is focused. This may vary from all crop or livestock producers in the nation to a very small group carrying out a specific activity.

In order to generate benefits in accordance with a certain objective (for example, increased production, increased sales, better use of the product, or access to a specific type and quality of fruit for export), extension must be a channel through which appropriate information flows. Individuals who disseminate information in the agriculture sector often also carry out a number of other activities. Extension experts have varying opinions on which of the following activities are legitimate extension functions and under what circumstances they qualify. However, they can all be frequently found in combination with information dissemination activities.

- **Extension agents** —public or private— link farmers and researchers by providing feedback to researchers on indigenous knowledge systems, producer reactions to new innovations, or consumer preferences, for example. This activity is part of the process of adapting research results into appropriate technology.

Organization and support of producer groups or associations is often a function of public extension field staff or NGO field staff.

Facilitating access to or distributing inputs is often undertaken by private extension agents and is a controversial function of public extension. Actual distribution of inputs in addition to advice on how to get and use inputs, however, is frequently provided by private or public agricultural field staff.

In addition, numerous other activities are performed by public or private extension staff: Provision of marketing information (prices, places of sale, grade requirements, etc.); collection and purchase of output; advice about and administration of credit programs; assistance to small-scale enterprises involved in activities such as food processing or manufacture of farm implements; collecting statistical data, and teaching at farmer training centers.

Economic Analysis of Private Extension

The extension system includes primarily public and private extension implementors, farmers, and researchers. These groups are not mutually exclusive, but may be combined in various forms. All three both demand agricultural information and also supply it.[8/] In order to provide information to farmers, extension demands information from research, and in turn supplies information to farmers. To provide feedback to research, extension also demands information from farmers. Farmers demand information from extension services (and other channels), and supply information to many users (public extension, agribusiness, marketers, etc).

This study is chiefly concerned with supply of agricultural information to farmers

from extension implementors, and demand for agricultural information by farmers. Specifically, it focuses on the private supply of extension services, as well as the demand for private extension services.

A variety of economic, political, social, and cultural factors underlie supply and demand of agricultural information among the public, private, and non-for-profit sectors in a given country. Two key economic factors affect the supply of agricultural information through private extension services:

- The willingness of producers to pay for extension services, alone or in a package with other goods and services.
- The likelihood that suppliers will be able to recover the costs of providing information services relative to the potential benefits.

At different levels of potential benefits and costs, the mix of suppliers from among the different public/private/non-profit categories

3.9. India: Private Extension for Milk Producers

The Anand Milk Union Limited (AMUL) in Gujarat provides a wide variety of information and training services to its members. It is an example of a project which combines empowering producers and promoting private provision of information. AMUL has a three-tiered structure: the primary society (village milk producers' cooperatives), the district milk producers' union, and the state milk marketing federation. Care should be taken in extrapolating from this example because the government owns perhaps 90 percent of the equity shares, so it is not a truly an autonomous farmers' association.

The primary society (PS) includes producers who supply milk on a regular basis. Milk is collected twice daily, tested for quality, and paid for daily on the basis of butterfat content. The society sells feed to its members at the milk collection centers. About 7 million small producers in over 60,000 villages are each earning an incremental income of nearly US$670 from milk sales.

In addition to management training for the management committees and presidents, all members are trained in a variety of topics related to cooperative structure and management. PSs generate revenue through local sales, sale of milk collected for testing, and bonus payments from the district union (DU) profits. The DU provides extension and vet services, trains staff (who then work with primary societies), and provides inputs, equipment, and technical services such as artificial insemination. Extension staff hold seminars, and animal husbandry is taught along with veterinarians. Each DU has its own feed plant and semen production center. The DU supports new primary societies with equipment, financing, setting up milk collection, training in issues related to the cooperative, and technical skills such as milk testing. The cost of most services provided by DUs is covered by sales of milk and feed, and PS fees

The state milk marketing federation (SF) centralizes marketing and purchasing to maximize the return to primary producers, which is 20 to 40 percent higher than what traders offer. Feed is 40 percent cheaper than at alternative sources, and farmers can buy in small quantities. SF experts also train DUs and PSs.

Box 3.10. Thailand: Pineapple and Contract Marketing

Private extension is significantly involved in pineapple production. Eighty percent of production supplies canneries, and both large plantations and small-scale growers grow pineapples. Canneries provide information on cultivation and try to encourage double-row planting because the fruit is smaller and less sugary, but small farmers prefer single-row planting because the investment, labor requirements, and risk are lower. The double-row method is gaining popularity, however, because the supply of land is decreasing, which illustrates the importance of other factors in technology adoption besides access to information.

The Siam Agro Industry Co. Ltd (SAICO) has ten extension agents for 3,500 farmers, and uses them to inspect supply, estimate prices, and recruit more farmers. Another cannery (SIFCO) has five extension staff who visit contract farmers every one or two months (300 to 400 farmers), but the company stopped holding meetings to discuss new production techniques because farmers know how to produce quality pineapples. The extension staff now focus on gathering data for setting prices.

changes. In instances where it is profitable to supply agricultural information or necessary to supply information in order to generate profits, the private sector is likely to engage in extension activities — and perhaps use other channels as well. This is because the objective of most private firms is profit maximization.

Conversely, the public sector, NGOs, and farmers' associations are likely to participate in the supply of agricultural information when it is, for example, required to improve the living standard of farmers, or to increase national agricultural production (and thus national income). Consider the case when it is profitable to supply agricultural information which also improves the living standard of farmers or national production. There are instances where the private sector has an incentive to undertake extension services which also happen to have social welfare benefits. Finally, the public sector may contract the supply of extension services to the private sector when it is more cost effective to do so.

The demand for agricultural information is not uniform. For example, the set of all rice farmers in a given country may include small-, medium- and large-scale farmers; subsistence and commercial farmers; farms operated by women heads of household or by members of an association; and farms growing rice for seed or for export. Different types of information are required to meet these diverse needs, and perhaps different types of extension services.

Conversely, suppliers of information may not all be willing or able to undertake the appropriate type of extension service activities to fill those needs. Various theoretical tools or concepts help to analyze how the supply of agricultural information to producers, through the channel of extension services, is distributed between public, private, and not-for-profit organizations.

Chief among these are the welfare economics concepts of public versus private goods (non-rivalry and free riders), externalities, moral hazards, and economies of scale.

Private and Public Goods

Agricultural information can be a pure public good —consumed by all without

reducing availability for any one individual; for example, how to prune a tree. It can also be a private good, paid for and benefiting only one individual; for instance, the results of a soil test and fertilizer recommendation for a single farm. Information has two major characteristics which affect the supply and demand for extension services. First, information can be characterized by non-rivalry; if it is shareable: goods can be exchanged, but after information exchange the giver still retains what he/she has given away (Repo 1987:5). The consumption of the information does not diminish the opportunity for others to also consume it. As agriculture becomes more sophisticated, however, the willingness to share may diminish, e.g., for market or consumer preference information.

Second, "information is diffusive, it tends to leak out and spread despite our efforts to protect individuals and innovations" (Repo 1987:5). Once the information has been disseminated by an extension agent (or over the radio or through a pamphlet), it can

Box 3.11. Pakistan: Private Extension and an NGO

The Aga Khan Rural Support Program (AKRSP) is an example of an NGO project with an extension component. The project focuses on rural development in the north in areas which are physically remote, with poor infrastructure and a restricted, declining resource base. The basic concept is to organize villagers for commercial activities. After a village organization is established, the members develop a close working relationship with AKRSP staff before a grant is given. Funding for the project is from a variety of donors and the government, and totals almost US$8.3 million.

There is one front-line staff member for every 200 households served, or one staff member for every 2.8 village organizations. Over four years, 526 village organizations have been established with a total membership of over 38,000. AKRSP has also helped form 110 women's organizations separate from the village organizations.

AKRSP has cooperated with other organizations to promote new technologies; for example, they worked with FAO, commercial companies, and government departments to develop seed potato production at the village level. Other technologies AKRSP has demonstrated and assisted in disseminating are new varieties of wheat, maize, apple, cherry, forage vetch, clover, fodder beet, turnip, various vegetable varieties, and a range of livestock-related technologies.

AKRSP uses both its own and line agency staff as extension agents. Much of the farmer training is done by bringing together village organization managers, leaders, plant and animal production specialists, and others from villages to district headquarters for short courses.

The key problem for AKRSP is likely to be follow-up after funding ends, but even so, there has been an important infusion of technical information, skill levels, and institutional development. In other cases where funding was removed after a successful project, techniques learned under the project continued to benefit producers.

continue to spread from farmer to farmer. It is difficult to exclude individual access to information —particularly if it is fairly generic and can be used by many farmers in an area (such as improved husbandry methods for traditional crop varieties).[9/]

Whether these properties of information provide a barrier or an opportunity for private sector extension depends on the role of information in the overall activities of the organization. Most provide information as a means to an end: private agro-processors or marketers to improve the quality and quantity of raw material supply for processing; input suppliers to sell more product; public sector services or NGOs/NFPs to increase productivity of food crops, reduce poverty, etc. In all organizations where potential benefits increase relative to the number of producers with the information, non-rivalry and diffusiveness of information are positive characteristics.

On the other hand, direct sellers of information have a vested interest in maintaining the quality of their product in order to maintain their market share. If an organization provides extension services directly to generate profits, it views non-rivalry and diffusiveness of information as negative. The same information, for example pest control techniques on vegetables, could be treated entirely differently by two extension suppliers based on their incentives. The agroprocessor wants to provide the information to as many farmers as possible at the lowest cost, whereas consulting firms want to charge as many farmers for the information as possible. To assure a market for their services, private direct sellers of extension generally focus on providing information that is in some way specialized. For example, pest control information may be combined with diagnostic services and supply of special inputs.

A firm selling information wants to avoid —or at least minimize— the "free rider" problem: They do not want information to "diffuse" to potential customers without charge. Thus the nature of information causes a market failure which manifests itself in the under-supply of extension services by firms selling information.

When information on agricultural practices becomes technically complex, the benefits cannot be captured by producers without access to additional resources such as chemicals, seeds, water, equipment, credit, access to storage, and transport. Although the information itself remains a public good and can be consumed without limiting availability to others, the benefits of acquiring the information can only be captured by those with access to the necessary complementary goods. Because so much research assumes a maximum level of input, extension tends to pass on this biased technology. In addition, the returns to private genetic research are usually higher than the returns to research on cultural practices, thus public extension may offer information which tends to benefit the private sector more than the farmer. At a high level of technical complexity or specialization, the relative benefits of information for farmers are higher, making them more willing to pay for information services —as long as there is no opportunity for a free ride. Additionally, when technical information is combined in a package that farmers perceive as reducing risks, thus increasing relative benefits, their willingness to pay is higher. They may pay directly or through dues to a producers' association or through lower prices for their output sold to processors.

Advanced commercial farmers are especially likely to pay for information even without attached services. For example, in the case of horticultural crops for export, farmers may require special information from consulting firms on the latest production techniques in order to keep their quality and prices competitive. Traditional farmers selling

only a small portion of their crop and animal products do value agricultural information, but allocate relatively fewer resources to this information.

Assuming that farmers are rational, they invest in information according to their perception of relative costs and benefits, tastes and preferences, and resource allocation. The argument for providing them with free extension services is that positive externalities will be generated as increased economic or social welfare, such as improved food security, increased national income, decreased poverty, etc. For example, if people have access to more and better food and thus are better nourished, they will be better able to work and contribute to the nation's productivity. In this way, the positive externalities can be compared to those of formal education.

It is costly to disseminate complex information. The message must be carefully packaged into educational materials, and there may be a need for fairly intense personal contact —especially in the early stages of product development. For a private company to recoup the costs of providing expensive extension services, there must be some way to charge for the information or to capture the benefits generated by the adoption of new technologies (for example, through sale of an input to farmers or sale of a final processed product to consumers).

In summary, the good "agricultural information" supplied through extension services and other channels can take on both public and private good characteristics. The public good attributes dominate in the early stages of agricultural development when there are few incentives for the private sector to provide extension services. Thus, in the early stages, information is provided as a public service by extension organizations run by both the public sector and NGOs/NFPs. It is also effectively exchanged through informal communication among farmers. Additionally, many private companies provide information (through extension-type services) as a part of their business operations. The information itself remains an inherently public good, but the suppliers are able to charge for it by attaching other goods and services.

As agriculture develops, agricultural information becomes more specialized, less easily shared, and not universally consumable, thus taking on some private good characteristics. Producers have an incentive to seek private consulting services when they require information that is highly specialized and unavailable from other sources. The information they obtain is proprietary and protected as a private good. In addition, public services may begin to charge for some or all of their services as information becomes more specialized and technically complex. However, farmers' skills and needs are rarely homogeneous; thus, at any moment in a given country, their information requirements may vary greatly, hence the need for heterogeneous extension services.

Externalities

Externalities are "costs and benefits for people not directly involved in the exchange . . . Externalities . . . arise only when it is too costly for those affected by the actions in question to negotiate with those responsible for the actions" (Roth 1987:9). The non-rival, diffusive characteristics of information lead to positive externalities of extension services. For example, a technical package disseminated by a private agribusiness firm may include some techniques which farmers can apply to other crops or animals with positive results.

In such a case, private extension leads to additional economic benefits which the firm does not appropriate. Thus the social value of private extension is greater than anticipated by the firm. It may be appropriate for government to supplement private extension

activities through the media and extension services.

Positive externalities also occur when information is passed from one farmer to another after initial contact with an extension agent or message of some kind. This positive externality is greatest when information disseminated is adapted to suit the needs of a large number of producers. It is minimized when the information is packaged in such a way that it is only useful under very special circumstances (for example, expensive equipment is required to use it).

Moral Hazards

Incomplete or mishandled information may lead to problems. Theoretically, these are not externalities, but rather practical problems. There is an element of moral hazard involved in the mishandling of information, for example in the case of potentially dangerous chemicals. Firms with a long-term perspective have a greater stake in providing complete information. Governments must assume some regulatory role because of the potential for misuse of information. Even with the best of regulations, alert farmers' organizations are needed to vet information from the commercial and public sectors.

Economies of Scale

Once institutions have been established for training extension staff, a management structure put into place, and staff placed in field, there are economies of scale involved in expanding the coverage of the operation. Such an established extension organization —whether private or public— is a barrier for other extension organizations considering entering the market for agricultural information in a given area. Therefore, in theory, an established public sector extension organization in an area would be a barrier to entry for private firms.

However, in practice, this is not likely to be a factor. As noted earlier, private firms usually undertake specialized extension activities as a part of their overall operations. The extension objectives of private firms and farmers' associations are likely to be different from each other, as well as from government extension objectives. There may be a few instances where private extension is a barrier to other firms, such as when the extension is done by sale representatives with territory to protect.

Application of Theory to the Main Organizational Types

Many organizations carry out extension as a part of their overall activities, but not as their primary objective. In most countries there is a mix of organizational types.[10/] The organizations typically involved in the extension system include government ministries or departments, private agribusiness firms, parastatals, private consulting firms, farmers' associations (or cooperatives), non-governmental organizations (including clubs), and formal educational and training institutions.

A Mix of Organizations is Required

There is no single type of organization that will provide farmers with complete, accurate, unbiased information; however, farmers are unlikely to seek information from only one source. They need multiple sources of information in order to evaluate its quality. The public sector is influenced by political and bureaucratic agendas. Private information is either tied to the sale of a product or the maintenance of specific quality and quantity standards in production. For example, information may be provided to growers on how to maximize production of a certain commodity at a given quality level, thus enhancing the profit potential for the private agribusiness firms (PAF). The same PAF, if it

is focusing on short- to medium-term profits, may not have an incentive to inform the farmers (or their neighbors) of the dangers of soil erosion and water contamination associated with long-term implementation of the production process. In the case of farmers' associations, information may be technically unbiased but focused on a specific commodity. Other commodities may be covered by other associations. In the case of NGOs, the main objectives tend to be altruistic, political, religious, etc. They provide extension as a part of project implementation which aims to serve a specific group or area, and the information is biased by that agenda. Thus multiple information sources are needed.

Analysis of the Case Studies

The case studies examine two broad questions:

> Under what circumstances is private extension most likely to succeed, and in what form?
>
> What is the role of private extension in an agricultural development strategy, and how can it complement public sector extension activities?

The evidence from the cases is not quantitatively rigorous but provides illustrations of several key topics:

- Private extension and the technical complexity of agriculture.
- Private extension as part of commercial firm activities.
- Private extension and farmers' associations.
- Complementarity between public and private extension.
- Assessing the performance of private extension.
- Assessing the government role in extension.

Private Extension and the Technical Complexity of Agriculture

Private extension tends to be more successful when agriculture is relatively advanced technically and commercially. As agriculture develops and is more highly commercialized, farmers require more specialized information and are more able to pay for it. This is illustrated by the evolution of agricultural services in developed and relatively advanced developing countries. Early incidence of private extension may focus on a limited group of relatively sophisticated farmers, and over time expand into activities which reach other farmers (Box 3.12). As a cautionary note, extension policymakers need to strike a balance between the income needs of the rural poor, and the labor-shedding characteristics of sophisticated agriculture.

Private Extension as Part of Commercial Firm Activities

Different types of commercial firms engage in extension activities as a part of their business. The two primary types of business involved in extension are input suppliers and marketers/processors (Box 3.13).

Input suppliers (seeds, agrochemicals, animal feeds, fertilizers and implements) sometimes undertake extension activities as part of the marketing process. Such private extension is related to, but not the same as, sales. It typically involves provision of information about both a firm's products as well as general information related to the product category (for example, pest control, plant diseases, or drought tolerance). In general, input suppliers have an incentive to carry out extension activities under the following three conditions:

- Farmers require purchased inputs to achieve desired production results (quantity and quality).
- Purchased inputs can be profitably used given relative prices of inputs and outputs.
- Input suppliers actively compete for the same market share.

Marketers/processors, both domestic and exporters, often provide extension support and supply inputs to farmers producing for them to ensure their supply of quality raw materials. Extension is often undertaken through contract growing schemes, for example sugar cane, malting barley, or milk. One reason agricultural schemes establish their own extension activities is to allow close and frequent contact with farmers, especially early on. The necessary level of contact is typically not possible with public extension services.

Processing and/or marketing firms undertake extension activities for three main reasons:

- The inherent problem of undersupply of information due to market failure.
- Inadequate public sector services (due to government failure and practical problems).
- To limit the risks and uncertainties of dependence on outside extension in terms of maintaining access to raw materials with required characteristics.

Box 3.12. Frozen Fruits and Vegetables in Mexico

Private extension services are available to the frozen fruit and vegetable industry in Bajio, Mexico from transnational companies (TNC). Bajio is very fertile, has produced fruit and vegetables since colonial times, and is near large population centers (Mexico City and Guadalajara). During the 1950s and 1960s, several U.S.-based processing companies established plants in Bajio to serve the U.S. market. They "introduced new crops, and delivered input packages (seeds, chemicals, and some machinery) [and technical assistance] to contracted growers" (de Janvry, Runsten, and Sadoulet 1987:52). Over time, some of the largest growers established freezing plants and began to provide processed vegetables directly to the U.S. companies.

As the market has grown and larger contract growers have turned from suppliers to becoming processors themselves, the TNCs have increasingly expanded their involvement with small-scale growers. The TNCs contributed access to new technology and the education to use it over 20 years, which increased the Mexican capability to compete in export markets for processed fruits and vegetables. The technical assistance of the TNCs includes both training and "policing" activities.

Contracted growers are constantly in turnover, so the TNCs must search for new potential suppliers and train them in production of these crops. They charge new growers for this service (and all other services) by offering them lower prices for their produce. For example, in the summer of 1986, growers who needed a full range of services were paid as low as 6.5 cents per pound for broccoli, while the large integrated growers were selling raw product to the TNCs at up to 13 cents per pound. Once the grower learns to produce the crops, visits from fieldmen are actually police actions to guarantee that chemicals are used properly (de Janvry, Runsten, and Sadoulet 1987:53).

Private Extension and Farmers' Associations

For the purposes of extension, farmers' associations (FAs) can be classified as either horizontally or vertically organized. Water users' associations or agricultural boards (*chambre d'agriculture*) are horizontally organized to defend and promote farmers' interests, while vertical organizations such as beekeepers, coffee growers, or dairy farmers are usually centered around a single commodity. Extension activities undertaken by commodity-based FAs for their members can compensate to some extent for the undersupply of agricultural information by private information sellers due to market failure. Suppose that better-grade tomatoes earn a higher price at the tomato paste processor and the processor itself is not undertaking extension activities for tomato farmers. A tomato FA can fill the need for information by organizing extension activities for its members. Typically FAs take on a range of activities and cross-finance between them, including processing, and bulk handling of inputs and outputs to generate funds for research, extension, and training. Large-scale farmers' associations are major suppliers of multicrop extension services in many developed countries.

Box 3.13. Commercial Firms and Private Extension

Private input suppliers can be very effective at communicating with farmers. Salesmen have an incentive to maintain good business relations with farmers, and farmers typically place a high priority on information about inputs. In a survey of 240 Pakistani farmers, 53 percent said they wanted information on pesticides and herbicides, 29 percent on use of inputs (such as seeds and fertilizers), 9 percent on cultivation practices (sowing methods, crop rotation), 5 percent on soil reclamation, and 4 percent on other topics (Nayman 1988:88). Thus a sales representative who also conducts extension activities is likely to be valued by farmers, but when input suppliers are involved in extension activities caution is needed. Sales reps working on commission have a strong incentive to sell more product, yet they may not have adequate training on safe use of agrochemicals, or on how to communicate the safe use message to farmers. Clearly this could be problematic if there is no accompanying efforts, perhaps by government or NGOs, to disseminate information on safe use.

Marketers/processors may need their own extension activities. When the Zaria/Cadbury tomato paste operation was established in Nigeria, managers found that the ratio of agents to farmers in the local extension system was 1:2,500. At that rate, if an agent had access to transport and could visit ten farmers each day (a rather high expectation), he would be able to visit each client once a year. The firm established its own extension activities for contracted tomato growers. Similar private extension efforts were established by the British American Tobacco company in Tanzania and Kenya and the Özhen company for broiler production in Turkey.

FAs are also important providers of extension in developing countries — usually associated with a particular commodity such as grapes in Bolivia (Box 3.14). Other examples are India (grapes); Colombia (sugar and coffee); Philippines (rice); and Zimbabwe (cotton and tobacco). Some developing-country farmers' associations focus more generally on rural development or politics. Many FAs organized around a cash crop or export commodity provide services mainly to relatively commercialized farmers — unless they are started as part of a development project.

In countries where farmers' associations want to be involved in extension activities, a range of issues needs to be addressed by policymakers and FA leaders and members:

- How can FAs be encouraged to organize and provide extension services without too much direct government intervention? This is especially important in countries where cooperatives and other farmers' organizations have been used by the government to coerce the rural population.
- Do FAs which serve mainly large-scale commercial farmers have any incentive to extend their services to smaller farmers growing the same crops? If so, what are the options for including small-scale farmers? If not, what role should the public sector play for the small farmers?
- What kind of changes could be made in the curricula of agricultural colleges and technical institutes that might help develop skills needed to form and manage farmers' associations?

Box 3.14. Extension Activities of a Bolivian Farmers' Association

In Bolivia, a farmers' association provides valuable technical information to a limited group of its members, the grape growers of COINCA (Cooperativa Integral Campesina). COINCA started its own winery, but could not absorb more than 40 percent of the crop from its 130 grape-producing members. The other grapes were sold to one of the large distilleries in the area (Tariza Valley) either directly or through COINCA as an intermediary. When members sold their grapes directly to the distillery, they were often shortchanged based on the sugar content — a quality measure determining price. COINCA began to monitor sugar content at the outside distillery for small producers, and taught them how to defend the quality of their product. This led the distillery to establish a premium for higher-quality grapes, which in turn was an incentive for producers to improve production, and thus seek the necessary information. The FA then taught the growers how to judge sugar content and market their crop more successfully.

Complementary Public and Private Extension Activities

For private extension activities to play a role in overall agricultural development, it is necessary to consider how they can complement and improve existing extension efforts. Replacing public extension with private is not realistic or desirable. In addition, for extension activities by commercial firms, it is fundamental to recognize that the objectives of extension are not the same as those of government service or donor-supported extension, but this does not preclude cooperation (Box 3.15).

Complementarity between private and public extension is already taking place in numerous industrialized countries, while public sector extension programs in countries with large subsistence-farming sectors may need to focus on alternatives for resource-poor farmers. In areas where the technological package is only relevant to a few larger farmers, public extension and NGOs/NFPs can perhaps generate the most benefits by focusing on needs assessment and diagnostic activities in order to identify appropriate technologies and programs (not necessarily including traditional extension) for helping resource-poor populations.

One area where complementary public/private extension efforts may be helpful is in encouraging "spillover" of technologies applied to high-value commodities to production of lower-value commodities. For example, when private extension activities reach farmers who produce certain items on contract, the new techniques may spillover from the contracted cash crops to food crops. The best possibilities for spillover occur when:

- Contract crops and those planted in the local farming systems are similar.
- Contract farmers carry out most of the actual cultivation and post-harvest techniques themselves.
- Techniques are not highly specialized for a single crop (Watts *et al.* 1988: 173).

Box 3.15. Public and Private Cooperation in Zimbabwe

The three commercial agrochemical firms in Zimbabwe most involved in private extension use variations of the same basic extension technique — field visits by sales representatives to address farm meetings organized by their own staff or those of public extension, Agritex. One firm uses local coordinators to extend their field sales staff, and organizes their own farm meetings through groups with which they have established a relationship. Most of the other private firms providing extension services attend meetings organized by Agritex.

This type of private extension is limited to areas where there is a strong market for a firm's products, and where the firm is pushed by competition to fight for market share. The activities of these firms provide opportunities for collaboration with the public sector in training, and sponsorship of field days, agriculture shows, and other events, and also offers the possibility for the public sector to sub-contract some extension work to private firms.

The same logic about the possibilities for spillover applies to livestock production.

Examples of spillover are the use of fertilizer in Kenyan French bean production (applied to local maize and other vegetable crops); increased use of fertilizers and insecticides on food crops by highland broccoli farmers in Guatemala; and use of animal traction, which spread from contract cotton and groundnut farming in various countries in Africa to a variety of other uses. Cases where there is little or no spillover are tobacco curing and sugarcane production, and any similar operation where contract farmers do little more than weed the crop. Spillover may be reinforced through radio, joint farm demonstrations by private and public sector staff, or other extension activities. Technology or new crops may also spread from contract farmers to other farmers — if they can bear the associated costs. If new technologies or crops require expensive inputs to make the yields worthwhile, a reliable supply of the input must be available or the technology or crop will not spread.

There are, however, obstacles to public/private collaboration:

- A credibility gap can exist between public and private sector staff. The extent of this problem depends to a great degree on the training of extension staff, the level of salaries and other support, and the complexity of the technology being delivered.

- In addition to credibility problems, public sector staff often feel inadequate next to better-supported, private sector staff, and thus avoid contact with them. Such avoidance can prevent cooperation in extension activities between private and public sector organizations. In situations where public sector staff have a relatively high level of education but low pay and an unmotivating work environment, it may be difficult to interest them in working together with the private sector unless their work situation is somehow improved by the interaction.

- Public/private collaboration on extension must take into account the need to safeguard proprietary information. At a high level of technical specialization, information is often viewed as proprietary by private organizations and thus protected rather than disseminated.

An important issue related to public extension is the possibility of cost-recovery through fee-for-service schemes, or farmer contributions to the cost of extension. Presumably, such an arrangement requires farmer willingness to pay for the extension services. All farmers value information. However, they will pay for it only if the information is unobtainable for free and the marginal benefit is greater than the marginal cost in the context of a farmer's budget. Relatively successful commercial farmers (including small-scale commercial) are more likely to meet these criteria.

Assessing Extension Performance: Public vs. Private Extension

There is a need for an organizational mix in the overall agricultural information system. It is difficult, however, to quantitatively assess the relative performance of different organizational types. Such empirical estimates are problematic because:

- It is difficult to isolate the effect of extension activities from other closely related variables such as quality of research, availability of inputs, prices, or the weather.[11/]

- Farmers typically have different incentives for being involved in extension, and thus different objectives.[12/]

- Within a country, private extension is relatively heterogeneous compared to public extension.

It is difficult to compare the aggregate performance of one with the other. Comparisons must be done on a case-by-case basis (Box 3.16).

A direct comparison would require private and public extension services with roughly the same level of staff education and salaries working with the same crops, type of clientele, and agroclimatic zone. The private sector tends to have higher salaries, more competition for jobs, greater willingness to spend money on program support (such as adaptive research and training), better transport, easier access to inputs, and higher intensity of coverage Because the ratio of extension agents to farmers is higher, they typically are assigned to work with fewer and more affluent farmers. All these elements reflect the different objectives and incentives of the public and private sectors. The public sector wants to have a large number of people in rural areas to disseminate information which benefits the public. The private sector must have economic results. Processors and marketers want their extension efforts to increase such factors as productivity of contract farmers, quality of product, and timeliness of harvest. Input suppliers want extension efforts to bring repeat customers as a result of proper use of their products.

If extension has a higher rate of return where the agents are better paid and motivated, and there is a strong market for the

crop and inputs are available, it is not possible to extrapolate and say that private extension will have a high rate of return on food crops for home consumption. Conversely, public extension may have a relatively high rate of return in a situation where a technology is disseminated which alleviates drought-induced famine—because of the value of food produced for home consumption. That does not mean, however, that more should be invested in public sector extension for all commodities. Even in the case of a parastatal and a private company working on the same commodity in the same area, the comparison would not be of extension activities so much as private versus public management of a commodity production and marketing organization.

Government Role in Extension

The major roles of government in extension are to:

- set conditions for different extension services (private and public) to operate competitively;
- ensure availability, access, and affordability of information channels and public sources; and
- implement extension where a public benefit exists but is not filled by the private sector.

In most developed countries, extension is a combination of public, commercial, and farmer-owned services. Some public extension assists farmers to balance and evaluate different pieces of advice from a variety of commercial sources. Policy design must distinguish between two levels of involvement of the public sector in extension. The government sets conditions for different extension services to provide farmers with advice, but government may also implement extension.

Extension design must guard against the tendency treat public extension as an all-purpose tool to transfer rural opportunity, or as a convenient resource suitable for any government task. Design should point out the limitations of extension as well as its expected benefits. Farmers and policymakers would then have realistic expectations and farmers and the private sector would thus be encouraged to pick up where the public sector ends. Another important element in the design of extension is the consistency of government policies. For example, there is little value in public extension promoting clean milking techniques if the government does not allow a higher price to be paid for cleaner milk. Extension design should include predictability, making rules and regulations transparent and applied evenhandedly, and availability of accurate information about relevant government intentions.

Box 3.16. Comparing Public and Private Extension

The McCormick vanilla outgrower scheme in Uganda provides a good example of the difficulty of comparing public and private extension. It is unreasonable to compare the performance of highly-trained and well-paid private extension agents who work with a few specialized farmers with that of Uganda's poorly-trained, poorly-paid public sector extension staff who work primarily with large numbers of rural poor growing food crops and raising animals. Comparisons of yield, quality of product, and income effect on farmers under such different circumstances are not valid.

Policy Issues, Recommendations, and Future Research

This section completes the discussion of the role of private extension in agricultural development by looking at policy implications, practical recommendations, and areas for future research. The recommendations are intended as practical ideas for both government extension planners and staff in development organizations.

Policy Issues

Market, infrastructure, financial constraints, or other policy issues may keep private organizations from starting or expanding activities that might involve extension. To encourage extension through commercial firms, governments may need to encourage overall private sector development through policies such as tax breaks, special financing terms, or easier licensing procedures. In addition, governments may need to remove regulations and other barriers to private sector extension. Encouragement of autonomous farmers' associations requires support for, and tolerance of, the formation of such groups, which may be difficult in some political systems. Policy issues related to the previous discussion of input suppliers and processors and marketers may arise in two areas:

- Liberalize input-supply markets to increase extension through private channels as input suppliers respond to demand for their products. Along with liberalization, however, policies are needed for which products a country will allow, and safe use of agrochemical products.

- Create a positive environment for investment in processing and marketing of agricultural products. Detailed discussion of this is beyond the scope of this paper, but clearly involves the need for adequate infrastructure (especially transportation and communications), as well as financial and political stability. In developing countries, joint ventures are a good route to take for bringing in both technical and managerial expertise—as well as sufficient financing to undertake extension activities. A policy of some importance in the high-value export sector is to avoid involvement of government parastatals.

Policy decisions are also needed on how much government support should be given to extension in areas where there is an incentive for private involvement. In developing countries with limited resources, it may be more cost-effective to shift resources for extension services on cash crops towards rural development programs for resource-poor areas. In addition, or as an alternative, public extension organizations may introduce fees-for-service where appropriate.

Finally, to enhance incentives for private involvement in developing countries, it is important to invest in improving human capital. This may mean strengthening domestic educational institutions and training programs in the country—or sending students abroad. Private companies seek the most highly trained and competent people available in all areas, including their extension activities.

Recommendations

A key beginning step for increased coordination of public and private sector extension activities is for project designers and implementors to stop perceiving extension as purely the domain of the public sector. The World Bank and other development organizations "tend to forget or ignore the existence of on-going research and extension activities carried out by private companies and often neglect to look at the potential for their greater involvement" (Lafourcade 1988:67). This is understandable in the sense that private sector extension activities usually reach a small number of farmers

compared to public extension services. In addition, private extension is an unknown quantity for many extension development experts, and how it fits in may be unclear. Finally, there may be resistance on the part of public sector extension decision-makers to collaborate with or contract extension tasks to private organizations.

A practical way to begin to change attitudes of extension planners (in government or development organizations) is to conduct an informal survey of all extension activities in the private and non-profit sectors as a part of background work for activities such as project preparation or government planning.

The World Bank helps governments answer fundamental questions about agricultural extension, education, and research such as why, for whom, and who pays? A typical scenario begins with a task force assembled by the government, which includes members from farmers' organizations, public and private researchers, extension, the media, input suppliers, and rural credit and educational organizations. The task force would prepare:

- a description of the present situation of extension, research, and education;
- an analysis of strong and weak points in the generation, transfer, and utilization of agricultural information and technology; and
- a draft for an agricultural information policy and an investment plan based on that policy for about five to ten years. The proposed policy options and investment plans are to be presented to a wider audience during a roundtable conference to inform, amend, agree, and seek commitment and ownership of policy and investment plans among funders and beneficiaries.

One way to involve commercial firms in extension activities —with or without the public sector— is to organize private sponsorship for farmer service centers and agricultural shows. Private farmer service centers perhaps managed by a farmers' association, would be useful in areas where access to agricultural inputs is limited. In areas where private organizations are involved in extension activities with a substantial group of farmers, government may choose a maximum support/minimum staff strategy. This entails reducing public-sector extension staff numbers but providing remaining staff with adequate training and support (especially transport) to enable them to play a complementary role. Key aspects of such a public sector complementary role are:

- work with farmers to improve their overall farm management;
- act as a resource person to help farmers find solutions to problems not addressed by private extension activities; and
- provide an additional perspective on technical questions which are addressed by the private organization.

Governments and NGOs may be able to help existing FAs to start or expand their own training and extension activities for members. An element which could be a precursor to FAs doing their own extension is to help bring relatively small farmer groups together into an association. This could be quite difficult and would require careful coordination between group leaders and facilitators. Where FA activity is already underway, a valuable activity might be study exchanges between farmers' association members from countries where FA extension is working and where it is yet to get started. The participants should include both members (leaders and rank-and-file) and some relevant government officials. Note that it is not always in the interest of government or the private commercial sector for farmers to be organized. This may be an

obstacle, and non-political NGOs should be especially cautious in undertaking activities which strengthen farmers' associations.

Future Research

There is a need for further study of the private extension experience of different countries. This section —and the entire paper— are intended to provide some grist for creative thinking on extension options in agricultural development (Box 3.17).

As a part of preparation for this study, a survey was prepared by one of the authors and sent to agricultural professionals with

Box 3.17. Creative Approaches and Things to Try

Extension financing, including charges attached to input or output prices by commercial firms, fees-for-service under a semi-public system or private consulting firm, subsidies to FAs (perhaps in combination with regular membership fees), and cross-subsidization using profits from other activities in a rural cooperative.

Encouraging partnerships between farmers and extension agents where both take a stake in a new activity and split the profits. Ideas are needed on how to avoid potential equity problems.

Privatization of services related to crop and livestock production may lead to private extension activities. Alternatively, public extension can be commercialized. Staff would remain civil servants, but fees would be charged for services.

Displacement of traditional crops by new cash crops in areas where farmers are growing on contract.

Develop intellectual leadership in extension. At the implementation level, the emphasis should be on cost effectiveness, and at the policy level, there is a need for high-quality staff to formulate conditions for different extension services to operate competetively.

Decentralize control of extension to regional or district centers, keeping the national office for setting generic standards of performance, training, and some special programs.

New information technologies are cost effective, such as interactive computer programs to train irrigation engineers in India or farmers in the U.S. Digital radio is used in the Sudan and the Philippines.

Natural resource planning requires a high level of participation. New techniques for village-based problem census and problem solving are successfully being introduced, in addition to new participatory techniques for rapid rural appraisals. Foster and educate informal but effective farmer groups about responsible stewardship of natural resources.

Contracting extension to the private sector has a number of advantages, including flexibility, a higher level of farmer participation, cost effectiveness, quality control, immediate response, and optimal use of existing resources.

Targeted use of donor funds for specific, short-term training is much easier to monitor with contracted indicators of success.

extension experience in twenty-three countries, but only five responses were received. Unfortunately detailed information on private sector extension services is very limited. Often extension experts are more familiar with public sector activities and do not have much knowledge of private sector extension activities, even in the countries with which they are the most familiar. Responses to the survey illustrate that both detailed information on private extension in developing countries and an understanding of how such activities fit into the overall extension system are seriously lacking. Field work is needed to assemble an overall picture of extension systems in developing countries.

Field work should examine the following questions based on the five variables discussed in the first section of this paper:

- What is the type of organization and what is its incentive for undertaking extension (to sell a product, assist association members, etc.)?
- What are the objectives of their extension activities? How successful are private sector extension efforts in terms of yield increases, quality improvement, or other relevant measures?
- What are the specific methods used? What level of expenditures are devoted to extension?
- What is the content of the extension activities (technical messages, collection of feedback, assistance with input supply or marketing, etc.)?
- What is the target audience? What groups are actually reached, how many people, how often?
- What is the relationship between the public/private mix and other elements like macroeconomic policy, political system, or commodities produced in the country?

Questions should also be included on the incidence of spillover, collaboration with other organizations (public or private), key problems of the organization directly or indirectly related to extension, and costs of extension activities. Depending on the country, this sort of informal survey can be done fairly quickly (two or three weeks). It will yield an overview of the extension system in the country, possibilities for improved collaboration, new ideas on extension methods, and a good basis for planning in a more realistic context. After the survey, planners should ask if the extension methods of other organizations should be imitated or adapted for other purposes.

Bibliography

BINDLISH, V., and EVENSON, R. 1993. Evaluation of the performance of T&V extension in Kenya. Washington, D.C.: World Bank.

BIRKHAEUSER, D., EVENSON, R. and FEDER, G. 1991. The economic impact of agricultural extension: A review. Economic Development and Cultural Change (April):607-650.

BOUIN, O., and MICHALET, CH.A. n.d. Rebalancing the public and private sectors: developing country experience. Paris: OECD. (mimeo)

BYERLEE, D. 1987. Maintaining the momentum in post-Green Revolution agriculture: A micro-level perspective from Asia. MSU International Development Paper No. 10. East Lansing: Department of Agricultural Economics, Michigan State University.

BYRNES, K. J. 1991. A cross-cutting analysis of agricultural research, extension, and education (AG REE) in AID-assisted LAC countries. Vols. 1 and 2. Washington, D.C.: USAID/Chemonics.

DE ROSNAY, J. 1975. Le macroscope, vers une vision globale. Paris : Editions du Seul.

DE JANVRY, A., RUNSTEN, D., and SADOULET, E. 1987. Technological innovations in Latin American agriculture. Program Papers Series No. 4. San Jose : IICA.

EVENSON, R. E. 1986. The economics of extension. In Investing in rural extension: Strategies and goals. G.E. Jones (ed). New York : Elsevier.

FAO. 1989. FAO's experiences in agricultural extension in agricultural and rural development. Paper presented at the Global Consultation on Agricultural Extension, FAO Headquarters, Rome, Italy, December 4-8.

FAO. 1991. International directory of agricultural extension organizations. Rome : FAO.

GILL, D. S. 1989. Returns to expenditure on agricultural extension services: Evidence from the literature. Staff paper 89-19. Department of Rural Economy, University of Alberta.

HAYWARD, J. 1989. Agricultural extension: The World Bank's experience and approaches. Presented at the Global Consultation on Agricultural Extension. FAO : Rome.

HUFFMAN, W. E. 1978. Assessing returns to agricultural extension. American Journal of Agricultural Economics 60(5):969-975

JAMISON, D. T., and LAU, L. J. 1982. Farmer education and farm efficiency. Baltimore: Johns Hopkins University.

JUDD, M. A., BOYCE, J. K. and EVENSON, R. 1986. Investing in agricultural supply: The determinants of agricultural research and extension investment. Economic Development and Cultural Change 35(1):77-111.

LAFOURCADE, O. 1988. Research and extension: Lending strategies. In Trade, aid, and policy reform: Proceedings of the Eighth Agriculture Sector Symposium C. Roberts (ed). p. 65-69. Washington D.C.: World Bank.

LOCKHEED, M. E., JAMISON, D.T. and LAU, L. J. 1980. Farmer Education and Farm Efficiency: A Survey. Economic Development and Cultural Change 29:37-76. Chicago : University of Chicago.

LOWDERMILK, M. K. 1981. Promoting increased food production in the 1980s: Approaches to agricultural extension in different production systems. In Promoting increased food production in the 1980s. Proceedings of the Second Annual Agricultural Sector Symposia. Washington, D.C. : World Bank. p. 76-103.

MORIS, J. 1991. Extension alternatives in tropical Africa. U.K. : ODI.

NAYMAN, O. B. Seekers of light or information-seeking habits of farmers: An explanatory survey. Punjab-Pakistan.

ORIVEL, F. 1983. The impact of agricultural extension services: A review of the literature. In Basic education and agricultural extension — costs, effects, alternatives. World Bank staff working paper no. 564. Washington D.C. : World Bank.

PETERS, T.S., and WATERMAN, R. H. 1984. In search of excellence: Lessons from America's best-run companies. New York: Warner Books, Inc.

PINEIRO, M. 1985. Agricultural research in the private sector: Issues on analytical perspectives. Proagro Paper No. 1. The Hague : ISNAR.

REPO, AATTO J. 1987. Economics of information. In Annual Review of Information Science and Technology Vol 22. M. E. Williams (ed). New York : Elsevier Science Publishers. p. 3-35.

ROTH, G. 1987. The private provision of public services. Washington D.C.: Oxford University Press for the World Bank.

WATKINS, T. A. 1991. A technological communications cost model of research and development consortia as public policy. In Research Policy 20:87-107. Netherlands : Elsevier.

WATTS, M., LITTLE, P. D., MOCK, C., BILLINGS, M. and JAFFEE, S. 1988. Contract farming in Africa. Vol. 1 Comparative analysis. N.Y. : Institute for Development Anthropology.

WORLD BANK. 1990. Agricultural extension: The next step. Policy and Research Series no.13. Washington D.C. : World Bank.

ZIJP, W. 1992. From agricultural extension to rural information management. In Public and private roles in agricultural development. J. R. Anderson and C. de Haan (eds). Washington, D.C. : World Bank. p. 61-80.

1/ When public sector services are referred to in this study they are meant to include all extension services provided by government regardless of approach. Extension services work on health, home economics, and other issues, but this study is limited to agricultural extension.

2/ The word "extension" has been criticized as inherently emphasizing the "top-down" dissemination of information while slighting other types of information flow among farmers, extension, and research — particularly activities that focus on participation of farmers as equal partners in the process. This study will use the term extension while recognizing that extension functions are multifaceted and go beyond top-down dissemination of new technologies.

3/ "Market failures for both technology development and diffusion have been recognized in the agricultural sectors of all countries. No countries are under the illusion that private sector market incentives will call forth adequate investment in research and extension (Evenson n.d.:19).

4/ "An exploration of the available literature in developing countries, relating extension expenditures to returns, indicates that most often reported work in this area is based on the same limited number of studies conducted during the 1970's." (Gill 1989).

5/ There are statistical problems with the estimation of benefits to investment in extension services. The two main problems are isolating productivity benefits attributable to extension and extrapolating the benefits of extension over time from an estimate of benefits at a point in time. Keeping these problems in mind, the results of the rate of return studies indicated that extension is in general a good investment.

6/ *Information*, in this presentation, means organized data. Data come from the outside, and are inputs into a sensory system. *Data* can be transformed into information, but data can only inform if they add something to the knowledge of the audience. Some information may be new to some, but not to others. Therefore, information has targeting built into it. *Extension* is one-way transfer of information. *Knowledge* is a different concept — an attribute of the human mind. It is the result of a lifetime of learning and forgetting. Knowledge cannot be transferred, but parts of knowledge may be coded into data and information, which may add something to someone's knowledge. In essence, this presentation treats knowledge, attitudes, and skills in the same way, and calls them all knowledge.

7/ These principles are: action-oriented, client-oriented, autonomy and quality of entrepreneur, people productivity, close contact with staff for shared values, specialization, simple structure with few bosses, balanced commitnent, and relaxation.

8/ Agricultural information includes not only information on production but any kind of information related to agriculture: price, farm management, how to source materials, how to identify buyers, processing and packaging, etc.

9/ Somewhat related to the second characteristic is the perishable nature of certain information, such as weather, prices, imminent pest attacks, or consumer preferences.

10/ "While the extremes correspond to the distinction between 'public' and 'private' services, much extension occurs within intermediary, mixed institutional types . . . " (Moris 1991:60).

11/ There are many ways to show performance such as adoption rates, yield increases, area expansion, changes in demand (for example, people demand more of a product that can be produced locally due to improved quality), change in the profit of private firms selling information (alone or in a package), diversification of cropping patterns, health of animals, weight of animals, mortality rates, and instance of certain diseases.

12/ The common method of assessing returns to extension is to compare the case after extension to that of before (or with vs. without). In this typical case the extension activities are being measured in terms of their success in attaining a given objective or set of objectives.

PANEL MEMBERS' COMMENTS

The panel members' comments focused on the following points: on the one hand, they referred to particular experiences in the area of extension from their own countries' perspective, bearing in mind the historical evolution of their agriculture, markets, products of strategic importance and the socioeconomic reality of the rural population; a second focus of attention were the changes that had been made to that service to agriculture, bearing in mind the institutional readjustment and restructuring within the framework of current needs, the availability of resources, the readjustment of markets, the private sector's current possibility to take on responsibilities in that area and the technical, operative and coverage limitations of that sector.

The panelists emphasized the need not to extrapolate methodologies without contemplating the strict socioeconomic and cultural reality of target rural areas and dwellers for an extension model. In that regard they agreed with the fact that in these processes, the participation of farmers should be ensured in order to identify, define and/or adjust the objectives and actions of a rural extension strategy to its productive reality.

On the other hand, they pointed out that the success of an extension program or strategy should necessarily take into account funding and credit actions that provided farmers with access to the technology that the private sector might offer. Also, the private and public sectors should consider farmers' real technical and financial capacities and thus avoid overestimating the amount of technology and services required.

It was also pointed out that efforts should be made to ensure the involvement of professionals in that privatization process and to that end, the necessary mechanisms in terms of funding, training and opportunities for specialization should be designed. Also, the limits between extension and the marketing of that service should be established on the basis of a code of ethics that protected low-income farmers from the voracity of the market. To that end, it was pointed out that state participation should be upgraded and extension should be submitted to a rigorous planning mechanism.

Discussion

The participants' discussion was oriented towards describing national, institutional and organizational experiences in the area of extension. They focused on the success achieved in countries with a high level of human capital and institutional organization; the difficulties encountered in transferring responsibilities to the private sector in countries with a lower relative level of development, where there was less support infrastructure for production, a lack of managerial capacity, limited technological information and market opportunities, and financial constraints. Furthermore, they pointed to deficiencies in defining policies and strategies and the scarce or nonexistent linkage between the private and public sectors in the privatization process.

In that context, the need to identify opportunities for the private sector was put forward, taking as a reference the existence of noncommercial organizations that could help in that process. In that regard, mention was made of trade associations, NGOs, professional, cooperative and other farmers' organizations as the possible protagonists in such changes. Emphasis was placed, bearing in mind the particular situation of each country, on the notion that such efforts should be accompanied by appropriate legislation to facilitate the transition while at the same time ensuring the equity of the efforts made and fair distribution of the benefits. As a corollary to that session, emphasis was placed on the need to urgently address the poverty affecting the vast majority of rural dwellers in the world.

LIVESTOCK SERVICES

PUBLIC AND PRIVATE SECTOR ROLES IN THE DELIVERY OF LIVESTOCK SERVICES

Dina L. Umali
Gershon Feder
Cornelis de Haan[1/]

Summary

Poor livestock health remains one of the main constraints to livestock development. Production losses due to diseases are estimated at US$2 billion per year in Sub-Saharan Africa and US$900 million per year in Latin America. At the same time, growing fiscal deficits in many developing countries, and, most recently, the shift from planned to market economies in Eastern Europe and the Commonwealth of Independent States, have sharpened the focus on market liberalization and privatization issues. The possible transfer of economic functions from the public to the private sector has extended as well to the delivery of agricultural support services in general and livestock services in particular. However, the privatization of traditionally publicly-provided agricultural services has raised questions regarding the efficiency of private sector delivery and welfare implications arising from potentially inequitable access to services by different segments of population, particularly the small farmers. This study applies economic principles to determine the appropriate roles of the public and private sectors in the delivery of livestock services. It also examines the factors which determine farmer demand and private sector supply of veterinary services, ilustrated by the analysis of brea-keven levels of operation of a representative private veterinary practice in Uganda.

The study finds that, in establishing the appropriate roles for the public and private sectors in the livestock services industry, it is necessary to obtain a clear understanding of the economic nature of each separate service to determine whether private delivery will be feasible and whether private provision will result in a socially optimal level of supply. After taking into account the economic character of each service, it was clearly evident that privatization of livestock services cannot and should not be undertaken as one broad strategy; a policy of selective privatization has to be pursued.

Livestock services can be grouped into two major functional categories: health and production services. Health services include curative and preventive services and the provision of veterinary pharmaceuticals. Curative services include the provision of clinical care, while preventive services consist of vaccination, vector control, eradication programs, and disease control measures such as quarantines, the slaughter of diseased animals, and movement restrictions. Livestock disease transmission to humans is prevented through animal product inspection. Production services include research and extension relating to improved livestock

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1/ Agriculture and Natural Resources Department of the World Bank. The opinions expressed in this paper are those of the authors and do not represent those of the World Bank.

husbandry and the provision of input supplies such as artificial insemination. The major actors in the livestock services sector include veterinarians and veterinary paraprofessionals, stock owners and herders, consumers, the government, and the inter-governmental and non-governmental donors (developing countries).

In determining the appropriate channel for delivery of various services, it is necessary to classify each service on the basis of its public or private good character, while taking into account any externalities, moral hazard problems, or free-rider problems that may accompany the production or consumption of the service. Vaccines, semen for artificial insemination, and veterinary drugs and supplies are private goods: their manufacturer can capture exclusively the returns from their sale and the resources used to produced these products reduce their availability to others. Thus, they can be efficiently supplied by the private sector. Government policies, such as veterinary inputs import restrictions, subsidies and price controls on these products, however, create barriers to entry for the private sector. Veterinary surveillance is a purely public good. The benefits derived from it cannot be exclusively appropriated by an individual livestock farmer; they are available to the whole community. Because other farmers can free-ride or gain the benefits without paying for it, private firms will have no incentive to provide this service. It will have to be undertaken by the government.

Vaccinations, diagnostic support, and vector control (tick and tse-tse) are similarly private goods, but their consumption involves externalities. The farmer who owns the animal(s) is the sole beneficiary of these services and no one else benefits from them during that time. The externality arises because these services reduce the risk of disease transmission to other animals and humans. Their effectiveness also depends on the degree of coverage of the livestock population; noncompliance by some farmers can jeopardize the whole program. Due to the externalities, these services will often be underused or not used by farmers. Thus, farmer participation is ensured by governments through regulations for compliance, public provision, or subcontracting of services to the private sector. Cooperatives, because they provide a mechanism of accounting for the externalities, have also been an effective mechanism for delivering these services. Tse-tse control in open ranges, however, is a public good, thus will remain in the public domain. Clinical diagnosis and treatment are generally private goods. The exception is clinical treatment of infectious diseases which involves externalities: it reduces the risk of disease transmission to other animals. Nonetheless, clinical intervention should exclusively remain a private sector responsibility because public intervention is still most cost-effective if directed at preventive measures such as vaccination or slaughter of afflicted animals.

Extension conducted through public channels (e.g., radio broadcasts) is a public good, whereas extension services tailored exclusively to an individual or a select group will be a private good. Similarly, the products of veterinary research may be public or private goods depending on whether clear property rights have been defined; for example, research output protected by patents are private goods. Consequently, their appropriate channel of delivery will depend on the type of service and the medium used. Animal quarantine is a public-sector policy intervention which serves as a second line of defence by offering additional protection from the spread of diseases. Drug quality control and food hygiene/inspection are similarly public-sector policy responses to the moral hazard problems (consumers cannot directly gauge the product's quality) associated with the processing and distribution of veterinary pharmaceuticals and livestock products respectively.

Several factors influence the farmer's incentive to consume livestock services: (i) the

type of disease; (ii) the degree of homogeneity of the livestock population, specifically the relative proportions of traditional and improved breeds; and (iii) the intensity of the production system. These factors influence the magnitude of the farmer's economic losses from diseases. At the same time, the profitability and sustainability of a private veterinary practice are influenced by (i) the size of the livestock enterprises, (ii) the value of the animals in the production system, and (iii) the density of the livestock population. The results of breakeven analysis of a private veterinary practice in Uganda clearly illustrates the importance of drug sales in private veterinary business.

The privatization of livestock services should be undertaken selectively. As a first step, the transfer of livestock services that are basically private goods to the private sector should be promoted. Governments should also explore other alternatives besides direct provision of livestock services. These include promoting private practice by establishing an effective legal framework for enforcement of some activities (e.g., vaccination certificates), subcontracting services to the private sector, promoting livestock insurance schemes, and fostering the development of producer organizations. In areas were livestock services are necessary but privately unprofitable, particularly for small farmers, targeted subsidized delivery may be explored.

Introduction

The livestock sector plays a crucial role in the economies of many developing nations as an important source of protein-rich products, a vital generator of employment and a source of much valued foreign exchange. For many farmers in the developing world, livestock also provides a means for storing wealth, a cushion for food shortages, a source of fertilizer and/or fuel, a means of transportation, and a source of traction in agricultural production. The ability of the livestock sector to attain its full productive potential is influenced by the availability and quality of livestock support services. Livestock services are important inputs to the livestock sector because they reduce the rate of mortality, minimize morbidity losses in terms of the impact of disease on growth, fertility, product quality, and work output, and increase livestock productivity and improve product quality through breed and husbandry improvements.

Poor livestock health, however, remains one of the main constraints to livestock development in many countries. Losses in Sub-Saharan Africa because of diseases are estimated at US$2 billion per year (FAO 1985, cited in de Haan and Nissen 1985). In Latin America, production losses due to five diseases —foot and mouth disease (FMD), hog cholera, tuberculosis, brucellosis, and rabies— are estimated at US$900 million a year (FAO 1990). At the same time, growing fiscal deficits in many developing countries and, most recently, the shift from planned to market economies in Eastern Europe and the Commonwealth of Independent States, have sharpened the focus on market liberalization and privatization issues. The possible transfer of economic functions from the public to private sector has extended as well to the delivery of agricultural support services in general and livestock services in particular. However, the privatization of traditionally publicly-provided agricultural services has raised questions regarding the efficiency of private sector delivery and welfare implications arising from potentially inequitable access to services by different segments of the population, particularly the small farmers.

This paper examines the appropriate roles of the public and private sectors in the delivery of various types of livestock services, such as clinical care, vaccination, quarantine, and food hygiene/inspection, to assist governments contemplating policy reform. It applies economic principles to determine the most economically efficient channel for delivery. The factors influencing farmer

demand and private veterinary supply are examined, illustrated by the analysis of breakeven levels of operation of a private veterinary practice in Uganda. Finally, the extent of public and private sector participation in livestock services delivery worldwide is reviewed.

The study finds that in establishing the appropriate roles for the public and private sectors in the livestock services industry, it is necessary to obtain a clear understanding of the economic nature of each separate service to determine whether private delivery will be feasible and whether private provision will result in a socially optimal level of supply. After taking into account the economic character of each service, it was clearly evident that privatization of livestock services cannot and should not be undertaken as one broad strategy; a policy of selective privatization has to be pursued.

Functional Classification of Livestock Services

Livestock services can be grouped into two major functional categories: health and production services. Health services consist of curative services, preventive services and the provision (production and distribution) of veterinary pharmaceuticals. Production services include research and extension services relating to improved livestock husbandry and the provision of input supplies such as seeds, feeds, and artificial insemination.

Curative services involve the provision of veterinary care to sick animals. It entails the diagnosis of the illness and its treatment. Preventive services serve to stop the new occurrence of disease and consist of four basic measures: (i) immunization of animals with sera or vaccines, (ii) eradication or control of carriers or vectors (such as ticks and tse-tse flies), (iii) disease control measures (such as quarantine, slaughtering, movement restrictions and import and export controls), and (iv) veterinary inspection and control of animal products to prevent animal diseases which infect humans, such as anthrax, brucellosis, African sleeping sickness and some parasitic diseases (Leonard 1990).

Production services improve livestock productivity by such means as the genetic upgrading of livestock through artificial insemination, the improved formulation of feeds, the use of improved forages, and changes in management practices. Artificial insemination provides farmers the option of rapid improvement in the quality and quantity of output of their stock while obviating the need to import sires from other areas (Miller and West 1970). It thus saves the farmer the expense of buying, feeding, and looking after pedigree sires.

Major Actors in the Livestock Services Sector

The major players that shape the livestock services sector are: the veterinarians and veterinary para-professionals, the stockowners (commercial livestock farmers, sedentary or mixed farm producers, pastoralists, and small backyard raisers), consumers, the government, inter-governmental and non-governmental donors, and private entrepreneurs providing specialized services to the sector. Veterinary paraprofessionals (e.g., field technicians, field vaccinators, producer representatives/ auxiliaries) assist veterinarians with their duties.

The extent of veterinary care they provide covers a whole spectrum, from simple tasks such as teaching farmers about proper animal care and sanitation to increasingly more complicated responsibilities such as the immunization of animals, assisting the veterinarian in surgical procedures, the treatment of minor diseases, to the diagnosis of disease and the application of appropriate treatments (de Haan and Nissen 1985; Leonard 1990; de Haan and Bekure 1991).

Because of the limited number of trained veterinarians in some countries and their unwillingness to serve in rural areas, para-professionals supplement the work of veterinarians by expanding the total area covered and the number of farmers serviced as well as freeing more time for the veterinarians to treat more serious cases.

Definition of Economic Terms

Products, whether they are commodities or services, can be classified in economic terms as either private or public goods. The principles of subtractability and excludability determine whether a product is closer to being public or private. Subtractability applies when one person's use or consumption of a good or service reduces or subtracts from its value to others, such as a veterinarian's treatment of the broken leg of one farmer's animal reduces the time the veterinarian has for other farmers. Excludability applies when access is denied to those who have not paid for the product, for example, the farmer who owns the injured animal is the sole beneficiary of the procedure.

A private good, therefore, is characterized by high subtractability and excludability and is exemplified by the diagnosis and treatment of an animals broken leg. **A public good**, on the other hand, has low excludability and subtractability. If a public good is available to one person, it is available to many or all. Consequently, private firms will not supply public goods because of the difficulty in restricting use to people who pay for them; this is also commonly referred to as the "free-rider" problem. It also leads to under-production (or no production) of such goods If the production decision is profit-motivated. Thus, governments may have to provide funding to get such goods produced, while using its powers of taxation to force all beneficiaries to pay for it (Head 1974; Feldman 1980; Leonard 1990).

Externalities (also referred to as "spillover" or "third-party" effects) arise when an individual in the course of rendering (or consuming) some service for which payment is received (is made), coincidentally also renders services or disservices to other persons for which payment cannot be exacted from the benefited parties or compensation enforced on behalf of the injured parties (Pigou 1932). For example, the treatment of an animal infected with a contagious disease like FMD reduces the risk of infection of other animals.

Typically, the individual causing the externality will not take the positive or negative effects of his/her actions into consideration when deciding what levels of services he/she should produce or consume; thus, either too little (in case of positive externalities) or too much (in the case of negative externalities) is produced or consumed.

These externalities, therefore, justify government intervention, such as the subsidization (taxation) of activities, to raise (reduce) production or consumption to socially desirable levels.

Moral hazard problems arise because consumers are unaware or are unable to assess visibly and directly the quality of the product they are purchasing: for example, the difference between an active and inactive vaccine. Because the producer knows the true quality of his/her output and the consumer does not, there is an incentive for the producer to change his/her behavior and pass on sub-standard goods to the consumer who is unable to tell the difference at the time of purchase.[1/]

To overcome the moral hazard problem, the state generally monitors such sectors and/or imposes regulations governing quality standards. In situations of critical public significance, the state assumes full control of the sector and engages in the activity itself.

Sectoral Delivery of Livestock Services

In assessing the most efficient channel for the delivery of various livestock services, it is necessary to classify each service according to its economic character (Table 4.1). Veterinary surveillance is a purely public good. The benefits derived from veterinary surveillance cannot be exclusively appropriated by an individual livestock farmer; they are available to the whole community.

Because of free riders, private firms will have no incentive to provide this service and its provision will have to be undertaken by the government. Vaccines, on the other hand, are purely private goods; entrepreneurs producing vaccines can capture exclusively the full benefit from the sale of their products. Thus, private entrepreneurs will have sufficient incentives to provide these products at socially desirable levels. The same holds true for semen production, artificial insemination and the production and distribution of veterinary pharmaceuticals.

Government policies influence private participation to the extent that they affect the economic incentives faced by the private sector. Restrictions on private importation of veterinary inputs and the subsidization of and price controls on these products create barriers to entry for the private sector.

Moreover, competition in the market for these commodities has shaped the pattern of delivery of other livestock services. As a result of increasing competition among private firms involved in the marketing of veterinary pharmaceuticals and supplies, these firms are providing extension services as a complementary service.

Veterinary and production extension services may be private or public goods depending on the medium used and the ease with which information flows to other farmers. Extension conducted through public channels (e.g., radio broadcasts) is a public good, whereas extension services tailored and provided exclusively to an individual or a select group such that the information cannot be easily transmitted to other farmers will be a private good. Similarly, the products of veterinary research may be public or private goods depending on whether clear property rights have been defined; for example, research output protected by patents are private goods. Thus, the appropriate sectoral channel for their delivery will depend on the type of service produced and the medium employed.

Purely private and purely public goods occupy opposite ends of the economic spectrum. Some livestock services lie between these limits, displaying varying degrees of private and public good characteristics.

Vaccination programs, tick control, and diagnostic support belong to the special category of private goods whose consumption involves externalities or spillovers. Vaccination and dipping for tick control protect animals from disease: the farmer who owns the animal(s) is the sole beneficiary of the procedure and no one else is able to benefit from the service during that time. The externality arises because the procedure reduces the risk of exposure of other animals (and humans in the case of zoonoses) to the disease. Similarly, diagnostic support enables a farmer to discover the disease affecting his/her livestock as well as inform other farmers of its existence in the vicinity. It should be noted that the effectiveness and success of these programs in controlling a disease outbreak or its total elimination depend on the full compliance of the majority of livestock producers with the specifications of the program.[2/] These preventive measures are often the only line of defense against some diseases, because infection is fatal. Thus, their effective enforcement becomes of critical importance. Tse-tse control in open ranges is a public good, since its benefits extend to the whole community and is subject to the free-rider problem.

Table 4.1. Economic Classification of the Types of Livestock Services.

LIVESTOCK SERVICES	TYPE OF ECONOMIC GOOD		MEASURES TO CORRECT		SECTORAL DELIVERY	
	PUBLIC	PRIVATE	EXTERNALITY	MORAL HAZARD	PUBLIC	PRIVATE
1. HEALTH SERVICES						
a. Clinical intervention						
Diagnosis		x*				YY
Treatment		x**				YY
b. Preventive						
Vaccination		x*			Y	YY
Vaccine production		x				YY
Vector control						
Tick control		x*			Y	YY
Tse-tse control	x	x*			Y	YY
Veterinary surveillance	x				YY	
Diagnosis support		x*			Y	YY
Quarantine			x		YY	
Drug quality control				x	YY	
Food hygine/inspection				x	YY	
Veterinary research	x	x			YY	YY
Veterinary extension	x	x			YY	YY
c. Provision of Vet supplies						
Production		x				YY
Distribution		x				YY
2. PRODUCTION SERVICES						
AI - semen production		x				YY
AI - insemination		x				YY
Research	x	x			YY	Y
Extension	x	x			YY	Y

Note: * - private good with consumption externalities; ** - private good with consumption externalities only in the case of infectious diseases; YY - economically justified; Y - economically justified under special circumstances.

In cases where the mobility of the carriers can be restricted through the installation of special screens and traps (already in use in the Central African Republic), tse-tse control is classified as a private good with externalities.

Government intervention, such as the subsidization of the services, is justified to raise production or consumption to socially desirable levels, because of the externalities associated with the consumption of these services. Diagnostic support, vaccination, and vector control (tick and tse-tse) services can be provided by the private sector if mechanisms exist to internalize or account for the externalities.

Box 4.1. Public Cost Recovery Programs: An Alternative

Many developing countries are currently faced with serious fiscal constraints and the overall policy of subsidization of these services has often resulted in tradeoffs between the quantity and quality of services provided. Anteneh (1983) found that in several countries in Africa, the government policy in the 1970s and 1980s of recruiting newly trained veterinary graduates placed increasing and unsustainable pressures on the budget. In some cases (e.g., Kenya in the mid-1980s), salary allocations rose to over 80 percent of the operating budget, resulting in declining availability and quality of services. Cost recovery has been recommended to insure the sustainability of public-sector programs (De Haan and Nissen 1985; De Haan and Bekure 1991). However, this strategy should be pursued only after farmer response to the additional cost involved has been carefully studied.

The few studies of farmer responses to cost recovery policies show disparate results and further study is required. For example, Sandford (1983) found that a dipping fee created a disincentive for regular and widespread dipping in Kenya, while under the Uasin Gishu Project in Kenya (financed by IFAD and the Danish government), it was found that farmers were willing to pay for dipping services, provided these services were guaranteed to be effective (de Haan and Bekure 1991). In China, with the central government's new policy of reducing funding from the central treasury and making provinces and townships budgetarily self-sufficient, cost recovery has become a critical issue. For example, Leishue county in Jiangsu Province implemented effective cost recovery measures through charges on essential services. Eighty five percent of total expenses were recovered with the remaining 15 percent plus staff performance bonuses being provided by the province. The county did not invest in livestock services that could be alternatively sourced (e.g., slaughterhouses) and achieved high levels of farmer contact as evidenced by the vaccination coverage rates for pigs, buffalo, and poultry of 100, 90, 75 percent respectively and a 100 percent AI coverage of pigs with 80-90 percent conception to first insemination. Conversely, the income from household charges levied against Jilin province's approximately 3.6 million rural households was estimated to be less than Y18 million, about 50 percent of the provincial Animal Health Bureau budget. That livestock services in Jilin were relatively poor in comparison to Jiangsu was in part due to fiscal constraints (World Bank 1987).

The extent of public-sector involvement in the delivery of these services therefore becomes a function of the degree to which the private sector is able to internalize these externalities. The nature of public sector intervention will depend upon the type of externality involved and may range from monitoring and regulation to insure compliance, the imposition of penalties for non-compliance, subsidization of services to raise consumption to socially optimal levels, or in extreme cases (e.g., zoonotic diseases and FMD which affects exports), public provision of the service. In the special case of tse-tse control in open ranges, its public good character requires that this activity remain in the public domain.

Clinical intervention involves two activities: diagnosis of the illness and its treatment. Clinical diagnosis and treatment are generally private goods. As noted earlier, the diagnosis and treatment of a broken leg is a purely private good.

There are, however, externalities associated with the diagnosis and treatment of an infectious disease. Through diagnosis, the farmer is informed about the infectious disease afflicting his/her animal(s), but at the same time, the process provides information to other farmers regarding the presence of the disease in the locality. Although the treatment provided by a veterinarian is a private good, the treatment received by the animal reduces

the risk of disease transmission to other animals and can subsequently reduce the risk of economic losses of other farmers.

Clinical intervention, however, does not always result in complete cures; a small percentage of the animals, despite being cured of the infectious disease, will remain carriers of the disease. Consequently, preventive measures such as vaccination and the slaughter of diseased animals are the recommended strategy for combatting infectious diseases, since they are more cost effective alternatives.

Remuneration of farmers for the slaughtered diseased animals will require public subsidy, although in some countries, animal insurance schemes funded by fees collected from farmers provide compensation to affected individuals (Box 4.2).

Theoretically, public intervention is economically justified if the service involves externalities in order to reduce or raise utilization to socially optimal levels. In practice, however, some activities, such as clinical intervention (which can be efficiently provided by the private sector) and vaccination and diagnostic support (which may require public intervention), may not always be completely separable. For example, a veterinarian who provides all three services has to travel to a distant clinical post to provide them.

If the transport costs to provide the latter two services require public subsidies, the separation of the transport costs associated with clinical intervention alone becomes administratively difficult. In such special cases, a subsidy to promote diagnostic support and vaccination (e.g., a subsidy of

Box 4.2. The Enzootics Control Fund in Germany

The Enzootics Control Fund (ECF) was an instrument to officially enforce measures for the control of enzootic diseases and to compensate livestock owners from losses; its legal base is derived from the Enzootic Control Act. Normally, 50 percent of the compensation for losses sustained due to epizootics was covered by the fund, while the balance was paid by the state. Compensation, however, was subject to the condition that the livestock owner had demonstrated his/her cooperation with the epizootics control program; for example, the livestock owners and private veterinarian had reported notifiable diseases to the state veterinary officer and had performed all the subsequent measures ordered by the officer. The ECF also supported financially measures against infectious diseases. It paid for diagnostic examinations in state veterinary investigation centers and compensated private practitioners for their participation in the epizootic control programs. Fixed fees were set by the fund for blood collection, tuberculinization, and vaccination. The fund subsidized the expenses for the disposal of the carcasses and the cost of losses arising from diseases of interest to the state but not classified as notifiable. As noted above, it also contributed funding to para-governmental organizations. Financing of the ECF was based on the obligatory payment of fees by livestock owners in all 11 states in Germany. The fees, which varied according to species, were calculated annually on the basis of the risks encountered by the fund during the past year and were collected on a per animal basis.

Source: Leonhardt 1990.

transportation costs) may unavoidably spill over to clinical intervention. This should not be perceived, however, as a justification for subsidization of clinical intervention. Clinical intervention should exclusively be a private sector activity and only vaccination and diagnostic support should be subject to subsidization.

Animal quarantine is a public-sector policy intervention which serves as a second line of defense against diseases. Since farmers are not likely to take into account the impact of diseases on other farmers and will tend to underinvest in preventive measures such as vaccination, vector control, and eradication programs, quarantine services offer additional protection from the spread of diseases.

Drug quality control and food hygiene/ inspection are similarly public-sector policy responses to the moral hazard problems associated with the processing and distribution of veterinary pharmaceuticals and livestock products respectively.

Extent of Privatization of Livestock Services

Both quantitative and qualitative data on the livestock services sector are scant and approximate measures have to be used to estimate the extent of private sector participation in their delivery. Veterinarians are the primary channel for the delivery of livestock health services. Thus, one approximate indicator that can be used to measure the degree of private participation is the ratio of the number of government to private veterinarians.

The study found that, in 1989, Europe, North America, Oceania, and most of Central and South America and Asia registered ratios less than 1, indicating the highly dominant role played by the private sector. Twenty-six of the 58 countries (45%) in these regions had ratios of less than 0.50, while 11 countries (19%) had ratios of less than 0.20.

In contrast, Africa (with the exception of South Africa and Zimbabwe) and most of the Middle East exhibited significantly high ratios, with the highest ratio, 45.3, registered by Jordan. Nevertheless, most countries displayed declining ratios between 1984 and 1989, indicating a trend towards increasing private-sector participation. Of the 126 countries studied, only 14 exhibited increasing ratios; 6 of the 14 countries showed a drastic rise in government involvement during the same period. In particular, the ratio of government to private veterinarians more than doubled in Kenya, Lesotho, Zambia, Peru, Hongkong, and Jordan.[3/]

Public and Private Delivery of Livestock Services: A Review

The provision of livestock services has often been in the domain of the public sector. Over time, a growing diversity has developed in the manner in which livestock services are delivered in individual countries. In most developing nations, livestock services still remain a government responsibility, while in the more developed countries, some support service functions of the government are being performed in partnership with, or have been transferred to, the private sector. In some instances, the transfer of responsibility from the public to the private sector was facilitated by donor agencies (Box 4.3 and 4.4).

The following discussion provides an overview of the extent of public and private sector participation in various countries and is based on a survey of expert opinions and a review of the literature.[4/]

Veterinary surveillance remains a public sector activity worldwide, but the responsibility for providing quarantine services, drug quality control, and food hygiene/inspection is being subcontracted to private veterinarians on a part-time basis by governments in Chile, Denmark, Germany (Leonhardt 1990), Ireland and the United Kingdom.

Box 4.3. Operation Flood in India

Operation Flood consisted of projects implementing the AMUL model in three states: Karnataka, Madhya Pradesh, and Rajasthan. Initiated in 1970, it was supported by a World Bank loan. The AMUL model is based the Anand Milk Union Ltd., a milk marketing cooperative in the Kaira District of Gujarat organized by a group of dairy producers in 1946 for the purpose of obtaining better prices and access to the Bombay markets. It consists of a three-tier cooperative structure owned and managed by the member farmers. At the base is the Dairy Cooperative Society (DCS), a village-level cooperative which receives milk twice a day, pays producers regularly based on the quantity and quality of milk delivered, and organizes production services to farmers. These support services included the sale of cattle feed concentrate, the promotion of fodder seed, artificial insemination, the provision of veterinary health services, and training programs for members. The DCSs are subsequently organized under a Milk Producer's Union, with usually one union per district. The union organizes milk collection for and milk processing at the Union dairy (pasteurization and packaging of fresh milk, and production of other dairy products), engages in distribution and marketing in urban centers, and provides production inputs and technical services to the DCSs. Aggregate planning of cooperative-sector input services, milk marketing, pricing policy, and participation in the National Milk Grid for transport and storage of milk is organized at union and Federation levels. In the AMUL model, the Boards of the DCSs, the unions, and the federation are composed of farmer representatives elected by members and have full autonomy over operations, pricing and marketing policy. The National Dairy Project (Operation Flood II) was initiated in 1980 and involved the further expansion of the program within the three original states and the intensive development of the AMUL model in other states. Operation Flood III was launched in 1987 as part of the Government of India's Seventh Five Year Plan to extend the program into more areas, and as of 1992 was still ongoing.

The replication of the AMUL model in different states entailed the coordinated efforts of the national and state governments, farmers, and donor agencies. The center for coordination and implementation of the project activities was the Dairy Development Corporations (DDCs) established in each state. The National Dairy Development Board, the government agency overseeing national dairy development, assisted the corporations by training DDCs and the union's staff. It assisted the Dairy Development Corporations in the design and construction of the union milk and feed plants, the preparation of marketing studies to determine plant product mixes, and other consulting services. Capital for establishing these corporations were supplied by the national and state (at least 20%) governments, and the Union themselves. The government also lifted its policy of subsidization of consumer prices of milk from state dairy plants upon commencement of the project to improve competition in the milk market.

Shah and Bhargava (1962) found that as a result of the project, milk yields increased significantly in participating villages, resulting in higher farm incomes. The number of participating farm families jumped from 1.8 million in 1981 to 4.5 million in 1986. The number of dairy cooperative societies increased from 10,400 to 42,700 during the same period; while the volume of milk procured more than doubled from 2.6 million liters in 1981 to 7.9 million liters in 1986. The rapid rise in participation is traced to the project's profitability: the financial rate of return (FRR) to landless families with cross-bred cows was 37 percent and was greater for farmers who could grow their own fodder. The FRR for the DCSs was 28 percent, and for producer unions 17 percent. Operation Flood stands out among the many joint government-private sector-donor undertakings because of its sustainability. One lesson that can be learned from the Indian experience is that the AMUL model depends for its efficient functioning on effective leadership and autonomous farmer control at all levels.

Source: Doornbos *et al.* (1990).

Box 4.4. The National Federation of Central African Livestock Producers

The National Federation of Central African Livestock Producers (FNEC) was organized by livestock producers to distribute veterinary pharmaceuticals after being faced with an almost complete collapse of the government livestock service in the seventies. Prior to 1982, National Agency for Livestock Development (ANDE) had a monopoly of veterinary drug marketing and distribution. But due to public-sector operational problems and upon recommendation by donors, the responsibility for veterinary drug marketing and distribution was transferred to FNEC in 1982. International assistance was also provided, including equipment, vehicles, and infrastructure necessary for this activity. Donor funding also provided an initial subsidy to FNEC to create the necessary working capital. At the same time, government sponsored training programs were reoriented towards teaching herders the proper use of these drugs.

Total FNEC sales of veterinary drugs increased dramatically from US$9,000 in 1981, to US$5.7 million in 1988. Moreover, the frequently expressed fear that herders would underdose and thus induce drug resistance was not borne out. A World Bank (1986) survey showed that 90% of the herders correctly used the drug against internal parasites, 65 percent and 85 percent correctly treated trypanosomiasis and piroplasmosis respectively. FNEC's general success in its drug importation and distribution activities encouraged individual herder associations to expand into the sales of other inputs such as concentrate feeds and medicine. In 1989, FNEC began providing extension services.

Source: World Bank 1986a.

Although these services are performed by private veterinarians, their employment by the government essentially defines their status as part-time civil servants. Thus, moral hazard problems are surmounted, since the level of services provided is still determined by the public sector.

Livestock services extension continues to be monopolized by the government in Africa and most of Asia and Latin America. However, in other regions, the private sector has turned this liability into an asset. In North America, Western Europe, Australia, Brazil (World Bank 1990), Argentina (World Bank 1989), and the Philippines, extension services are an integral component of private-sector marketing strategy (Box 4.5). Private veterinarians and sales agents of agribusiness and veterinary pharmaceutical companies provide information regarding livestock upgrading, improved production practices, hygiene and sanitation, and feeding as a complementary service. Due to increasing competition in the livestock services market, complementary livestock services extension is designed to promote and strengthen customer loyalty and expand market shares.

In Argentina and Brazil, the structure of the livestock industry has enabled private consulting firms specializing in the provision of technical and extension services to flourish. These private consulting firms thrive because their services are tailored to the needs of a specific farmer or farmer group and are not necessarily relevant to other producers, minimizing free-rider problems. Moreover, there is a growing tendency toward market segmentation in extension services in the two countries. Private consulting firms cater to the specialized technical and extension needs of

the large-scale farmers, while government efforts have concentrated on the medium- and small-scale enterprises. This trend may be attributable to large-scale farmers taking advantage of economies of scale in the use of the private consulting services.

Box 4.5. Dairy Extension in Argentina: A Private Firm's Initiative

During the 1970s, the dairy sector in Argentina was plagued with serious problems: low productivity, unstable milk supply due to seasonal influences, and low milk quality. These problems were mainly the result of poor animal nutrition and inadequate farm hygiene. In 1976, a recession hit the dairy industry; farmers began moving out of dairy production as the real prices of milk declined, input prices rose, and other farm activities became more lucrative. Dairy processors realized that their own growth would be constrained if they did not take action to address the problem. They felt that the technology available to farmers had to be improved, that inputs at reasonable prices had to be made accessible to farmers, and that the farmers needed to be better organized if support was to be channelled to them. The two largest dairy plants, the Santa Fe-Cordoba United Cooperatives (SANCOR) and La Serenisima decided to act and undertake their own "dairy development projects."

SANCOR formed an extension department with a central office staffed by 7 professionals and 8 regional offices, each managed by an agronomist assisted by middle-level technicians. Each office dealt with almost 40 cooperatives using two basic approaches: providing extension to the cooperatives and assisting small group of farmers (usually 6-15) to meet monthly on their farms to discuss the visited farm's progress and problems. SANCOR initially assisted in financing the group's technical assistance, but after 30 months, each group of farmers paid for the professional agronomist itself. As of 1990, SANCOR had 120 farmer groups participating in the program. SANCOR also published its own magazine and bulletins and broadcasted radio and television programs. Artificial insemination circuits as well as accelerated heifer-rearing programs aimed at getting heifers calving at less than 36 months of age were also organized by SANCOR. In addition, SANCOR supplied and financed a varied list of farm inputs. As an indicator of the success of the SANCOR's program, milk production increased by 15 percent between 1976-85 despite a 24 percent decrease in the number of dairy farms participating.

La Serenisima also formed a strong technical assistance department to tackle the same three problems faced by SANCOR. La Serenisima, a private company, deliberately targeted medium- to large-scale farmers. Its staff consisted of over 60 professionals, 30 administrative staff, and 50 milk-quality inspectors working on technical assistance, including three social scientists. La Serenisima established five regional offices, each with five zone offices. Each zone office worked with a group of up to 25 farmers. Magazines, bulletins, radio and television programs were all part of the development effort. During 1978-85, although the dairy farm areas feeding La Serenisima shrank by more than 6 percent, production increased by almost 50 percent.

Source: World Bank 1989.

Similarly, veterinary research exhibits both public and private good characteristics and the sectoral performance of this function will depend on the type of research performed. The survey shows that veterinary research remains a government function in most developing countries. Such public-sector dominance of veterinary research is partly attributable to the fact that the market for new livestock products (e.g., new breeds and drugs) in many developing countries is still small or undeveloped and thus makes private research unprofitable.

In developed nations, agribusiness (e.g., feed suppliers) and veterinary drug companies and privately-funded research institutes also conduct research on the development of improved breeds, feeds, and husbandry management, and new vaccines and drugs. These firms generally cater to larger or multiple markets (domestic and/or foreign), thus they are able to take advantage of economies of scale. Furthermore, because they usually hold proprietary rights to their research output, they are able to appropriate the returns on their investments. Consequently, there is adequate incentive for private research.

Clinical intervention is exclusively provided by the private sector in Uruguay, Australia, New Zealand, North America, and the Western European countries; in the rest of the world, public-sector involvement varies significantly. In most countries, the private sector primarily provides clinical services to the medium- and large-scale livestock enterprises, while the government supplies the clinical needs of the small-scale farmers. The segmentation of the market largely derives from economies of scale associated with the delivery of livestock services.

The survey shows that public-sector involvement in vaccination programs ranged from mere regulation to complete provision. In African and Asian countries, vaccinations are predominantly or exclusively conducted by government veterinarians and veterinary auxiliaries. In Brazil (World Bank 1990), Argentina (World Bank 1989), Morocco, and the West European countries, the government partially "subcontracts" its vaccination functions to the private sector, particularly for vaccinations for the more critical infectious diseases such as FMD and brucellosis. However, farmer compliance is strictly monitored by the government through the issuance of vaccination certificates or the inspection of vaccination receipts (issued by the private veterinarian).

In Africa, Asia, and Latin America, medium- and large-scale farms raising improved breeds utilize the services of private veterinarians to vaccinate their animals, while small-scale farmers rely on the government for the same service. The inadequacy of coverage and/or occasional unreliability of government services have been inducements for medium- and large-scale farmers to undertake their own vaccination programs.

The "national" significance of the disease may necessitate government intervention to insure the effectiveness of a vaccination program or adequate use of clinical services. The impact of zoonotic diseases transcends livestock farmers and is felt by the rest of society. Moreover, since many countries ban livestock product imports from countries with FMD, exporting countries where livestock products account for a large proportion of exports (e.g., Brazil and Argentina) find it in their best interest to assume control of FMD vaccination programs to insure their effectiveness.

Vector control is largely the shared responsibility of the public and private sector worldwide, although there is increasing private-sector participation. The medium- and large-scale livestock enterprises in Kenya generally manage their own dip or spraying facilities, while the small-scale enterprises mainly rely on government-operated facilities. In North America and Oceania, farmers generally operate their own dip or spraying facilities. Tse-tse control over open rangelands in several African countries remains in the public domain due to its public-good character. In the Central African Republic, however, livestock farmers find it economical to install special screens and traps to control the tse-tse flies.

Vaccines in most developing countries are produced by government research laboratories, although private companies (mostly subsidiaries of multinationals) have set up local plants for their production. In many cases,

vaccine production is integrated with the production of veterinary drugs by the same private companies. In Kenya, Australia, Brazil, Uruguay, and the United Kingdom, the domestic vaccine requirement is supplied by both the public and private sectors; whereas domestic supply is exclusively produced by private firms in Botswana, Morocco, Canada, the United States, Argentina, Chile, and Western Europe. In China, vaccines of any type were not used for dairy cattle, but vaccines for hog diseases were prepared in vaccine laboratories under the control of the Animal Health Bureau (World Bank 1987).

Factors Influencing Private Demand and Supply of Veterinary Services

Several factors influence the economic losses from diseases and therefore the farmer's incentive to consume livestock services.

The risk of economic losses is a function of the type of disease, the degree of homogeneity of the livestock population, and the nature of the production system. For example, brucellosis causes abortions in cattle which lead to significant losses in production, whereas the lesions from FMD may be debilitating but treatable. Thus, the farmer may forego treatment of the latter.

In general, traditional and improved breeds exhibit different productivity characteristics, and thus economic values, and different degrees of susceptibility to specific diseases. For example, production losses of dairy cattle due to FMD, which above all affects milk production, are generally significantly higher than for beef cattle. Consequently farmer response may significantly differ according to the type of animal concerned. Box 4.6 illustrates how farmer response has varied in different countries.

The profitability and sustainability of private veterinary practice are influenced by the size of the livestock enterprises, the value of the animals in the production system, and the density of the livestock population. The large fixed costs associated with the provision of veterinary services (e.g., transportation, buildings, and veterinary equipment) establish the lower bound for demand for the veterinarian's or veterinary health personnel's services to ensure economic profitability. Therefore, the existence of large-scale high-density livestock enterprises will favor private-sector participation since these enterprises will have the capacity to generate such a volume of demand. In predominantly smallholder and low density areas, the demand is often insufficient to sustain private practice. This arises because the private practitioner's transactions cost per animal exceeds the smallholder's perceived returns from the service.

Finally, in areas where publicly provided livestock services are available, private practitioners may not be able to compete if public services are highly subsidized.

Economies of scale also apply to the consumption of livestock services. The cost per unit of the veterinary visit decreases as the flock size increases. Therefore, from the farmer's perspective, this cost differential can become a screening device as to who can afford veterinary services. Farmers with large herds can take greater advantage of veterinary services than small farmers since their cost per unit is smaller and thus makes the services more affordable. Membership in producer associations/cooperatives, however, has been an effective measure taken by small farmers to overcome the handicap of higher per unit costs. Small farmers can take advantage of economies of scale through increased coordination and pooling of their livestock services needs under the auspices of these organizations. For example, producer organizations can set up clinical routes and designated field stops where member farmers can seek the services of the association's veterinarian or veterinary health personnel. Furthermore, producer associations provide the

Box 4.6. Factors Influencing Farmer Demand of Livestock Services: Some Country Examples

In Kenya, small farmers with Zebu stocks, which have higher resistance to tick-borne diseases, showed little interest in taking their animals to dipping facilities. On the other hand, medium- and large-scale Kenyan livestock enterprises generally manage their own dip or spraying facilities, because the risk of exposure to diseases resulting from herd-mixing in government dips, the cost of moving animals to government dip facilities, the inadequacy/unreliability of government facilities in addition to economies of scale of large-scale operations provide economic incentives for medium- and large-scale farmers to operate their own facilities (World Bank 1986).

In Argentina, farmers in the extensive breeding areas found the gains from FMD vaccination to be less than the cost of assembling the animals and inoculating them. In contrast, in the intensive cattle-fattening areas, where animals from the breeding farms are subsequently sent, producers find vaccinations imperative because of the higher risks of losses (World Bank 1989). In Brazil, cattle farmers in the extensive farming areas in the north, northeast and center-west often evaded vaccinating their animals for FMD because they perceived the costs outweigh the benefits of disease control (World Bank 1990). For these farmers, the cost of vaccinating their animals not only includes the cost of the vaccine and the veterinarian's fee, but also the cost of repairing the cattle crushes, the labor required to assemble the animals, and the weight losses associated with moving and gathering the animals for vaccination. Since farmers experienced low mortality rates from FMD, they found vaccination uneconomical.

To further illustrate the varying incentives farmers receive for the use of livestock services for different diseases, Felton and Ellis (1978) reports a cost/benefit ratio 1:8 for the Rinderpest vaccination campaign in Nigeria, while Domenech *et al.* (1981) calculated an internal rate of return between 12 and 53 percent for brucellosis control in Chad.

mechanism for overcoming the externalities associated with the provision of some livestock services. Since the veterinarian or veterinary health auxiliary is employed by the producer association and all members equally provide financial support for the organization, free-rider problems are eliminated. In Indonesia, farmer cooperatives specializing in livestock production employed veterinary staff as a service to members (Box 4.7).

Private Practice Breakeven VLUs in Uganda: A Case Study

Private entry into the livestock services sector depends on whether an economically profitable practice can be sustained. An important concern for private practitioners then, is the minimum number of animals that need to be serviced in order to breakeven (profits = 0). The following discussion presents the results of the estimation of breakeven VLUs under three different production systems (traditional, intermediate, and high intensity) in Uganda.[5/]

The sources of revenue are the consulting fees and mark-ups on drug sales. In this study, it is assumed that the average fee per animal is $2, $12, and $20 under the traditional, intermediate, and high intensity systems, respectively, and that additional revenue may be generated through mark-ups on drug sales amounting to 25 or 50 percent. Table 4.2 lists the costs involved in operating a private practice[6/].

Box 4.7. Private Veterinarians and Livestock Cooperatives in Indonesia

In 1989, 1,036 or approximately 33 percent of Indonesian veterinarians were working in the private animal health sector (FAO-WHO-OIE 1990). Some were in small-animal practice in the larger towns, but there were a few full-time practices serving the livestock industry. Where the private sector could not fill the demand for veterinary services, the deficit was commonly made up by government or university veterinarians acting as consultants to the larger commercial enterprises outside government working hours. In addition, drug distributors and animal feed manufacturers who used medicaments in their products were required to employ staff veterinarians. These agribusinesses provided livestock services to farmer clients and followed up complaints or problems concerned with their products. While the private sector provided less job security, salaries were substantially higher than in government, particularly in drug companies. Thus it was expected that the private-sector animal health services will expand with the growth of the technically advanced livestock industries. However, the requirements of most smaller farmers will continue to be met by the government livestock service for the foreseeable future (Hutabarat 1990).

Farmer cooperatives which specialized in livestock production also employed veterinary staff as a service to members. In particular, the Association of Milk Cooperatives of Indonesia (GKSI), whose members included livestock/dairy cooperatives, village unit cooperatives, and village dairy cooperatives (locally known as Kooperative Unit Desa or KUD), provided technical services to their farmer members. The GKSI specifically provided livestock health and artificial insemination services and conducted extension activities covering animal nutrition and feeding. In 1987, the dairy cooperatives under GKSI employed over 20 veterinarians to service their farmer members (Winrock International Institute for Agricultural Development 1986).

Table 4.2. Costs and Returns to Private Veterinary Practice in Uganda, 1990

ITEMS	COST/YEAR US($)
COSTS	
DEPRECIATION	
Vehicle	450
Vet. Equipment	2,078
Subtotal	2,528
OPERATING EXPENSES	
Supplies:	
Hypodermic syringe, nylon	30
Hypodermic needles, packs of 12	20
Nylon suture material, cassette	70
Nylon suture material, refills	30
Catgut sutures, cassette	250
Calving rope (nylon)	20
Disposable uterine catheters, 25s	20
Teat canulae, pack of 12s	10
Chemicals	200
Insurance	650
Rent-clinic	1,500
Utilities	400
Stationery and post.	200
Subs. & memberships	100
Subtotal	3,500
Fuel and maintenance ($0.18/km, 40 km/trip)	
100 trips/year	720
200 trips/year	1,440
240 trips/year	1,728
Cost of capital (38%/yr)	
100 trips/year	2,564
200 trips/year	2,838
240 trips/year	2,947
Total Costs	
100 trips/year	9,312
200 trips/year	10,306
240 trips/year	10,703
Additional Revenue	
Drug sales 10,698	
25% sales mark-up	2,675
50% sales mark-up	5,349

Source: World Bank data.

The breakeven VLUs under traditional, intermediate, and high intensity production systems are presented in Table 4.3. The results of the analysis clearly illustrate the importance of drug sales in private veterinary business. The results also imply that, assuming 200 trips per year and 25 percent margin on drug sales, a private veterinarian must treat an additional 500 VLUs/year under the traditional system, 83 VLUs/year under the intermediate system, and 50 VLUs/year under the high intensity system to earn an income of US$1,000.

Table 4.3. Number of VLUs by Production System for a Private Veterinary Practice to Breakeven or Earn Profits of US$1,000 in Uganda, 1990

PRODUCTION SYSTEM	FEE/ ANIMAL ($)	BREAKEVEN VLUs/YEAR			PROFIT = US$1,000		
		Pure Vet Service	Vet Service + 25% margin	Vet Service + 50% margin	Pure Vet Service	Vet Service + 25% margin	Vet Service + 50 % margin
Traditional							
100 trips/year	2	4,656	3,319	1,982	5,156	3,819	2,482
200 trips/year		5,153	3,816	2,478	5,653	4,316	2,978
240 trips/year		5,352	4,014	2,677	5,852	4,514	3,177
Intermediate							
100 trips/year	12	776	553	330	859	636	414
200 trips/year		859	636	413	942	719	496
240 trips/year		892	669	446	975	752	530
High Intensity							
100 trips/year	20	466	332	198	516	382	248
200 trips/year		515	382	248	565	432	298
240 trips/year		535	401	268	585	451	318

NOTE: Breakeven VLU - (Depreciation costs + operating costs - drug sales margin)/fee per animal.

Conclusion

The privatization of livestock services should be undertaken selectively. As a first step, the transfer of livestock services that are basically private goods to the private sector should be promoted. In the case of livestock services whose comsupmtion involves externalities or whose delivery has asociated moral hazard or free-rider problems, there is a need for mechanisms to correct these market failures to insure that the private sector provides them at socially optimal levels. Otherwise, public-sector intervention will remain essential. Transfering the responsibility for the provision of these "private goods" to the private sector will ease the financial burdens of the government. To promote these sectors, governments should work toward removing any barriers to private development of these industries, such as the removal of price subsidies and trade barriers, elimination of restrictions on private practice, and the abolition of public input monopolies. Private enterprises will only respond if appropriate economic incentives exist.

Governments should explore other alternatives besides direct provision of livestock services. These include promoting private practice by establishing an effective legal framework for enforcement of some activities (e.g., vaccination certificates in Argentina), subcontracting services to the private sector, promoting livestock insurance schemes (e.g., insurance schemes in Germany), and fostering the development of producer organizations. In areas were livestock services are necessary but privately unprofitable, particularly for small farmers, targeted subsidized delivery may be explored.

Bibliography

ANTENEH, A. 1983. Financing Animal health services in some African countries.

LPU. International Livestock Center for Africa. LPU Working Paper No. 1.

BLANKART, C.B. 1987. Limits to privatization. European Economic Review. No. 31:346-351.

DE HAAN, C. and NISSEN, N. J. 1985. Animal health services in Sub-Saharan Africa. World Bank Technical Paper No. 44. Washington, D.C.:The World Bank.

_____ and BEKURE, S. 1991. Animal health services in Sub-Saharan Africa: Initial experiences with alternative approaches. World Bank Technical Paper No. 134. Washington, D.C.:The World Bank.

DOMENECH, J.L., COULOMB, J. and LUCET, P. 1981. Brucellosis in Chad: Impact of animal disease control in Africa. Berlin.

DOORNBOS, M. *et al.* 1990. Dairy aid and development: India's Operation Flood. New Delhi:Sage Publications India Pvt. Ltd.

FELDMAN, A. M. 1980. Welfare economics and social choice theory. Boston:Kluwer Nijhoff Publishing.

FELTON, G. and ELLIS, P. 1978. Studies on the control of Rinderpest in Nigeria. Study No. 23, England, Reading University.

FOOD AND AGRICULTURE ORGANIZATION. 1990. Strengthening animal health services in developing countries. FAO expert consultation. Rome:FAO.

_____. 1989. Argentina agricultural services project annexes. Report No. 90/89 CP-ARG-12 PB. Rome:FAO/World Bank Cooperative Programme Investment Centre, FAO.

_____, WORLD HEALTH ORGANIZATION, and INTERNATIONAL OFFICE OF EPIZOOTICS. Animal health yearbook (various issues). Rome:FAO.

HEAD, J. G. 1974. Public goods and public welfare. Durham, North Carolina:Duke University Press.

HUTABARAT, N. (Agricultural Counselor of the Embassy of Indonesia). 1990. Personal communication.

MILLER, W. C. and WEST, G. P. 1978. Black's veterinary dictionary. 9th ed. London:Morrison and Gibb Limited.

LEONARD, D. K. 1990. Draft research proposal on the organization of animal health services in Africa. Presented at the International Livestock Centre for Africa.

LEONHARDT, H.G. 1990. Animal health system of the Federal Republic of Germany. mimeo. 14 pp.

PIGOU, A. C. 1932. The economics of welfare. 4th ed. London:Macmillan.

SANDFORD, S. 1983. Management of pastoral development in the Third World. New York:John Wiley and Sons.

UNITED STATES DEPARTMENT OF AGRICULTURE. 1990. World agriculture trends and indicators 1970-89. Statistical Bulletin No. 815. Washington, D.C.: Economic Research Service, United States Department of Agriculture.

UMALI, D.L. 1992. Public and private sector roles in agricultural research: Theory and experience. World Bank Discussion Paper No. 176. Washington, D.C.:World Bank.

UMALI, D.L., FEDER, G. and DE HAAN, C. 1992. The balance between public and private sector activities in the delivery of livestock services. World Bank Discussion Paper No. 163. Washington, D.C.:World Bank.

WINROCK INTERNATIONAL INSTITUTE FOR AGRICULTURAL DEVELOPMENT. 1986. A review of the livestock sector in the Republic of Indonesia. Report prepared for the Asian Development Bank and the Republic of Indonesia, Morrilton, Arkansas: Winrock International Institute for Agricultural Development.

WORLD BANK. 1990. Brazil: Key policy issues in the livestock sector: Towards a framework for efficient and sustainable growth. Sector Report No. 8580-BR. Washington, D.C.:The World Bank.

_____. 1989. Argentina agricultural sector review. Vol II: Technical annex. Report No. 7733-AR. Washington, D.C.:The World Bank.

_____. 1987. China: The livestock sector, Washington, D.C. World Bank.

_____. 1986a. Central African Republic National Livestock Project. Staff Appraisal Report No. 5909-CA. Washington, D.C.:The World Bank.

_____. 1986b. Kenya Animal Health Services Project. Staff Appraisal Report No. 6367-KE. Washington, D.C.:The World Bank.

1. Blankart (1987) suggests that markets can develop devices to overcome the deficiency of quality uncertainty. For such goods, which he refers to as 'experience goods,' "the customers can extrapolate their experiences of previous transactions, and the suppliers accumulate goodwill in order not to disappoint the consumer's expectations." Brand loyalty developed through guaranteed quality of products is an example.

2. The failure of several producers to follow the requirements of the program (e.g., to properly vaccinate all animals) can cause the resurgence of the disease and jeopardize the health and productivity of the animals of all other farmers.

3. Umali *et al.* (1992) provides a detailed listing of the results.

4. The information on public and private-sector activities was compiled primarily by means of personal interviews with livestock and agricultural specialists in the World Bank, the United States Department of Agriculture, and various embassies, supplemented by information from recent literature on the topic.

5. The traditional production system is characterized by smallholder/pastoralist farming and low productivity (e.g., less than 500 li. of milk per year and less than 12% offtake), while the intermediate production system is typified by more capital intensive operations and higher productivity (e.g., from 500-2500 li. of milk per year and 12-18% offtake). The high intensity production system includes feedlots, ranching, and intensive dairy production; it is very capital-intensive, with levels of production greater 2500 li. of milk per year and greater than 18% offtake.

6. Refer to Umali *et al.* (1992) for detailed listing of veterinary practice investments.

PANEL MEMBERS' COMMENTS

Governments were responsible for establishing which veterinary services could not be delegated to the private sector to avoid situations in which small farmers failed to comply with minimum animal health standards, causing problems on a national scale.

The majority of the countries had the common intent of privatizing livestock services, as long as that was done selectively and governments retained control over services which affected the public well-being. Many recommended that semi-public services be established, others that small farmers set up cooperatives for the provision of animal health, nutrition and genetic services, as in Costa Rica.

Because of the importance of governments' promoting the well-being of society, public services in many countries were delivered at very low cost, and others at no cost at all to the farmer, but with relative effectiveness. It was also suggested that such services could be subsidized and delivered by the private sector in conjunction with the state, which had the obligation to safeguard the well-being of the country.

Many countries were passing through a transition stage (public to private) in which the economy was no longer centralized, and it was suggested that special importance be placed on support for private services, as in the case of small-farmers' cooperatives.

The course being taken by cooperatives at the international level was having a major impact on government policy and was creating new mechanisms between the public and private sectors. The private sector was increasingly interested in livestock research and development, and such factors made it all the more important for farmers to participate directly and continuously.

FINANCIAL SERVICES

FINANCIAL SERVICES FOR AGRICULTURE: THE PUBLIC-PRIVATE COMPLEMENTARITY

Carlos Pomareda [1/]

Summary

Agriculture is seen as a group of activities, including primary production and agroindustry, with strong links to national and foreign food industries. The many actors in the agricultural system are linked directly through markets or contracts. Their financial needs increase as they modernize their operations and become more involved in international trade.

Financial resources and services are in greater demand today to accelerate the process of technological innovation, improve managerial capabilities and develop production strategies that are in accord with the goal of natural resource conservation. Financial mechanisms currently in place do not always provide satisfactory responses, mostly because of the cost of capital, short amortization periods and requirements related to collateral.

In the financial sectors, there are many actors who share common interest: maximizing profits and minimizing risks. Agricultural development banks have been an exception. Inasmuch as the goverment was responsible for covering their losses, they have provided low-interest credit and have been lax in enforcing repayment of loans. Goverment can no longer afford to continue this practice, and has demanded that the banks change.

During the transition to a more efficient and equitable financial system, the private sector has developed interesting mechanisms for inter-industry financing, and private commercial banks have increased their participation in the direct and indirect financing of agriculture. There is concern that this process is overlooking many enterprises, especially the smallest and weakest ones.

Several policy measures have been suggested to ensure that the process will produce a more democratic financial structure. For example, special attention should be paid to supporting the corporate organization of small producers, to providing incentives for intra- and inter-industry financing, to developing Central Bank policies aimed at encouraging private-bank involvement in agriculture, and to restructuring agricultural development banks.

Introduction

In the current context of the reach for competitiveness, the commitment to conservation of natural resources, and the desire for an urgent response to social problems, a new framework of relations between the public and private organizations, within the scope of the world market, is needed. This paper raises some of the key issues in policy making in the building of complementary relations between the public

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1/ Director of Program I: Agricultural Policy Analysis and Planning, Inter-American Institute for Cooperation on Agriculture (IICA). The views expressed are those of the author and should not be attributed to IICA.

and the private sectors involved in the financing of agriculture.

In general, it is agreed that increased global benefits will accrue as prices move towards equilibrium and aggregated investment grows. However, there has been concern that, in this transition, there will be a lopsided accumulation of benefits to investors with greater capabilities to access resources, and who make the best of their market opportunities.

In the first section, the paper reviews the current thought regarding the liberalization of financial markets. There is a tendency toward the elimination of subsidies for the financing of the private agricultural sector. In many cases, proposals also include the elimination of public agricultural development banks. No debate will be begun here regarding interest rate subsidies; however, the elimination of agricultural development banks appears to be a simplistic way of restructuring a new institutional system. With this caveat, the remainder of the paper provides arguments for a new financial framework in which public and private entities complement efforts, with the purpose of providing more financial resources and services for agriculture.

In the second section, the main actors in the financial system and in agriculture as a productive sector are identified, with special attention to public and private entities. If agricultural enterprises that are more competitive and sustainable are to be achieved, it will require certain investment and financing conditions, discussed in the third section. At the same time, these needs pose a challenge for the financial system in providing the resources and services needed by users, while satisfying standard financial institution performance requirements.

These aspects are presented in the fourth section, highlighting, on the one hand, the conflict of interest inherent in the different objectives and goals of producers and those of financial institutions and, on the other, the uneasy relationship between private sector objectives and overall social goals. Any policies developed must reconcile these interests, as well as develop mechanisms for achieving multiple goals.

Thus, the fifth section offers suggestions for public policy. The international development funding organizations will be instrumental in shaping the financial institutions of the future.

A Liberalized Financial Environment[1]

An analysis of the logic behind financial liberalization is reviewed in this section. Directed credit policy has progressed under the assumption that lesser-developed countries (LDCs) have imperfect and inefficient financial markets; hence, state intervention is required to direct the flow of credit to the preferred or high-priority sectors. In an imperfect financial market, there is a great disparity between private and social profits deriving from loans granted to different sectors, which may be attributed to three factors: (1) banks may overestimate the risk, administration, and collection costs associated with extending loans to high-priority sectors; (2) the banks' desired rate of return on loans may be higher than the correct marginal social rate of time preference; and (3) banks may not take into consideration the external benefits which expansion in high-priority sectors will yield for the rest of the economy.

Governments in LDCs have used various instruments to direct the flow of credit to their high-priority sectors. These include, among others, imposing a general ceiling on lending rates, giving lower rediscount rates to priority sectors, requiring banks to allocate a certain proportion of their loans to priority sectors, creating specialized banks to serve the credit needs of high-priority sectors, and establishing special credit guarantee programs for high-priority sectors. All of these were often carried out at the same time.

Critics of directed credit policy have appealed to both theory and fact to point out its untenability and adverse effects on the financial markets. Their main contention is that it has repressed the financial system. As a consequence of ceilings on lending rates that are below the market-clearing rate, deposit rates have to be kept low to allow bank profibility, thereby causing financial disintermediation. The lack of available loans forces potential investors to rely more on self-finance, which has strong repercussions for some sectors of the economy, including those considered by government as high-priority.

The strangulation of funds flowing to priority sectors often causes monetary authorities to institute an excessively liberal rediscounting policy. This unnecessarily raises money supply, which in turn causes a high inflation rate. The high inflation rate produces a negative real rate on deposits that ultimately results in more financial disintermediation.

The directed credit policy is further weakened by the fungibility of funds (Adams *et al.* 1990). That is, borrowers may use loans for purposes other than the ones stated in the loan contract. In this case, it is useless to direct credit to priority sectors. It is also argued that when interest-rate ceilings become more restrictive to make credit cheaper to priority (rationed) sectors, the size of the loans granted to the nonpriority (nonrationed) sectors increases, while that of priority sectors decreases. Adams *et al.* (1990) argue strongly that directed credit policy further aggravates the problem of income inequality.

In the early 1970s, McKinnon (1973) and Shaw (1973) encouraged financial liberalization as a way to develop the financial markets of LDCs. This would involve the freeing of the interest rate, so that the supply of funds would equal the demand. For LDCs, this would stimulate an upward adjustment in the interest rate to reflect the true scarcity of funds. Additionally, other policies that tended to repress the financial system would need to be dismantled.

In the early 1980s, several countries caught a financial liberalization fever. It could be attributed largely to the IMF and the World Bank, which began to emphasize financial liberalization in their programs. It should be noted that the world entered the 1980s under the effects of the second oil shock, and many countries, especially in Latin America depended on the IMF and/or the World Bank for financial assistance to enable them to restructure or stabilize their economies.

So far, the results of financial liberalization are mixed. In some countries of Latin America, as of the mid-1980s, financial liberalization seemed to have failed (Diaz-Alejandro 1985), but the 1990s presage an improved scenario (ALIDE 1992). The different results of financial liberalization apparent in several countries have been attributed to diverse factors (Corbo and de Melo 1987; McKinnon 1987). One was unfavorable external shocks; another was an inappropriate order of economic liberalization; still another factor was macroeconomic mismanagement during the transition from a politically repressed regime to a liberal one.

The McKinnon-Shaw view has been challenged by several authors, notably Wijnbergen (1983), Taylor (1987) and Diaz-Alejandro 1985) and on several occasions by institutions such as ALIDE, the Association of Latin American Development Finance Institutions. In his empirical analysis using Korean data, Wijnbergen found that the substitution between deposits and curb market loans was more important than that between currency and time deposits. Since banking system deposits are subject to reserve requirements, the shift from curb market (which provides one-for-one intermediation) to deposits would cause a decline in the total supply of funds to the business sector.

That it is not easy to restructure an economy via financial liberalization alone is apparent in the title of Diaz Alejandro's article: "Good-Bye Financial Repression, Hello Financial Crash." Corbo and de Melo indicated that the Southern Cone countries of Latin America, namely Argentina, Chile and Uruguay, introduced wide-ranging liberalization reforms between the second half of the 1970s and the first half of the 1980s, with variation in timing and intensity. Interest rates were deregulated at the same time that anti-inflationary measures were introduced. Real interest rates shot up to unprecedented levels. McKinnon (1987) attributed the high interest rates to the breakdown of proper financial supervision over the banking systems of the Southern Cone. Bad loans that had been rolled over several times constituted a large proportion in the loan portfolio of banks, creating what Harberger (1985) calls a "false" demand for credit, and the eventual collapse of banks.

The failure of financial liberalization efforts in several countries has prompted many economists to rethink their theories. There was a consensus that liberalization *per se* is not doomed to failure. Several countries did it and emerged successful; but the execution of it was not as simple as first thought. Many have recognized the need to closely examine the context within which liberalization is being introduced. In particular, it has been noted that a certain degree of stability must first be achieved by the economy before any attempt at liberalization is made; otherwise, stabilization takes precedence over liberalization. Also, many have recognized the importance of examining closely the process of liberalization, and of managing it properly. Thus, emphasis is on the order and speed of economic liberalization. There is a consensus that domestic markets must be deregulated first, to ensure that resources are reallocated more efficiently. The liberalization of the current balance of payments accounts must follow. The last to be liberalized would be the capital account of the balance of payments.

Box 5.1. Liberalization of Financial Markets and Deregulation

There is a crucial distinction between wholesale liberalization of financial markets and properly monitored deregulation. A clear understanding of this distinction could have at least mitigated several unfortunate developments:

- In Chile, banks allowed the debt of affiliated firms to rise even though these firms were doing badly and should have been forced to liquidate. Hence, less credit was available for more profitable independent firms.
- Bankers suddenly placed in a free market environment failed to recognize that the increase in the interest rates tended to redirect their loans away from low-risk, low-return activities, resulting in 'adverse selection' (Stiglitz and Weiss 1981). Better bank monitoring might have resulted in less upward pressure on lending rates.
- De facto deposit insurance provided incentives for undue risk-taking. Banks with poor portfolios were able to attract new funds by raising deposit rates, thereby forcing less-risky banks to match these rates.

Source: Lamberte 1992.

Even the most prominent advocates of financial liberalization have recently taken a different view. While still endorsing a liberal financial policy and cautioning policy makers against going back to the financial repression syndrome, McKinnon (1991) takes the view that in the presence of macroeconomic instability and problems of the moral hazard in banks, an interest rate ceiling on loans is in order. Views on financial policy have apparently swung from one extreme to the other, with the most recent view taking the middle ground in view of the need to manage the transition from a repressed financial regime to a more liberal one.

This brief review of current issues on financial liberalization provides information regarding the environment in which agricultural enterprises have to compete for financial resources. It would appear that the times for subsidized interest rates and directed credit of agriculture are gone.

Identifying Actors in the Agricultural and Financial Sectors

It has been usual to discuss agricultural financing within the scope of relations between farmers, agricultural development banks and informal financial intermediaries. Here we can see that, even in the countries with the less-developed financial systems, it is worthwhile to look at a broader scenario, where many actors engage in transactions of commodities, inputs, capital goods, financial services and non-financial services. Figure 5.1 identifies these actors. We start with the recognition that agriculture should no longer be considered solely as the activities directly related to production of crops, trees and livestock (Piñeiro 1988). Agriculture is in fact a conglomeration of many activities within a system with different levels of use of the land. It is also recognized as a series of chains (with important transnational liaisons) through which primary commodities are produced and transformed into numerous final consumer products. Thus, agriculture should be visualized as an agriculture-agroindustry complex. On the other hand, agriculture is only one of the multiple activities underway in the rural space.

We can identify many actors in the productive system (as shown in Figure 5.1) who relate with each other through market transactions and contracts. Three observations are important: First, within each segment are important differences, including groups with varying capabilities, revealed by their stock of physical assets and state of knowledge. Second, the reciprocal dependence that these groups have created as they all participate in the market for goods and services. Third, to a lesser or greater degree, many of the actors in agriculture have international partners. Moreover, this partnership is growing as the economies become more interrelated.

These three observations become relevant if we are to evaluate the financial relationships between the various parties involved and the prevalent financial climate. Two of these relationships are, first the existence of intraindustry financing (ALIDE 1992), which has been growing, especially in cases of articulated efforts between primary producers and agroindustrial firms. The second is the growing financial relations with external partners, one of the elements providing most dynamism to trade-related enterprises in the agricultural system (IICA 1990)

These two types of relations should be seriously considered and quantified. They should also be encouraged in the process of mobilizing financial resources for private investment in agriculture, and should be kept in mind in the process of building stronger public-private and private-private relations.

The financial agents most directly related to agricultural enterprises have been the informal and formal rural lenders and agricultural development banks (ADBs) (Adams *et al.* 1990). Central Banks have played the traditional role of financing agency to recapitalize ADBs after a systematic loss of funds, due to poor performance.

In an examination of the actors in the financial sector related to agriculture, a brief comment is made regarding their evolution and challenges in response to the liberalization of financial markets and the recuperation of the role of central banks: as the controls on interest rates are released and as agricultural development banks are deprived from the privilege of providing credit at less than market rates, one expects interest rates to tend to equalize for loans of similar characteristics. As a result, informal financial intermediaries

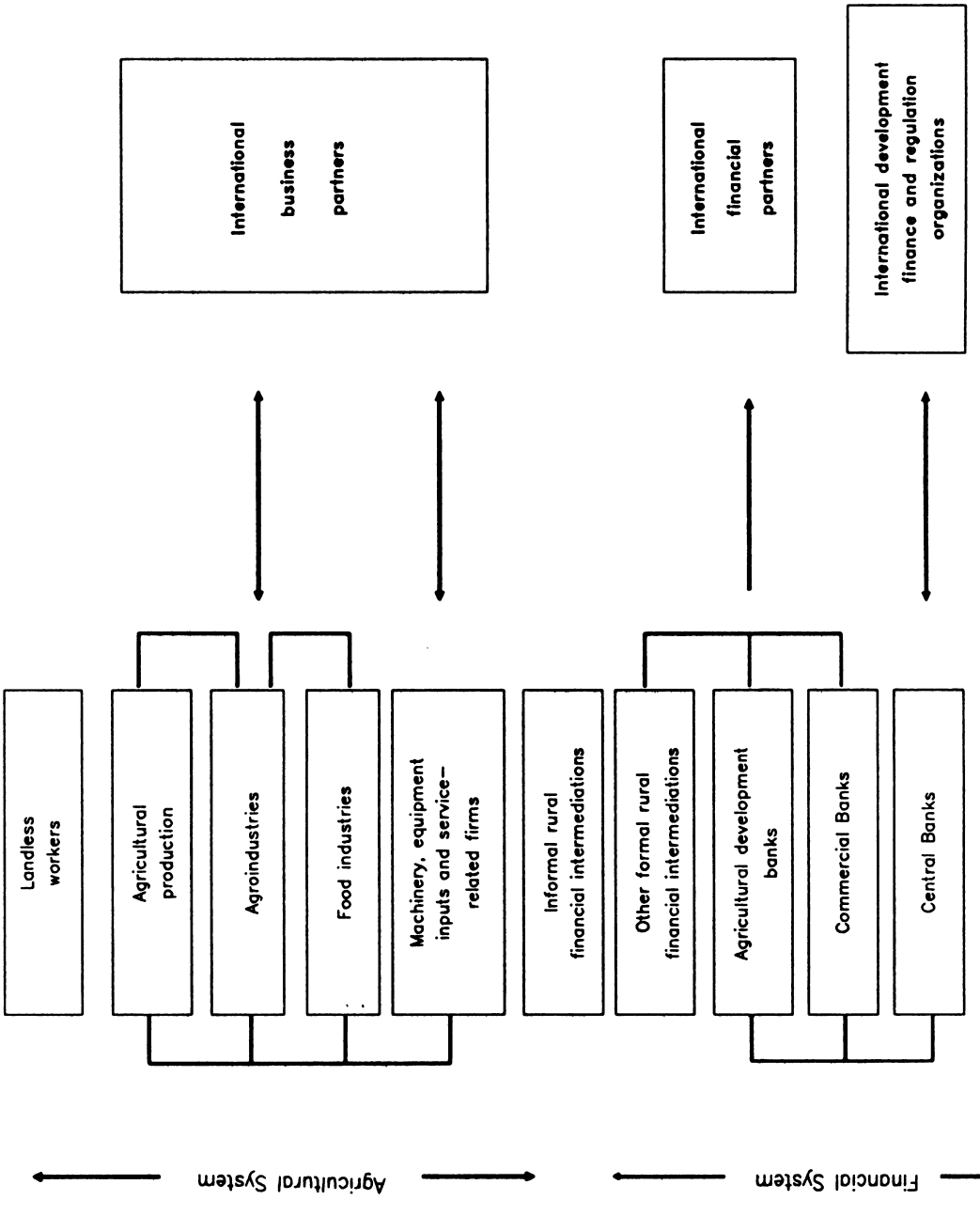

Figure 5.1 Actors in the Agricultural and Financial Sector

Source: Adapted from Pomareda (1984)

intermediaries may find themselves facing a reduced demand for credit; and agricultural development banks will be getting rid of the smaller, riskier loans, shaping up their portfolios. At the same time, one would expect commercial banks to take some additional share in the supply of financial resources to agriculture, but with preference for more commercial operations as a natural response to the goals of private financing entities. One would expect, therefore, a smaller amount of institutional credit to small producers acting individually.

Box 5.2. Alternatives for Agricultural Financing

The financing of agriculture can not be left to the banking system alone; thus firms involved in agriculture and agroindustry should seek resources in the financial market. In Central America the stock market is developing as an interesting alternative. In the particular case of Costa Rica, which contributes to most of the size of the Central American financial operations, 70 percent are public assets, especially government bonds, the remaining being provided by the private sector. To date, only one percent of traded assets belong to corporate shares. The development of this financial market in Central America is seen as the most important means of contributing to strengthening regional integration and eventual monetary unity.

Source: La Nacion, Costa Rica, May 3, 1993.

The corollary is that the current policies would be creating an environment for the emergence of new financial intermediaries in rural areas; for the smaller producers to get organized as a means to access together for commercial loans; and for better interaction among partners in the domestic and foreign agroindustrial sector.

This creates one of the most important policy issues for the agenda: Are small- and medium-sized enterprises a goal in the structure of agriculture and, if so,what can be done to encourage and accelerate the creation of mechanisms for more financial resources to flow towards such enterprises?

Financial Resources, Conditions and Services Required

The challenges and opportunities offered by the process of globalization imply that firms in agriculture need to considerably improve their capabilities to cope with the challenges ahead. The requirements are two: first, to become better prepared to compete in domestic and international markets; second, to comply with the requirements of not deteriorating their own natural resource base and the environment. Both aspects demand financial resources, particular financial conditions, and a number of financial services.

Box 5.3. During Adjustment, the Number of Financial Institutions Declines

An important fact observed during the process of macroeconomic adjustment is the decline in the number of financial institutions, either through merging or closing. In the case of Argentina, for example, between 1980 and 1992 the total number of financial entities declined by 50 percent, although public entities did not change. Private national banks declined by 30 percent and private international banks increased by 18 percent. In Costa Rica, during the period of adjustment between 1985 and 1992, the official credit to agriculture declined, but intraindustry financed increased two-fold. In Chile, between 1986 and 1992 foreign investment grew from US$184 millions to US$1150 millions.

Source: ALIDE (1992). Rol de la Banca de Fomento en el Contexto de la Liberlización Financiera.

Technological innovations and managerial capabilities constitute the most needed improvements in agriculture. Technological innovations require new strategic inputs, capital assets and knowledge that firms have to acquire, either in the market directly or through firms that provide services (Goodman *et al.* 1987). Improving managerial capabilities at all levels in the enterprise implies the acquisition of educational material, participating in training events, accessing information and receiving direct technical assistance. Usually the financial entities that serve agriculture do not provide financing for these needs.

The achievement of more sustainable enterprises implies investments for the improvement of quality and stock of natural resources. Although with difficulty, this can be done if amortization periods are short and if the lending strategy does not review current discounting procedures. The problem is aggravated by the fact that are usually the poorer producers who need more from the improvement in the quality of their resources base.

The requirements to be competitive and to take the path toward sustainable enterprises all have financial implications. One refers to the cost of capital, which also has to reflect the challenge of being competitive. Second, the administration costs of the loan provided have to be reasonable. And third, there are forgone producer earnings due to frequent trips and time devoted to comply with paper work required by the lender. Evidently these conditions need to be substantially improved for the financial system to be a real partner to producers.

The ADBs have traditionally organized their loan portfolio by commodities; furthermore, in the recent financial environment, this portfolio has been concentrated in very short-term loans (ALIDE 1992). The need for change in practice is evident. On the other hand, commercial banks, usually with much less involvement in agriculture, manage their loan portfolios by projects. Within the project structure, there is emphasis on the financing of capital assets and infrastructure, and a very limited support for the improvement of capabilities. This practice follows the hypothesis that those requesting financing have the ability to make their project viable, an assumption not always entirely true.

The financial services required in modern agriculture derive primarily from the relations that enterprises in agriculture maintain with partners in other sectors and abroad. It is evident that today's financial services are as important as credit *per se*, especially for firms involved in transactions in foreign markets.

One service subject to much discussion and controversy is agricultural insurance. The issue will become more important as the impacts of weather instability become more severe and as more capital assets are put at risk, and as agriculture is less protected by traditional pricing policy instruments. For a long time, crop insurance was provided by public institutions with heavy subsidies and strong evidence of moral hazard (Hazell, Pomareda and Valdes 1986). During recent years, however, because of a new way of visualizing government intervention in agriculture, there are few such programs. Private insurance in agriculture should be encourged as a required service. So far, it has been quite selective and premiums reflect the structure of the insurance industry in each country. In most cases, insurance seems to be a very profitable business.

An important issue demanding action is the limited use that producers make of services provided by the financial system. The data that follow illustrate the case of three programs in Venezuela as of 1991. It is often the case that farmers are accused of being backward and not sensitive to market signals. Rather, one should look for the explanation for farmers' behavior in their insufficient access to

information. In this regard, a most important policy issue pertains to the role of government in supporting programs for the wide diffusion of information.

Box 5.4. New Financial Services for Agricultural Modernization

As enterprises in agriculture become modernized and more involved in trade, their requirements for financial services grow. In contrast with agricultural banks, most commercial banks are already providing such services. They are grouped in three major areas:

a. Credit: specific lines for agroexport; joint financing with international counterparts; investment financing with social commitment (with participation of development finance); co-financing with other banks.

b. Deposits: deposit certificates; savings accounts; checking accounts, investment certificates; accounts in foreign currency; overnight interest payments; master accounts.

c. Services: exchange of foreign currency; international transfers; credit letters, traveler checks, credit cards, trust funds, payment of local commercial accounts to government/firms, automatic tellers.

A recent survey revealed that the demand for financial services is growing; thus bank profits are derived increasingly from the provision of such services rather than from credit operations. The reasons given are low demand for investment money; innovation in the quality of services, and also the fact that financial services are provided on the basis of commissions, thus they do not affect the bank balance.

Source: F. Delgado 1993, personal communication.

Multiple Goals: A Conflict of Interest in the Evidence

The public-private relationships that are required to induce adequate financing of agriculture must be developed in the understanding that there are goals and objectives of agricultural enterprises, banks and governments which do not always harmonize. A brief review of these issues allows an understanding of the policy needs that will stimulate the appropriate scenario. Agricultural producers and investors, given their goals and financial needs, would always prefer lower interest rates, longer periods of amortization and low administration costs.

Box 5.5. The Crop Insurance Programs

Regarding the financial viability of all-risk crop insurance programs, they will need premium rates around 20 percent to be able to cover indeminities and administration costs. Reinsurance is also an unavoidable requirement. In the mid-1980s, most public agriculture insurance programs had premiums of 5 percent, thus depending heavily on government subsidies.

Source: C. Pomareda 1986.

Box 5.6. Knowledge of Formal Financial Intermediaries

It is often the case that services provided by formal financial intermediaries in agriculture are not known by producers, whether as a result of insufficient effort of the financial entity or lack of user interest. This lack of knowledge tends to be more significant among smaller producers, as evidenced by a recent survey of the following financial support programs in Venezuela.

The data reflect the percentage of farmers that indicated: A = does not know the program; B = knows the program but does not use it; C = knows the program and has made use of it; D = is not interested in knowing about it; E = does not respond.

Response	CORPOINDUSTRIA				BANCO INUSTRIAL (BIV)				FONCREI			
	L	M	S	VS	L	M	S	VS	L	M	S	VS
A	22.4	25.0	27.4	32.2	29.2	36.4	40.3	48.4	21.1	30.2	36.7	52.8
B	51.4	42.5	36.2	34.9	39.9	36.9	30.5	21.6	49.0	41.6	37.4	23.8
C	9.9	17.5	22.5	16.5	14.1	10.4	8.5	6.1	18.3	13.3	6.0	2.7
D	15.8	14.6	14.7	16.5	16.1	16.3	20.3	22.6	11.2	14.8	18.9	19.9
E	0.5	0.4	0.2	0.2	0.6	0.9	0.4	0.2	0.4	0.4	0.9	0.7

L = LARGE M = MEDIUM
S = SMALL VS = VERY SMALL

Source: OCEI. Encuesta Cultivativa del Sector Industrial 1991. Cuadros 15, 17 y 19.

There is also an expectation of not providing collateral. Unfortunately, in reality they face exposure to uncertain market prices and risks derived from climatic instability, pests and diseases, and the usual vagaries of agriculture. All this, added to the small size of loans requested, makes most agricultural investors unappealing clients for commercial banks.

Commercial banks are businesses like any others; therefore, management of their portfolio of assets and liabilities, and the strategy for the services they provide, obey the usual criteria of utility maximization; a point of convergence in the axis of returns and risks (Jessup 1990). They operate under market interest rates and rarely discriminate in favor of agricultural projects; they do discriminate, however, against smaller and riskier loans. Collateral requirements are still a major demand on any loan provided, and no alternatives seem to be available. In a typical analysis of the cost structure of a commercial loan operation, one would expect the following components: financial cost, administration and legal costs, and the cost of risk insurance. Agricultural loans usually have a high proportion of the last two components, and one can understand why they do not parallel the interests of commercial banking, unless insurance is provided and size of loan is increased.

An awareness of the above characteristics of agricultural projects and the interests of commercial banking has provided the rationale for public ADBs. As has been shown through many experiences, ADBs have existed thanks to government subsidies to interest rates and allotments to cover high administration costs (Pomareda 1984). Poor loan recovery has been a common feature. Their performance has been severely questioned on many grounds,

thus ADBs have been set out simply as government agencies to channel financial resources to agriculture. Even today, there are some ADBs which do not take deposits nor provide services other than credit. They were rarely managed as banks, thus the structure of assets and liabilities in their portfolios, and strategies for diminishing administration costs were not present. There are, however, notable exceptions, and during the past decade several development banks have made important improvements in their performance.

It must be clear that the criticism of the past performance of agricultural development banks should be kept separate from the rationale for development financing. The goals of development, the new financial needs and the awareness of structural conditions that limit the access to credit by small producers have to be matched by a development finance strategy. ADBs can still play an important role in such a strategy. In recent years, some ADBs are moving up to follow the role of second-floor banks, thus stimulating the emergence of other financial intermediaries. Some ADBs are financing new non-traditional needs in agriculture, which may justify special financial conditions. Such may be the case of reforestation projects, human capital formation, development of new technologies and strategic inputs, among others.

Another separate but related issue in banking concerns the making of profits in financial transactions as such. During periods of financial stress, uncertaintly in production and inadequate management of exchange rate policy, many countries have seen an extraordinary flourish of financial operations with very limited amounts going into private investment. There has been also the case of borrowing at subsidized rates for use in the financial market. This issue is one that deserves major attention, as financial liberalization and larger financial flows are not always indicators of improvement of investment.

From the above, we see that, left alone, the financial system may evolve into a facilitator of an economic structure that is not consistent with the development strategy. This is not the time to return to severe government controls in the capital markets; the evidence has demonstrated the pervasive effects of traditional measures. Still there is justification for government regulation; there are many means by which governments can orient the performance of the financial system as a useful means for development, without serious distortions.

The Policy Issues

The modernization of agriculture requires an important influx of financial resources, favorable financial conditions and new financial services. There are already important gains from the reform in the financial system; however, the allocation of resources is biased toward enterprises who seem to be better candidates in the eyes of the commercial financial institutions.

The process has taken this direction partially because the financial market acts as a mechanism for efficient resource allocation without explicit differentiation of social needs. Also, the allocation of resources and the provision of financial services follow from the criteria and decisions enforced by financial intermediaries interested fundamentally in profits at low risk, within their usual strategy of expansion of market share.

New policies aimed at creating a financial system that is a partner for the agricultural productive sector must depart from past policies that created undesirable conditions and privileges for a few. The new policies could include some of the following:

- Incentives for smaller farmers, assisting them in organizing corporate groups to become more attractive to lenders.
- Provide technical assistance and preinvestment funds to producers to prepare projects that include specific measures to diminish the impact of risks and activities that improve managerial capabilities.

- Create fiscal incentives to corporations and industrial organizations that commit themselves to financing and technical assistance to producers, especially the smaller and most needy.

- Manage central bank policy instruments, such as leverage requirements, to stimulate the commercial banking system to provide credit to agricultural enterprises.

- Legislate to promote commercial banks without dominant ownership; *i.e.*, many owners, of no more than 5% by individual share.

- Help the agricultural development banks to redefine their functions, to improve their managerial skills, and to place themselves properly in the financial market.

- Stimulate the emergence of new financial intermediaries (loan and saving agencies, cooperatives) and assist them in the improvement in their managerial capabilities and in the strengthening of their financial position.

- Develop a public investment strategy that privileges the development of human capabilities and infrastructure to ameliorate the risk exposure of the most-needed producers.

In general, the policies should be aimed at the strengthening of a financial system, with important linkages abroad, to become a partner to the productive structure. The public sector can play an important role in the enforcement of these policies; yet the banking system has to take its share of responsibility. We must demand that, in the provision of financial resources and services and, in contrast with other services (also discussed in this symposium), there are obvious conflicts of interest. Once they are managed properly, there will be gains for everyone; that day will come when more financial resources are assigned and managed properly in agriculture.

Bibliography

ADAMS, D.W., GONZALEZ VEGA, C. and VON PISCHKE, J.D. Eds. 1990. Crédito agrícola y desarrollo rural: La nueva visión. Ohio State University. Columbus, Ohio.

ALIDE. 1992. Rol de la banca de fomento en el contexto de la liberalización financiera. Caracas, Venezuela.

CORBO, V. and DE MELO, J. 1987. Lessons from the Southern Cone policy reforms. Research Observer 2(2).

DIAZ-ALEJANDRO, C. 1985. Good-bye financial repression, hello financial crash. Journal of Development Economics 19:1-2: 701-30.

GOODMAN, D., JORJ, B. and WILKINSON, J. 1987. From farming to biotechnology. Oxford:Basil Blackwell Ltd.

HARBERGER, A.C. 1985. Lessons for debtor country managers and policy makers. In: International debt and the developing countries. G.W. Smith and John Cuddington (eds), Washington D.C.: World Bank, 1985.

HAZELL, P.B.R, POMAREDA, C. and VALDES, A. 1986. Crop insurance for agricultural development. Baltimore:Johns Hopkins University Press.

IICA. 1990. La modernización de la agricultura. San José, Costa Rica:IICA.

JESSUP, P.F. 1989. Modern bank management. St. Paul Minnesota:West Publishing Co.

LAMBERTE, M.G. 1992. Financial and trade liberalization and the agricultural sector. Washington D.C.:APAP II. USAID.

MCKINNON, R.I. 1973. Money and economic development. Washington D.C.:The Brookings Institution.

MCKINNON, R.I. 1987. Financial liberalization in retrospect: Interest rate policies in LDCs. In: The state of development Economics: Progress and perspectives. G. Ranis and T. P. Schultz (eds). New York: Basic Blackwell, Inc.

MCKINNON, R.I. 1991. The order of economic liberalization: Financial control in the transition to a market economy. Baltimore and London:The John Hopkins University Press.

PIÑEIRO, M.E. 1988. La modernización agrícola y sus vínculos intersectoriales en el desarrollo de América Latina y el Caribe. Comercio Exterior 38 (8).

POMAREDA, C. 1984. Financial policies and management of agricultural development banks. Boulder, Colorado, Westview Press.

POMAREDA, C. 1986. The financial viability of crop insurance. In: Crop Insurance for Agricultural Development. P. Hazell, C. Pomareda and A. Valdes (eds). Baltimore and London:The John Hopkins University Press.

ROTH, G. 1987. The private provision of public services in developing countries. EDI Series in Economic Development. Oxford. Oxford University Press.

SHAW, E.S. 1973. Financial deepening in economic development. New York: Oxford University Press.

STIGLITZ, J. and WEISS, A. 1981. Credit rationing in markets with imperfect information. American Economic Review (June):393-410.

TAYLOR, L. 1987. Structural macroeconomies: Applicable models for the Third World. New York: Basic Books.

WIJNBERGEN, SWEDER VAN. 1983. Interest rate management in LDCs. Journal of Monetary Economics. p. 433-52.

1. This section draws on Lamberte (1992).

PANEL MEMBERS' COMMENTS

The former tendency of governments to use agricultural development banks as tools for implementing their social policies was underscored, with examples of countries' experiences that had contributed to a misinterpretation of the purpose of such institutions and to a failure to take their mandate into account when evaluating their performance. Their profitability in private hands had therefore been underrated, as with any other financial organization.

In regard to recommendations for transforming such institutions in the context of the opening up of markets, the requirements for a transition period for that type of institution were not being taken into account, since said transformations involved comprehensive structural changes.

The actors in the agricultural area receiving support from financial institutions, mainly from deveolpment banks, were commercial farmers and the poorest farmers. In the majority of cases, an important sector of small farmers occupying the intermediate ground between the other two groups had been bypassed. It was argued that significant production potential existed in that segment of farmers to contribute to an increase in quality.

Discussion

The participants illustrated various aspects of the topic with specific experiences in their countries, among them: bearing in mind the development of the countries' financial sectors, it was argued that there was an important area for governments to ensure an orderly transition in the trasformation of financial institutions so that they could adapt to new development strategies. What was important were considerations of "financial prudence." The private sector, for its part, should concern itself with giving impetus to "financial diversification and innovation."

In regard to the design of financial institutions in the context of new development strategies, examples were given of experiences illustrating the "group responsibility or warranty" feature, incentives for credit officers and the promotion of technological and environmental conservation.

SERVICES FOR THE PROMOTION OF TRADE

SUPPORT SERVICES FOR PROMOTION OF TRADE: THE ROLES OF THE PUBLIC AND PRIVATE SECTORS

David Tunik [1/]

Summary

The liberalization of the foreign sector is one of the structural adjustment and reform measures accepted by a growing number of developing countries since the 1980s. The process of liberalization fosters the "outward" growth of the economy, with the greatest emphasis being placed on private investment and the development of export potential. To this end, the goverment complements private sector efforts to foster growth, anticipates changes in the international context and promotes actions in the country, and abroad, to facilitate the export of commodities.

Measures to open up the economy do not automatically lead to a drastic increase in the volume of exports. It is necessary to give the process a boost, developing an integrated program that considers both the development and conversion of the production sectors, with a clear emphasis on international markets, and reinforcing the necessary support services and infrastructure. In the future, the external sector must contribute not only to renewed growth but also to the necessary long-term changes in the structure of the economy.

Exportation provides a country with the means to expand the market for its products. As the scale of production increases, it is possible to cut unit costs, lower prices in the country and abroad, and, as a result, generate greater employment, increase production and make full use of the installed capacity. The opening of the economy fosters competitiveness and leads to a more efficient allocation of resources and to the dissemination of technologial changes that benefit the economy as a whole. At the same time, it makes a variety of products readily available to the consumer, without burdensome taxes. The opening of the economy also promotes production by facilitating the importation of inputs for both the primary and manufacturing sectors.

A program to develop exports includes a series of interrelated elements that are brought together in national economic development plans. The development of exports involves a series of institutions, as well as the central agency responsible for promoting trade: ministries responsible for production, transportation and foreign relations; commercial and development banks; institutions that provide services such as quality control and packing; and business sector associations, such as sectoral chambers of commerce and similar organizations.

The clear definition of functions and responsibilities, as well as corresponding inter-institutional integration and coordination mechanisms, are essential to the success of export programs. Once the appropiate macro-economic framework is established, the export

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1/ Consultant on International Trade. Chief of Latin American and Caribbean Officce on the Center for International Trade UNCTAD/GATT (until 1992).

process must involve entities from both the public and private sectors in order to properly integrate the principal elements of the process; identify opportunities on international markets; adapt and develop the supply of exports; identify, promote and develop investment projects for exports; strengthen human resources; and develop export support services and infrastructure in the country and abroad.

Some of the principal support services and infrastructure are: a) in the country: trade information; certification and quality control; packing; financing and credit insurance; joint export mechanisms; costs and prices; legal issues and controversies; procedures; publicity; specialized farmers' markets; missions; international distribution; b) abroad: trade bureaus; specialized farmers' markets; missions; international negotiations; promotion of investments. In the public sector, the Export Promotion Agency is in charge of operations. In most countries, formulas have been established to ensure that efforts are properly coordinated and integrated within the public sector and between the public and private sectors. This is carried out through high-level export boards, commissions or committees, or their equivalent.

The Opening of the Economy and Trade Development

Adjustment programs

The liberalization of the foreign trade sector is part of structural reform and adjustment measures adopted by an increasing number of developing countries as of the 1980s. The liberalization process is focused on an outward growth of the economy with strong emphasis on private investment and the development of the export potential. The process (Fig. 6.1) starts with the definition of national economic development objectives, determined by the countries' policies and strategies. This will in turn set up the economic framework to enable the development of the foreign trade sector, including a new institutional framework as well as the formulation of a medium-term export development plan.

For this purpose, the government adopts a role complementary to the private sector effort in reactivating growth; anticipates changes in the international environment; and promotes new actions within and outside the country to facilitate the development of export activities.

The adjustment programs for the export sector usually include the establishment of a "neutral" rate of exchange, which means not having a negative effect on the export sector; the elimination of anti-export bias; the opening of the economy to international competition; privatization schemes and an active role for the private sector; at the government level, reduction of the public sector deficit and control of inflation to stimulate savings and the development of export-oriented investments.

Export development

A drastic increase of exports in response to the opening of the economy is not automatic. The process should be activated through a set of carefully concerted actions, starting with the formulation of an export development strategy and the establishment of an adequate framework for the trade sector. It must take into account development aspects; the reconversion of the productive sectors with a clear focus on the international market; and the strengthening of support and infrastructure services required. The foreign trade sector should therefore not only contribute to the reactivation of growth, but in the long term contribute also to the necessary transformations of the economic structure.

Exports represent the vehicle through which a country can expand the market for its products. As the level of production increases, costs can be reduced, both for internal

consumption as well as for the export market; this should stimulate additional employment, increase the level of production and promote a better utilization of production capacity. The opening of the economy stimulates competition, contributes to a more efficient allocation of resources, and to the dissemination of technological changes, all of which will benefit the economy.

Import regimes

Trade liberalization measures adopted by an increasing number of countries have a direct effect on the import regime of products utilized by the agricultural sector; in fact, import items previously subject to restrictions or monopolies have been opened to a healthy competition. Considering the economy of scale resulting from larger orders (import value and shipment costs), it has become interesting to observe the strengthening of specialized importing companies through tailor-made import procurement programs, such as the ones offered by the International Trade Centre UNCTAD/GATT (ITC).

Elements of an Export Program

Participants

An export development program includes several interrelated elements, integrated under the framework of the national economic development plans. It involves several organizations, in addition to the focal point institution for trade promotion (hereafter called the TPO): ministries responsible for production, transport, external affairs; commercial and development banks; institutions responsible for export-related services such as quality control and packaging; and business sector associations such as chambers of commerce.

Requirements

To reach a sustained growth of exports, it is necessary to (Box 6.1 and 6.2):

- Design an export-oriented macroeconomic policy with clear and positive signals to the business community.
- Evaluate main obstacles affecting expansion of exports, establishing relative importance, possible formulas to overcome the obstacles identified, and the role to be played by the public and private sectors.
- Provide incentives and support measures, including physical infrastructure.
- Evaluate export supply and analyze the export potential vis-a-vis international demand.
- Formulate a mid-term export promotion and development strategy, to ensure continuity in the work to be undertaken by the different institutions involved (this is a relatively new concept for most developing countries), as well as the formulation of export development programs for specific product groups.
- Identify natural, human and financial resources, as well as technological inputs required for the implementation of the export programs.
- Identify, develop and/or strengthen the physical infrastructure and support services required .

Most frequent obstacles

The analysis of experiences of several Latin American countries covered by an ITC study some years ago indicated that export promotion and development efforts are frequently limited by:

a. Lack of adequate strategies and well-conceived national trade promotion programs of an integrated nature.

b. National institutions without sufficient authority and, in many cases, without the necessary resources to formulate and execute coordinated export programs.

c. Insufficient coordination among the different participating institutions, including main institutions involved in trade promotion and those related to export-oriented production and to the business community, which will have the ultimate responsibility in the execution of the export programs.

d. Frequent changes in the "rules of the game."

Interinstitutional coordination

Organizations involved

Research was undertaken by the ITC in 1989 which covered some 80 developing and developed countries, aimed at determining the distribution of institutional responsibilities related to the foreign trade sector. Concerning agricultural exports, the study indicated that, with few exceptions, the official organizations (ministries of agriculture, specialized institutes for agricultural extension or equivalents), play limited roles in trade promotion, as they focus their activities on policy matters and on internal supply.

The focal point for export promotion (TPO) is the main institution with responsibilities for export promotion and development. Its structure varies from one country to another: in some cases, it is a government body under the umbrella of a ministry; in others, it is an autonomous or semi-autonomous organization with the participation of the private sector.

While acknowledging the importance of the TPO, it must be emphasized that export promotion and export development are not the sole responsibility of any one organization, but rather call for a national effort with the participation of several institutions from the public and private sectors. An adequate interinstitutional mechanism of coordination is therefore most vital.

Concerning the private sector, several organizations are involved in trade promotion activities. Among them: associations of industrialists; agricultural producers; chambers of exporters, industry and of commerce; and other professional organizations. The importance of their involvement varies from one country to another: In some countries, the private sector participates in the operational mechanisms related to the export sector and has a strong presence in the institutional coordination mechanisms; in other cases, it has an advisory role or is responsible for the operation of export-related schemes, for instance the issue of certificates of origin to benefit from the generalized system of preferences (GSP). It may influence the TPO through its representatives on boards of directors or other high-level coordination bodies. In many countries, the private sector has an active participation in the operation of support services for export.

Coordination mechanisms

A key to the success of an export program is the definition of functions and responsibilities, and the corresponding mechanisms to ensure a real integration of efforts and interinstitutional coordination. Different high-level coordination bodies include foreign trade councils, boards, commissions, and committees. Some of these mechanisms limit their composition to participants of the official sector, sometimes with the participation of the private sector in an advisory capacity. Some others include the participation of representatives of both the public and private sectors.

Examples of the first case include: the Foreign Trade Councils of Colombia and of Ecuador; the Economic Coordination Council in Paraguay; the Ministerial Council for the Development of Exports in Sri Lanka. The second case includes: the Foreign Trade Council in Bolivia; the National Export Promotion Council (CONAPEX) in Guatemala; the National Export Promotion and Investment Council (CONAFEXI) in Honduras; the Joint Trade and Industrial Consultative Commission of Kenya; and the Export Promotion Council of Sudan.

While the functions of these coordination mechanisms may change, the following are common:

- Formulations and/or policy recommendations for the foreign trade sector.
- Linkage of trade policies with social and economic development programs.
- Approval of development programs for the external sector.
- Approval of corrective measures related to bureaucratic or operational problems affecting the export process, at the product or support service level.
- Ensuring coordination in the execution of programs at the public-sector level, and between the private and public sectors.
- Definition of policies concerning bilateral and multilateral agreements and economic integration schemes.

Some countries have also established marketing boards, in particular for agricultural products. These boards usually have a semi-public status, and cover activities of a regulatory as well as promotional and trade nature. Some examples: meat and grains in Argentina; jute in Bangladesh; coffee in Colombia; cardamon, silk, coffee and tea in India; citrus in Israel; sugar in the Dominican Republic; and horticultural products and dates in Tunisia.

Participation of Small Agricultural Producers in Export Activities

New prospects

Rising standards of living, especially in northern hemisphere countries, has created a regular demand for products such as flowers and new varieties of fruits and vegetables, which are mostly supplied by developing countries. Technological changes in transport, cold storage and distribution facilities have facilitated this process, opening possibilities for large and small agricultural producers, who tend to cater for the internal market, either for fresh consumption or for industrial processing.

Frequent problems

Among the most frequent problems affecting the participation of small agricultural producers in an export drive are:

- Difficulties in accessing the technology for producing the quality and varieties required by the international market.
- Lack of knowledge of international standards.
- Difficulties in ensuring the necessary inputs required for the production process.
- Difficulties in consolidating a duly classified and adequate supply for the export market.

- Lack of knowledge and experience of international marketing techniques.

- Lack of international marketing channels.

Some Experiences

ITC experience in several technical cooperation projects aimed at supporting the participation of small agricultural producers in an export drive shows that isolated actions in some of these areas are not sufficient, and if the intention is to obtain concrete results, a medium-term program of a continuous nature is required.

Some interesting examples of ITC technical cooperation projects involving small agricultural producers and export enterprises, with the cooperation of a government body, and quite often with the support of specialized international cooperation, include export villages in Sri Lanka, a project in support of exports of fresh horticultural products in Guatemala, and toquilla straw products in Ecuador.

Infrastructure and Support Services for Export

Box 6.1 shows a list of main requirements for a sustained export drive. While fully acknowledging the importance of all of them, we will concentrate now on the last point: infrastructure and support services for export, with particular emphasis on the role and responsibilities which could be undertaken in the future by the private sector. The main services to be analyzed are those indicated in Box 6.3. Among the main services are:

a. **In the country:** Trade information; certification and quality control for export; packaging; export financing and export credit insurance; joint export marketing schemes; trade disputes and other legal problems; export procedures; publicity; trade fairs and exhibitions; international physical distribution.

b. **Abroad:** Trade representations; specialized trade fairs; trade missions; international trade negotiations; investment promotion.

The private sector can play a significant role by ensuring some of these services. An adequate economic environment, with clear and stable rules of the game, is required.

We will now comment on each of these services and the role currently played by the private sector, as well as its future role. Most countries are allocating more to the foreign trade sector within their economic development strategies, and the position within these plans of agricultural and agroindustrial products is described.

Within the country

a. Trade information

This covers information on market opportunities, requirements and obstacles. It is particularly important in the case of exports of agricultural and agroindustrial products, for the frequent restrictions they have to face in the international market.

Trade information services (TIS) is a function performed without exception by the TPO. The business sector organizations related to the export sector often offer also these services to their members.

In view of the importance of this function in terms of export development as well as export promotion, and the cost and complexity of setting up a TIS, it is advisable to consider, as part of the interinstitutional coordination and

integration of efforts, the establishment of a "national trade information system for the foreign trade sector" with the participation of the different institutions involved, according to their priorities and main areas of interest. In this type of scheme, the system can also cover information on import products, for instance fertilizers, seeds and other agricultural items, as well as basic food imports, for which regular information on prices, market trends and suppliers can be ensured.

b. Certification and quality control

In some countries, export certification services are provided by an official laboratory, the operation being financed through a levy on exports (for instance the case of LATU in Uruguay). In other countries, it is open to competition among different organizations. This is the case of Chile, where several private sector institutions and universities compete in the supply of quality control and certification services for export.

For the purpose of complying with quality requirements in the case of agricultural and agroindustrial products, it is particularly important for the producer and the exporter to have a complete and updated information on standards, specifications and all kind of regulations from the buyer, including commercial quality aspects (pesticides residuals, phyto-sanitary certificates, environmental protection measures). Several sources of information are available: ISO, EEC, UN/ECE, CODEX Alimentarium, ministries of agriculture, health, and environment.

Concerning imports for the agricultural sector, it is of particular importance to have a clear formulation of specifications for the procurement process in order to facilitate quality control.

c. Packing and packaging

Inadequate packing and packaging not adapted to transport requirements and to the demands of the import market constitute a major handicap, in particular for new exporters. This involves structural and graphic design, new materials and technologies. In countries where a specialized institution does not exist, this function is most often provided by a technological institute.

d. Export financing

Financial support services include financing of production facilities for export, as well as pre- and post-shipment. Development banks, private and official banks are in one way or another involved in this activity. We will not comment on the distinct modalities and operational mechanisms concerning export financing, as the subject is covered elsewhere.

e. Export credit insurance

An important number of developing countries have established specialized institutions, in general of a private nature, which offer to the exporters credit insurance covering commercial and political risks, the last with government guaranty. Seven or eight institutions of this type exist in Latin America and the Caribbean. A joint ECLAC/ITC project in the 1980s stimulated the creation of a regional association.

f. Joint export marketing schemes

These ensure a marketing channel for small- and medium-sized enterprises which do not establish their own marketing channels abroad. Different types of schemes have been developed, among them: export consortia, trading companies; cooperatives; and export groups. Nevertheless, it is not possible to

recommend one as the most favorable, as the scheme adopted will depend on the particular conditions of each country and the type of products covered.

g. Costing and pricing

The competitiveness of a product can be substantially improved by an adequate costing and pricing for export. An important amount of documentation of particular interest for new exporters is available. In many countries, chambers, exporters' associations and training institutions offer advice on this subject.

h. Legal aspects

Chambers of commerce, exporters' associations, and specialized law firms make available assistance on contractual aspects and controversies related to foreign trade. In some cases, government support or a joint action could be important. Support services for legal aspects are equally relevant for export and import operations.

i. Export procedures

Trade promotion organizations, chambers and other business sector organizations offer advice on this subject, especially for new exporters, through seminars, manuals and other documentation. It is the concern of many countries to simplify export procedures, for example, by establishing a one-stop mechanism.

j. International physical distribution (IPD)

The physical distribution network includes, in addition to transport, all infrastructure facilities required for ensuring the transfer of the export product from its origin to its final destination. (In the case of agricultural products, it will start with the post-harvest phase.) Many councils of transport users have expressed interest in the subject, which goes beyond the usual functions of these councils (freight negotiations and information on tariffs, routes and modes of transport). TPOs in several developing countries have also expressed interest in this subject and have included activities on IPD in their work programs.

k. Export publicity

This includes the preparation of promotional material such as catalogues, directories and other types of literature. Directories are often produced by chambers or other private sector organizations, the cost being totally or partially covered by paid publicity. In some countries the, TPO is frequently involved in the preparation and financing of publicity material used for trade missions, fairs or promotional programs abroad.

l. Free zones

Free-processing zones are utilized by many developing countries, in particular in Asia, Latin America and the Caribbean, to stimulate the creation of new sources of employment and to generate additional foreign currency. To a large extent, activities tend to concentrate on textiles, garments and the assembly of metal, electric and electronic products. Nevertheless, it does not exclude facilitating the processing and further export of agroindustrial products.

m. Trade fairs within the country

Many countries utilize trade fairs as an instrument to support the expansion of their exports. There is a clear trend in favor of the organization and participation in specialized fairs —both within the country and abroad— rather than in general types of fairs. In addition to the

TPO, which normally includes this function among its activities, private sector organizations are also often involved, and in some cases the private sector takes on the overall responsibility. A Paris-based organization groups main international fairs at the world level. Another organization based in Lima (AFIDA) groups the main Latin American international fairs.

Abroad

a. Commercial offices

These represent one of the most important support services abroad, and one that demands a substantial amount of financial resources. Current activities include market research, identification of trade opportunities, support to participation in trade fairs, investment promotion, and joint ventures. In addition, commercial offices ensure a regular flow of information on the geographic area they cover. Commercial offices depend directly from the TPO, though in many cases diplomatic representations complement or strengthen their work. In some developed countries, the private sector has been given the possibility of appointing personnel abroad (the Scandinavian countries); in other cases, the bilateral chambers abroad perform these functions (Germany).

b. Specialized trade fairs

Participation in specialized trade fairs abroad (for instance, ANUGA, SIAL, and ALIMENTARIA of Barcelona for food products) not only supports actual business, but also contributes to the identification of product adaptation requirements and possibilities of developing new products for export. Chambers and sectorial organizations of producers and exporters have an active role, together with the TPO.

c. Trade missions

Official support to trade missions is of particular importance, as this is one of the most efficient mechanisms to reach new buyers. Quite often trade missions are organized to coincide with the participation in a specialized trade. Thorough preparatory work is required, not only for the selection of the participants and the products to be covered, but also for the logistic aspects abroad, in particular identification and contacts with potential buyers.

d. International trade negotiations

This function is usually the responsibility of the ministries of foreign affairs, with the support of other public sector institutions, such as the TPO; the business sector should be involved in the preparatory work, as well as in the actual negotiations.

e. Investment promotion

Foreign investments or a joint venture with a local partner not only contribute to the mobilization of financial resources, but facilitate the acquisition of new technology and ensure better access to distribution channels abroad. An increased interest in promoting export-oriented joint ventures has been noted in recent years, with particular emphasis on the transfer of know-how and distribution channels abroad, provided by the foreign partner. Some regional technical cooperation programs implemented by ITC in this area have been extremely well received by the beneficiary countries: one covering support to joint ventures among enterprises from selected Asian countries and partners from Europe, USA and Canada; another joins among enterprises from three South American countries and similar enterprises from Spain.

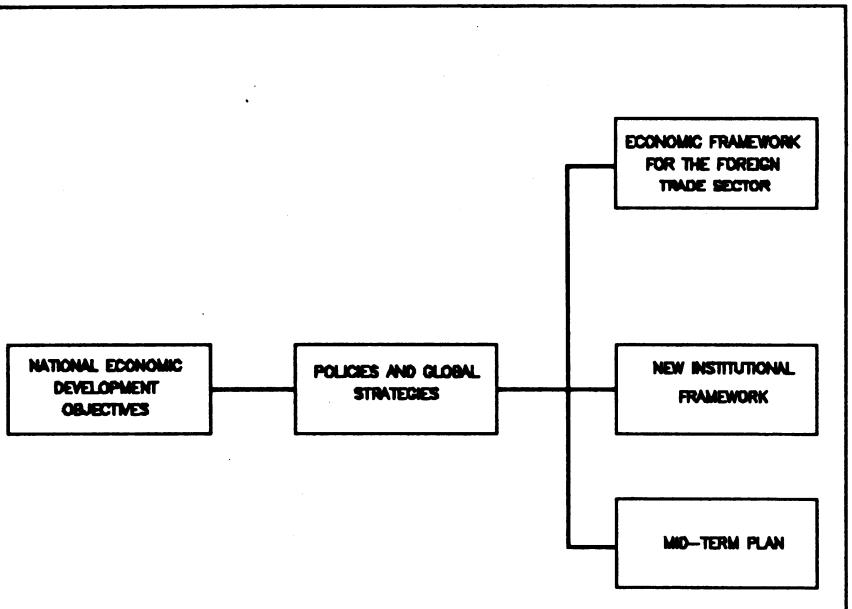

Figure 6.1. Basic Approach.

Box 6.1. Requirements for an Export Program

1. Design of macroeconomic policies
2. Evaluation of obstacles and definition of roles
3. Support and incentive measures
4. Analysis of export supply and export potential
5. Formulation of strategies and sectoral programs
6. Identification of resources required
7. Infrastructure and support services

Box 6.2. An Export Program

1.	DESIGN OF MACROECONOMIC POLICIES	• Export-oriented • Conveys positive signals
2.	EVALUATION OF OBSTACLES	• Identification of main obstacles • Appoach to solve them • Definition of roles for each sector
3.	SUPPORT AND INCENTIVE MEASURES	• Incentives • Physical infrastructure
4.	ANALYSIS OF EXPORT POTENTIAL	• Evaluation of export supply • International demand and export potential
5.	MID-TERM STRATEGY	• Includes promotion and development • Guidelines for action and roles • Sectoral programs
6.	RESOURCES REQUIRED	• Human • Financial • Technological
7.	SUPPORT SERVICES	

Box 6.3. Infrastructure and Support Services

1. Within the country

- Trade information
- Certification and quality control
- Packing and packaging
- Export financing
- Export credit insurance and guarantees
- Joint export marketing schemes
- Costing and pricing
- Legal aspects
- Export procedures
- International physical distribution
- Export publicity
- Free zones
- Trade fairs within the country

2. Abroad

- Commercial offices
- Specialized trade fairs
- Trade missions
- International trade negotiations
- Investment promotion

PANEL MEMBERS' COMMENTS

Ricardo Poblete

It was emphasized that in Chile, the state intervened only to correct market imperfections. Prices should reflect costs and constitute the market indicatiors. In that regard, prices were not controlled and were free of subsidies.

In view of the small domestic market, "foreign" was the only way to grow. A realistic exchange policy was therefore in place, with low tariffs across the board, but a sliding scale for tariffs came into effect when there were sharp fluctuations in international markets.

The state reduced the time frame for official procedures, particularly in the customs systems. In 1974, the Ministry of Foreign Affairs established Pro-Chile in order to: a) promote trade, b) manage commercial and international negotiations and c) conduct multilateral and bilateral relations.

The establishment of Pro-Chile was a contributing factor to the country's spectacularly high growth rates, and in attaining a per capita GDP of US$3,000. Exports were developed basically through private-sector participation and through unfettered free trade.

In 1976, Fundacion Chile was established as a nonprofit, financially self-sustaining private concern, with an initial fund of US$50 million, to encourage technology transfer in the area of renewable natural resources, especially in agriculture and agroindustry, forestry and marine resources.

After 17 years of existence, its equity capital reamined intact and it had set up 28 pilot agricultural trading companies. In addition, it had introduced plant species and developed new products. Similarly, it had promoted research into post-harvest tecnhology, under the concept of total quality. The key to its success lay in orienting its agricultural pilot strategy toward demand, along with a great deal of pragmatism. Trading companies had been transferred to the production sector. Information on trade was provided not only by the private sector, but also by the central bank, state universities, and others. Quality control played a key role in the strategy, and the government was responsible for plant health controls in agricultural exports and imports. The field of packaging and packing materials had also played an important role in the development of Chilean exports. Chilean companies competed at the international level in the design of packing materials.

In the financial sphere, all banks were private, and foreign companies also participated by investing venture capital.

Despite their limited resources, Pro-Chile and the Ministry of Foreign Affairs sought out trade opportunities for the private sector. In that regard, the Chileans were imitating Japanese entrepreneurs, since they traveled on missions in order to observe and subsequently copy products, as well as management and production systems.

Multinational agri-food corporations, both Chilean and foreign, had invested more in the agroindustrial and distribution stages than in the production stage, based on efficiency, competitiveness and excellence.

Gyorgy Rasko

In Hungary, complementarity, rather than competitiveness, was the strategy governing exports to Europe. Trade

agreements had been signed with a number of countries outside the sphere of the Commonwealth of Independent States, and a key factor was currency conversion, which was authorized only for the principal exporting companies, but not for the public in general.

Raising the competitiveness of agri-food products demanded an increase in the size of production units, which required changes in legislation. Thus, the law on bankruptcy (1990), the law on privatization (1992) and the law on agrarian reform (1993) were passed.

The knowledge gleaned from the Chilean experience was applied to the Hungarian strategy. The three state-owned marketing enterprises were dissolved and replaced by 300 private companies. Similarly, the Food Marketing Office, similar to Pro-Chile, was established for the purpose of trade promotion.

John K. Karanja

In **Kenya**, safaris used to be a significant source of earnings, but now coffee and tea account for 60 percent of Kenya's exports. Until 1990, 40 percent of economic activity was state-run, but in 1993, the proportions had undergone drastic changes.

Agricultural markets had been opened up completely, especially the wheat, sugar, rice and dairy product markets. In all cases, prices of uncontrolled products went up. An attempt was made to break a monopoly on milk products. In grains, particularly maize, progress had been slower than other produce because it was a sub-sistence crop.

Private vegetable crops had been sown, with exports mainly to Europe and the Middle East. The government supported imports of specific inputs for exports.

Discussion

The discussion included questions such as: Had privatization in Hungary proved easier for small companies than for large ones? How much official support had there been for food-processing companies in Hungary? Which were guarantee funds and how were they managed?

In reply, it was stated that the guarantee funds had been formed with the Hungarian Government contributing 50 percent and the European Community 50 percent. The commercial banks had now joined that guarantee fund, but those resources were not channeled to companies with less than 60 employees.

Hungary had incurred a debt of US$20 billion, which it was in the process of repaying. The foreign debt was reduced by US$7 billion over a period of three years as a result of the privatization of state-owned companies. At present, the financial and economic sectors were relatively stable and inflation was under control.

Since the establishment of the guarantee fund, 70,000 private companies had been formed, but one-third of them had gone bankrupt owing to the very strict bankruptcy laws. Two-thirds of the cooperatives had declared bankruptcy, accelerating their privatization.

Another question on Hungary was: How "special" were the special loans as compared with normal bank loans?

The answer was that, in general, the cost of such loans was only about two points lower than the market rate. The special loans were for small companies, and the requirements regarding collateral were less stringent than in the commercial banks.

With regard to the Chilean experience, it was pointed out that the Institute for Agricultural Development (INDAP) had

assisted small farmers with floating capital. The credit system was designed to be as competitive as possible and such cases were the exception.

To sum up, the moderator concluded that clear rules should be sought, not only at the macroeconomic, but also at the micro-economic level. The establishment of institutions in Hungary for making the transition towards a market economy was most interesting. Kenya's case was different, but progress had been made in the transition nonetheless.

TRANSITION TO A NEW PUBLIC AND PRIVATE BALANCE

ISSUES IN THE TRANSITION TO A NEW BALANCE

Rodolfo Quiros Guardia[1/]

This document provides a broad conceptual framework for addressing issues relevant to the transition to a new balance between the public and private sectors.

In order to achieve this balance, it will be necessary to define and organize a new structure for the participation of the public and private sectors in the provision of services required by the agricultural sector. Consequently, an analysis should be made of actions different countries have already undertaken, or will undertake, during this transition.

To do this, it is necessary to consider two basic premises: first is the long-standing belief that services should be provided primarily by the private sector, which means reducing the role of the state. The second is the fact that the papers and ensuing discussions of this symposium will give rise to conclusions and recommendations that should be taken into consideration in defining the actions to be taken during the transition. The broad conceptual framework outlined herein is intended to help organize and incorporate such recommendations and conclusions into a useful format.

The definition of a new order for the provision of services by both the public and private sectors has been a topic of discussion for years, and is not as new as it may seem. Actually, it has been discussed in recent decades in many countries throughout the world. What is new is the importance many governments and international agencies are now attaching to it, given the efforts to make changes in the production structure and the state apparatus.

The push for change is based on the need to reverse the lingering effects of economic development models that have become ineffective or obsolete, and is intended to help national economies gain a better position in an increasingly interdependent world. Such was the case of centrally-planned economies and economies which followed an import-substitution model in limited economic spheres, in relative isolation from international markets. In other cases, structural change and changes in the provision of services grew out of the need to make a given country or sector more competitive, enabling it to participate more fully in the world economy or in economic spheres that have been expanded through the formation of free-trade zones or common markets.

Whatever the motive for redefining the balance between the public and private sectors in generating goods and services, the primary objective seems to be to make the provision of these goods and services more efficient, effective and productive.

This process involves two elements which go hand in hand. One is to allow market forces to determine the allocation of resources for the provision of goods and services, which encourages the private sector to take an important role in economic development. The other is the need to reduce the size of the state, simplifying the tasks it undertakes, increasing

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1/ Director of IICA's Program IV: Trade and Integration.

its productivity and reducing losses incurred in the provision of services.

Nevertheless, the fact that farmer groups and small farmers face serious difficulties in gaining real access to such services demands that the state oversee the development of conditions and mechanisms that will ensure access to services provided now by the private sector in a market economy. Also, the state must continue to intervene in those areas in which the market is not fulfilling its role, either by providing the service itself or by regulating private-sector activities. Examples include certain types of economic research, marketing and rural credit information services, as well as specific veterinary services. Another example is certain foreign trade services which, under international agreements, must be provided or endorsed by the state (e.g., certificates of health, certificates of origin).

Four Conditions

Literature on this subject, as well as the experiences of several countries with privatization and downsizing the state, have shown that at least four conditions must exist for such undertakings to be successful.

The first is a clear political strategy which provides both an appropriate legal framework and the organization required to the make the transition in an orderly fashion. Also, it is important to deal politically with the concerns of social groups that may feel threatened by the new order, or by the fear that regional and cultural differences will be exacerbated.

The second condition required for achieving this new balance is the existence of the appropriate economic infrastructure. The success of the private sector in providing services will depend, to a great extent, on the level of development of the particular economic system and on the capacity of the capital market and financial system to support the establishment and strengthening of enterprises.

A third condition is the willingness of the private sector to meet the new challenges involved in providing services. In this respect, its capacity to organize into businesses and acquire the necessary technical and managerial information would also seem to be a necessary condition.

The fourth and final condition is that there be a clear understanding of the new objectives and style of the public administration. Efforts to privatize state-run enterprises and downsize the state apparatus do not intend to bring an end to public administration. They do require, however, that public officials be trained in new techniques for economic regulation, and be capable of offering alternatives to private-sector proposals for generating goods and services.

From the point of view of public administration, the authors N.M. Al-Saigh and A.M. Buera identify three stages in the above-mentioned processes: planning, transition and supervision. Using the experiences of the Arabian countries as a foundation, they assess the relative importance of a series of strategic factors in each stage.

Based on this outline and bearing in mind the experience of Latin America, Table 1 shows some of these strategic variables *vis-a-vis* the necessary conditions identified in the preceding point. The breakdown is presented in order to point out some of the variables that may be important during the transition to a new balance in the provision of services by both the public and private sectors, as discussed in this paper.

On another level, the new balance between the public and private sectors offers businesses a number of options regarding the organization of administration and management and the ownership of the assets needed to provide

the services. J.W. Eaton identifies and lists these options as follows:

- Management of a public enterprise by lease
- Privatization, without the sale of assets
- De-nationalization, with a partial sale of assets
- Privatization, with the total sale of assets
- Partial or total transfer of a public service to private enterprise
- Sale to an existing or specifically organized (ad hoc) cooperatives
- Privatization through the partial or total sale of assets, in which employees or employee associations acquire common stock.

Table 2 presents the options listed above, grouped by economic doctrine to which they belong.

Lastly, Table 3 illustrates the conceptual framework presented in this brief paper.

Bibliography

AL-SAIGH, N.M. and BUERA, A.M. 1990. La privatización en el mundo árabe: Requisitos previos al éxito. Revista Internacional de Ciencias Administrativas 57(1):139-150.

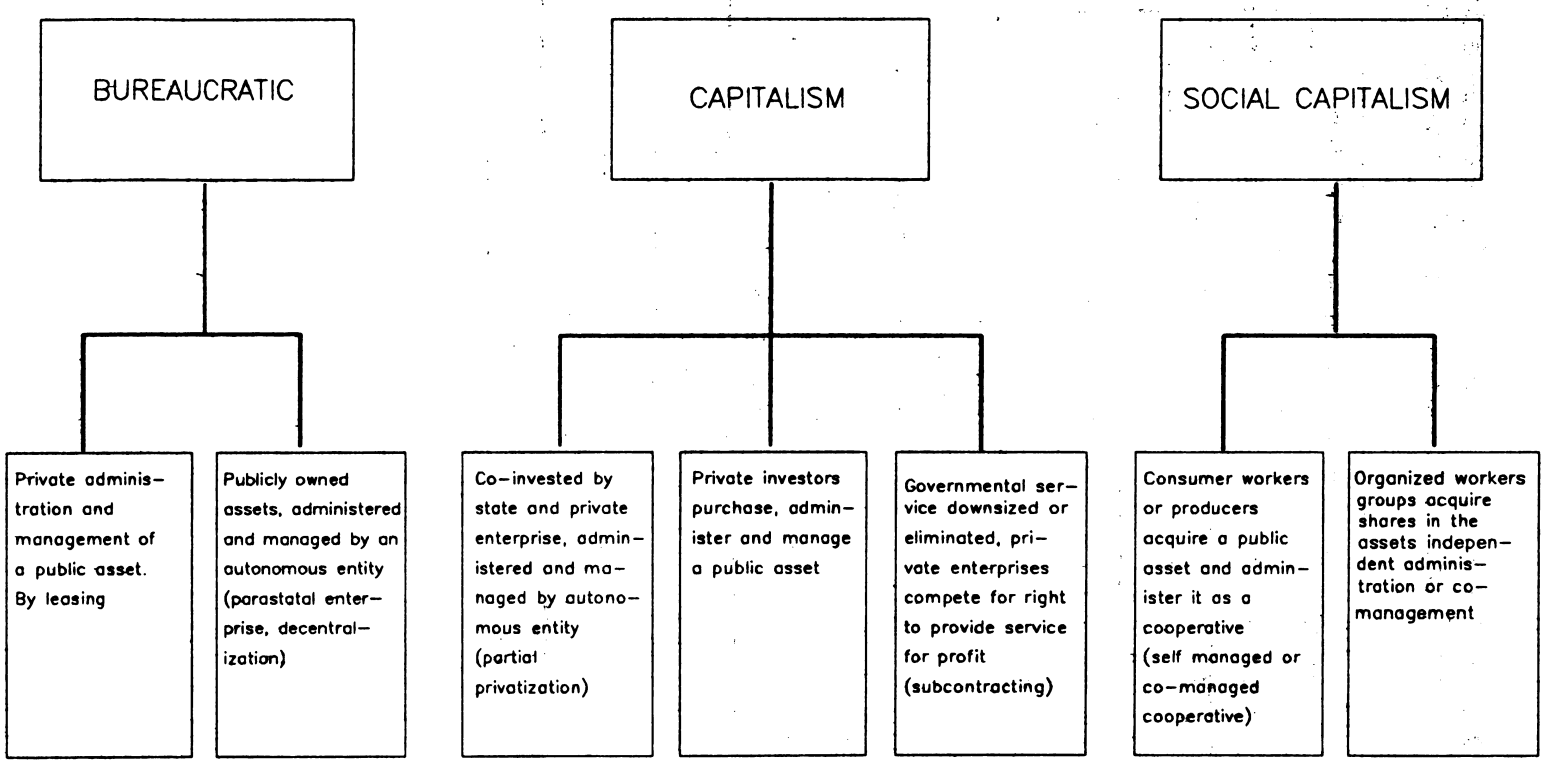
EATON, J.W. 1989. Estrategias para la Privatización Burocrática, capitalista y populista. Revista Internacional de Ciencias Administrativas 56(3):187-205.

Table 7.1. Downsizing the State: Strategic Variables in the Transition Stage.

SELECTION OF THE STRATEGIC VARIABLES	STAGES OF THE PROCESS		
	PLANNING	TRANSITION	SUPERVISION
I. POLITICAL-LEGAL FRAMEWORK			
1. Political stability		x	
2. Acceptance of downsizing process		x	
3. Degree of state participation in provision of services		x	
4. Stability of the legal system on which downsizing is based		0	
5. Strength of the legal system governing the ownership of private property in the sector or service		0	
6. Protection of the intellectual property rights		0	
II. ECONOMIC CONTEXT			
1. Overall and sectoral indicators of economic activity		x	
2. Progress achieved in economic liberalization		x	
3. Environment and security for private investment by nationals and foreigners		0	
4. Size of the market and clarity concerning criteria for privatization in sectors or target activities		0	
5. Fiscal and incentive policies		0	
6. Labor and salary policies		0	
7. Development of the capital market and the system for funding downsizing		0	
8. Availability of infrastructure, production factors, and human and social capital		x	
9. Degree of organization of business sector		x	
III. BUSINESS ENVIRONMENT			
1. Maturity, strength and organization of the business sector		x	
2. Attitude toward authority in organizations		x	
3. Availability of technical and managerial training		0	
4. Acceptance of innovation in the business sector		x	
5. Degree and facility of business organization in the service or sector		x	
6. Geographic coverage and type of service producer		0	
7. Existing technical and managerial capabilities		x	
8. Past experiences in the efficiency and profitability of providing services		x	
9. Labor organizations, obligations and benefits		0	
IV. PUBLIC ADMINISTRATION			
1. Existence of a political-administrative body to facilitate the process		0	
2. Progress achieved in administrative reforms		x	
3. Mechanisms for facilitating relations between the public and private sectors		0	
4. Training in new regulation and supervision techniques		x	
5. The existence of programs for downsizing the bureaucracy and relocating personnel		x	
6. Governmental programs to support and complement the process		0	

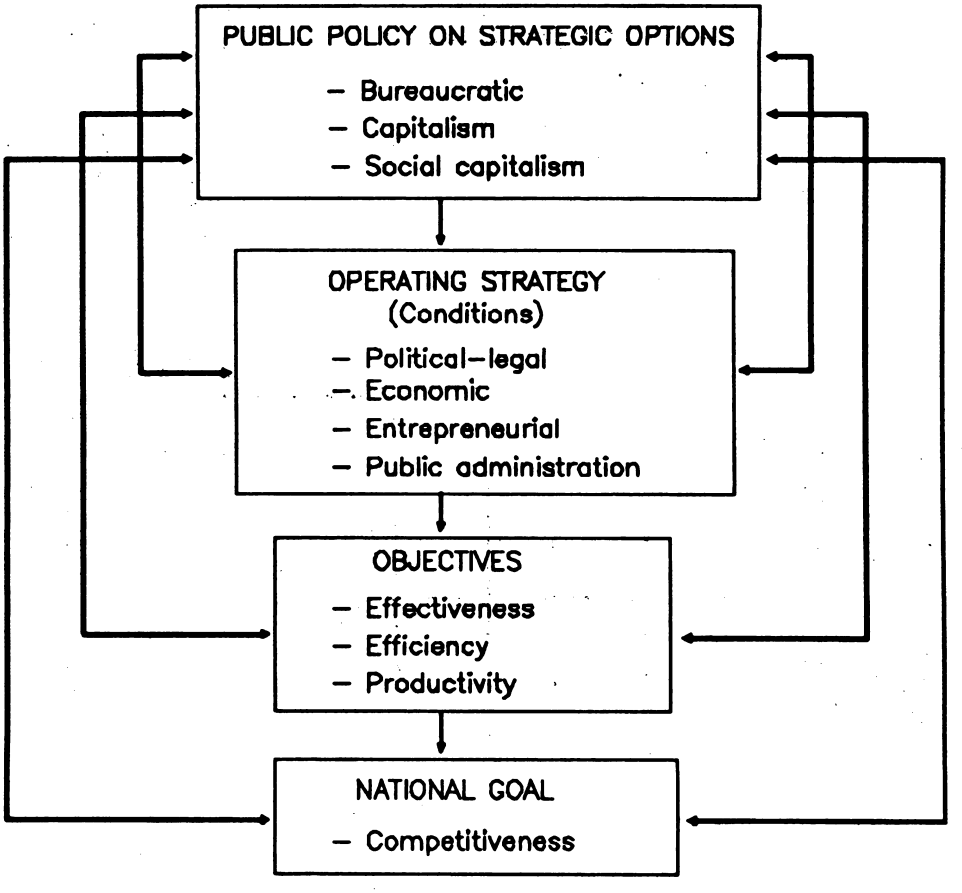
0 = Key strategic variables

Figure 7.1. Options for Downsizing State Ownership and Management assets.



Source: Revista Internacional de Ciencias Administrativas 34(3)1989.

Figure 7.2. Model for a "Public Policy" for Reducing the Rol of the State in the Provision of Services (Synopsis).



PANEL MEMBERS' COMMENTS

The moderator of the panel stated what she considered were the fundamental principles that had been set forth during the course of the symposium.

- Sustainable development stood as the most important objective at the public macro-policy level.
- Every country should set specific short- and long-term goals within the context of that global objective.
- Privatization was not an universal solution for all situations, or for all sectors.
- Public property, relatively unprofitable activities, activities which required long payout periods and those that involved high risks, should continue to be supported by the state. Aspects relative to equity merited special attention.
- The country's political, economic and social situation should be borne in mind in public-private relations.
- Potential, feasible and acceptable areas for privatization should be clearly defined. These areas were particular to each country.
- An optimal public/private mix of opportunities and workability should be sought, so as to provide an appropriate framework for the sector or activity in question.
- Emphasis should be placed on the need to improve operational efficiency, cost effectiveness and the coverage of public services in the poorest areas.
- It was essential to follow a detailed plan, especially during the transition period.
- The transition period was critical. The reduction in public-sector services should be linked to the responsibilities taken on by the private-sector concerns. Overlap periods gave rise to social tension and should be appropriately managed.
- The delivery of services by the private sector also involved risks and imperfections which should be perceived and dealt with through public policies.
- Public policies should therefore consider the establishment of regulations and controls over the private sector.

Finally, she mentioned certain aspects of a general nature that should be borne in mind:

- There was no formula or general prescription for all countries or sectors.
- It was essential for policy designers and international agencies to keep an open mind on public/private-sector relations.
- It should be understood that political statements were easy to make, but making them operative was complex and at times frustrating for all.

- There should be no fear of failure, but nor should exaggerated expectations be created as to the merits of privatization.

- It should be understood that the private sector was not organized and ready to take on responsibilities that the public sector wished to transfer to it. The private sector would take areas in which risks were low and profits high.

- Finally, the path to be followed and the timing of privatization should be analyzed in detail before setting the process in motion. (M.S. Gill, India)

Poland had started on the road to privatization two years ago, but the political situation was difficult. There were economic problems, among which inflation was the most serious, since it affected capital markets, pushed up interest rates and discouraged investment. Furthermore, public institutions had become weakened, there were deficiencies in control, as well as a lack of reliable information for decision-making. That, in short, was the backdrop against which privatization was being carried out.

The privatization process was far from simple, particularly in agriculture. There were around 1,500 farms and all of them wanted to become private concerns. Distributing collective farmlands as small private holdings, however, gave rise to problems unless suitable markets existed, or unless the new owners had sufficient financial resources. Public agricultural agencies responsible for marketing (price stabilization), land, and farm credits had been established to spur the process on. That type of state intervention had been aimed at completing the first stage in the formation of markets. (Jerzy Sobocinski, Poland).

The issue of modernization stood on three pillars: competitiveness, equity and sustainability. The manner in which that was solved had to do with political stability.

Of the 17 to 18 million agricultural holdings in Latin America, 15 million belonged to poor farmers with problems of access to markets, and therefore they were not direct clients of the private sector. In view of that reality, experiments had been conducted on how best to combine competitiveness and equity.

In Chile, subsidized bonds were provided to assist rural dwellers. In Colombia, welfare financing had been channeled to municipalities, and private companies operated that type of services.

Privatization and decentralization were closely linked. Both sought to ensure that companies and citizens alike had greater participation and control over decision-making. (Manuel Chiriboga, IICA)

Discussion

The panel was asked, "What is the right approach?" since political and economic stability were the established prerequisites for privatization, yet many argued in favor of privatization because it contributed to political and economic stability. On the other hand, two processes were taking place simultaneously: privatization and decentralization. What was the relationship between these two processes? Were they complementary or alternative?

In reply to that question, it was pointed out that Venezuela began with economic adjustment, which gave rise to political instability. In El Salvador, however, political stability had been considered a necessary condition for carrying out economic reform. Thus, we saw two totally different situations. What should be emphasized, however, was the interrelation and interdependence between political and economic affairs.

Another speaker mentioned the topic of paternalism. The public sector was too paternalistic. The mentality of small farmers who felt incapable of succeeding on their own had to be changed. That involved making a start through education. It was also important to underline that in agriculture, social issues should be kept separate from the topics of production and competitiveness.

It was mentioned in another statement that the countries of Eastern Europe were experiencing both political uncertainty and economic instability. Dr. Quiros, however, had given a long list of requirements for transformation which were practically impossible to fulfill in those countries. The following question was therefore posed: "What, in your opinion, is the most important of all the requirements you mentioned?"

In answer to the question, the main speaker stated that he was not sufficiently familiar with the situation in Eastern Europe; nevertheless, generally speaking, a privatization process was similar to a set ofsimultaneous equations. The process should concentrate on the sectors that were easiest for the private sector to manage, instead of a multisectoral approach. That demanded clear criteria for the sectors and had additional implications. Therefore, it should be determined which sectors fulfilled the greatest number of the requirements.

With regard to paternalism, he stated that much suffering had been caused by paternalism, but on the other hand, private companies had continued to exist. There was no such thing as a homogeneous private sector, and the latter had organized itself as a political lobbying group rather than a group to take on the new responsibilities stemming from liberalization, except in traditional areas such as exports.

Finally the social problems of poverty, malnutrition, lack of education, etc., should be solved through the economic structure. What should be shown was the cost of solving those problems.

APPENDIX

DOCUMENTATION

Basic Documentation

1. CARSALADE, H.; GRIFFON, M. and DE LATTRE, M. How can the role of public sector agricultural research be defined?

2. JAFEE, STEVEN and SRIVASTAVA, JITENDRA. The development, production, and distribution of improved seeds: Farmer, private, and public sector roles.

3. POMAREDA, CARLOS. Financial services for agriculture: The public-private complementarity.

4. QUIROS, RODOLFO. Issues in the transition to a new balance.

5. SCHWARTZ, LISA A. and ZIJP, WILLEM. Public and private roles in the delivery of extension services.

6. TRIGO, EDUARDO. Public-private sector relations in agricultural research and development: Notes on experiences and issues.

7. TUNIK, DAVID. Support services for the trade sector: The roles of the public and private sectors.

8. UMALI, DINA L.; FEDER, GERSHON and DE HAAN, CORNELIS. Public and private sector roles in the delivery of livestock services.

Additional documentation

ANTOCHI, CHORCHE. Public and private sector roles in the provision of agricultural support services in Romania.

CHERIF DAOUSSA, BICHARA. La production et la diffusion des semences au Tchad.

CHIRIBOGA, MANUEL. El desarrollo rural en América Latina en los 90.

CHRISTOV, ROUMEN. Extension service in the agricultural sector in Bulgaria: Present state and perspectives.

TRIGO, EDUARDO and KAIMOWITZ, DAVID. Agricultural research and technology transfer in Latin America in the 1990s.

FINAL LIST OF PARTICIPANTS

Algeria

Amroune Almahouacif
Directeur Technique et Chef de
projet au Centre National
Pedagogique Agricole (CNPA)
Cite Said Hamdine
BP 14, Gir Mourad Rais 16300
Algiers
Fax (213) (2) 56-07-65/394-784
Telex 936 67349

Argentina

Carlos Torres
Director Nacional
INTA
Buenos Aires
Tel. (0054) 1 381-5932
Fax: (0054) 1 111-917

Bangladesh

M. Sujayet Ullah Chowdury
Executive Vice Chairman
Bangladesh Agricultural Research Council
BARC Complex, Farm Gate
Dhaka 1215
Fax 880-2-813032

M. Ayubur Rahman
Director General
Department of Agricultural Extension
2nd Floor, Middle Building
Khamarbari, Farmgate
Dhaka
Fax 880-2-863220

G. M. Shahjahan
Member Director for Livestock
Bangladesh Agricultural Research Council
BARC Complex
Farmgate, Dhaka
Fax 880-2-863220

Belize

Wendell Parham
Policy AnalystMinistry of Agriculture and
Fisheries
Belmopan
Tel. 501-08-22672/22241
Fax 501-08-22409

Brazil

Antonio Paes de Carvalho
Secretario General
Fundación Bio-Río
Cidade Universitaria, Ilha do Fundao
Av. 24, S/N
UHA-DO Fundao
CEP 21944, Río de Janeiro,
Fax (0055) 21 260-7920

Bulgaria

Hertzelina Pinkas
Country Director, VOCA
Saborna Str. 14
Sofia
Tel. 359-2-871-751
Fax 359-2-873-059

Roumen Hristov
Vice Minister
Ministry of Agriculture
Sofia
Tel. 359-2-800-655
Fax. 359-2-870-542

Cameroon

Clobert Tchatat
Chef de la Division des
Projets Agricoles
Ministere de l'Agriculture
Yaounde
Fax: 237-22-50-91
Telex 978 8325

Tchad

Bichara Chérif Daoussa
Director Général
Ministère de l'Agriculture
B.P. 441
N'Djaména
Tél. B 51 37 63
D 51 25 77
Fax 515119
Télex 5303 KD

China

Xie Guoli
Deputy Director
Office of External Economic Relations
Ministry of Agriculture
11, Nongzhanguan Nanli
Beijing 100026
Fax 86-1-5002448

Colombia

Carlos Gustavo Cano
Director Ejecutivo
Corporación Colombia Internacional
Apartado Aéreo 12314
Santafé de Bogotá
Tel. 57-1-214-3800/612-0578
Fax 57-1-214-7431

Costa Rica

Juan Rafael Lizano
Ministro de Agricultura y Ganadería
Ministerio de Agricultura y Ganadería
San José

José Joaquín Acuña
Viceministro de Agricultura y Ganadería
Ministerio de Agricultura y Ganadería
San José

Hernán González
Subdirector
Dirección de Planificación
Ministerio de Agricultura y Ganadería
San José
Tel. (506) 31-2344
Fax. (506) 31-2341

Pedro Cussianovich
Secretario Ejecutivo
Secretaria de Ejecutiva de Planificación Sectorial Agropecuaria (SEPSA)
Ministerio de Agricultura y Ganadería
San José
Tel/Fax (506) 320677

Ronald Meza
Secretaría Ejecutiva de Planificación Sectorial Agropecuaria (SEPSA)
Ministerio de Agricultura y Ganadería
San José

Gerardina González
Directora
Cámara Nacional de Agricultura
P.O. Box 1671-1000
San José, Costa Rica
Tel. (506) 338567
Fax (506) 33-8658
San José

José Rafael Corrales
Subdirector
Cámara Nacional de Agricultura
P.O. Box 1671-1000
San José
Tel. (506) 338567
Fax (506) 33-8658
San José

Leopoldo Pixley Sinclair
Subdirector
Investigaciones Agrícolas
Ministerio de Agricultura y Ganadería
San José

Orlando Ramírez
Director
Oficina Nacional de Semillas
Apartado 10309-1000
San José, Costa Rica
Tel. (506) 235922
Fax (506) 235431

Alvaro Rodríguez
Director
Investigaciones Agrícolas
Ministerio de Agricultura y Ganadería
San José

José Carlos Salas
Gerente General
Servicio Nacional de Agua Subterránea
Riego y Avenamiento (SENARA)
San José
Tel. (506) 226711
Fax (506) 228785

Chile

Ricardo Poblete
Departamento Agroindustrial
Fundación Chile
Santiago
Tel. (56) 2 2281446
Fax. (56) 2 2426900/2281446

Dominican Republic

Alfonso Arias Jiménez
Embajador Extraordinario y Plenipotenciario
de República Dominicana en Costa Rica
Apartado Postal 4746-1
San José

El Salvador

Silvia de Machuca
Directora de la Oficina de Planificación
Ministerio de Agricultura y Gandería
79 Avenida Norte No. 717
Colonia Escalón
San Salvador
Tel. 503-23-4981/24-1787
Fax 503-23-4187

Estonia

Maido Pajo
Expert, Land Board of Estonia
Ministry of Agriculture
Land Board of Estonia
Mustamae Tee 51 p/k1635
300006 Tallin
Tel. 528401
Fax 7-0142-602160/440601
Telex 173216

Ghana/Gana

Hector Mercer-Quarshie
Chief Research Officer/
Station Manager
Nyanktalopala Agricultural
Research Station
P. O. Box 52
Tamale

Guatemala

Arturo Aguirre
Viceministro de Agricultura
Ministerio de Agricultura
Palacio Nacional
Ciudad de Guatemala
Tel 517560
Fax 536807

Guyana

John Browman
Programme Manager,
Caribbean Community Programme for
Agricultural
Development (CCPAD)
Caribbean Community Secretariat
Bank of Guyana Building
Avenue of the Republic
Georgetown
Tel. (592) 2 52961/5
Fax. (592) 2 57341

Honduras

Luis H. Zelaya
Director UTN-RUTA
Edificio Recursos Naturales, 3er Piso, UPSA
Apartado Postal 1258
Tegucigalpa
Tel. (504) 327909
Fax. (504) 325375/327548

Hungary

Gabor Pellerdy
Ministry of Agriculture
Kossuth L. ter 11, H 1860
Budapest
Tel. 36-1-1533-000
Fax 36-1-1530-518

Gyorgy Rasko
Secretary of State
Ministry of Agriculture
Kossuth L. ter 11, H 1860
Budapest
Fax 36-1-111-5819/112-0836
Tel. 36-1-1328-191

India

Pratima Dayal
Joint Secretary
Ministry of Agriculture
Government of India
Krishi Bhaven
New Delhi 110001
Tel. 91-11-382357
Fax 91-11-384555
Telex 953-3165054

Iran

Valiollah Bandpay
6 Omidian St. Soodeh St. Yasser Av.
Tehran 19786
Tel. 98-21-287493
Fax 98-21-8008677

Ivory Cost

Ouayogode Bakary
Directeur des Programmes de Recherche
Ministère de l'Enseignement supérior
de la Recherche Scientifique
BP V 151 Abidjan
Fax 225-22-6294/6985

Bohe Gui Bernard
Sous Directeur de la Vulgarisation
Ministère de l'Agriculture et des
Ressources Animales
B. P. V82 Abidjan
Tel. (225) 21-01-27
Fax (225) 21-46-18

Coulibaly Mamadou
S/Directeur au LANADA
06 PoP 353 Abidjan 06
Fax 225-22-45-38

Bouraima Osseni
Sous-Directeur de la Recherche-Developpement
Ministère de l'Enseignement Superieur et
de la Recherche Scièntifique
Abidjan

Kenya

John K. Karanja
Chief Economist
Ministry of Agriculture
P. O. Box 30028
Nairobi
Tel. 254 2 721843
Fax. 254 2 720586

Latvia

Janis Adamsons
Deputy Minister of Agriculture
Ministry of Agriculture
2 Republic Sq.
226168 Riga
Tel. 7-0132-325107
Fax 7-0132-320593

Lithuania

Vytautas Bite
Director
Dept. of International Relations
Ministry of Agriculture
Gedimino pr 19
2025 Vilnius
Fax 7-0122-224440

Mexico

Santiago Bedolla
Director Ejecutivo
Fundación Tecnología de Producción
Culiacán, Sinaloa
Calle Miguel Hidalgo No. 760
Tel. (67) 161293
Fax. (67) 160609

Carlos Montañez
Director de Crédito
BANRURAL
Agrarismo 227, Séptimo piso
Colonia Escandón
México, D.F.
Tel. 52-5-271-5249
Fax 52-5-271-5249

Armando Carrillo
Asesor
Fundación Tecnología de Producción
Culiacan, Sinaloa
Calle Miguel Hidalgo No. 760
Colonia Centro
Tel. (67) 161293
Fax. (67) 160609

Nicaragua

Juan Ramón Aragón Marín
Miembro del Consejo Directivo
Unión Nacional de Agricultores y Ganaderos
Reparto Las Palmas
Edificio Julia Pasos 1 Cuadra Norte
Apartado 4526
Managua
Tel. 505-2-664110/664974/662075
Fax 505-2-662433

Pakistan

Zafar Altaf
Chairman
Pakistan Agriculture Research Council
PARC Building, G-5/1
P.O. Box 1031
Islamabad
Tel. 92-51-823966
Fax 92-51-820216/812968

Panama

Carlos Sousa-Lennox M.
Secretario Ejecutivo
Asociación Nacional de Ganaderos
(ANAGAN)
Ciudad de Panamá
Tel. 507-251337/251236
Fax 507-251337

Carlos Enrique Pitty
Director Ejecutivo
Asociación Nacional de Avicultores
de Panamá (ANAVIP)
Ciudad de Panamá
Tel. 507-610343/611272
Fax 507-611352

Paraguay

Arsenio Vasconcellos
Viceministro de Ganadería
Ministerio de Agricultura y Ganadería
Asunción
Tel. 595-21-446-472
Fax 595-21-447250
Telex 399 324

Peru

José Dancé
Presidente
Junta Directiva
FUNDEAGRO
Lima
Tel. 51-14-750047
Fax 51-14-750192

Poland

Jerzy Sobocinski
Director
Privatization Department
Ministry of Agriculture
Wspolma 30, Warsaw
Tel. 48-2-6286307
Fax 48-22-623-2750

Romania

Aurelian Dochia
President
National Agency for Privatization
2-4. Ministerului St.
70109 Bucharest
Fax 4013-12-08-09

Gheorghe Antochi
State Secretary for Private Agriculture
Ministry of Agriculture
Blvd. Carol I, No. 24
70044 Bucharest
Fax 40-1-613-03-22

Russian Federation

Eugenia V. Serova
Advisor to the Minister of
Agriculture of the Russian Federation
1/11 Orlicov 1
Moscow 107139
Tel. 7-095-2078905
Fax 7-095-2078362

Switzerland

David Tunik
Consultor Comercio Internacional
65 Chemin Des Voirets
1212 Ginebra
Tel. (41-22) 7945930
Fax. same

Sri Lanka

Vajira Liyanage
Executive Secretary
Council for Agricultural Research Policy
Ministry of Agriculture Development
and Research
Colombo
Tel. 94-1-69-7103
Fax 94-1-58-0721

Tanzania

Augustine S. Lamosai
Ag. Assistant Commissioner
Livestock Planning Section
Ministry of Agriculture
Dar es Salaam
Tel. 255-51-27231

Tunisia

Hedi Lahmari
Director General, Agence de
Vulgarisation et Formation Agricole
Ministry of Agriculture
30 Rue Alain Savary
Tunis
Fax 216-1-797-280

Turkey

Ali Eryilmaz
Director General
Agricultural Production and Development
Ministry of Agriculture and Rural Affairs
Milli Müdafaa Caddesi No. 20
Yenisehir-Ankara
Fax 90-4-417-0026

Uganda

Joseph Barama Sabiti
Principal Agricultural Officer
Ministry of Agriculture, Animal
Industry and Fisheries
P.O. Box 102
Entebbe
Fax 256-42-21047

Ukraine

Boris Kirichenko
Chief
Department of Foreign Relations
Ministry of Agriculture
24, Kreshchatik Str.
252001 Kiev
Tel. 7-044-229-5075
Fax 7-044-229-8756

Uruguay

Juan Pedro Hounié
Presidente
Junta Directiva INIA
Andes 1365, Piso No. 12
Montevideo
Fax 598-2-923633

Venezuela

Carlos Machado Allison
Fondo Nac. de Investigación Agrop. (FONAIAP)
El Limón, Maracay
Estado Aragua
Tel. (43) 837943
Fax (43) 830021, 831423

Zimbabwe

Shadrack Mlambo
Deputy Permanent Secretary
Ministry of Lands, Agriculture & Water
1 Borrowdale Road
Harare
Fax 263-4-734646

J. Makadho
Director of Agritex
Box 8117/Causeway
Harare
Tel. 263-4-794601/707311
Fax 263-4-730525

International Organizations

Australian Universities and Colleges Limited

Ian Fairnie
North American Representative
International Development Program
Curtin University
144 Two Appletree Square
Minneapolis, MN 55425-1637
United States of America
Tel. 1-612-854-5800
Fax. 1-612-854-9214/6948

Center for International Cooperation in Agricultural Research for Development (CIRAD)

Henry Carsalade
Director General
42 Rue Scheffer
75116 Paris, Francia
Tel. 1-47043215/46206740
Fax. 1-47551530

Michel Griffon
Head, Economics and Sociology Division
42 Rue Scheffer
75116 Paris, Francia
Tel. 1-47043215/46206740
Fax 1-47551530

Esquel Group Foundation

Juan Felipe Yriart
President
Maryland, U.S.A.
Fax 301-718-8872

Danish International Development Agency (DANIDA)

Flemming Winther Olsen
Livestock Development Specialist
Technical Advisory Division
Ministry of Foreign Affairs
Copenhagen, Denmark

Inter-American Development Bank

Lucio Reca
1300 New York Ave., N.W.
Washington, D.C. 20577
U.S.A
Tel. 202-623-1820

Inter-American Institute for Cooperation on Agriculture

Martín E. Piñeiro
Director General
Sede Central, Apartado Postal 55
2200 Coronado, Costa Rica
Tel. (506) 29-0222
Fax. (506) 29-2741/29-2659

Jorge Werthein
Director de Relaciones Externas
Sede Central del IICA

Carlos Pomareda
Director
Programa I: Análisis y Planificación de la Política Agraria
Sede Central del IICA

Eduardo J. Trigo
Director
Programa II: Generación y Transferencia de Tecnología
Sede Central del IICA

Manuel O. Chiriboga
Director
Programa III: Organización y Administración para el Desarrollo Rural
Sede Central del IICA

Rodolfo Quirós G.
Director
Programa IV: Comercialización y Agroindustria
Sede Central del IICA

David Wilson
Director
Programa V: Sanidad Agropecuaria
Sede Central del IICA

Carlos A. Rucks
Director de Operaciones del Area Sur
Sede Central del IICA

José R. Nagel
Director para la Coordinación de Asuntos Institucionales (DICAI), Enc., y
Director del Centro Interamericano de Documentación e Información (CIDIA)
Sede Central del IICA

Nelson Espinoza
Director del Centro de Programas y Proyectos de Inversión (CEPPI), Enc.
Sede Central del IICA

Rafael Trejos
Consultor
Programa I: Análisis y Planificación de la Política Agraria
Sede Central del IICA

Luis Ampuero
Especialista en Proyectos
Sede Central del IICA

Robin Bourgois
Especialista en Análisis y Planificación de la Política Agraria
Sede Central del IICA

Geraldo Calegar
Especialista en Proyectos de Inversión
Sede Central del IICA

Lizardo de las Casas
Jefe, Proyecto Hemisférico Instrumentos de Política Económica para la Modernización de la Agricultura
Santafé de Bogotá, Colombia

Francisco Enciso
Especialista en Generación y Transferencia de Tecnología
Sede Central del IICA

Gonzalo Estefanell
Jefe, División de Estrategias y Proyectos de Cooperación Técnica
Sede Central del IICA

Walter Jaffé
Especialista en Generación y Transferencia de Tecnología
Sede Central del IICA

David Kaimowitz
Especialista en Generación y Transferencia de Tecnología
Sede Central del IICA

International Maize and Wheat Improvement Center

Donald L. Winkelmann
Director General
P.O. Box 6-641
México 06600, D.F. México
Tel. 52-595-42100
Fax 52-595-41069/43097

International Food Policy Research Institute (IFPRI)

Francesco Goletti
Researcher, Markets and Structural Studies Division
1200 17th St., NW
Washington, D.C. 20036-3006
United States of America
Tel. 202-862-5609
Fax 202-467-4439

International Fund for Agricultural Development (IFAD)

Thomas Elhaut
Senior Economist
107 via del Serafico
00142 Rome, Italy
Fax: 39-06-504-3463

The World Bank

Michel Petit
Director of Agriculture
The World Bank
1818 H Street, N. W.
Washington, D.C. 20433

Robert Bronkhorst
The World Bank, LA2AG
Washington, D.C.
United States of America
Tel. 202-473-9227

Michael Macklin
World Bank
New Delhi, India

Gershon Feder
Division Chief
Agricultural Policies
The World Bank
Tel. (202) 473-0378
Fax (202) 334-0568

Ivar Serejski
Extension Specialist
The World Bank
Washington D.C.

Dina Umali
Consultant
The World Bank
Washington D.C.

Steven Jaffee
Consultant, Agriculture and Natural Resources Department
The World Bank
Washington D.C.

Douglas Forno
Division Chief (AGRTN)
The World Bank
Washington D.C.

Willem Zijp
Extension Specialist (AGRTN)
The World Bank
Washington D.C.

Alan Hurdis
USAID/RND/AGR
Washington, D.C.

Geoffrey Fox
Division Chief, ECH NR
The World Bank
Washington D.C.

United Nations Food and Agriculture Organization (FAO)

Tito E. Contado
Senior Officer
Agricultural Training and Extension
Human Resources, Institutions
and Agrarian Reform Division
Food and Agriculture Organization
Rome
Fax 39-6-579-73152

International Organizations: Representations in Costa Rica

Agencia Internacional de Desarrollo

Ron Venezia
Director de la Misión
Apartado 10053
San José, Costa Rica
Tel. 506-204545
Fax 506-203434

Centro Agronómico Tropical de Investigación y Enseñanza (CATIE)

Rómulo Olivo
Subdirector General
Turrialba, Costa Rica
Tel. 506-566081/566431
Fax 506-561533

Juan Antonio Aguirre
Jefe del Area de Economía de
la Producción y la Conservación
Turrialba, Costa Rica
Tel. 506-566081/566431
Fax 506-561533

Center for International Cooperation in Agricultural Research for Development (CIRAD)

Jean Laboucheix
Delegado para América Latina y
el Caribe
Apartado 1127-2050
San Pedro de Montes de Oca
San José, Costa Rica
Tel. 506-2559720
Fax 506-250940

Consejo de la Tierra

Javier Gatica Pardo
Asistente de Proyectos
9no. Piso Edificio Instituto
Nacional de Seguros
San José, Costa Rica
Tel. (506) 23-3418

Escuela de Agricultura de la Región Tropical Húmeda (EARTH)

José Antonio Zaglul
Director
Apartado 4442-1000 San José
Tel. 506-552000/226100
Fax 506-552726

Inter-American Development Bank

Juan Manuel Corredor
Representante en Costa Rica
Apartado 1142-1007 Centro Colón
San José, Costa Rica
Tel. 333244
Fax 331840

France

Philippe Cujo
Delegado de la Cooperación Regional
Científica y Técnica de Francia
Embajada de Francia
Apartado 10177
1000 San José
Tel. 506-244105
Fax 506-537410

Guy Christophe
Embajada de Francia
Apartado 10177
1000 San José
Tel. 506-244105
Fax 506-537410

Spain

José Alvarez
Consejero de Agricultura
Embajada de España
San José
Tel. 506-33-6576
Fax 506-55-0908

Unidad Regional de Asistencia Técnica (RUTA)/Banco Mundial

Martín F. Raine
Economista Agrícola
Proyecto RUTA II
Naciones Unidas/BM
Apartado 211-2100
San José, Costa Rica
Tel. 506-554011
Fax 506-226556

Rubén Nuñez
Consultor RUTA/BID
Proyecto RUTA II
Naciones Unidas/BM
Apartado 211-2100
San José, Costa Rica
Tel. 506-554011
Fax 506-226556

PROGRAM OF THE SYMPOSIUM

1. *Background*

While in most developing countries agricultural production is organized as a private sector activity, agricultural support services, such as agricultural research and extension, seed development and marketing, veterinary and financial services, are usually provided by public agencies. These agricultural services can be subdivided into functions that differ considerably in their economic and technical characteristics. In carrying out some of these functions, private agents are able to generate a reasonable profit; however other functions have characteristics which qualify them as public goods. For some functions, market forces would not produce results that are in the best interest of the nation, thus justifying some form of corrective action on the part of the government.

Therefore, the government's decision to intervene in the total provision of a support service, or a specific component thereof, should be based on an in-depth analysis of the characteristics of each function. In fact, several studies indicate that certain functions could be carried out efficiently by private enterprises, and that the role of the government should be limited to monitoring and regulation. The government is in a better position to provide other aspects of these same general services.

The roles of public sector and private entities in providing agricultural services is changing as agriculture evolves, as stronger links are forged within the international economy and as the countries move forward in the implementation of institutional reforms. How these roles are played will vary from country to country, according to the particular conditions of the agricultural structure. With this in mind, the process of institutional reforms should recognize the needs and possibilities of different types of farmers.

2. *Objetives of the Symposium*

The principal objective of the symposium is to bring together authorities from developing countries and officials from international cooperation organizations that have experience in providing agricultural support services, with a view to discussing the roles the public and private sector should play in the provision of these services.

The findings of recent studies conducted by both the World Bank and the Inter-American Institute for Cooperation on Agriculture (IICA) will serve as the basis for discussion, and will be complemented by the presentations of the participants from the countries.

The objectives of the symposium will be attained through presentations and panel and general discussions. Group discussions will be organized in order to formulate recommendations for the proper management of the support services sector. It is expected that the countries' presenations on their experiences in privatizing agricultural services will be useful to the participants in designing reforms for their respective systems.

3. *Schedule*

Sunday, May 16

Arrival of participants and registration

Monday, May 17

08:30 - 09:15	Registration	
09:15 - 10:00	Juan Rafael Lizano, Minister of Agriculture and Livestock of Costa Rica Michel Petit, Director of Agriculture, World Bank Martín E. Piñeiro, Director General, IICA	
10:00 - 10:20	Coffee Break	

SESSION 1. Agricultural Research

	Moderator:	Henri Carsalade, CIRAD
10:20 - 11:00	*Presentation:*	Eduardo Trigo, IICA
11:00 - 12:30	*Panel:*	Carlos Torres, Argentina Zafar Altaf, Pakistan Ouayogode Bakary, Cote d'Ivoire
12:30 - 14:00	Lunch	
14:00 - 15:00	General Discussion	

SESSION 2. Seed and Genetic Material

	Moderator:	Don Winkelman, CIMMYT
15:00 - 15:45	*Presentation:*	Steven Jaffee, World Bank
15:45 - 16:00	Coffee Break	
16:00 - 16:40	*Panel:*	Orlando Ramirez, Costa Rica Ali Eryilmaz, Turkey M. Sujayet Chowdhury, Bangladesh
16:40 - 18:00	General Discussion	

Tuesday, May 18

SESSION 3. Agricultural Extension and Information

	Moderator:	Juan Felipe Yriart, ESQUEL Group
09:00 - 09:40	*Presentation:*	Williem Zijp, World Bank
09:40 - 10:30	*Panel:*	Jose Dancé, Peru M. Ayubur Rahman, Bangladesh Hedi Lahmari, Tunisia
10:30 - 10:45	Coffee Break	
10:45 - 12:30	General Discussion	
12:30 - 14:00	Lunch	

SESSION 4. Livestock Services

	Moderator:	David D. Wilson, IICA
14:00 - 14:40	*Presentation:*	Dina Umali, World Bank
14:40 - 15:45	*Panel:*	Edwin Perez, Costa Rica Augustine S. Lamosai, Tanzania Sekou Sangare, Guinea
15:45 - 16:00	Coffee break	
16:00 - 18:00	General Discussion	

Wednesday, May 19

SESSION 5. Financial Services

	Moderator:	Gershon Feder, World Bank
09:00 - 09:40	*Presentation:*	Carlos Pomareda, IICA
09:40 - 10:30	*Panel:*	Carlos Montañez, Mexico Thomas Elhaut, IFAD H. S. Dillon, Indonesia
10:30 - 10:45	Coffee break	

10:45 - 12:30 General Discussion

12:30 - 14:00 Lunch

SESSION 6. Services for the Promotion of Trade

Moderator: Francisco Gutierrez, INCAE

10:45 - 11:45 *Presentation:* David Tunik, Switzerland

11:15 - 11:45 *Panel:* Ricardo Poblete, Chile
Gyorgy Rasko, Hungary
John K. Karanja, Kenya

11:45 - 12:30 General Discussion

12:30 - 14:00 Lunch

SESSION 7. Transition Toward a New Public-Private Balance

14:00 - 14:30 *Opening remarks:* Rodolfo Quirós, IICA

Panel: M. S. Gill, India
Manuel Chiriboga, IICA
Douglas Forno, World Bank
Xie Guoli, China
Shadrack Mlambo, Zimbabwe

15:30 - 15:45 Coffee break

15:45 - 16:30 Group Discussion

16:30 - 17:30 Concluding session

4. *Participants*

Professionals who have been working on the topics to be discussed during the seminar .

5. *Site of the Symposium*

Inter-American Institute for Cooperation on Agriculture; United State Room, San Isidro de Coronado, Costa Rica.

6. *Lodging*

Participants will stay at the Hotel San Jose Palacio, located 10 minutes from San Jose, on the Autopista General Cañas. Telephone: (506) 202034/202035.

7. *Airport*

Symposium staff will be at the airport to help the participants with entry procedures.

8. *Transportation*

Transportation will be available for all official activities of the symposium. The schedule will be distributed during registration.

9. *Languages*

9.1 Documents

All documents related to the symposium will be available in both Spanish and English, with abstracts in Spanish, English and French.

9.2 Simultaneous Interpretation

Simultaneous interpretation services will be provided in Spanish, English and French.

10. *Insurance*

Participants will be covered by short-term health, accident and life insurance.

11. *Climate*

San Jose is located at an altitude of 1,200 meters above sea level. In May, temperatures range from 16° to 24°C, and afternoons are often rainy. IICA Headquarters is located outside the city, in San Isidro de Coronado, where the temperature tends to be cooler than in San Jose.

This book was printed at
IICA Headquarters
in Coronado, Costa Rica
in January 1994,
with a press run of 800 copies.

IICA

WORLD BANK

Market liberalization and a greater role for the market in the allocation of resources are part and parcel of the structural adjustment programs that were adopted by a growing number of developing countries in the 1980s and the early 1990s. As a result, the agricultural sector, and agricultural support services in particular, had to redefine the roles of the state and civil society, as well as the ways in which they interact.

In most developing countries, agricultural production is a private-sector activity. Nevertheless, agricultural services, including agricultural research and extension, seed development and marketing, and veterinary and financial services, have usually been provided by the public sector.

The roles of the public and private sectors in providing agricultural services are evolving as agriculture itself changes, as ever stronger links are forged with international economies, and as a result of institutional reforms under way in the countries. Also, the roles the public and private sectors take in providing agricultural support services will vary, depending on the structure of agriculture in each country.

It will be possible to determine under which conditions certain services (or specific functions within a service) should be provided by private agents, or when state intervention is preferable, through an in-depth analysis of the nature of each function.

With this in mind, the World Bank and the Inter-American Institute for Cooperation on Agriculture (IICA) held a symposium in San Jose, Costa Rica to discuss appropriate roles for the private and public sectors in the provision of agricultural services. Participants in the meeting included state authorities, experienced professionals from the private sectors of developing countries, and officials from international cooperation organizations with experience in the field. During the event, the results of studies recently conducted by the sponsoring institutions were discussed and papers were presented by participants from the countries.

This publication is comprised of summaries of the studies, the principal papers, presentations on experiences in the countries and general discussions, as well as recommendations for effective management of the agricultural support services sector.

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