Institutional Innovation in Agricultural Research and Extension Systems in Latin America and the Caribbean
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Acronyms and Abbreviations

ACEs  Civil Associations for Extension (Asociaciones Cívicas de Extensión – Venezuela)
AgGDP  Agricultural Gross Domestic Product
AKIS  Agricultural Knowledge and Information Systems
ARD  Agriculture and Rural Development
ASTI  Advanced Science and Technology Institute
BSc  Bachelor of Science
CATIE  Tropical Agricultural Research and Training Institute (Centro Agronómico Tropical de Investigación y Enseñanza – Honduras)
CBOs  Community Based Organizations
CENTA  National Center for Agricultural and Forestry Technology (Centro Nacional de Tecnología Agropecuaria y Forestal – El Salvador)
CGIAR  Consultative Group for International Agricultural Research
CIARA  Foundation for Training and Applied Research for Agrarian Reform (Capacitación e Investigación Aplicada a la Reforma Agraria – Venezuela)
COFUPRO  National Coordination Office for PRODUCE Foundations (Coordinadora Nacional de las Fundaciones PRODUCE – Mexico)
COLCIENCIAS  Colombian Institute for Science and Technology Development (Instituto Colombiano para el Desarrollo de la Ciencia y la Tecnología)
CONACYT  National Science and Technology Board (Consejo Nacional de Ciencia y Tecnología – Mexico)
CONAFOR  National Forestry Commission (Comisión Nacional Forestal – Mexico)
CONICYT  National Commission for Science and Technology Research (Comisión Nacional de Investigación Científica y Tecnológica – Chile)
CORFO  Corporation for the Promotion of Production (Corporación de Fomento de la Producción – Chile)
CORPOICA  Colombian Corporation for Agricultural Research (Corporación Colombiana de Investigación Agropecuaria – Colombia)
DGSA  Agricultural Services General Directorate (Dirección General de Servicios Agrícolas – Guatemala)
DIA  Directorate for Agricultural Research (Dirección de Investigación Agropecuaria)
DICTA  Department of Agricultural Science and Technology (Dirección de Ciencia y Tecnología Agropecuaria – Honduras)
<table>
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<tr>
<th>Acronym</th>
<th>Full Form</th>
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<tr>
<td>EMATER</td>
<td>State Corporation (<em>Empresa de Assistência Técnica e Extensão Rural</em> - Brazil)</td>
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<td>EMBRAPA</td>
<td>Brazilian Agricultural Research Corporation (<em>Empresa Brasileira de Pesquisa Agropecuaria</em> – Brazil)</td>
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<tr>
<td>EMBRATER</td>
<td>Federal Corporation (<em>Empresa Brasileira de Assistência Técnica e Extensão Rural</em> – Brazil)</td>
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<td>FAO</td>
<td>Food and Agriculture Organization of the United Nations</td>
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<td>FDI</td>
<td>Fund for Development and Innovation</td>
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<td>FEAS</td>
<td>Small Farmers Organization, Sierra Peru (<em>Proyecto de Fomento de la Transferencia de Tecnología a las Comunidades Campesinas de la Sierra</em>)</td>
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<td>FIA</td>
<td>Agricultural Innovation Fund (<em>Fundación para la Innovación Agraria</em> – Chile)</td>
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<td>FIP</td>
<td>Fisheries Research Fund (<em>Fondo de Investigación Pesquera</em> – Chile)</td>
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<tr>
<td>FNDCT</td>
<td>National Foundation for Development of Science and Technology (<em>Fondo Nacional de Desarrollo Científico y Tecnológico</em> – Brazil)</td>
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<tr>
<td>FONAIAP</td>
<td>National Fund for Agricultural Research (<em>Fondo Nacional de Investigación Agropecuaria</em> – Venezuela)</td>
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<tr>
<td>FONDAP</td>
<td>Fund for Advanced Research in Priority Areas (<em>Fondo de Áreas Prioritarias</em> – Chile)</td>
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<tr>
<td>FONDECYT</td>
<td>National Fund for Development of Science and Technology (<em>Fondo Nacional de Desarrollo Científico y Tecnológico</em> – Chile)</td>
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<td>FONDEF</td>
<td>Fund for Promotion of Science and Technology Development (<em>Fondo de Fomento al Desarrollo Científico y Tecnológico</em> – Chile)</td>
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<tr>
<td>FONTAGRO</td>
<td>Regional Fund for Agricultural Technology (<em>Fondo Regional de Tecnología Agropecuaria</em>)</td>
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<td>FONTEC</td>
<td>National Fund for Technology and Productive Development (<em>Fondo Nacional de Desarrollo Productivo y Tecnológico</em> – Chile)</td>
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<td>FPPL</td>
<td>Hillside Farmers’ Fund (<em>Fondo para Productores de Ladera</em> – Honduras)</td>
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<td>FPS</td>
<td>PRODUCE Foundation of Sonora (<em>Fundación PRODUCE de Sonora</em> – Mexico)</td>
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<td>FTE</td>
<td>Technology and Extension Fund (<em>Fondo de Tecnología y Extensión</em>)</td>
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<td>FUNICA</td>
<td>Nicaragua Fund for Agricultural Technology (Agriculture-specific competitive science and technology fund) (<em>Fundación para el Desarrollo Tecnológico Agropecuario y Forestal de Nicaragua</em>)</td>
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<tr>
<td>GDP</td>
<td>Gross Domestic Product</td>
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<td>IADB</td>
<td>Inter-American Development Bank</td>
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<tr>
<td>IBTA</td>
<td>Bolivian Institute of Agricultural Technology (<em>Instituto Boliviano de Tecnología Agropecuaria</em>)</td>
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<td>ICA</td>
<td>Colombian Institute for Agriculture and Livestock (<em>Instituto Colombiano Agropecuario</em> – Colombia)</td>
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<tr>
<td>ICTA</td>
<td>Institute of Agricultural Science and Technology (<em>Instituto de Ciencia y Tecnología Agrícolas</em> – Guatemala)</td>
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<td>IDIAP</td>
<td>Panamanian Institute of Agricultural Research (<em>Instituto de Investigación Agropecuaria de Panamá</em>)</td>
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<tr>
<td>IFPRI</td>
<td>International Food Policy Research Institute</td>
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<td>IICA</td>
<td>Inter-American Institute of Agricultural Cooperation (<em>Instituto Interamericano de Cooperación para la Agricultura</em>)</td>
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<tr>
<td>INCORA</td>
<td>Colombian National Institute of Agrarian Reform (Instituto Nacional Colombiano de la Reforma Agraria)</td>
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<tr>
<td>INDAP</td>
<td>Agricultural Development Institute (Instituto de Desarrollo Agropecuario – Chile)</td>
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<td>INIA</td>
<td>National Institute of Agricultural Research and Technology (Instituto Nacional de Investigación y Tecnología Agropecuaria – Chile, Mexico, Peru, Uruguay)</td>
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<td>INIAP</td>
<td>National Institute for Agriculture and Livestock Research (Instituto Nacional Autónomo de Investigaciones Agropecuarias – Ecuador)</td>
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<td>INIAs</td>
<td>National Agricultural Research Organizations (Instituto Nacional de Investigación Agropecuaria)</td>
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<tr>
<td>INIF</td>
<td>National Institute for Forestry Research (Instituto Nacional de Investigación Forestal – Mexico)</td>
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<td>INIP</td>
<td>National Institute for Research on Animal Husbandry (Instituto Nacional de Investigación Pecuaria – Mexico)</td>
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<tr>
<td>INTA</td>
<td>National Institute for Agricultural Technology (Instituto Nacional de Tecnología Agropecuaria – Argentina, Nicaragua)</td>
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<tr>
<td>IRR</td>
<td>Internal Rate of Return</td>
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<tr>
<td>LAC</td>
<td>Latin America and the Caribbean</td>
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<tr>
<td>LCSER</td>
<td>Agriculture and Rural Development Unit of Latin America and the Caribbean of the World Bank</td>
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<tr>
<td>LCSES</td>
<td>Environmentally and Socially Sustainable Development in Latin America and the Caribbean Region of the World Bank</td>
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<td>Ln</td>
<td>Log inverse</td>
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<tr>
<td>MFP</td>
<td>Ministry of Finance and Planning</td>
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<tr>
<td>MOA</td>
<td>Ministry of Agriculture</td>
</tr>
<tr>
<td>MSc</td>
<td>Master of Science</td>
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<tr>
<td>NARI</td>
<td>National Agricultural Research Institute</td>
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<tr>
<td>NGO</td>
<td>Non-Governmental Organization</td>
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<td>NIS</td>
<td>National Innovation System</td>
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<td>NPM</td>
<td>New Public Management</td>
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<td>NRI</td>
<td>Natural Resources Institute</td>
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<tr>
<td>OECD</td>
<td>Organization for Economic Corporation and Development</td>
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<tr>
<td>PhD</td>
<td>Doctor of Philosophy</td>
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<tr>
<td>PIEA</td>
<td>Agricultural Research and Extension Project (INCAGRO) (Proyecto de Investigación y Extensión Agrícola – Peru)</td>
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<tr>
<td>PRODETAB</td>
<td>Agricultural Technology Development Project (Projecto de Desenvolvimento de Tecnologia Agrícola – Brazil)</td>
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<tr>
<td>PRODUCE</td>
<td>PRODUCE Foundation (Fundación PRODUCE – Mexico)</td>
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<tr>
<td>PROMSA</td>
<td>Agricultural Services Modernization Program (Programa de Modernización de los Servicios Agropecuarios – Ecuador)</td>
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<tr>
<td>Abbreviation</td>
<td>Description</td>
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<tr>
<td>PRONAPPA</td>
<td>National Program to Support Small Agricultural Producers (<em>Programa Nacional de Apoyo al Pequeño Productor Agropecuario</em> – Uruguay)</td>
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<tr>
<td>PRONATTA</td>
<td>National Program for Transfer of Agricultural Technology (<em>Programa Nacional de Transferencia de Tecnología Agropecuaria</em> – Colombia)</td>
</tr>
<tr>
<td>R&amp;D</td>
<td>Research and Development</td>
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<tr>
<td>RADA</td>
<td>Rural Agricultural Development Authority (Jamaica)</td>
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<td>S&amp;T</td>
<td>Science and Technology</td>
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<td>SAGARPA</td>
<td>Ministry of Agriculture (<em>Secretaría de Agricultura, Ganadería, Desarrollo Rural, Pesca y Alimentación</em> – Mexico)</td>
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<td>UEFC</td>
<td>Competitive Fund Management Unit (<em>Unidad Ejecutora del Fondo Competitivo</em> – Ecuador)</td>
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<td>UK</td>
<td>United Kingdom</td>
</tr>
<tr>
<td>UMATAs</td>
<td>Agricultural Technical Assistance Units at the Municipality Level (<em>Unidad Municipal de Asistencia Técnico Agropecuaria</em> – Colombia)</td>
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<tr>
<td>USA</td>
<td>United States of America</td>
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<tr>
<td>USAID</td>
<td>United States Agency for International Development</td>
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Agricultural modernization is a key element in the development strategy of almost all Latin American and Caribbean (LAC) countries. Agriculture in LAC is just too important as an economic sector to be ignored. Primary agriculture employs on average about 20 percent of the population in the region, has significant forward and backward linkages to the rest of the economy (creating jobs in agricultural processing and, to a lesser extent, in agricultural input industries), and generates important export income. Raising agricultural productivity is key in making agriculture more competitive in rapidly liberalizing world markets (due to free trade agreements with the United States and other LAC countries), as well as increasing the incomes of rural populations (many of which are desperately poor).

Agricultural research and extension services play a crucial role in raising agricultural productivity, but the performance of these services has for long been considered problematic in many LAC countries, as they failed to adapt to changing circumstances (McMahon 1992). To revitalize the performance of the agricultural research and extension systems, governments throughout the LAC region (in close collaboration with the World Bank and other development partners) started to experiment with a series of institutional reforms during the 1990s. These institutional reforms – in particular with respect to the sustainability of funding for research and technology transfer – have in common a set of principles that can be summarized as follows:

- diversification in execution and funding;
- allocation of funding on a competitive basis;
- demand-driven funding;
- empowerment of local communities; and
- increased private sector implementation.

This study aims to review these institutional reform experiences on the basis of a literature review and seven case studies on specific experiences in different LAC countries. The case studies were conducted in Brazil, Chile, Colombia, Ecuador, Mexico, Peru and Venezuela. Some of these countries had World Bank funded agricultural research and extension projects (e.g. Colombia, Venezuela, Ecuador, Peru and Brazil), while the agricultural institutional reform process in all countries was driven by the countries’ needs and desire for change and improvement in the sector. The study tries to distill lessons from these experiences and provide guidance to key policy makers in national governments, the World Bank and other development partners on potential problems and issues regarding agricultural research and extension services that need to be tackled at the institutional and policy levels. It also attempts to reshape the thinking behind development strategies relating to the agriculture and rural sectors.

1 However, there are a few Caribbean countries in which agricultural production is such a marginal economic activity as compared to other more important sectors, that it may play no role, or a very marginal one, in the country’s development strategy.
This report is organized in four additional chapters besides the introduction (Chapter 1). Chapter 2 describes the analytical framework used in this study and focuses in particular on: (a) changes in the external environment to agricultural research and extension; (b) past performance of agricultural research and extension; and (c) schools of thought that have strongly influenced the reform agenda. Chapters 3 and 4 summarize the reform experiences in agricultural research (Chapter 3) and agricultural extension (Chapter 4), respectively. Although the underlying reform principles have been largely the same across both agricultural research and extension, the way they have been applied and worked out differ quite significantly across the various case study countries and LAC as a whole.

In the final chapter (Chapter 5), the principal conclusions and recommendations of the complete study on agricultural institutional reform are summarized. The remainder of this introductory chapter will provide a brief historical overview of institutional developments in agricultural research and extension in the LAC region.

1.1 Institutional developments and profile

Public agricultural research and extension made a relatively late start in Latin America and the Caribbean (LAC). The Latin American continent had emerged from colonial rule well before the European colonial powers started to introduce agricultural research and extension activities throughout their colonies at the turn of the 20th century. Although immigrants from Europe and the USA brought with them the necessary scientific expertise and experience, public agricultural research and extension activities did not take off in most LAC countries until later in the 20th century. Somewhat of an exception is Brazil, where the first agricultural experiment station dates back to 1860, but for long this remained an isolated event (Beintema et al. 2001).

Pardey, Roseboom and Anderson (1991) state three reasons for the delayed development of agricultural research (and extension) in Latin America: (a) as noted, colonial rule ended before agricultural research and extension activities emerged; (b) agricultural land and labor in Latin America were relatively abundant and, therefore, the pressure to innovate was relatively low; and (c) most states were weak and lacked the capacity to organize public goods and services, and raise taxes to finance them.

It was not until the Great Depression of the 1930s that the necessity for investment in public agricultural research and extension became paramount for several reasons: competition in agricultural world markets increased sharply as commodity prices dropped and trade barriers increased, while a rapidly growing population raised concerns over food security. As a result, governments started to put more serious effort into building agricultural research and extension capacity, usually under the direct responsibility of the Ministry of Agriculture. During the 1940s and 1950s, these national efforts were, in a substantial number of LAC countries, supported by technical and financial support provided by the Rockefeller Foundation and the U.S. Agency for International Development (USAID) (Pardey et al. 1991).

Very early on in the establishment of public agricultural research and extension, the overly bureaucratic culture of most LAC Ministries of Agriculture stood out as a severe handicap to the effective implementation of agricultural research and extension activities. To overcome these problems, many of the larger LAC countries opted to move agricultural research (and, in some instances, agricultural extension as well) out of the Ministry of Agriculture and to organize a
Institutional Innovation in Agricultural Research and Extension Systems in Latin America and the Caribbean

Introduction and Institutional Antecedents

A semi-autonomous agency with considerable organizational and managerial flexibility. The first country to adopt this “national agricultural research institute” (INIA) model was Argentina in 1957; many other LAC countries followed suit throughout the 1960s and 1970s. This was an important institutional innovation that helped agricultural research break away from badly managed and highly politicized state bureaucracies. Moreover, it consolidated rather fragmented agricultural research capacities into a single organization with a clear mission and objectives. Hence the so-called “INIA” model triggered a very rapid expansion of agricultural research capacity (both in numbers and in quality) during the 1960s and 1970s. This expansion came to a sudden standstill – or even reversal – during the 1980s, as a consequence of the debt and economic crisis that severely affected many LAC countries at that time. Most INIAs were unable to adjust to these new realities (they had become large and inflexible bureaucracies themselves) and rapidly lost their efficiency and effectiveness (McMahon 1992, Byerlee et al. 2002). This inflexibility is best illustrated by the fact that for many public agricultural research organizations in the region the share of salaries in total agricultural research expenditures increased sharply at the expense of operating and capital expenditures during the 1980s.

In most of the smaller LAC countries, the Ministry of Agriculture continued to be directly responsible for the implementation of public agricultural research throughout the second half of the 20th century. El Salvador, Nicaragua and Uruguay are exceptions to this generalization, as they adopted the INIA model in late 1980s and early 1990s. In the case of El Salvador and Nicaragua, extension was also part of the transfer. In most other small countries, however, the INIA model was never really an option because of the economies of scale. Nevertheless, most ministerial research departments also slipped into a deep crisis during the 1980s and have been criticized frequently for their lack of efficiency and effectiveness.

In addition to the lead agencies in public agricultural research (INIAs and ministerial research departments), a large number of other agricultural research agencies can be found in most countries, such as government agencies that focus on specific components of the agricultural research agenda (e.g., forestry and fisheries), universities, commodity boards, producer organizations and NGOs. Their performance varies widely, and there is often a lack of cohesion among the various research providers.

The overall dissatisfaction with the performance of public agricultural research led to an important change in the early 1990s. Rather than trying to reform research organizations (in particular INIAs) from within, multilateral organizations, such as the Food and Agriculture Organization (FAO), the Inter-American Development Bank (IADB) and the World Bank, embarked on an agenda that advised countries to focus on the incentive structure for public agricultural research and to shift the funding for agricultural research from the input side (a lump-sum government grant) to the output side (competitive funding schemes, contract arrangements, etc.). This new way of funding of agricultural research came with several other important changes, namely: (1) greater stakeholder participation in research priority setting, making research more demand-driven; (2) enhanced cross-institutional collaboration (by setting aside competitive funding for joint proposals only); and (3) mobilization of additional (private) funding. With greater competition for resources, agricultural research organizations will have to improve their performance or lose their market share. The push to reform the agricultural institutional set up was also stimulated by numerous external factors as shown in Box 1.1.
In contrast to agricultural research, both the funding and implementation of public agricultural extension remained the responsibility of the Ministry of Agriculture in most LAC countries throughout the 1960s, 1970s, and 1980s. During this period, the extension service model was that of technology transfer in a rather top-down, one-way direction. By the early 1990s, the frustration with these usually highly bureaucratic, centralized, under-trained and over-staffed extension services was such that there was considerable consensus and support for bold reforms. This has resulted in a complete dismantling of the national agricultural extension services in quite a number of LAC countries during the past ten to fifteen years. The centralized technology transfer model has been replaced by a decentralized advisory service model, the implementation of which is handed over to local governments (states, provinces or municipalities) or contracted out to NGOs, farmer organizations, private firms, etc., through competitive bidding. In addition, the financing of these advisory services is increasingly being shifted from the central government to local governments (states, provinces or municipalities) or to the beneficiaries themselves. The stronger service-orientation of the extension services has often led to a differentiation of farmers into different economic strata, with different needs and different abilities to pay for services delivered.

In addition to the traditional nation-wide extension services, there is a large number of other public providers of advisory services such as commodity boards (usually crop specific), farmer organizations, NGOs, universities and agricultural societies. Also, public and private input suppliers and credit institutions are often an important source of information and advice to farmers.

Public investments in agricultural extension are not well-documented. The latest global survey by FAO on investments in agricultural extension dates back to the late 1980s. Moreover, the profound changes in public

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**Box 1.1:**

**Drivers of Agricultural Institutional Reform**

The 1990s was a period of significant transition for Latin America and the Caribbean (LAC). Many LAC countries were embarking on a process of democratization and trade liberalization. These systemic changes had dramatic repercussions on the development of agricultural research and extension systems in the region. Most notably, agricultural innovation systems were impacted by:

- Free trade and globalization, which increased competition and demanded that producers maximize their true comparative advantage;
- Fiscal restraints, due to economic crises, that reduced and demanded more efficient use of public resources;
- Greater role of the private sector in the provision of specialized services;
- Decentralization, with increased responsibilities and resources being devolved to the local level; and,
- Civic participation in decision-making processes at all levels.

These factors stimulated the reform process in the region and allowed the agricultural sector to keep pace with the changing demands of its new environment.

agricultural extension over the past ten to fifteen years (i.e., the dismantling of national extension services) make comparisons over time rather problematic.

Encouraged by support from major international donors, LAC countries expanded investment in agricultural R&D at a rapid rate during the 1960s and 1970s. The growth rate peaked at nearly 10 percent per year during the late 1970s, but dropped to less than 1 percent per year on average during the difficult financial and economic times of the 1980s. It recovered during the early 1990s, but has been stagnant or declining since then (Beintema and Pardey 2001).

Despite the slower growth in agricultural research expenditures over the period 1976-1996 in LAC, the region has the highest research intensity ratio of any developing region, whether research expenditures are measured as a share of agricultural GDP, expenditures per capita or expenditures per economically active agricultural population. However, the LAC countries invest substantially less than developed countries, particularly in terms of agricultural research expenditures per economically active person in agriculture.

National agricultural research capacity in the LAC region differs hugely. In a review conducted in the late 1990s, Brazil alone accounted for close to a third of the region’s total public agricultural research capacity, estimated at 15,780 FTE researchers in 1996. The top four countries (Argentina, Brazil, Cuba and Mexico) accounted for about 74 percent of the regional agricultural research capacity. At the other end of the spectrum, 19 LAC countries employed fewer than 50 agricultural researchers (Figure 1.1). They are nearly all Caribbean countries, and five of them reported not to have employed any agricultural research staff whatsoever in 1996.

The same review showed quite substantial differences in the level of training of researchers and in expenditure per researcher. While 82 percent of

Figure 1.1:  
Size distribution of agricultural research systems in Latin America and the Caribbean, 1996

![Size distribution of agricultural research systems in Latin America and the Caribbean, 1996](image)
Brazilian researchers held graduate degrees, just 20 percent of Guatemalan and 27 percent of Honduran researchers did. Only in Brazil and Mexico did more than half of the researchers have graduate degrees, and only in Brazil and Chile did 20 percent or more hold a Ph.D.

There was a steady increase in the educational level of researchers between the early 1970s and 1996. The share of researchers holding a Ph.D. increased six-fold, and the share holding an MSc degree more than doubled; at the same time, the proportion holding a BSc degree fell from 77 percent to 33 percent. These regional figures are strongly affected by the inclusion of the progress that Brazil and Mexico have made in training researchers. Excluding these two countries, the share of LAC researchers with graduate degrees falls to 55 percent, with just 18 percent holding a Ph.D.
2. Factors Shaping the Institutional Reform Agenda

The concept of an innovation system can be defined as “a network of organizations, such as individuals, organizations and enterprises, focused on bringing new products, new processes, and new forms of organization into economic use, together with institutions and policies that affect their behavior and performance. Innovation systems focus not merely on the science suppliers, but on the totality and the interaction of actors involved in innovation.” The application of this concept to the agricultural sector presents opportunities for expanding the knowledge base and offers alternatives in the development of agricultural technology.

One way of trying to understand how agricultural innovation systems change and evolve is by adopting an evolutionary metaphor—an agricultural innovation system is a living organism that has to adapt itself to changes in its environment. The more successful agricultural innovation systems are in understanding these changes and adapting to them, the more productive they will be. A strict evolutionary perspective implies that adaptation to changes in the external environment is based completely on trial and error—we cannot influence the outcome. A more accurate metaphor would be to see an agricultural innovation system as an intelligent living organism—it has the capability to learn and correct itself.

This evolutionary conceptual framework of how agricultural innovation systems change and adapt is illustrated in Figure 2.1. In addition to changes in the external environment and learning from past experiences (the feedback loop), a third factor has been added—namely, schools of thought. These schools are based in part on accumulated experience, but also have a strong normative component as they propose an ideal model that should be pursued. In this chapter, each of the three factors shaping the reform agenda will be discussed in detail.

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2.1 Exogenous changes to the agricultural innovation system

Trade liberalization and globalization are profoundly affecting agricultural production in the LAC region. There is a clear shift away from the rather autarkic import-substitution and self-sufficiency policies pursued in the past. By eliminating trade barriers, local markets are becoming more integrated into world markets. This opens up new export opportunities but, at the same time, leads to more international competition. As a consequence, farmers are forced to reconsider their true comparative advantage. This may result in profound changes in the composition of agricultural output in many countries and, hence, in the demand for agricultural knowledge and technology. At the same time, increased competition will make staying on the competitive edge in agricultural production more demanding. This places important new demands on the agricultural innovation systems throughout the LAC region.

Policymakers have started to attach greater importance to agricultural innovation policies for two reasons: (1) as noted above, there is an increase in the demand for new agricultural knowledge and technology as a response to increased competition; and (2) other interventions to stimulate or protect agricultural production (e.g., price subsidies) are increasingly restricted by trade agreements. Science and technology (S&T) policies are usually exempted from such restrictions. In particular, some of the bigger LAC countries in recent years have adopted ambitious policies to stimulate S&T investments. Brazil and Mexico, for example, both intend to double their R&D expenditures as a percentage of the Gross Domestic Product (GDP) within this decade.

The return to democracy in many LAC countries has profoundly changed the political landscape of the region since the late 1980s. This change has facilitated two important developments that are also affecting agricultural innovation systems, namely: (1) government decentralization; and (2) more active participation of the population in decision making processes at all levels of government. At the same time, there has been a widespread trend in the region (and in the rest of the world) towards a more market-oriented economy along with a more critical attitude towards government intervention. In the case of agricultural research and extension, governments have started to scrutinize the public-good character of these activities more closely and to explore opportunities of shifting at least some of the responsibility for these activities to the private sector.

New opportunities and threats to the agricultural sector are not only the result of trade liberalization and globalization, but also of changing local demand. Nowadays, in most LAC countries the population is highly urbanized and demands more diversified and better quality food products. Food processing industries and supermarkets have become the dominant players in the food production chain. Increasingly they dictate what needs to be produced, including the quality characteristics of the products, their delivery date and their price. As a consequence, food processing industries and supermarkets have started to exert major influence over production technologies in primary agriculture.

The overall picture that emerges is that of an agricultural sector that is undergoing profound changes. On the one hand, there are successful entrepreneurial farmers (some small, but primarily medium and large)
producing for the new local and international markets; while on the other hand, there are many small farmers stuck in traditional agricultural production systems who produce for declining markets or their own consumption. Poverty among these farmers is often high, and their economic perspectives are limited. Improving the livelihoods of this large group of rural poor constitutes an enormous challenge to governments and places severe pressure on public agricultural research and extension agencies to target poor farmers in marginal areas.

2.2 The feedback loop: learning from experience

In development literature, there is a lot of criticism of the performance of public agricultural research and extension agencies in LAC, and throughout the developing world in general. This negative picture, however, is supported only partially by aggregate economic data on agricultural productivity trends, multi-factor productivity studies, or by rate-of-return studies on public agricultural research and extension investments. In all three instances, the reported performance of the LAC region is positive and around the world average.

The agricultural productivity trends in Figure 2.2 show that in terms of agricultural labor productivity the LAC region (split here into Central America and the Caribbean, and South America) sits halfway between other developing regions and developed countries.5 The LAC region is relatively land abundant, but at the same time has experienced for the past 40 years relatively slower growth in land productivity than Asia and Africa.

Central America and the Caribbean clearly differ from South America in the level of the land-labor ratio (they have less than half the South American ratio), as well as its trend (declining in the case of Central America and the Caribbean and increasing in the case of South America). The latter suggests there is substantially higher pressure on land in Central America and the Caribbean than in South America. Nevertheless, land productivity growth in South America exceeded that of Central America and the Caribbean by around 15 percent on average over the period 1961 to 2000. Most remarkable, however, is that labor productivity growth in South America exceeded that in Central America and the Caribbean by some 50 percent on average over that same period. This has further widened the agricultural labor productivity gap between the two sub-regions. In 2000, output per agricultural laborer stood at US$ 4,773 in South America and US$ 1,981 in Central America and the Caribbean.

Based on Figure 2.2, the two-dimensional productivity graph considers only two inputs: land and labor. All other inputs (such as fertilizers and capital goods) and changes in the quality of land and labor or other possible explanatory factors for productivity changes are neglected. Multi-factor productivity analysis allows for a more complete coverage of the various inputs used in agricultural production as well as the inclusion of potential productivity-shift factors, such as the policy environment and investments in infrastructure and S&T. However, very few MFP studies focusing on agricultural productivity in Latin America and the Caribbean have actually included an S&T variable. The few that have, suggest a positive elasticity on the same order as in global studies.

5 The productivity trends in Figure 2.2 have been constructed using FAO crop and livestock production indices in combination with FAO agricultural land and labor data. The plotted productivity trends all start in the south-west corner and generally move to the north-east corner. The dotted lines represent fixed land-labor ratios. By using log scales, the length of the productivity trend reflects the percentage growth over time. The longer the trend line, the greater the growth.
Table 2.1 summarizes the results of some 450 rate-of-return studies on investments in applied agricultural research and agricultural extension worldwide. Despite large differences between these studies in terms of coverage and methodology used, they tend to suggest that agricultural research and extension activities generally command high Internal Rates of Return (IRR). The reported median IRR across all regions is 41 percent for extension and 49 percent for applied agricultural research. The reported median IRR for Latin America is 46 percent for extension and 47 percent for applied agricultural research. Neither deviate significantly from the global medians.

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6 Alston et al. (2000) give similar high IRR results for agricultural research.
One of the general conclusions from these rate-of-return studies is that, even considering all the serious attribution problems, investments in agricultural research and extension are profitable, and more investment is warranted. However, these studies do not indicate how much more should be invested and in what.

Despite high rates of return, there may be considerable room for improving the efficiency and effectiveness of agricultural research and extension activities. Determining this would require a closer analysis of the organization and management of public agricultural research and extension services. This is in line with a broader trend towards greater professionalism within government, as well as greater accountability and transparency of government. In the next section we will discuss these ideas in more detail.

### 2.3 Schools of thought that influence the reform agenda

There are two schools of thought that have influenced much of the current thinking about reforms in agricultural innovation systems, namely system analysis and new public management.

Because of a greater emphasis on impact, agricultural S&T strategies have shifted during the past decade from a National Agricultural Research System (NARS) perspective to an Agricultural Knowledge and Information System (AKIS) perspective and, more recently, to an NIS (national innovation system) perspective. The latter comprises a far broader set of actors than traditional agricultural research, extension and education agencies. Innovation takes place throughout the whole economy, and not all innovations originate in formal R&D. This new perspective places more emphasis on the roles of farmers, input suppliers, transporters and processors in the innovation process.

While each of the three system concepts has its own strengths and weaknesses, they can be seen as interlinked and cumulative: NARS focuses on the...
generation of knowledge, AKIS on the generation and diffusion of knowledge, and NIS on the generation, diffusion, and application of knowledge (Figure 2.3).

Figure 2.3a depicts research as the sole source of innovation. Without research, it implies, there is no innovation. A more accurate way of depicting the link is shown in Figure 2.3b, in which the NARS is no longer seen as the epicenter of innovation but simply one of its various sources. Knowledge and information may spill into the innovation system from domains other than the NARS and, perhaps even more crucially, knowledge and information may emerge from outside the realm of formal research because of on-farm as well as off-farm learning (up and down the agricultural production chain)—that is, learning through doing, using and interacting. Institutional, organizational and managerial types of innovation, in particular, more often have their origins in on-site learning processes rather than off-site formal research. These forms of innovation are usually far more complex and difficult, because one cannot experiment and fine-tune them off-site.

By adopting an NIS perspective, bigger issues come into focus than when adopting a more limited NARS or AKIS concept. By starting at the knowledge-application end, the question of why farmers innovate or why they do not becomes a major issue for debate and research. What are the constraints that keep them from innovating? Is it prices in the market, for example, or the lack of (or lack of access to) technology? Are farmers passive recipients, or do they actively search for innovations? What are the roles of input suppliers, cooperatives, traders, processors, NGOs and government extension services in technology diffusion? What are the relative strengths and weaknesses of each diffusion channel? How can it be improved, and what can be done to reach more farmers through it? We may learn that the most critical bottleneck is not the lack of available technology, but whatever prevents other factors from playing their often far more crucial role.

One of the difficulties of introducing an innovation system approach is that members of traditional agricultural research organizations feel uncomfortable...
with it because it expands the agenda beyond their present capabilities. Knowledge and expertise on institutional innovation is usually very limited among national agricultural research organizations. In any case, if we want to achieve more impact, we have to pay attention both to technological and institutional innovation.

The new public management (NPM) school, which aims to foster a performance-oriented culture in a less centralized public sector, has a set of six core characteristics:

- **Productivity**: try to find ways to squeeze more services from the same – or a smaller – revenue base;
- **Marketization**: contract out the implementation of policies to the private sector or to semi-autonomous, non-profit agencies, and replace traditional bureaucratic command and control mechanisms with market strategies;
- **Service orientation**: to make government programs more responsive, turn the service delivery system upside down. Instead of designing programs from the point of view of service providers and managing them through existing bureaucratic structures, reformers try to put citizens (as service recipients) first;
- **Decentralization**: transfer more service-delivery responsibilities to local governments and front-line managers;
- **Policy**: separate the government’s role as purchaser of services from its role in providing them; and
- **Accountability for results**: focus more on outputs and outcomes instead of processes and structures. Replace top-down, rule-based accountability systems with bottom-up, results-driven systems (Kettl 2000).

Although new public management has often been interpreted as being anti-public sector, NPM is not about whether tasks should be undertaken by government or not. It is about getting the public sector working better.

Australia, Chile, New Zealand and the UK are well known for their early experimentation and adoption of NPM ideas and concepts during the 1980s. In recent years, these ideas and concepts have become increasingly popular and spread quickly around the globe, including many developing countries. Hence, experiences with NPM approaches are accumulating rapidly.

Batley (1999), who has studied a series of new public management interventions in developing countries, provides some insightful observations that are also of relevance to the current study:

- Indirect – regulatory, contracting, financing and enabling – roles of government are usually weakly developed.
- Experience in contracting should be developed progressively, focusing first on cases where services are less critical and can be specified and measured. Particularly for research and extension, the specification and measurement of service delivery is complicated and difficult.
- Managerial autonomy needs to be within a clear policy framework and matched by ex post managerial accountability to users or elected representatives. If the accountability mechanism does not work properly, decision-making power ends up with the service managers.
- Where radical reforms to service delivery mechanisms are externally imposed under crisis conditions, they are rarely effectively implemented.
The introduction of competitive S&T funding schemes has been the principal vehicle for institutional reform in agricultural research throughout the LAC region during the past 10-15 years. Most importantly these competitive funds have:

- Helped to improve the governance of agricultural research;
- Induced a diversification of research suppliers;
- Improved the client orientation of agricultural research activities; and
- Stimulated cross-institutional collaboration.

Not every competitive fund contributes, by definition, to these reform themes, but can be designed to do so. For example, standard competitive S&T funding schemes promote competition rather than collaboration between different research agencies, but by requiring joint proposals or by giving joint proposals extra evaluation points, cross-institutional collaboration can be stimulated.

Case studies in five different countries (i.e., Brazil, Chile, Colombia, Ecuador and Mexico) were conducted to document and analyze the experience with competitive S&T funding schemes. In addition to agriculture-specific competitive S&T funds, this study also identified a substantial number of general competitive S&T funds that finance agricultural research. In Chile and Mexico, these reforms were initiated by the governments themselves, with a vision to improve the quality of agricultural innovation systems through increased competition and participation. The oldest of these general competitive S&T funds originated from within the university sector and supported primarily academic, disciplinary research. Increasingly, however, general competitive S&T funds have emerged in recent years that emphasize economic rather than academic impact. The volume of resources for agricultural research activities provided by these general competitive S&T funds is quite substantial in at least three of the five case study countries (i.e., Brazil, Chile and Mexico). Hence, these general competitive S&T funds have been taken into account to get a more balanced picture of the impact of competitive financing on the agricultural innovation system. Table 3.1 provides a summary of the various competitive S&T funds in the five case study countries.

Competitive S&T funds can differ greatly on aspects such as:

**Academic versus economic impact**

In most countries competitive S&T funds started in the university sector. These funds focus on academic research, and selection is based on academic excellence within a particular discipline. Increasingly, however, the economic impact of research is taken as the primary selection criteria rather than academic excellence. The two need not be mutually exclusive,
but which of the two is dominant in the selection process can change the outlook of the competitive S&T fund profoundly. The establishment in recent years of sector-specific competitive S&T funds in Brazil, Chile, Colombia and Mexico reflects a trend towards a greater emphasis on the economic impact of S&T.

**Target objective**
Competitive S&T funds often focus on only one particular component of the S&T agenda, such as a particular discipline, technology field (e.g., biotechnology), research problem, economic sector, or a specific group of producers (e.g., small farmers or big enterprises).

**Target audience**
Competitive S&T funds may target specific groups of researchers on the basis of their institutional affiliation (e.g., only researchers at universities can apply), their career path (e.g., only post-graduate researchers can apply), or their geographical location (e.g., state-specific S&T funds such as in Brazil and Mexico).

**Target intervention**
While most S&T funds focus primarily on financing (agricultural) research activities, many operate multiple funding windows financing various other aspects of the agricultural innovation process, such as technology transfer activities, research equipment and infrastructure, training of researchers, study tours abroad, foreign exchange programs, workshops and conferences, feasibility studies and risk capital.

**Selection procedure**
Calls for project proposals can range from very general (the more academic-oriented funds) to very specific (the more economic-oriented funds) in terms of research and technology transfer needs. Another important difference is the use of pre-proposals in the selection procedure, which results in a staged selection procedure. Only after a pre-proposal (usually only 1-2 pages) has been reviewed and accepted will the applicant(s) be asked to develop a full proposal. This can substantially reduce the time and effort invested by both the competitive fund and the applicants in the selection procedure. PROMSA in Ecuador has had very good experiences with this staged selection process. In Mexico, many of the CONACYT funds use a staged selection procedure, while the PRODUCE foundations have recently started to adopt the method.

**Specific requirements**
Such as: (a) joint collaboration between research institutes, universities or companies (or specific combinations of them); and (b) a minimum amount of private co-financing.

**Level of financing offered**
Most competitive S&T funds only cover operational research expenses. Some, however, will accept overhead charges, charges for the use of infrastructure, salaries of temporary staff and bonuses for research staff directly involved in the project as legitimate expenses that can be charged. Hence the share of the competitive S&T fund in total project costs can differ greatly.

The remainder of this chapter summarizes the principal experiences across the five countries by focusing on four important institutional reform themes to which competitive funding schemes have contributed, namely: (a) governance (section 3.1); (b) diversification (section 3.2); (c) client orientation (section 3.3); and (d) cross-institutional collaboration (section 3.4).
Table 3.1:
Competitive S&T funds in the five case study countries

<table>
<thead>
<tr>
<th>Country</th>
<th>Agriculture-specific competitive S&amp;T funds</th>
<th>Other specific and general competitive S&amp;T funds of relevance to agricultural research</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brazil</td>
<td>• PRODETAB (Agricultural Technology Development Project) is a joint project of EMBRAPA and the World Bank and operates a competitive research fund. A specific aim of the PRODETAB competitive fund is to support cross-institutional research initiatives. The project started in 1997 and has been completed in 2004. • FNDCT Agribusiness is one of the 14 sector-specific competitive S&amp;T funds under the umbrella of the National Foundation for the Development of Science and Technology (FNDCT). FNDCT Agribusiness was initiated in 2000 and is financed by a specific tax on the import of technology. • The National Council for S&amp;T Development (CNPq) operates a competitive S&amp;T fund for basic research. It targets mainly universities and is in operation since the early 1980s. • FNDCT Biotechnology was initiated in 2000 and is one of the 14 sector-specific competitive S&amp;T funds under the umbrella of FNDCT. It is financed by a specific tax on the import of technology. • FNDCT Water was initiated in 2000 and is one of the 14 sector-specific competitive S&amp;T funds under the umbrella of FNDCT. It is financed by a specific tax on the use of water. • FNDCT University-Industry was initiated in 2000 and is one of the 14 sector-specific competitive S&amp;T funds under the umbrella of FNDCT. It is financed by a specific tax on the import of technology. • FNDCT Research infrastructure. Each FNDCT sector fund must place 20% of its budget into the Research Infrastructure Competitive Fund. • State-specific competitive S&amp;T funds. In at least 15 of the 27 Brazilian states general competitive S&amp;T funds have been established. The most important one is the State of São Paulo Research Foundation (FAPESP), established in 1962. The financing of FAPESP is based one percent of all state tax income. Most state-specific competitive S&amp;T funds have been modeled after FAPESP, including the financing by means of a fixed share of state tax income.</td>
<td></td>
</tr>
<tr>
<td>Chile</td>
<td>• The Agricultural Innovation Fund (FIA) was created by the Ministry of Agriculture in 1981. It led a rather dormant existence between 1981 and 1994, but saw its budget (paid by the Ministry of Agriculture) increase rapidly during the past 10 years. FIA operates several instruments, of which a competitive fund for agricultural innovation projects is the most important. • The National Fund for the Development of Science and Technology (FONDECYT), created by the National Commission for Scientific and Technological Research (CONICYT) in 1981, is the oldest competitive S&amp;T fund in the country. It supports basic scientific and technological research in all knowledge areas. In addition to its regular competitive research fund, FONDECYT operated several more specific funds in support of: (a) international scientific collaboration, (b) post-doctoral research, (c) research clusters, and (d) centers of excellence. The latter is known as the Fund for Advanced Research in Priority Areas (FONDAP).</td>
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### Table 3.1 (continued)

<table>
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<tr>
<th>Country</th>
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<th>Other specific and general competitive S&amp;T funds of relevance to agricultural research</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chile</td>
<td>• The Fisheries Research Fund (FIP) was created by the Fisheries Department of the Ministry of Economic Affairs and Energy in 1991. Financing is derived from advanced payments of fisheries royalties.</td>
<td>• The Fund for the Promotion of Scientific and Technological Development (FONDEF), created by CONICYT in 1991, was originally setup with the assistance of an IDB loan as a drawdown competitive S&amp;T fund to strengthen and exploit the country’s S&amp;T capacity. Its main aim is to strengthen link between research institutions and technology-based companies. Private counterpart funding of at least 20% required. FONDEF finances research in ten priority areas, of which three are of direct relevance to the agricultural sector, namely: (a) agriculture; (b) forestry; and (c) fisheries and aquaculture.</td>
</tr>
<tr>
<td></td>
<td>• The Fund for Development and Innovation (FDI), created by the Corporation for the Promotion of Production (CORFO) in 1995, supports innovation activities that are pre-competitive and benefiting the general public. It co-finances the following activities: (a) the development and adaptation of new technologies; (b) technology diffusion; (c) capacity building; and (d) market development. Private counterpart funding of at least 20% required.</td>
<td>• The National Fund for Technological and Productive Development (FONTEC), created by CORFO in 1992, supports innovation activities in the private sector. It co-finances technological innovation, infrastructure, and technology transfer projects initiated by the private sector on a competitive basis. Public support not more than 50% of total project costs.</td>
</tr>
<tr>
<td></td>
<td>• None reported.</td>
<td></td>
</tr>
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</table>

Colombia

• The National Program for the Transfer of Technology (PRONATTA), created in 1995, is a joint project by the Ministry of Agriculture and the World Bank. Its last call for proposals took place in 2001. A follow-up project is currently being negotiated.

• The Colombian Institute for Science and Technology Development (COLCIENCIAS) manages several competitive S&T funds. Of the 11 COLCIENCIAS programs, four manage competitive S&T funds of relevance to agricultural research, namely: (1) The National Program for Basic Sciences; (2) The National Program for Agricultural S&T; (3) The National Program for Maritime S&T; and (4) The National Program for Environmental S&T. The budget of COLCIENCIAS has declined sharply since 1997.

Ecuador

• The Agricultural Services Modernization Program (PROMSA), a joint project by the Ministry of Agriculture and the World Bank, established a competitive S&T fund in 1999.

• None reported.
### 3.1 Governance

The introduction of competitive funding schemes for agricultural research and technology transfer activities has in many instances led to important changes in the governance of national agricultural innovation systems. Whereas in the past the national agricultural research agencies could set research priorities quite independently (they received an all-inclusive lump sum based on a broad research mandate), today priority setting responsibilities have shifted due in part to competitive S&T funding schemes.

Most competitive S&T funding schemes only cover a part of total project costs. Most common is that they pay for the operating costs of a project, and the implementing agency picks up salary and capital costs. As a consequence, competitive S&T funding schemes tend to leverage a far larger part of the agricultural research budget than their financial contribution would suggest. This comes at the expense of the implementing agencies, which see their room for setting research priorities reduced. In extreme cases, the research agenda of an implementing agency is controlled completely by outside financing sources. This seems, for example, to be quite common among universities. How strictly a competitive S&T fund controls the priority setting process differs greatly between the agriculturespecific and general competitive S&T fund. Specific competitive S&T funds tend to define research needs

<table>
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<tr>
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<th>Other specific and general competitive S&amp;T funds of relevance to agricultural research</th>
</tr>
</thead>
</table>
| Mexico   | • The Sector Fund for Research on Crops, Livestock, Fisheries, Aquaculture, Agrobiotechnology and Genetic Resources, created in 1996, is financed jointly by the Ministry of Agriculture (SAGARPA) and the National Science and Technology Board (CONACYT).  
• The Sector Fund for Forestry Research, Development and Technological Innovation, created in 1996, is financed jointly by the National Forestry Commission (CONAFOR) and CONACYT.  
• The PRODUCE foundations are state-specific competitive agricultural S&T funds. They were established in 1995. Funding based on national, state, and producer contributions. The latter is usually in kind. The PRODUCE foundations put 20% of their resources in (commodity specific?) competitive funds for regional research. CONACYT provides counterpart financing for these regional research activities. | • The Sector Fund for Academic Research, created in 1996, is financed jointly by the Ministry of Education (SEP) and CONACYT. It targets basic research at universities.  
• The Sector Fund on Water Research, created in 1996, fund is financed jointly by the National Water Board and CONACYT.  
• The Sector Fund for Environmental Research, created in 1996, fund is financed jointly by the Ministry of the Environment and Natural Resources (SEMARNAT) and CONACYT.  
• The CONACYT/Mixed Funds are state-specific competitive S&T funding schemes financed jointly by CONACYT and the respective state governments. They were initiated in 2001 and at present 26 of the 32 states have their own fund. |
up front (i.e., before placing a call for proposals),
while general S&T funds leave this far more open. In
the latter instance, it is usually academic relevance
that matters most in the selection procedure, while in
the former, it is economic relevance.

Competitive S&T funds can contribute positively to the
governance of the agricultural research process in the
following ways, namely:

**Improved identification and prioritization of agricultural research needs.** This is usually the case in the more
specific competitive S&T funds. General S&T funds usu-
ally do not prioritize research needs ex ante and, hence,
leave much of the initiative of selecting research topics
to the individual researchers. This may result in a rather
supply-driven agricultural research agenda. Farmer
participation at this stage of the agricultural research
process is considered quite crucial and will be dis-
cussed further in the section on client orientation.

**Improved formulation of research project pro-
oposals.** The introduction of competitive funding
schemes requires a strong project culture within ag-
ricultural research and technology transfer agencies.
For some agencies, it took some time to adjust to
the new rules and regulations. Universities seem
to have more experience with competitive funding
schemes.

**Objective selection of agricultural research projects.**
All project proposals are reviewed by external review-
ers. Research projects that are approved and selected
for financing are listed publicly. Many competitive S&T
funds have project databases that can be consulted
on line.

**Improved monitoring and evaluation (M&E) of project
implementation.** This has long been a weak spot in
most agricultural research and technology transfer
agencies. Internal reporting mechanisms are often
non-existent and sanctions on non-reporting are
seldom applied. Consequently, competitive fund-
ing schemes have introduced innovations in M&E
(see Box 3.1).

Competitive S&T funds can also lead to governance
problems, namely:

**By lacking sufficient objectivity.** Particularly in small
science communities (31 of the 40 LAC countries have
fewer than 200 agricultural researchers), it can be very
difficult to organize impartial reviews of research proj-
ect proposals. A solution may be to mobilize foreign
reviewers, but this can be quite costly to organize and
manage.

**By using a limited time horizon.** Competitive S&T
funding schemes, which usually only fund short-
term (2-4 years) projects, are not necessarily the
best funding instrument for long-term agricultural
research activities, such as plant breeding and
strategic research.

**By being relatively inflexible in adjusting project
proposals and implementation.** Strict adherence to
selection transparency and procedures can jeopardize
efficient selection and implementation of agricultural
innovation projects. Simple mistakes in budgets or
incomplete documentation sometimes result in an
outright rejection of project proposals.

**By not fitting within existing bureaucratic procedures.**
Government agencies often find it extremely difficult
to administer a research grant within existing bu-
reaucratic procedures. For example, resources often
cannot be transferred to the next financial year. A way
to avoid this problem is by stalling the research grant
in a non-profit foundation, which administers the grant
on behalf of the research project. While this adds to
Box 3.1. Monitoring and evaluation of project implementation in Ecuador

The Agricultural Services Modernization Program (PROMSA) in Ecuador has developed, in close collaboration with Natural Resources International (NRI), a state-of-the-art monitoring and evaluation (M&E) system for its competitive funding scheme. For individual projects financed under the Competitive Fund, a system of objectives and milestones (for inputs, activities and outputs) was established and formed the basic elements of a log-frame approach. The system is based on self-monitoring by project implementers, who summarize progress in quarterly reports. Data on all projects and milestones are recorded in a database that uses a system of “alert” signals or flags to indicate that a project has become a “problem project”. While in “alert” status, a project is not eligible for payments from the Fund. If the project does not clear its “alert” status by correcting deficiencies or rescheduling milestones within a specific time-frame, it will be cancelled.

The evaluation of subprojects is based on: (1) annual reports by researchers, (2) feedback from project-specific reference groups of users and other interested individuals, and (3) bi-annual supervision visits to each project. The establishment of a reference group for each project is an innovative approach to decentralized evaluation in which beneficiaries participate. Each project identifies a group of four to eight individuals from the target group or other interested stakeholders (other researchers, extension staff, agribusiness, etc.). The exact group composition and function are fairly flexible, but ideally the group participates in designing, planning and implementing the project. The group meets several times a year to consult on project issues.

M&E of the Competitive Fund as a whole is based on several mechanisms, including (1) the annual operating plan combined with quarterly reports on implementation according to the proposed work plan; (2) direct access to data on project implementation and overall performance of the project portfolio provided by the project database; (3) visits by PROMSA officers to projects and other organized activities to observe first-hand processes being employed in administering the competitive fund; and (4) special studies and external evaluation of competitive fund operation, outcomes and impacts.

3.2 Diversification

One of the principal arguments for recommending the introduction of competitive agricultural S&T funds is the relative monopolies of poorly functioning and slow responding national agricultural research organizations (INIAs) should be broken. When parts of the operating budgets that normally would have gone to the INIAs are placed in competitive agricultural S&T funds, other research providers are given the opportunity to compete for these resources. In all five countries studied, other research providers have been quite successful in capturing a substantial part of the competitive S&T funding made available in this manner. This has led to a diversification of research providers and, hence, more competition. The INIAs have lost market share in four of the five countries (Chile, Colombia, Ecuador and Mexico) during the past ten years. In some instances, this greater competition for resources seems to have triggered a change in behavior among INIA researchers in recent years. In the overall administrative costs of an innovation project, timely and undisrupted disbursement of research resources may create some savings as well. In most countries this is a widely accepted legal construct.
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Colombia and Ecuador, for example, rejection rates of project proposals submitted by INIA researchers were higher than average during the first few calls for proposals, but improved substantially later on.

An indication of the relative strength of the INIAs in mobilizing competitive funding is provided in Table 3.2. In all instances, the INIAs mobilized only about half, or less, of the competitive funding available. Universities usually represent the second largest category of recipients of agriculture-specific competitive S&T funding. In Chile, however, they represent the largest category, and in Mexico, they represent the largest category in two of the three funds.

Because most competitive funds pay only a part of the project costs, diversification of research providers has been limited mainly to public agencies (in particular universities) that receive a core contribution from the government. In the case of technology transfer projects, however, competitive funds often attract NGOs and private companies as implementing agencies. In those instances, the counterpart contribution is usually provided by the direct clients of the project (i.e., farmers) rather than the implementing agency. In Table 3.2, competitive funds that fund only research activities do not report participation by NGOs, while those that fund both research and technology transfer activities do.

3.3 Client orientation and participation

Client orientation and participation are important characteristics of some (but not all) of the agriculture-specific S&T funds. In particular, funds that focus on adaptive agricultural research and technology transfer activities have adopted strategies for involving farmers (to a greater or lesser extent) in: (a) identification and prioritization of innovation needs; (b) project development; (c) project selection; (d) project implementation; and (e) project financing. Examples of such funds are FIA in Chile, PRONATTA in Colombia, and the PRODUCE Foundations in Mexico (see Box 3.2). To reach their clients, these funds have adopted decentralized strategies or are in the process of doing so. Table 3.3 summarizes the principal characteristics of all agriculture-specific competitive S&T funds in the five case study countries.

Table 3.2: Distribution of competitive funding by type of implementing agency

<table>
<thead>
<tr>
<th>Country</th>
<th>Competitive fund</th>
<th>INIA</th>
<th>Other public (research) agencies</th>
<th>Universities</th>
<th>NGOs</th>
<th>Others</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brazil</td>
<td>PRODDETAB</td>
<td>52</td>
<td>11</td>
<td>30</td>
<td></td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>FNDCT Agribusiness</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>Chile</td>
<td>FIA</td>
<td>10(^{b})</td>
<td>15</td>
<td>38</td>
<td>17</td>
<td>20</td>
</tr>
<tr>
<td>Colombia</td>
<td>PRONATTA</td>
<td>43(^{c})</td>
<td>4</td>
<td>9</td>
<td>21</td>
<td>23(^{d})</td>
</tr>
<tr>
<td>Ecuador</td>
<td>PROMSA</td>
<td>38(^{c})</td>
<td>37</td>
<td>11</td>
<td>14</td>
<td></td>
</tr>
<tr>
<td>Mexico</td>
<td>SAGARPA/CONACYT</td>
<td>23</td>
<td>23</td>
<td>53</td>
<td></td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>CONAFOR/CONACYT</td>
<td>30</td>
<td>17</td>
<td>47</td>
<td></td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>PRODUCE Foundations</td>
<td>51(^{e})</td>
<td>4</td>
<td>16</td>
<td>9</td>
<td>19</td>
</tr>
</tbody>
</table>

\(^{a}\) Competitive S&T fund managed by EMBRAPA to foster cross-institutional collaboration.

\(^{b}\) INIA’s share dropped from 25% during the late 1990s to 10% in 2002.

\(^{c}\) Rejection rates of project proposals by INIA were initially substantially higher than average, but have improved in recent years.

\(^{d}\) These are all joint ventures between different research agencies.

\(^{e}\) Initially the PRODUCE Foundations only targeted INIFAP (Mexico’s INIA). As of 1996, however, other providers can compete as well. Since then, INIFAP’s share has declined steadily.
While stronger client orientation and participation are generally considered positive, there are also some critical views on this development:

- It leads to a research agenda that focuses too much on short-term problems, rather than on long-term opportunities.
- Spillover effects of farmer participation in projects tend to be very limited. Farmers who participate benefit; others do not.
- Representation of farmer interests is often highly skewed towards the more advanced and richer farmers. In that sense participative processes often do not yield egalitarian outcomes.
- Farmers are not the only beneficiaries of agricultural research and extension. Consumers and the public in general should share in the decision making processes as well.
- Complete control of the fund by farmers, as in the case of the PRODUCE Foundations in Mexico, can derail a project completely, when there are insufficient checks and balances. About a third of the PRODUCE Foundations in Mexico, for example, have been classified as functioning unsatisfactorily.

Box 3.2. Farmer leadership in the PRODUCE Foundations in Mexico

The establishment of the PRODUCE Foundations in all 32 Mexican states in 1995 was an important institutional innovation in financing agricultural research in Mexico. These private foundations were set up to facilitate stronger stakeholder participation and to decentralize priority setting, project implementation and, in part, devolve the financing of agricultural research and technology transfer activities to the state level. Foundation boards are dominated by farmer representatives (the chairperson is always a farmer), and priorities are ideally set in close consultation with all stakeholders. Activities of the PRODUCE Foundations are coordinated by a National Coordination Office (COFUPRO). About 75 percent of PRODUCE Foundation funding comes from the federal government and 25 percent from state governments (this balance varies from state to state).

The PRODUCE Foundation in the state of Sonora (FPS) operates seven consultative committees, one for each of the principal production chains in the state. Each consultative committee has 12 members, and sets research and technology transfer priorities in each of their production chains. Sometimes wider consultations are held as part of the priority setting process. After priorities are set, a call is made for proposals. Proposals are reviewed by two referees, one a farmer and the other a technical or scientific expert. Proposals that pass the review go to the consultative committee for formal approval. Project approval rate is on the order of 50 percent of new proposals submitted; usually projects that are approved are also financed. Although many projects have a 2-4-year time horizon, funding is strictly annual, which means each year a new proposal has to be submitted for approval of the next phase of the project. Approval of the next phase depends on the project’s satisfactory performance. Monitoring and evaluation is another role of the consultative committee.

The PRODUCE Foundation in Sonora has strong farmer participation and is one of the better functioning foundations. This reflects the state’s long tradition of farmer involvement in agricultural research and extension through the patronato, a farmer organization that has financially supported agricultural research since 1964. According to COFUPRO, the PRODUCE Foundations work very well in eight states, reasonably well in fifteen, and not well at all in nine. Most of the latter states are in southern Mexico, where low levels of organization among farmers are common. Finding representative volunteers (they are not paid) for Foundation boards and committees is often a problem, as is their proper functioning. Lack of proper oversight could easily lead to misuse and misallocation of resources, a problem that needs serious attention to safeguard what could be a very effective model of resource allocation.
### Institutional Innovation in Agricultural Research and Extension Systems in Latin America and the Caribbean

#### Table 3.3:
Client orientation and participation characteristics of agriculture-specific competitive S&T funds

<table>
<thead>
<tr>
<th>Country</th>
<th>Competitive fund</th>
<th>Client orientation and participation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brazil</td>
<td>PRODETAB</td>
<td>Innovation needs formulated and prioritized by the steering committee of the fund (mainly government officials) in consultation with stakeholders. Involvement of private sector (companies or producer organizations) in project development and implementation an important selection criteria for funding. Project selection itself is centralized and by experts. Special attention given to the concern of a bias in the allocation of resources towards the richer and more dynamic parts of the country.</td>
</tr>
<tr>
<td></td>
<td>FNDCT Agribusiness</td>
<td>Private sector has a majority vote on the Board of the fund. Priority setting document written by consultancy firm. Project selection centralized and by experts.</td>
</tr>
<tr>
<td>Chile</td>
<td>FIA</td>
<td>FIA has recently started with regional (instead of national) consultations of farmers and other stakeholders in order to formulate regional priorities. It also has started with regional calls for proposals in addition to the national call for proposals. A few small information offices have been opened to improve FIA’s regional presence. Project selection itself is centralized and by experts. Most projects sponsored by FIA, depending on their particular objective, involve the participation by farmers.</td>
</tr>
<tr>
<td>Colombia</td>
<td>PRONATTA</td>
<td>At the local level, PRONATTA has created nodes which bring together local researchers, extension agents, farmer representatives, government officials, and other interested stakeholders. There are about 20 of these nodes throughout the country. They identify and prioritize local research needs and develop project profiles, which are submitted to one of the five regional coordination units of PRONATTA. The selection of projects is done in two stages – first by a regional panel and ultimately by a national panel (consisting of the chairs of the regional panels). In both cases a scoring method is used. Only the highest scoring projects are funded. PRONATTA strongly favors farmer participation in the implementation of the projects.</td>
</tr>
<tr>
<td>Ecuador</td>
<td>PROMSA</td>
<td>Research priorities based on past studies and further refined during a workshop using a scoring approach to develop priorities in a three-way matrix of commodities, agro-climatic regions, and thematic areas. Participation of farmers in this priority setting exercise seems to have been low. Project selection is also centralized and by experts. Each project, however, has a reference group consisting of direct beneficiaries (i.e. farmers) and other interested stakeholders (other researchers, extension staff, agribusiness, etc.). Ideally, this reference group participates in project design and in the planning, implementation, and monitoring and evaluation of the project.</td>
</tr>
</tbody>
</table>
Research priorities are based on a nation-wide, decentralized priority setting exercise conducted by the PRODUCE foundations in each of the 32 states. From this priority setting exercise, which took place in 2001, not only state-level priorities have been derived, but also regional and national research priorities. Projection selection is centralized and by experts.

The forestry sector (including forestry research agencies) is being asked to submit research needs, which form the basis for the call for proposals. Project selection is centralized and by experts.

PRODUCE foundations have been set up in each of the 32 states. Strong involvement of farmers at all levels. Farmers have a majority vote on the boards of the foundations and provide the chairman of the board. Identification of innovation needs as well as project selection decentralized to production chains at the state level. Farmers are required to co-finance (usually in kind) technology transfer projects.

### 3.4 Cross-institutional collaboration

One of the concerns about competitive S&T funding schemes is that the competition will be detrimental to cross-institutional collaboration. In Mexico, for example, this was raised as a serious concern. In part, this reflects the fact that funding for operating research costs within the Mexican agricultural innovation system is rather scarce, which leads to increased competition. At the same time, however, there are competitive S&T funding schemes (such as PRODETAB in Brazil and PRONATTA in Colombia) that are specifically targeting this issue by requiring or favoring joint project proposals (see Box 3.3). In these instances the competitive S&T fund is being used as an instrument to enhance cross-institutional collaboration. Usually such collaboration is constrained by bureaucratic rules and disputes over who has to pay what.

An interesting new development in Ecuador is the use of the competitive S&T funding scheme for facilitating international collaboration. A major break with the past is that Ecuadorian institutes now take the lead in identifying strategic international counterparts and solicit their collaboration. For small countries, this is a particularly important element to consider.

Cross-institutional collaboration should not be limited to collaboration between research agencies, but should also include collaboration between research agencies and other innovation partners such as farmer organizations, technology transfer agencies, NGOs and private businesses. As discussed in the previous section, many competitive S&T funding schemes promote and often insist on such forms of collaboration.

Competitive S&T funds may in some instances not only have a negative effect on cross-institutional collaboration, but also on collaboration between researchers within the same institute or university. In particular at universities, competitive funding schemes seem to have created a very individualistic culture. To some
Box 3.3. The PRODETAB Competitive Grants System in Brazil

The Agricultural Technology Development Project (PRODETAB), which closed at end-December 2005, was implemented by the Brazilian Agricultural Research Corporation (EMBRAPA) and supported by a World Bank loan of US$60 million. The primary project vehicle was the Competitive Grants System (CGS) for agricultural research technology development and transfer, established in 1997 with a total budget of approximately US$72 million to be spent over five years. Project execution was delayed by the government’s policy of fiscal restraint, which reduced budget allocations to the project, combined with the effects of devaluation and the inherently unpredictable nature of research projects. The closing date was extended twice for a total of three years, to December 31, 2005.

Managed and partly-financed by EMBRAPA, the project was open to all legitimate agricultural research providers nationwide. Its primary objective was to integrate and diversify the national agricultural research system (SNPA) through collaborative research and broader public and private sector participation, including universities, farmer organizations and NGOs. Five priority areas were funded: (a) family agriculture; (b) natural resource management; (c) advanced technologies; (d) agribusiness; and (e) new strategic areas of geographic or thematic research. These areas reflected changing priorities in national and global agricultural research, which focus on poverty reduction, environmental sustainability and increased productivity. The project targeted both producers and consumers of agricultural research and was client driven, involving consumers in establishing research priorities; it entailed cost sharing among research partners, commercial use of research outputs and outreach links with research beneficiaries.

The CGS used a demand-based bidding process, with research proposals submitted by diverse public and private research entities competing for funding. Allocations of grant funds were based solely on the quality of proposals, ranked according to a scoring system agreed to by EMBRAPA and the Bank, and described in the Operational Manual. Cost-sharing terms were: SNPA members other than EMBRAPA contributed a minimum of 10 percent; EMBRAPA, a minimum of 15 percent; and private firms, from 20 percent to 50 percent depending on size, financial capacity and the priority area of the research. Small farmer organizations contributed in kind (mostly labor).

Between 1997 and December 2005, eight bidding events yielded 139 approved research projects representing over 470 independent research subprojects. With an approval rate of 20 percent, the PRODETAB CGS was highly competitive. The project stimulated impressive growth in the number of institutions partnering to conduct and finance agricultural research in Brazil. Some 258 institutions were involved in execution including 35 EMBRAPA agencies and 100 private firms, and another 400 entities participated as collaborators. The poorest North/Northeast region received 130 subprojects, the Southeast 172, the Center-West 84 and the South 84. About 35 percent of all subprojects supported family agriculture. EMBRAPA undertook 218 subprojects, state research institutions 63, universities 144 and other entities 45. Despite special efforts to allocate more funding to the poorer North/Northeast region, the wealthier South/Southeast still absorbed about 54 percent of the funding.

Among its many achievements, the project raised awareness of the importance of close involvement in research, and galvanized innovative agricultural technology in Brazil. Research partners (including private and excluding EMBRAPA) contributed 42 percent of all counterpart funding. The innovative LABEX (External
Virtual Laboratories) system launched in 1998 through EMBRAPA’s collaboration with the US Agricultural Research Service created one of the strongest agricultural research partnerships in the world. Finally, the project created more effective interaction between scientists and national agricultural research institutions, greater openness of EMBRAPA to the national and global research community, increasingly demand-driven definition of research priorities, more decentralized research efforts, and improved quality of scientific research in general due to program standards and selectivity.

Of the funding provided by the PRODETAB Competitive Fund to these 139 research projects, 52 percent ended up with EMBRAPA, 30 percent with universities, 11 percent with state agricultural research organizations, and 7 percent with other agencies. Divided by geographical region, 41 percent of the funding went to the South-Eastern part of the country, 21 percent to the Central-Western part, 19 percent to the North-East, 13 percent to the South, and only 6 percent to the North. Despite special efforts to allocate more funding to the North and North-Eastern parts of the country, the wealthier parts of the country still absorb most of the funding.

extent this is the result of financing only small projects (the one-researcher, one-project syndrome). Increasingly, competitive S&T funds are paying attention to this issue by developing funding instruments that favor the creation of research clusters, networks and consortia. This may induce a move towards financing bigger and more complex projects.

3.5 Conclusions and pending issues

Fifteen years ago the role of competitive S&T funds in financing agricultural innovation activities was marginal throughout the LAC region, but today it is a widely accepted and increasingly important financing instrument. As illustrated in the previous sections, the instrument has helped in particular to: (a) improve the governance of agricultural research; (b) diversify the set of research providers; (c) enhance client orientation and participation; and (d) facilitate cross-institutional collaboration. These developments are not only due to the introduction of agriculture-specific competitive S&T funds, but also (and probably increasingly so) to the expansion of general competitive S&T funds. Moreover, these latter funds are becoming less focused on academic impact and more focused on economic impact. This has created, in several countries, important new funding windows for agricultural research. Another development noted in some countries is the rise of competitive S&T funds targeting innovation activities by large and medium-sized commercial enterprises. For the large majority of farmers, these funds are out of reach (unless they join forces in the form of producer organizations or cooperatives), but for small groups of large and medium-sized agricultural enterprises, these funds can be quite important.

As documented in this chapter, competitive S&T funds differ widely in terms of objectives, target audience and mode of operation, among other things. In that sense, each fund is unique and has its own strengths and weaknesses. Moreover, competitive S&T funds are evolving over time as they learn what works and what does not. At the same time, they have to accommodate new demands and new priorities. There is always room for further improvement. However, based on the accumulated experience over the past ten years, competitive S&T funding instruments in the LAC region have passed their experimental phase and can now be considered a generally accepted and standard financing mechanism.
Looking towards the future, we identified several problems in competitive S&T funding that need careful attention. One such problem is how the instrument fits with other financing instruments and, in particular, with core funding given directly to the implementing agencies. Nearly all competitive S&T funding schemes only provide for operating costs and assume that the implementing agencies will absorb (most of) the salary and capital costs. This may give the impression that the S&T funds, by controlling operating expenses, also steer the allocation of other expenses. In reality, the situation is more complex, because hiring of research staff and investing in research infrastructure usually result in commitments that run longer than the length of individual research projects. Therefore, the ultimate research agenda is not just the result of market forces (i.e., competitive funding schemes), but also of strategizing on the part of agricultural research providers regarding staffing and investments in physical resources. These strategic decisions determine to an important extent the type of research projects being submitted to competitive S&T funds. In particular, lifetime employment policies, still common in many public agricultural research organizations throughout the region, place major limitations on the flexibility of the agricultural research system to accommodate rapidly changing research demands.

Direct management costs of the competitive S&T funds reviewed are on average 5-10 percent of their turnover. However, they can be substantially higher during the establishment phase of funds (Gill and Carney 1999) as well as for small funds. The latter may be confronted with high (and sometimes prohibitively high) fixed costs. In contrast, clustering of competitive S&T funding mechanisms in one agency, usually under the umbrella of the Ministry of Science and Technology, is quite common in larger LAC countries. While focusing on different parts of the S&T agenda, different competitive S&T funds use the same administrative staff, procedures and software, which leads to important cost savings.

The costs applicants incur when preparing project proposals are invisible costs of competitive S&T funds, and the question should be asked whether the benefits of the instrument exceed the costs. This is a difficult question to answer because many benefits are intangible. One way of reducing the costs applicants incur is by adopting a staged selection procedure, in which a full project proposal is developed only after the project idea has been approved. Another alternative is to opt for bigger research projects, given that project development costs have a major fixed cost component.

High management costs are one reason why competitive S&T funding is a less suitable financing instrument for small countries. Another, perhaps more important, factor is the lack of competition. A scientific community of a certain size is needed to make the instrument work effectively. We suggest a threshold of at least 100 researchers. This means that in 24 of the 40 LAC countries an agriculture-specific competitive S&T fund is presently out of reach.

In contrast to agricultural extension (see next chapter), reforms in agricultural research have paid relatively little attention to the financing or co-financing of agricultural research activities by direct beneficiaries. In part this reflects the fact that agricultural research is considered more of a public good than agricultural extension, which favors public rather than private financing of agricultural research. Nevertheless, mobilizing more financial support from farmers for agricultural research should be explored more strongly. In particular, matching fund schemes, such as those operating in Australia, deserve more attention as a way to achieve joint public-private financing of agricultural research.
The dismantling of national agricultural extension services and the introduction of decentralized agricultural advisory services have changed the system of technology diffusion and adoption in many LAC countries dramatically during the past 15 years. The institutional reforms that are part of this rather radical change focus in particular on:

- Enhanced client orientation and participation;
- Decentralization of service delivery;
- Outsourcing of service delivery; and
- Co-financing of services by direct beneficiaries.

These reforms are very much in line with the ideas and concepts of the new public management (NPM) school, as discussed in Chapter 2. Based on a literature review and two case studies (Peru and Venezuela), this chapter highlights and discusses recent reforms in agricultural extension.

By the mid-1980s, national agricultural extension services in Latin America and the Caribbean (and in many other countries around the world; see Rivera et al. 2001) were being criticized severely for being outdated, inefficient and very costly (Berdegué 2001). More specific criticism focused on:

- The top-down approach used by most extension services based on a linear innovation model. Seen as passive clients rather than active participants, farmers had hardly any control over the quality of extension services provided.

- Frequent incidences of corruption, clientelism and extreme bureaucracy, which undermined the legitimacy of the services.

- Overstaffing extension services with large numbers of poorly trained (and often poorly paid) staff, and the almost permanent lack of operational resources.

- The lack of effective planning and monitoring and evaluation of activities.

- The perceived low impact of extension services, in part due to the difficulty of attributing technology diffusion to specific interventions.

Bold reforms were considered necessary. At the same time, most LAC countries, due to the debt and economic crisis that affected the region during the 1980s, had to adopt severe structural adjustment measures and cut government expenditures drastically. This further undermined national agricultural extension services and sent them into a deep crisis. Restructuring and reorganizing national agricultural extension services from within (which several countries attempted unsuccessfullly) was no longer considered a realistic option, and so many countries decided to dismantle the national agricultural extension services and adopt completely new modes of supporting technology and knowledge diffusion among farmers. Table 4.1 summarizes for 15 LAC countries the reforms that took place in agricultural extension during the 1990s.
### Table 4.1: Changes in agricultural extension services in Latin America and the Caribbean during the 1990s

<table>
<thead>
<tr>
<th>Country</th>
<th>Old structure (pre-1990)</th>
<th>Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bolivia</td>
<td>IBTA (responsible for research and extension)</td>
<td>IBTA dismantled. Establishment of four regional Agricultural Technology Development Foundations (FDTAs), which each manage a competitive funding scheme for agricultural research and technology transfer projects.</td>
</tr>
<tr>
<td>Brazil</td>
<td>EMBRATER (federal) + EMATERs (state)</td>
<td>In 1990 the federal government delegated responsibility for extension to the states and EMBRATER was closed down. In several states the EMATERs have been merged with their research counterparts. The current government has plans to recreate a federal agency for extension.</td>
</tr>
<tr>
<td>Chile</td>
<td>INDAP (outsourcing of service delivery since 1978)</td>
<td>No change in structure as such, but service provision re-oriented to small and resource-poor farmers. Differentiation in the types of technical assistance provided, as well as the level of co-financing required. Outsourcing no longer restricted to private firms; NGOs and farmer organization can also bid.</td>
</tr>
<tr>
<td>Colombia</td>
<td>INCORA and ICA</td>
<td>INCORA and ICA both dismantled. Extension provided through a highly decentralized network of some 1000 Agricultural Technical Assistance Units at the municipality level (UMATAs). However, there is a plan to dissolve the UMATAs and create new provincial agencies, each covering several municipalities.</td>
</tr>
<tr>
<td>El Salvador</td>
<td>MOA: Rural Development General Directorate</td>
<td>Ministerial research and extension functions transferred to CENTA in 1993. The Technology Transfer Division of CENTA operates three services: (1) agricultural and forestry extension; (2) technical assistance to farmer groups; and (3) training and certification.</td>
</tr>
<tr>
<td>Guatemala</td>
<td>MOA: Agricultural Services General Directorate (DGSA)</td>
<td>Responsibility for technology transfer activities being transferred from DGSA to Municipal Technical Units.</td>
</tr>
<tr>
<td>Honduras</td>
<td>MOA: Agricultural Extension Department (DEA)</td>
<td>DEA dismantled. Introduction of a competitive S&amp;T fund consisting of two programs: (1) National Sustainable Rural Development Program (PRONADERS) focusing on small farmers; and (2) National Agro-Food Development Program (PROAGRO) focusing on commercial farmers.</td>
</tr>
<tr>
<td>Jamaica</td>
<td>MOA: Extension Division</td>
<td>Establishment of the Rural Agricultural Development Authority (RADA), which took over the extension function of MOA in 1990. Works at parish level.</td>
</tr>
<tr>
<td>Country</td>
<td>Old structure</td>
<td>Change</td>
</tr>
<tr>
<td>-------------</td>
<td>------------------------------------</td>
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<tr>
<td>Honduras</td>
<td>MOA: Agricultural Extension Department</td>
<td>DEA dismantled. Introduction of a competitive S&amp;T fund consisting of two programs: (1) National Sustainable Rural Development Program (PRONADERS) focusing on small farmers; and (2) National Agro-Food Development Program (PROAGRO) focusing on commercial farmers.</td>
</tr>
<tr>
<td>Jamaica</td>
<td>MOA: Extension Division</td>
<td>Establishment of the Rural Agricultural Development Authority (RADA), which took over the extension function of MOA in 1990. Works at parish level.</td>
</tr>
</tbody>
</table>

- **Coordination to regions and implementation to NGOs, farmer organizations, private firms, etc.**
- **Yes**
- **Yes**
<table>
<thead>
<tr>
<th>Country</th>
<th>Old structure (pre-1990)</th>
<th>Change</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mexico</strong></td>
<td>MOA: Extension Service</td>
<td>Extension service dismantled in 1994. Establishment of state-level PRODUCE Foundations which manage competitive funding schemes for agricultural research and technology transfer activities. Services are provided by a wide range of public and private agencies. There are several other programs (e.g., rural credit) that also provide technical advice.</td>
</tr>
<tr>
<td><strong>Nicaragua</strong></td>
<td>MOA: Agricultural extension Directorate</td>
<td>Ministerial research and extension functions transferred to INTA in 1993. In 1995, INTA created three modules of extension/advisory service provision: (1) mass media and demonstration; (2) public technical assistance; and (3) private technical assistance. The first two forms of service are provided by INTA, the latter by private firms. Co-financing is required for public and private technical assistance. The expectation is that the public contribution will decline over time. In 2000, an agriculture-specific competitive S&amp;T fund (FUNICA) was established which has a specific funding window for technical assistance projects.</td>
</tr>
<tr>
<td><strong>Peru</strong></td>
<td>MOA: national extension service</td>
<td>In the early 1990s the Peruvian government reduced its direct involvement in agricultural innovation to that of agricultural research only. Technology diffusion was left to the private sector and civil society. Nevertheless, MOA continued to subsidize some specific technology transfer activities. Between 1993 and 1999, for example, MOA operated a project to support technology transfer activities to small farmers in the Sierra (FEAS), which was co-financed by IFAD. In 2001, MOA (in collaboration with the World Bank) launched the Agricultural Research and Extension Project (PIEA), which provides support for extension activities through a competitive fund. The fund pays up to 75% of project costs. Direct beneficiaries have to pay or mobilize the rest. Projects are implemented by NGOs and private companies.</td>
</tr>
<tr>
<td><strong>Trinidad and Tobago</strong></td>
<td>MOA: Extension, Training and Information Division (ETID)</td>
<td>Decentralization of MOA activities into two regions: Regional Administration North and Regional Administration South.</td>
</tr>
<tr>
<td><strong>Uruguay</strong></td>
<td>MOA: Extension Directorate</td>
<td>Extension service dismantled. Technology assistance provided through the following programs managed by MOA: National Program to Support Small Agricultural Producers (PRONAPPA), “Programa de Reconversión y Desarrollo de Granja,” and “Programa Nacional de Desarrollo de Pequeños y Medianos Ganaderos.”</td>
</tr>
<tr>
<td><strong>Venezuela</strong></td>
<td>MOA: Extension Directorate</td>
<td>Extension service dismantled. Establishment of the Foundation for Training and Innovation for Agrarian Reform (CIARA) in 1995. CIARA operates an agricultural extension program through which it contracts (on a competitive basis) highly decentralized extension services.</td>
</tr>
</tbody>
</table>

Sources: Alfaro (2002), Berdegué and Marchant (2002), Dinar and Keynan (1998), and various websites.
<table>
<thead>
<tr>
<th>Country</th>
<th>MOA: Extension Director</th>
<th>Old structure (pre-1990)</th>
<th>Change</th>
<th>Client orientation and participation</th>
<th>Decentralization</th>
<th>Out-sourcing</th>
<th>Co-financing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mexico</td>
<td>MOA: Extension Service</td>
<td>Extension service dismantled in 1994. Establishment of state-level PRODUCE Foundations which manage competitive funding schemes for agricultural research and technology transfer activities. Services are provided by a wide range of public and private agencies. There are several other programs (e.g., rural credit) that also provide technical advice.</td>
<td>Farmers have a majority vote on the boards of the PRODUCE Foundations and are closely involved in project selection.</td>
<td>To states and to different programs</td>
<td>Yes</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Differentiation of farmers into distinctive groups with different needs and different abilities to pay for services. Market incentives (i.e. co-financing) used to focus extension staff on the needs of farmers.</td>
<td>INTA has divided the country into five regions</td>
<td>Partially</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Nicaragua</td>
<td>MOA: Agricultural extension Directorate</td>
<td>Ministerial research and extension functions transferred to INTA in 1993. In 1995, INTA created three modules of extension/advisory service provision: (1) mass media and demonstration; (2) public technical assistance; and (3) private technical assistance. The first two forms of service are provided by INTA, the latter by private firms. Co-financing is required for public and private technical assistance. The expectation is that the public contribution will decline over time. In 2000, an agriculture-specific competitive S&amp;T fund (FUNICA) was established which has a specific funding window for technical assistance projects.</td>
<td>Regional and local client consultations in problem identification and priority setting.</td>
<td>Yes</td>
<td>Yes</td>
<td></td>
<td></td>
</tr>
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<td>Regional and local client consultations in problem identification and priority setting.</td>
<td>Yes</td>
<td>Yes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Trinidad</td>
<td>MOA: Extension, Training and Information Division (ETID)</td>
<td>Decentralization of MOA activities into two regions: Regional Administration North and Regional Administration South.</td>
<td>Country divided in seven regions, each consisting of several provinces. During the first phase of PIEA only in three of the seven regions' calls for proposals were placed.</td>
<td>Yes</td>
<td>Yes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Uruguay</td>
<td>MOA: Extension Directorate</td>
<td>Extension service dismantled. Technology assistance provided through the following programs managed by MOA: National Program to Support Small Agricultural Producers (PRONAPPA), “Programa de Reconversion y Desarrollo de Granja,” and “Programa Nacional de Desarrollo de Pequeños y Medianos Ganaderos.”</td>
<td>In the case of PRONAPPA through decentralized consultation. In other programs through market incentives (i.e., co-financing).</td>
<td>At the municipality level Civil Associations for Extension (ACEs) coordinate the implementation of extension activities. The beneficiaries of extension have a majority vote on the boards of these ACEs.</td>
<td>Yes</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Venezuela</td>
<td>MOA: Extension Directorate</td>
<td>Extension service dismantled. Establishment of the Foundation for Training and Innovation for Agrarian Reform (CIARA) in 1995. CIARA operates an agricultural extension program through which it contracts (on a competitive basis) highly decentralized extension services. At the municipality level Civil Associations for Extension (ACEs) coordinate the implementation of extension activities. The beneficiaries of extension have a majority vote on the boards of these ACEs.</td>
<td></td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td></td>
</tr>
</tbody>
</table>

Sources: Alfaro (2002), Berdegué and Marchant (2002), Dinar and Keynan (1998), and various websites.
4.1 Client orientation and participation

Whereas farmers traditionally have been seen as rather passive recipients of information provided by extension services, the new approaches adopted in recent years see farmers as active partners in the search for information. The traditional approach reflects a strict linear and supply-driven model of technology generation, diffusion and adoption. This has been (and to some extent still is) a very dominant model in conceptualizing agricultural innovation processes. The new, more client-oriented approaches place considerably more emphasis on the demand side of the innovation process.

By adopting a stronger client orientation, the traditional extension approach of one message for all farmers is no longer appropriate. To be relevant, the advisory services provided need to be tailored to the specific circumstances and needs of the farmer. Moreover, such advice should cover not only the technical aspects of agricultural production, but also the economic and financial ones. In Chile, for example, for each farmer entering an advisory services trajectory, a business plan is made setting out how to transform the farm into an economically viable enterprise. The idea is that farmers will be intensively supported during a limited period of time (4-5 years) to make the transition. After that they will have to rely on more generic or private sources of information and knowledge. In most other countries, extension/advisory services still have a more generic character, but rely on greater farmer participation in identifying and prioritizing extension/advisory needs through local forms of consultation. However, even in such consultations, the emphasis has shifted more towards market opportunities (rather

Box 4.1. The establishment of Civil Associations for Extension (ACEs) in Venezuela

A key institutional innovation introduced by the new agricultural extension system in Venezuela was the creation of Civil Associations for Extension (ACEs) at the municipal level throughout the country. These associations play a key role in the decentralization of extension services and the empowerment of direct beneficiaries and local governments in the governance of agricultural extension.

The ACEs are legal entities constituted by representatives of the municipalities and the beneficiaries of extension services. The governing board is composed of seven members, with at least four representatives elected from among the beneficiaries and with at least one representative each from the municipality and the state. The ACEs coordinate the implementation of extension activities. Over time, their responsibilities have gradually increased from participating in the preparation of the municipality’s annual extension plan, approving these plans, and evaluating the performance of the implementing agencies, to finally selecting and directly contracting the implementing agencies.

This systematic strengthening and gradual transfer of responsibilities led to the development of a local power base. The ACEs demonstrated their capacity when ACE representatives participated in discussions with the Minister of Agriculture and the President of the National Rural Development Institute during budgetary crises at the national level. Another indicator of the ACEs’ huge potential as facilitators for rural development initiatives is the fact that they have been able to access additional funding from other government programs. The ACEs represent an important forum for social groups (e.g., small farmers and, particularly, women) whose participation in political and economic processes has been neglected in the past.
than simple technological opportunities), and how they can be exploited and further developed. A good example is the adoption of a production chain approach to problem identification and prioritization by the PRODUCE Foundations in Mexico.

For the poorest and most disadvantaged farmers with little access to land and other resources, the hard reality may be that there is no economically viable future in agriculture. For them, other non-agricultural types of advice on how to escape poverty (as well as other policy instruments) will be more relevant than those focusing on agricultural production. This requires much needed differentiation in rural poverty policies and instruments.

In addition to stronger farmer orientation, farmer participation in the governance of new extension/advisory services has also been adopted widely. Usually this has coincided with strong decentralization of those services (see section 4.2) and the establishment of local extension/advisory units having considerable autonomy. Farmer participation can range from regular consultation to full control over the organization and management of extension/advisory units (e.g., by a majority vote of farmers on the Board of these units). Venezuela, for example, has created Civil Associations for Extension at the municipal level where the direct beneficiaries (i.e., farmers) have a majority vote (see Box 4.1). Another form of farmer participation that has been adopted in several countries is for them to pay, at least in part, for advisory services, and let the market do its work in signaling demand and controlling the quality of services provided (see section 4.4).

4.2 Decentralization

Traditionally, government structures in Latin America have been highly centralized. However, with the return to democracy of several major LAC countries during the late 1980s and early 1990s, government decentralization emerged high on the political agenda to enhance: (a) the democratic character of government (i.e., introducing grassroots democracy); and (b) the efficiency and effectiveness of government by focusing more on client needs. The latter argument is based on new public management ideas and concepts, discussed in Chapter 2. This general overall trend has also strongly influenced reforms in agricultural extension.

Several forms of decentralization can be identified, namely:

- **Deconcentration**: transfer of effective control (and resources) by the national extension services to their field offices. The Mexican extension services underwent such decentralization in the early 1990s before they were dismantled in 1994.
- **Delegation**: when a sub-national government or parastatal acts as an agent of the central government in the implementation of agricultural extension services.
- **Devolution**: full responsibility for agricultural extension services transferred to sub-national governments or specific private-interest groups such as commodity boards.

In all three cases of decentralization, the idea is to bring the operational management of extension/advisory services closer to farmers and to give those farmers some form of control over management (see previous section). Most decentralization that has taken place in the LAC region during the past 10-15 years is of the delegation type. Typical of this form of decentralization is that sub-national governments have some freedom on how to implement services, but financing depends mainly on the central government. Only in the case of Brazil can one speak of actual devolution of responsibility, i.e., states have to organize
Box 4.2. Decentralization of agricultural extension services in Colombia

Within an overall drive for decentralization in the early 1990s, municipalities in Colombia were assigned the legal obligation to maintain extension units called UMATA (Unidad Municipal de Asistencia Técnica Agropecuaria). Municipalities receive funds from the central government to run the UMATAs and may obtain additional funding from other sources. For client farmers (small farmers only) services are free.

Key insights reported by Katz (2002):

- The number of municipalities and small farmers reached by extension services has increased substantially with the UMATA system. The number of extension agents is much higher; the number of clients per extension agent is slightly lower.
- Annual costs have increased more or less synchronously with the increase in coverage. Costs per client have been reduced by about 10 percent.
- The quality of services appears to have deteriorated with decentralization.
- Links to research have weakened, and political interference by municipal authorities affects service quality. On the other hand, one aspect of quality has apparently improved: extension agents are now much closer to farmers and, therefore, more aware of their needs and constraints, and can respond to their real demands.
- Technical and training support, as well as links to research, need to be specially designed for decentralized systems. In addition, a system of horizontal experience exchange between decentralized extension units would ensure that, although independent, they are tied into a knowledge and experience system.
- As services are free for users, the accountability of extension agents to farmers is still rather weak, although there may be some social accountability when extension agents are local. Adequate financial participation in services that are private goods would enhance accountability.
- Municipal committees for rural development should take up the function of prioritizing and coordinating development activities. In these, representatives of rural communities should have the majority. However, these committees have not been established everywhere and rural community representatives’ control over them is mostly weak.
- When conceptualizing the approach, it was assumed that municipalities would make use of private sector firms to fulfill their legal obligations. However, most municipalities prefer to employ extension staff. It is unclear whether this is because suitable private sector actors are not available or because of political reasons.
- A decentralized extension system does not guarantee control by farmers. Local authorities are just as likely to take decisions that go against the interests of small farmers as a distant extension directorate. The same is true of local development committees and similar entities.
- Decentralized, independent systems require considerable management capacity at decentralized levels, and considerable efforts and investments will be needed to develop this capacity.

Most recently (i.e., 2004), the Colombian Ministry of Agriculture has proposed to organize agricultural extension services at the provincial level. Provinces would be expected to outsource extension services delivery to the private sector.
and finance their own extension services. This has led to considerable diversity in how extension is organized throughout Brazil and in its intensity and quality.

Decentralization of the central government’s responsibility for agricultural extension/advisory services to lower tiers of government has been widely adopted throughout the region (Table 4.1). However, the level of decentralization varies widely from states (e.g., in Brazil and Mexico) to regions (e.g., in Bolivia and Nicaragua) to municipalities (e.g., in Colombia and Venezuela). Finding the right balance of decentralization is not easy. In Colombia, for example, experience with decentralization of extension to the municipal level has been mixed (see Box 4.2). Hence, Colombia now plans to consolidate extension activities at the provincial level. Each province comprises several municipalities. In this way, the government hopes to improve the quality of the services and reduce management costs.

Another form of decentralization is to outsource the implementation of agricultural extension activities (see section 4.3). Particularly when this is done by lower levels of government, the number of implementing agencies may increase greatly.

**4.3 Outsourcing**

Characteristic of recent agricultural extension reforms in the LAC region is outsourcing the implementation of agricultural extension/advisory services to local NGOs, farmer organizations, private businesses, etc. Ten of the fifteen LAC countries reported in Table 4.1 have some experience with outsourcing agricultural extension activities. In most instances, relatively small and location-specific agricultural extension/advisory contracts are put up for bidding (i.e., extension projects rather than programs), allowing a wide variety of local providers to compete. In principle, the funding of agricultural extension/advisory services remains public. Often, however, attempts are made to transfer at least part of the financial burden to the direct beneficiaries. This should help increase responsiveness and accountability of service providers to clients (see section 4.4).

Chile is a very early pioneer of outsourcing agricultural extension services, not only in Latin America and the Caribbean, but also worldwide. It adopted outsourcing of its public extension services as early as 1978, when it introduced a voucher program for agricultural extension services. Despite many changes in Chile’s extension/advisory program over the years, since 1978 Chile has always stuck to the principle of competition and outsourcing of agricultural extension/advisory services (Berdegué and Marchant 2002).

A requirement for outsourcing government services is to separate policy, priority setting and implementation activities within the government. In a traditional government bureaucracy, these activities are usually integrated. In the new setup, however, the Ministry of Agriculture remains responsible for formulating policy regarding agricultural extension/advisory services, but contracts out the implementation of these services to the private sector and delegates the responsibility for priority setting to the direct beneficiaries (See Box 4.3 for an example in Honduras).

Priority setting by direct beneficiaries can be done through various forms of consultation or by creating a market for extension services. The latter can be achieved by requiring a contribution from farmers or, as in the case of Chile, by providing farmers with vouchers that they can use in a market-like setting. Often, however, a combination of consultation and market signals is used. Priorities are set ex ante through consultation, but at the same time projects have to mobilize a minimum contribution by direct beneficiaries in order to qualify for funding.
By outsourcing the implementation of extension services to local NGOs, farmer organizations and private businesses, Ministries of Agriculture have radically reduced the number of extension staff under their direct administrative responsibility. However, this does not necessarily mean that the total number of extension agents in individual LAC countries has declined. This depends more on how much public funding governments have continued to make available for extension services delivered privately, as well as on the ability of the new schemes to mobilize other resources, most importantly, contributions by farmers themselves. Mejía (2003) reports, based on data from 109 different extension schemes across nine LAC countries, a more than five-fold increase in both agricultural extension funding and staffing between 1990 and 2000. The increase in staffing is due almost completely to outsourcing. Given the methodology used (i.e., surveying existing agencies), these figures appear to capture the rapid expansion of new extension schemes throughout the LAC region (84 percent of the reported schemes did not exist ten years), but fail to capture the dismantling of the old schemes. Hence, the net balance of whether agricultural extension funding and staffing
has increased or decreased over the past 10-15 years remains undetermined, which makes it impossible to say much about how recent reforms have affected the intensity with which services are being provided (i.e., in terms of the number extension staff per million farmers or extension expenditures per farmer).

Outsourcing of extension services requires considerable organizational and managerial capacity within the government. Very transparent bidding and selection procedures are needed to keep corruption or favoritism from slipping into the project selection process. Particularly when the responsibility for project selection is delegated to lower levels of government, it is important to make sure that sufficient checks and balances are in place to secure objective selection.

Quality control of extension services provided by many small service providers is a major concern in most outsourcing schemes. Several countries have adopted a system of formal certification of extension agencies. Without such a certificate, an agency cannot submit proposals for funding. It is extremely important to keep the certification process free from corruption and favoritism. Another important quality control tool is to tightly monitor and evaluate (M&E) the implementation of contracted extension projects. This requires substantial discipline of all parties involved to follow M&E procedures. Financial incentives to do so (i.e., no release of funds before reporting is completed) seem to be quite effective.

4.4 Co-financing

An important element of most agricultural extension reforms is to shift some or all of the financing of agricultural extension/advisory services to the direct beneficiaries. The more specific the advice being provided (induced by decentralization and stronger client orientation), the stronger the argument that the service is a private rather than a public good and, hence, should be financed privately. However, there are many different shades along the public-private spectrum regarding agricultural extension services, requiring different financing formulas (see Box 4.4). The adoption of environmentally friendly technologies, for example, may be more in the interest of the general public rather than individual farmers. So if left to farmer choices only, such technologies will not be promoted. Therefore, public financing is required.

Another factor that often leads to differentiation in the level of co-financing is the ability of farmers to pay for services. Many of the new extension/advisory service schemes differentiate farmers into different economic strata and request different levels of co-financing. The poorer strata of farmers may still receive their services for free or pay only a small contribution, while the richer strata of farmers are requested to pay a substantial contribution, if not pay the full costs. In the latter instance, the extension/advisory services for these groups of farmers are often off-loaded to the private sector altogether.

Most schemes are introducing co-financing gradually. Farmers have to get used to the fact that they have to pay for something that was free in the past. At the same time, however, farmers can be expected to become more critical of the quality of services delivered, which is reflected in their willingness to pay. This is another reason for adopting co-financing – it helps to reveal the demand for agricultural extension and advisory services. As to be expected, an increase in the contribution to be paid by farmers often leads to some decline in the demand for agricultural advisory services. In several cases, concern has been expressed that co-financing requirements are being pushed too fast and too far.
At the same time, however, farmer contributions are sometimes quite soft. Extension projects funded by the PRODUCE Foundations in Mexico, for example, value the in-kind contributions by farmers (labor and land) in monetary terms as an expense by farmers. Similarly, agricultural advisory services in Chile provide farmers access to subsidies and credit, the value of which exceeds requested farmer contributions many times.

4.5 Conclusions and pending issues

Agricultural extension services in many LAC countries have undergone profound changes during the past 15 years. What all these countries have in common is that they no longer believe in a national agricultural extension service organized on the basis of a top-down, bureaucratic command structure as an effective way to
tackle technology and knowledge diffusion in agriculture. However, a well-defined alternative model does not seem to exist. Hence, the reforms implemented during the past 15 years can be characterized as highly experimental and diverse. Even within one country, often different approaches are being tried simultaneously. While one can identify some common characteristics (i.e., client participation, decentralization, outsourcing, and co-financing) across the reforms that have been implemented, no common new extension model has emerged. Perhaps instead of expecting one to emerge, multiple approaches and experimentation should continue to be promoted. Technology diffusion is a dynamic process that is not easy to standardize or convert into a routine activity.

When making agricultural extension or advisory services more client-oriented and demand-driven, the critical assumption is that farmers are well-organized and prepared to assume new responsibilities. In many LAC countries, however, the level of farmer organization is often low, particularly among poor farmers in marginal areas. Moreover, democratic traditions are often relatively weak, and weaker groups in society may easily become side-lined (e.g., women and indigenous populations). Helping to build stronger and more representative farmer organizations is a critical precondition to make the more client-oriented and demand-driven extension schemes work. Otherwise, many of the dividends that could be reaped from this new approach will not materialize.

For most LAC countries (as well as for most other countries around the world), outsourcing of agricultural extension/advisory services delivery is quite a new experience. It is creating a new market, but one with rather peculiar characteristics and bottlenecks. There are, in essence, two types of extension markets emerging: one in which the government buys services on behalf of the beneficiaries, and one in which the beneficiaries buy (often with financial support from the government) services directly. In the latter instance, the advisory services provided are seen primarily as a private good and, hence, there is a strong aim to devolve financing responsibility completely to farmers (see Box 4.5). When the government buys the extension/advisory services, they are seen primarily as a public good.

The high fragmentation of the agricultural advisory services market that is now emerging creates some important second generation problems, namely:

The advisory services provided are only as good as the knowledge they pass on to farmers. Therefore, service providers need continuous access to new knowledge and its applications. In the old situation, where there was a single national extension service, subject matter specialists often played an important role in translating the latest research findings into extension messages and responding to specific questions coming from the field. These positions no longer exist, and most private extension/advisory services firms are too small to have their own specialists. While research-extension linkages have always been problematic, in the new situation the disconnection seems to be even deeper. Possible solutions could be to create new intermediary agencies that function as knowledge clearinghouses or reorient and expand the technology transfer programs of national agricultural research organizations.

Most private advisory services firms are very small and unstable, and do not provide much of a career path for advisory service personnel. Moreover, these firms are also too small to invest much in training their own staff. The risk of losing staff after they have been trained is too high. In some countries, staff turnover among service providers is reported to be problematically high. A possible solution (adopted by some countries) is to
make public resources available to train staff of private service providers and thereby improve the quality of the services provided.

Most private advisory firms are too small to put much effort into quality control. Hence, this responsibility ends up with either the financing agency or the direct beneficiaries. In both cases, the disadvantage is that corrective measures materialize rather late. Consolidating service providers into larger, more professional agencies may help to improve the overall quality of the services as well as resolve some of the problems mentioned earlier.

**Box 4.5.**

**The creation of an agricultural advisory services market in Peru**

In the early 1990s, the Peruvian Government decided to reduce its direct involvement in agricultural innovation to research only and leave the responsibility for technology diffusion to the private sector and civil society. As a consequence, government technology diffusion activities were drastically cut back in the expectation that an agricultural advisory services market would emerge and take over.

The principal position taken by the government has been that agricultural advisory services are primarily a private good. The new market for agricultural advisory services may need some public support during its development stages, but this support should be phased out over time. The bottlenecks in this emerging market are seen primarily in terms of high transaction costs due to inadequate information, inexperience and insecurity. Those problems are particularly severe for small farmers in marginal areas and for disadvantaged groups, such as indigenous populations and women. Large commercial farmers already have extensive experience in acquiring technical advice through the market and do not need assistance. In supporting the purchase of agricultural advisory services by small and disadvantaged farmers, the government expects farmers and service providers to become acquainted with the functioning of a farmer advisory services market. This experience should ultimately lead to a mature market for agricultural advisory services that could operate without government subsidies.

For the time being, however, the Agricultural Research and Extension Project (PIEA) of the Ministry of Agriculture has been operating a competitive fund for agricultural extension projects since 2001. The basic idea of this competitive fund is that poor farmers in marginal areas formulate extension projects in close collaboration with NGOs, farmer organizations and private companies. The fund pays up to 75 percent of project costs, while the direct beneficiaries of the project (i.e., farmers) have to pay or mobilize the rest. In addition to providing financial support, the fund also plays an important facilitating role in this private market by monitoring the quality of project proposals and their implementation.
During the past 15 years, programs to reform research and extension systems in Latin America have gained much support. This has been driven by the need for a more competitive agricultural sector in an increasingly globalized world. This competitiveness is based on increased productivity, product quality, food safety and value added. New communications technology and biotechnology have also been important drivers and will continue to be so.

Among the most important of these reforms has been the separation of funding from implementation. In countries such as Chile, Mexico and Brazil, there has been an increase in specialized funding bodies, which are exerting an increasing influence in priority setting and funding allocation. On the other hand, implementing agencies also are becoming specialized and more dependent on those agencies that allocate money on a competitive basis.

As a result of these reforms, new institutional players, more open trade policies and diversified funding schemes present a complicated decision-making environment for managing research. There has been an evolution towards a broader national agricultural innovation system (NAIS), which recognizes wider sources of innovation (including farmers, suppliers, etc.) and places increased importance on feedback loops among research, development and technology adoption.9

Although the underlying principles of reform are largely the same for both research and extension (and also across countries), the implemented reforms differ considerably and particularly so between research and extension. This difference can be traced back principally to a difference in the perceived "public good character" of the activity. On the public-to-private good scale, agricultural extension is usually considered more of a private good and agricultural research more of a public good. This is not to deny that there are agricultural extension activities that fit squarely in the public good category and agricultural research activities that are purely private, but across the board one can notice a stronger withdrawal of government from agricultural extension activities than from agricultural research activities. Co-financing targets for agricultural extension are generally higher than for agricultural research and usually aim to reduce government support to zero in the medium to long run. In addition, private delivery of services has become quite common in agricultural extension but not in agricultural research.

Table 5.1 very schematically depicts contrasting combinations of public/private financing and implementation of agricultural research and extension. The classic public-private dichotomy is that of public-sector agencies financed by general tax revenues (box A, Table 5.1) versus private-for-profit companies selling products and services to private individuals (box I). Traditionally, farmer-oriented agricultural research and extension activities have been considered to

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belong primarily in box A. The current agricultural research and extension reforms, however, argue that other modalities of financing and service delivery may be desirable under certain circumstances and that diversification of financing and implementation modalities should be promoted. As indicated above, not all agricultural research and extension services have an equally strong public-good character. When services lead to significant private benefits to specific groups or individuals, more specific financing instruments may be warranted, such as specific taxes or levies, individual payments or a mix of different contributions. Specific taxes or levies, for example, are quite common among commodity boards running their own research and extension facilities. By screening agricultural research and extension activities more strictly for their public-good character, public resources could be freed up and used for truly public-good activities (including agricultural research and extension activities with a strong public-good character) or for reducing the budget deficit.

The other opening created by the reforms in agricultural research and extension is that the delivery of public goods is no longer the exclusive domain of government bureaucracies. It is important to highlight that the public or private character of the implementing agency does not necessarily define the public or private character of the services delivered. To facilitate the diversification of service providers, important institutional changes are needed, such as a clear separation between policymaking and implementation roles within government and the introduction of transparent contract arrangements between the policymaking entity and the implementing agency. Competitive S&T funding schemes have been important pioneers of such contract arrangements.

In Latin America and the Caribbean, the implementation and financing of farmer-oriented agricultural research is still primarily public (i.e., in box A), while the implementation and financing of agricultural extension has moved out of box A, towards boxes D, E, F, G, H, and I. The diversification of agricultural research providers, as discussed in Chapter 3, has been limited mainly to public providers (i.e., universities). Because competitive S&T funds for “public-good” agricultural research usually only provide for operating costs, they tend to exclude non-public providers.10

Table 5.1
Privatization of service implementation versus financing

<table>
<thead>
<tr>
<th>Financing source</th>
<th>General tax revenues (public goods)</th>
<th>Specific taxes or levies (limited public goods)</th>
<th>Individual payments (private goods)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agricultural research and extension</td>
<td>A</td>
<td>B</td>
<td>C</td>
</tr>
<tr>
<td>implementing agencies</td>
<td>Public sector: ministry departments, autonomous public agencies, universities, commodity boards</td>
<td>C</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Civil society: farmer organizations, NGOs, CBOs, etc.</td>
<td>D</td>
<td>E</td>
</tr>
<tr>
<td></td>
<td>Business sector: Private for-profit companies</td>
<td>G</td>
<td>H</td>
</tr>
</tbody>
</table>

10 An exception is the Fisheries Research Fund (FIP) in Chile, which operates on the basis of paying full project costs and has attracted both public and non-public research providers.
The dismantling of national agricultural extension services has in many LAC countries induced an outsourcing of extension activities to civil society and the private sector. Most governments in the LAC region no longer see it as their role (if they ever did) to provide public agricultural advisory services to large commercial farmers. Those farmers fit squarely in box I— they can buy these services in the private market on an individual basis. Buying private advisory services individually is often too expensive for market-oriented small and medium-sized farmers, and so some pooling of resources on the demand side is required. Agricultural advisory services for these farmers fit in boxes E and H. For small subsistence farmers, however, funding of agricultural extension is often still primarily public because of equity reasons. Agricultural advisory activities for these farmers fit in boxes D and G.

The limitation of the classification in Table 5.1 is that it only identifies sharply distinct categories, while in reality things are a lot more diffuse and complex. Implementing agencies, for example, are often active in different markets, producing public goods for one group of clients and private goods for another. As a consequence, they often have multiple sources of public and private funding. Many agricultural research or extension service outputs, however, have a mixed public/private good character— benefits of the service accrue to farmers, but also to consumers and the public in general. In such instances, public and private interests should be brought together and share the funding of the service. These types of public-private partnerships can be quite difficult to achieve, due to differences in culture and problems in clearly understanding each other’s roles and responsibilities.  

A matching grant mechanism is a financing tool that facilitates the sharing of interests and funding between public and private actors, but is rather underutilized in Latin America and the Caribbean. To stimulate farmers to finance agricultural research and extension activities collectively, the government matches every x dollars mobilized by farmers with a dollar.  

The intensity of government support can vary and should depend on the perceived spill-over of benefits to the public in general. Sometimes equity arguments are used to give stronger public support to agricultural research and extension activities for specific disadvantaged farmer groups. A matching grant mechanism is an important financing instrument that LAC countries could use in financing a great deal of their agricultural research and extension activities. Further experimentation with this instrument is highly recommended.

Perhaps the most important lesson to be learned from the past 15 years of reforms in agricultural research and extension is that institutional experimentation and change is a permanent aspect of innovation. In other words, innovation is not only about developing and adopting new technologies, but also about developing and adopting new ways of organization and management in innovation and production processes. Particularly in dynamic economies, such processes change permanently and rapidly. Therefore, it would be a mistake to see current experimentation as a transitional period and to believe that agricultural research and extension will eventually settle on a new, fixed model of operation. Instead, one should promote an institutionally dynamic setting in which organizations and systems permanently learn from their experiences and experimentation, and adjust their modes of operation to rapidly changing circumstances. It is this quality and ability that will make the difference.

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11 See Byerlee and Echeverría (2002) for a discussion and examples.

12 Australia has been very successful in introducing matching grant schemes for agricultural research during the 1990s. See Alston et al. (1999) and Brennan and Mullen (2002) for further details.
between successful and unsuccessful agricultural innovation systems.

Opting for institutional dynamism makes one more concerned about how to sustain such dynamism rather than how to sustain specific institutional arrangements. Institutional arrangements are transitional – they will work for five, ten or perhaps twenty years but will evolve over time or be replaced. Many competitive S&T funding schemes, for example, have changed their objectives and mode of operation substantially since they started or have been replaced by new schemes. Adopting stronger and better M&E tools is a critical step towards a learning organization or system model. However, institutional learning processes have been largely absent or weak in agricultural research and extension organizations throughout the LAC region. Even more problematic in most LAC countries is the lack of coordination and learning at the system level. How do the different components of the agricultural innovation system fit together, what are their strengths and weaknesses, and how can they create more synergy? In a situation of institutional change and dynamism, these questions need permanent attention and a home in a system-wide oversight body.

To give two examples, one question that stood out with regard to competitive S&T funding schemes is how they relate to core funding provided directly to the implementing agencies and to paying for salaries and capital costs. Core funding, to a large extent, defines the supply side of the market, and the competitive funding the demand side of the market. Another question that arose is how to deliver to the many small agricultural advisory agencies that have emerged in several LAC countries, new knowledge about technological, financial and economic options for their clients.

Stronger client (i.e., farmer) orientation and participation is seen as an essential step towards a more demand-driven and, therefore, more relevant agricultural research and technology transfer system. However, the success of such models depends crucially on the level and quality of organization among farmers. The political reality is that the level and quality of farmer organization is usually positively correlated to economic status – i.e., rich farmers are better organized and more often sit on the boards of rural organizations (including those dealing with agricultural research and extension) than poor farmers. Hence, the outcome of the farmer participation model, particularly in a dual economy setting characteristic in many LAC countries, may not necessarily be as egalitarian as expected.¹³ Policymakers should, therefore, consider corrective measures in the design of farmer-oriented and participative agricultural research and extension models. One such measure, already in frequent use, is to differentiate farmers into different economic strata and design instruments specific to each of the strata. Such differentiation is already quite common in agricultural extension (e.g., Nicaragua), but less so in agricultural research, perhaps because research activities are less farmer-specific.

Farmers in the LAC region are faced with rapidly changing agricultural markets due to changing consumer demands and trade liberalization. They have to change and modernize their production in order to confront these challenges and turn them into opportunities. The innovations needed are as much institutional as they are technical. Production chains have to be improved and new markets opened. This will require new partnerships, new rules and regulations, and new forms of innovation. An innovation system perspective, rather than the more traditional NARS and AKIS perspectives, may help to identify and analyze these broader contextual developments.

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¹³ See de Janvry et al. (1989) for a more in-depth discussion.
The “spill-over” of technology from the science pool in the North (but increasingly also from the South) has been a constant characteristic of the agricultural innovation systems in the LAC region in the past. Also in the future, there continues to be a large potential for innovation through the introduction of knowledge and technologies from regional and international sources. This demands different research and innovation strategies for countries of different size. Small countries also will have to focus primarily on the import and adaptation of technology to local needs. Medium-sized countries will also have to focus on the import of knowledge and technology, but are also in a position to conduct local strategic research and innovate with locally developed knowledge. Finally, only the larger countries will have the capacity to implement a broad research spectrum in collaboration with international research colleagues and, through these networks, exchange and import technology. International and regional networks, which include the centers of the Consultative Group on International Agricultural Research (CGIAR), have great potential to facilitate spillovers. However, many of these networks face institutional and financing barriers, and further thinking and institutional reform is necessary to make these a permanent presence in the region.
References


Chema, S., E. Gilbert, and J. Roseboom. *A Review of Key Issues and Recent Experiences in Reforming Agricultural...*


Appendix I

Institutional Reform of Agricultural Research and Extension in Latin America and the Caribbean

Johannes Roseboom, Matthew McMahon, Indira Ekanayake, and Indu John-Abraham

Background

The Latin America and Caribbean region (LAC) has been undergoing an evolutionary process in its agricultural research and extension systems in recent years. This transformation of agricultural innovation systems has been explained metaphorically as following the nature of an “intelligent living organism” that must learn and adapt to changes in its environment in order to be successful. What was once a linear process, driven by a top-down action plan where research and advisory services were dominated by government agencies, is slowly being transformed into a network of diverse stakeholders influencing the process of agricultural innovation. Traditionally, the unidirectional process of research and extension has been initiated by an agricultural agenda defined by the central government, for which the national agricultural research institutes (INIA for its Spanish acronym) were tasked with identifying strategies to address these priorities. The research was then implemented and finally its results disseminated to the farmers for adoption. The current incarnation of agricultural innovation systems have been typified by the engagement of a wider set of actors, including universities, farmers, input suppliers and other private sector interests, who offer their unique insights to feed the process of innovation in a practical and demand-driven manner. As such, the concept of “innovation” extends beyond the formal research and development (R&D) to more effectively incorporate learning through experience, which has proven more circular in nature, with the intention of more directly contributing to improved rural livelihoods. On the institutional side, these reforms have led to greater specialization, with policy formulation, financing and implementation being increasingly separated from one another.

The push towards institutional reform was stimulated by numerous external factors, forcing this evolutionary process (See Box 1). After a period of strong support in the 1960s and 1970s, public funding for research and extension activities in LAC began to wane in the 1980s and 1990s. The strained economic context for many countries required the search for more cost-effective and efficient strategies for producing, disseminating and applying new knowledge and information in agriculture. At the same time, the demand for innovation became all the more pressing, as increased global competition required improvements in agricultural productivity. Consequently, many countries in the region in recent years have sought to revitalize their agricultural research and extension systems through a series of institutional reforms, with particular attention given to the sustainability of funding for these services. Reflective of the drivers of reform, the focus has been on the following principles: i) diversification in execution and funding; ii) allocation of funding on a competitive basis; iii) demand-driven financing; iv) empowerment of local communities; and, v) increased private sector participation in implementation of the reform agenda.

14 As published in En Breve, No. 90, May 2006.
A series of case studies from the LAC region, including Brazil, Chile, Colombia, Ecuador, Mexico, Peru and Venezuela, were conducted to review these institutional reform experiences in agriculture and distill lessons learned to further advance agricultural innovation systems in the region. The following summarizes some of the key trends in both agricultural research and extension based on the analysis of these varied country experiences.

**Innovations in Agricultural Research**

In recent years, competitive science and technology (S&T) funding schemes have transformed the traditional practice of lump-sum government grants for publicly-funded research into a more robust and demand-driven system. The competitive S&T funding schemes have improved the incentive structure of grants for potential grantees, thereby promoting the improved quality of research. The competitive funds for agricultural research have contributed significantly to: i) improved governance; ii) greater diversification of research suppliers; iii) improved client-orientation; and, iv) increased cross-institutional collaboration.

**Improved Governance**

New rules and norms have taken shape with the introduction of competitive funding schemes in agricultural research and technology transfer activities. Rather than the research priorities being defined almost solely by the national research agencies, the increased participation of other key stakeholders has expanded the decision-making role of private research entities in defining priorities. Researchers and research agencies also have had to adapt to the competitive grant process, and as a result, the quality of research proposals and the management of the resources have improved. This increased competition also has caused national agricultural research organizations to become more agile and results-oriented in order to effectively compete for these limited resources. The competitive funds also have increased the level of transparency and objectivity in the selection process, by requiring that all proposals be reviewed by external, technically competent reviewers, and the final selection is made public. Such processes, however, come with a price as they require a larger overhead to manage and monitor the grants systems.
Greater Diversification of Research Suppliers

Competitive funds allow for the expansion of the supply of researchers, which has resulted in a greater diversity of actors (from both the public and private sectors, including universities, non-governmental organizations (NGOs), producer organizations and other organized village-level communities including women’s’ groups) competing for these resources. By opening the pool of possible candidates, the awareness and competition for these grants has become more intense, creating greater specialization among institutions based on comparative advantage. As seen in Table 1, the INIAs have faced growing competition from other research institutions, mustering only about half or less of the competitive funding available.

Table 1: The Rise of New Partnerships in Research

<table>
<thead>
<tr>
<th>Country</th>
<th>INIA</th>
<th>Other public (research) agencies</th>
<th>Universities</th>
<th>NGOs</th>
<th>Others</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brazil</td>
<td>52</td>
<td>11</td>
<td>30</td>
<td>—</td>
<td>7</td>
</tr>
<tr>
<td>Chile</td>
<td>10</td>
<td>15</td>
<td>38</td>
<td>17</td>
<td>20</td>
</tr>
<tr>
<td>Colombia</td>
<td>43</td>
<td>4</td>
<td>9</td>
<td>21</td>
<td>23</td>
</tr>
<tr>
<td>Ecuador</td>
<td>38</td>
<td>—</td>
<td>37</td>
<td>11</td>
<td>14</td>
</tr>
<tr>
<td>Mexico (SAGARPA/CONACYT)</td>
<td>23</td>
<td>23</td>
<td>53</td>
<td>—</td>
<td>2</td>
</tr>
</tbody>
</table>

Table 2: Bringing Farmers Closer to the Table

<table>
<thead>
<tr>
<th>Country</th>
<th>Competitive Fund</th>
<th>Client Orientation and Participation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brazil</td>
<td>PRODETAB</td>
<td>Innovation needs formulated and prioritized by the steering committee of the fund (mainly government officials) in consultation with stakeholders. Involvement of private sector in project development and implementation is an important selection criteria for funding. Special attention given to bias in allocation of resources towards richer and more dynamic parts of the country.</td>
</tr>
<tr>
<td>Chile</td>
<td>FIA</td>
<td>Consultations with farmers and other stakeholders have been conducted at the regional (instead of the national) level. A few small information offices have been opened to improve FIA’s regional presence. Project selection remains centralized and in the hands of experts. Most projects selected involve farmer participation.</td>
</tr>
<tr>
<td>Mexico</td>
<td>PRODUCE</td>
<td>PRODUCE foundations have been established in all 32 states. Farmers are closely involved at all levels. Farmers have a majority vote on the boards and provide the chairman of the board of the foundations. Farmers are required to co-finance technology transfer projects, principally through in-kind contributions.</td>
</tr>
</tbody>
</table>
Improved Client-Orientation and Participation

Many of the competitive S&T funds have incorporated increased participation of beneficiaries, namely farmers, including women farmers who are often underserved, and other producer organizations, in various aspects of agricultural research, especially in the identification of priorities and sources of financing. The greater attention given to the opinions and involvement of clients in research projects has contributed to a more responsive and pragmatic agenda to address key needs of the producers. In order to more effectively reach their target beneficiaries, many countries, including Brazil, Chile, and Mexico, have adopted more demand-driven approaches for their funding structures (See Table 2).

Increased Cross-Institutional Collaboration

Many competitive agricultural funding schemes have encouraged greater collaboration among research institutions by favoring joint proposals and innovative strategies for partnerships with other key stakeholders, such as farmer associations, NGOs, as well as relevant international counterparts.

Agricultural research systems have made strides in the right direction to be innovative and produce demand-driven research, but the need to keep pace with advancement in related sciences, such as information technology and communications, has lagged. The increased involvement of the private sector could facilitate this process, and consequently, requires particular attention.

Innovations in Agricultural Extension

The failures of agricultural extension services in the Latin America and Caribbean region during the 1980s resulted in dramatic changes in the nature of the extension business. The lack of active involvement of farmers, coupled with inefficiency, due to excessively bureaucratic procedures, poor planning and low capacity levels of human resources, yielded limited returns. Consequently, the institutional reforms pursued in the region essentially dismantled existing structures, and rebuilt new models to support technology and knowledge diffusion among farmers.

Decentralization

Common to the experience of most countries in LAC has been the trend towards decentralization, including that of agricultural extension services. By bringing advisory services closer to its clients, information is readily and easily accessible to farmers and be more tailored to their specific needs (See Box 2). However, the levels of decentralization vary widely from country to country. A single extension model does not work in all instances and for all countries, and the country context defines what works best.

Client-Orientation

In order to better meet the needs of farmers, extension services in recent years, have adopted a more demand-driven approach by incorporating farmers as active partners in identifying the priorities for advisory services. As such, extension services have extended beyond technical information on agricultural production to also include guidance on a wider range of issues, such as financial and economic concerns, among others. In fact, most countries have geared advisory services more towards market opportunities in response to greater trade liberalization. In Chile, for example, extension agencies offer each farmer assistance in developing a business plan to support the economic viability of their farm. Over the course of approximately four to five years, that farmer will receive continuous and intensive assistance to facilitate this transition.
**Co-financing**

Co-financing of extension services is becoming more commonplace in the LAC region, yet there are important distinctions that define what should be paid for and who should pay. For example, specific advice provided to individual clients would suggest that the service is a private good. At the same time, the adoption of environmentally-friendly technologies may be more in the common good, suggesting the need for public financing. The ability to pay also should distinguish the level of co-financing. Poor farmers may still receive advisory services for free, at a nominal fee or through in-kind contributions, while wealthier producers may be requested to pay a substantial portion, if not all, of the cost of the service. Through the Peruvian Agro-Innovation and Competitiveness project (INCAGRO), for example, the Government has sought to create or strengthen an agricultural advisory services market by paying up to 75 percent of project costs through competitive funds, while requiring the direct beneficiaries to pay or mobilize the remainder, thereby creating a culture of payment for demanded services. Payment, at least in part, by farmers to receive advisory services, will likely make services more client-oriented, and better identify demand and manage quality control of services.

**Outsourcing**

A characteristic of recent agricultural extension reforms in the LAC region has been the outsourcing of advisory services to NGOs, farmer organizations, private businesses, etc. Generally, public resources are used to fund competitive contracts of local service providers of extension services. This requires the transition from a highly centralized and integrated structure to a clear separation among the policy, priority setting, and implementation entities within the government. Venezuela has demonstrated a new model for decentralized and demand-driven extension services. The municipal ACE offices contract extension services, mainly from private firms and NGOs, which has increased the ability of beneficiaries to choose service providers that best meet their needs. Other countries have followed similar models with increased private sector participation. Consultations with farmers as well as the use of market mechanisms have supported the definition of service priorities by users of advisory services. Outsourcing also demands considerable organizational and managerial capacity within the government. Clear and transparent procedures and regulations governing the bidding and selection process, as well as monitoring and evaluation of the contracts, are critical to successful outsourcing schemes.

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**Box 2: Civil Associations for Extension in Venezuela**

Venezuela has introduced a new decentralized system of agricultural extension through the creation of locally managed Civil Associations for Extension (or ACEs for its Spanish acronym). The ACEs are legal entities comprised of representatives from the municipal governments as well as beneficiaries of the extension services. The responsibilities have gradually increased from participating in the preparation of the municipalities' annual extension plans, approving these plans, evaluating the performance of the implementing agencies, to finally selecting and directly contracting the implementing agencies. With their increased responsibility in extension activities, the ACEs have become more empowered and a valuable resource, as demonstrated by their discussions with high level officials in the Ministry of Agriculture and the National Rural Development Institute during national budgetary crises. Not only that, they have been able to access additional funding from other government programs.
Future Trends and Challenges

Trade Liberalization
The rise of free trade agreements in the region has stimulated greater demand for agricultural innovation. Agricultural research and extension services are increasingly shaped by market demands for improved quality, cleaner or more specialized (e.g. – organic, eco-friendly) production. Producers are more market-oriented, and consequently, are requiring the same of national innovation systems, and consequently, putting more demands on national innovation systems.

Fast Pace of Technology
Science and technology are rapidly evolving, particularly in the areas of telecommunications and biotechnology. New information and research quickly replace the knowledge of yesterday. As such, countries face increased pressure to stay on the cutting edge of innovation to remain competitive. The development of human capacity proves paramount to staying ahead of the curve.

Sources of Funding
Traditional funding sources for public research and extension systems have a continued and well-justifiable role to play to meet the needs of the rural poor. The competitive grant schemes, which have proven to be efficient funding instruments in the LAC region, need to be complemented with a sustained level of public funding, as they generate innovation of a public good nature. At the same time, there are various opportunities to explore alternative or additional sources of funding. For example, resources generated through the use of intellectual property rights, such as patents, trademarks, or plant breeders’ rights, could be reinvested into the public research system. Not only that, as agriculture has demanded a broader range of innovations, resources from other sector ministries invested in innovation has impacted on agriculture. This, in turn, has resulted in greater integration of agriculture into the broader national S&T system.

Sustainability of Agricultural Institutional Reform
Conceptually, the sustainability of agricultural institutional reform has to be driven by a concerted effort by all stakeholders towards a demand-driven way of thinking about agricultural innovation systems. The agricultural institutional reforms discussed above are sustainable only when there is broad participation and investments from both the private and public sectors. The roles of the various stakeholders must be clear and concretely defined in order to secure their effective engagement.

Policy and Institutional Framework
Agricultural research and extension systems have had to adapt and modernize to confront the challenges of rapidly changing agricultural markets, and turn them into opportunities. To achieve institutional and technical innovations, concurrent and supportive modifications in the policy framework are needed in the national context. For example, countries must establish proactive policies to capture potential “spill-ins”, in order to facilitate the adaptation of technology and information developed elsewhere in the world.

Amongst those challenges mentioned above and the lessons learned from two decades of reforms in agricultural research and extension is that institutional experimentation and change is a permanent fixture. The process of innovation has evolved from a linear to a circular approach, where the “feedback loop” encourages learning from various sources and through all stages of the process. To meet the overall challenges posed by these changes, new partnerships, rules and regulations, and new forms of innovation are required, and the adoption of an innovative system perspective is the way forward.
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