

MODULE I

Coordination and Collective Action for Agricultural Innovation

OVERVIEW

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EXECUTIVE SUMMARY

Actors in an agricultural innovation system (AIS) innovate not in isolation, but through interacting with other actors—farmers, firms, farmer organizations, researchers, financial institutions, and public organizations—and the socioeconomic environment. In other words, agricultural innovation is an organizational phenomenon influenced by individual and collective behaviors, capabilities for innovation, and enabling conditions. Interaction, coordination, and collective action are based above all on the actors' capacity to identify opportunities for innovation, assess the challenges involved, and access the social, human, and capital resources required for innovating, learning, and sharing information. Better coordination can improve the design and implementation of innovation policies by allowing more actors to voice their needs and concerns, resulting in more inclusive policies and faster diffusion of innovations. Stronger interaction and coordination can also induce all actors in an innovation system, particularly public research and extension organizations, to be more aware of and responsive to the needs and concerns of other actors, especially resource-poor households. Despite such advantages, interaction and coordination have been difficult to achieve for the same reasons that hinder collective action: opportunistic behavior; lack of trust, incentives, and capacity; and difficulties in setting and enforcing rules. Interaction and coordination in

the innovation systems of developing countries are hampered as well by segmented markets, different technological regimes, lack of collaboration cultures, inappropriate incentives, weak channels of communication, and insufficient innovation capabilities.

Effective interaction, coordination, and collective action are based on existing capabilities, appropriate incentives, and the empowerment of individuals; thus they rely on voluntary action. Coordination and interaction can emerge spontaneously or be induced by specific public or private programs. Effective coordination requires (1) a committed and capable leadership; (2) appropriate incentives; (3) an enabling environment, in which important stakeholders that coordinate their activities have the mandate, culture, and freedom to participate; (4) stable support programs; (5) efforts to strengthen the capabilities for innovation and collective action; and (6) adaptation of public organizations to participate more effectively in innovation processes. The organizational innovations (committees or councils, platforms or networks, and diverse associations) reviewed in this module show that many innovations are not planned in detail beforehand; instead, they result from the adaptation of organizational structures in response to emerging problems or opportunities. They also show that creative and committed individuals guide the adaptation and that an enabling environment allows the organizations to change.

RATIONALE FOR INVESTING IN COORDINATION AND COLLECTIVE ACTION FOR INNOVATION

Many different actors in an AIS generate and disseminate innovations, including farmers, firms, farmer organizations, researchers, financial institutions, and public organizations. These actors do not innovate in isolation; rather, they innovate through interacting with other actors and the socioeconomic environment. Their interactions take different forms, such as consultations to define innovation policies, joint research activities, or participation in or facilitation of innovation networks and value chains (box 1.1). Agricultural innovation is increasingly recognized as an organizational phenomenon influenced by individual and collective behaviors (World Bank 2006). These behaviors, in turn, depend on the individual and collective capabilities possessed by the actors, on culture,¹ incentives, routines, and the environment (Ekboir et al. 2009).

The importance of interaction, coordination, and collective action in innovation systems has been recognized for more than two decades (Freeman 1987; Lundvall 1992; Nelson 1993). Common reasons for AIS actors to interact and address issues collectively include improved identification of opportunities for and challenges with innovation; leveraging of human and capital resources; learning and information sharing; and (obviously) economic and/or social benefits. Interaction and coordination may also improve the design and implementation of innovation

policies by allowing more actors to voice their needs and concerns, resulting in more inclusive policies and faster diffusion of innovations.² Stronger interaction and coordination also induce all actors, especially public research and extension organizations, to be more aware of and responsive to the needs and concerns of other actors, especially resource-poor households. Box 1.2 illustrates the benefits arising from one type of interaction: learning alliances (see also IAP 4 in module 4). The more general economic, social, and environmental benefits of investing in coordination, interaction, and collective action for agricultural innovation and in building organizational capabilities are summarized in the sections that follow.

Fostering economic growth

Better-connected actors with stronger innovation capabilities help to solve coordination problems among potential partners, build trust for collaboration, build up innovation capabilities, and develop a better understanding of the needs and capabilities of other actors in the AIS, especially marginalized groups. Other economic benefits of coordinating more capable actors include the following:

- Lowering the cost of searching for and using technical and commercial information, easing the identification of emerging technical, social, and economic needs and opportunities, facilitating experimentation on alternative

Box 1.1 Main Terms Used in This Module

Innovation network. A diverse group of actors that voluntarily contribute knowledge and other resources (such as money, equipment, and land) to jointly develop or improve a social or economic process or product. These networks are also known as *innovation platforms*.

Farmer organization. An organization integrated only by farmers seeking solutions to production or commercial problems.

Value chain. The set of linked activities conducted by the different actors that a firm organizes to produce and market a product.

Organization. A group of actors that collaborate over a sustained period. An organization can be either

formal or informal. Collaboration may take different forms, including frequent exchanges of information, joint priority setting for policies and programs, and joint implementation of innovation projects.

Innovation brokers. Teams of specialists that combine a strong background in science with knowledge of business and commercialization and/or the creation of innovation networks. Innovation brokers are also known as *change agents* or *technology brokers*.

Innovation capabilities. The skills to build and integrate internal and external resources to address problems or take advantage of opportunities.

Source: Author.

Box 1.2 Role of Learning Alliances in Enhancing Interaction and Improving Innovation Capabilities in Central America

A learning alliance is a process-driven approach that facilitates the development of shared knowledge among different actors. Learning alliances contribute to improved development outcomes because lessons are identified and learned more quickly and because stronger links among research organizations and other actors in the AIS improve the focus on research and development practices.

Since 2003, international and local nongovernmental organizations (NGOs), a national university, the International Center for Tropical Agriculture (CIAT), and the International Development Research Centre (IDRC) have come together to explore how learning alliances can improve links between research and development actors. The learning alliance has worked with 25 agencies as direct partners, and through their networks it has influenced 116 additional organizations. Over the years, the alliance fostered change in

organizations working with 33,000 rural families in El Salvador, Guatemala, Honduras, and Nicaragua by significantly changing the partners' attitudes and practices. As they became better connected, organizations working on similar topics improved their access to information and knowledge of rural enterprise development and their access to improved methods and tools. Attitudes shifted from competition to collaboration. Partners experienced how working together enhanced their capacity to serve rural communities and attract donor funding. The increased effectiveness of the partners' projects and the development of more strategic new projects indicate how development practices and knowledge management improved. These shifts have contributed to a more efficient innovation system, as seen in the shared use and generation of information, joint capacity-building programs, and large-scale, collaborative projects.

Source: Author, based on CIAT 2010.

Note: CIAT = Centro Internacional de Agricultura Tropical.

solutions, opening market opportunities, and developing competitive capabilities.

- Integrating more effectively into innovation networks.
- Developing new skills and more effectively using human, social, physical, and financial resources, thus fostering economic growth.
- Participating in the development and diffusion of innovations, including action-research projects and new approaches to extension.

Producing public goods

Individuals and organizations with facilitation and/or brokering skills (in other words, with the capacity to promote interaction) produce three important public goods. First, by linking public, private, and nonprofit actors, they facilitate the identification of emerging trends and improve policy dialogues and the design and implementation of innovation and agricultural policies at the global and domestic level. Second, by interacting more actively with researchers, they help researchers to generate more relevant scientific information. Third, by interacting with extension organizations, they can help extension services to become more receptive

to the needs of nonpublic actors and help them to use technical and commercial information, thus strengthening their innovation capabilities.

Reducing poverty

Poor households usually have limited human, social, physical, and financial resources (Neven et al. 2009). Individuals and organizations with facilitation and/or brokering skills can help these households to pool their limited resources among themselves or with other actors (for example, NGOs or supermarkets) to achieve economies of scale, enter new markets, or access new resources, such as technical information or credit (World Bank 2006). Although the direct impact of farmer organizations on poverty seems relatively modest (see TNs 2 and 4), organizations can have important indirect effects on poverty by fostering economic growth, creating employment, preventing buyers from benefiting at the expense of suppliers, building innovation capabilities, and protecting marginal groups (such as women or landless farmers) from further marginalization (for example, see IAPs 4 and 6). They can also negotiate with authorities on behalf of their members,

increasing the public resources invested in poverty alleviation and affirmative action programs.

Improving environmental outcomes

Innovations that improve the sustainable use of natural resources are usually developed and diffused by networks with a diverse set of partners and capabilities (IAP 1). Their diversity facilitates access to a large pool of technical information, the implementation of participatory and action-research programs, effective diffusion activities (such as farmer-to-farmer extension), and collective action for the management of common resources. Individuals and organizations with stronger capabilities and facilitation and/or brokering skills can also help to articulate environmental demands that are often excluded from national policies. These demands are often linked to poverty alleviation, because poor households tend to live in unfavorable and fragile environments.

CONTENT OF THIS MODULE

After looking in detail at past experiences with coordinating and fostering collective action for innovation (such as through formal and informal coordination agents and/or organizations), this module describes the conditions, instruments, and incentives for coordination and discusses ways of building innovation capabilities in groups of actors in an AIS. It also briefly reviews key policy issues; new directions, priorities, and indicators that can help to monitor progress and assess the results of investing in interaction and coordination; and the conditions and capabilities that improve the chances of success.

PAST EXPERIENCE

Despite their advantages, interaction and coordination have been difficult to achieve for the same reasons that hinder collective action: opportunistic behavior; lack of trust, incentives, and capacity; and difficulties in setting and enforcing rules. Interaction and coordination in the innovation systems of developing countries are also hampered by segmented markets, different technological regimes, lack of collaboration cultures, inappropriate incentives, weak channels of communication, and insufficient innovation capabilities.

Interacting in a sustained way has proven difficult, particularly among research and educational institutions, which have an important role to play in facilitating access to scientific information, generating information that is

needed but does not yet exist, and preparing professionals with strong skills in disciplines required by innovating actors.³ To play this role, researchers must interact intensively with other actors in the innovation system. While in recent years public research institutes and universities in developing countries have been pressed to open up to the needs of other stakeholders in the innovation system, few have been able to adapt because they do not have the capabilities and incentives to interact with nonacademic agents, have weak research capabilities, and resist change (Ekboir et al. 2009; Davis, Ekboir, and Spielman 2008).^{4,5} Similarly, most farmers and NGOs have weak links with public organizations and governments, including the traditional research, extension, and regulatory agencies as well as local authorities and financing organizations.

The sections that follow review the main elements of effective interaction, coordination, and collective action, starting with the conditions for effective interaction and coordination and the instruments and incentives needed. The main types of coordinating bodies and organizations are described, and the crucial need to build innovation and organizational capabilities in new or existing organizations is discussed.

Conditions that foster the effective interaction and coordination of actors for collective action and agricultural innovation

Interaction and coordination for collective action and agricultural innovation can be successful only if (1) the AIS actors perceive that the benefits of contributing to a common effort are bigger than the associated costs; (2) they have the appropriate human and social resources to participate in collective action; and (3) they feel that they can influence the processes in which they participate. Interaction and coordination may emerge *spontaneously*. An effective value chain, in which actors collaborate (often without formal contracts) to supply a particular product to a market, is an example of spontaneous coordination. Coordination may also arise from *deliberate interactions*, such as a multistakeholder forum where innovation policies are discussed.

Effective interaction, coordination, and collective action are based on existing capabilities and on appropriate incentives and empowerment of individuals, and thus they rely on *voluntary action*.⁶ Because effective interactions and trust seldom emerge spontaneously, programs that support intermediaries and build innovation capabilities are often necessary to facilitate the process. Box 1.3 lists factors essential to effective interaction and coordination.

Every innovation is a new combination of resources, particularly ideas, skills, information, different types of capabilities, interorganizational learning and knowledge, and specialized assets. Organizational innovations are as important as product or process innovations.

Individuals or organizations may facilitate the exchange of resources and the coordination of actions to develop innovations. This process among heterogeneous actors may increase the diversity of resources and ideas that are available. The greater the variety of these factors available to innovators, the greater the scope for them to be combined in different ways, producing innovations that can be both more complex and more sophisticated. But variety is not enough for effective innovation. It is also necessary to have the incentives and capacity to search the pool of ideas and know how to combine them. In other words, incentives and innovation capabilities determine how actors innovate.

Effective coordination for innovation occurs when (1) a committed and capable leadership promotes the collaboration; (2) one organization offers appropriate (often new) positive and negative incentives to individuals from cooperating organizations (such as researchers or farmers); (3) important stakeholders that coordinate their activities have the mandate, culture, and freedom to participate; and (4) individuals participating in the collaboration do not change often (a relatively common problem with high-level civil servants).

Other factors are also essential to interaction and cooperation:

- Interactions and cooperation are not costless or easy to implement; therefore, they have to be managed with a clear view of the outcomes being sought and the associated costs.
- Interaction and collaboration thrive only if they are based on trust, which fosters greater commitment, more thorough knowledge sharing, and better conflict resolution.
- Motivated, capable, and autonomous facilitators are essential for inducing collaboration. Well-connected facilitators and collaborators pull promising new entrants into their networks and collaborate with a wide assortment of partners, exposing them to more experiences, different competencies, and added opportunities. In rapidly changing industries, facilitators lacking such connections fail to keep pace.
- Facilitators work effectively only when financing is sustainable and stable. Private actors will rarely pay for services that are initially difficult to define and whose real value can be determined only after the intervention finishes. For this reason, public funds should be made available to support coordinators of innovation processes and the implementation of institutional and organizational innovations.
- Inducing actors to alter their behaviors may require changes in laws and regulations. Given the uncertain nature of innovation processes, such changes should be introduced after they have been tried in pilot projects and after different actors (private firms, public research organizations, and relevant stakeholders such as the main ministries, regulators, and NGOs) have been involved in policy design, consultations, strategizing, and implementation. It is also important to invest in preparing high-quality information to support decision making, such as background studies commissioned from national or international think tanks and experts, sectoral dialogues between employers and employees' unions, and high-level steering groups (see module 6, TN 1 and TN 2).
- Interaction and coordination require adaptive management to help participating actors to change their behaviors as new actors join the informal organization and the innovation process matures. Adaptive management cannot be implemented well without monitoring and evaluation systems that focus more on processes than on outcomes.
- Many public research and higher education organizations in developing countries have incubator programs to foster the emergence of private firms and other organizations. Before expanding these programs, it is important to assess their capabilities to manage innovation programs and, if their capabilities are weak, to consider creating new, dedicated agencies, not necessarily within the public sector. Also consider divesting from obsolete schemes and institutions.
- "System failures" are prevalent, caused by weak incentives for collaboration, conservative organizational cultures, lack of trust among potential partners, regulations and programs that hamper interactions, and ineffective financing for innovation. By diminishing these failures, facilitators or collaborators promote collective action, the production of public goods for innovation, and the development of the innovations themselves.

Sources: Authors, based on Fountain 1999; Axelrod and Cohen 1999; Hakansson and Ford 2002; Fagerberg 2005; Powell and Grodal 2005; Klerkx and Leeuwis 2009; Klerkx, Aarts, and Leeuwis 2010.

Instruments and incentives for interaction, coordination, and organization of actors for agricultural innovation

Effective coordination and organization of actors for agricultural innovation can be supported with different instruments, including building capabilities for innovation (TN 4); joint priority setting or technology foresight exercises (TN 1), joint research and/or innovation programs, efforts to foster the emergence of innovation platforms (module 4, TNs 1 and 2) and value chains (TN 3), the creation of venture capital (module 5, TN 6), and support for establishing innovation brokers (module 3, TN 4). Innovation councils and advisory committees involving different ministries can coordinate policies, joint priority setting, and technology foresight exercises, which are often supplemented with temporary stakeholder consultation arrangements (see module 7, TN 3). Innovation forums and market and technology intelligence can create common visions among agents, thus fostering coordination.

If they do not provide proper *incentives* for organizations and especially individuals, coordination initiatives result only in formal interactions that have little effect on the AIS. Individuals respond to the incentives offered to them. When organizations do not introduce incentives to support external collaboration and coordination, their members (whether researchers, employees, or farmers) simply continue their normal activities. For example, it has been very difficult for research and education organizations in developing countries to participate in innovation processes.

Effective participation of nonacademic actors in the governing bodies of research organizations can induce research organizations to interact better with nonacademic agents. For this to happen, the nonacademic actors must have a good understanding of the dynamics of innovation and research (Ekboir et al. 2009). When the agricultural technology institutes are part of the agriculture ministry and the latter has little interaction and no formal links with the offices in charge of general scientific and innovation policies (research councils or other ministries), agricultural research and innovation policies can be divorced from other science and technology policies. This separation has two important consequences. First, the incentives offered to researchers often discourage interactions with farmers, especially when these incentives value indexed publications over participation in innovation processes. Second, incentives for innovation are often designed in ways that prevent farmers from using them. For example, it is common to offer tax incentives for private investments in research and innovation, but

for most farmers and small companies the tax deductions are too small to finance research or innovation projects.

At the macro level, policies can facilitate coordination by setting new incentives and rules by which agents operate. At other levels of the AIS, successful coordination of actors requires *innovation capabilities* (discussed later) and appropriate incentives, such as effective markets (which create opportunities to benefit from innovations) and innovation funds (see module 5, TN 2). At lower levels, actors in the AIS coordinate their actions in response to public incentives (such as social programs financed by local or international donors), market opportunities (such as high-value agriculture), or problems that affect whole communities (such as the management of natural resources). Programs to promote collaboration at the lowest levels of the AIS include funding innovation brokers (see module 3, TN 4), extension agents, and incubators; fostering the emergence of innovation networks (TN 2); providing resources for coordination activities (such as face-to-face meetings), and building actors' capabilities so that they can better search for and use technical and commercial information. Finally, because innovators and brokers cannot innovate in an unfavorable environment, physical and communications infrastructure should be developed, institutions must be strengthened, and regulations must be updated periodically to adapt to new technologies and market requirements (see module 6 on the enabling environment for AIS).

Types of coordinating bodies and organizations in the AIS

Aside from the traditional coordinating activities led by ministries of agriculture, a wide array of coordinating bodies contributes to agricultural innovation. Coordinating bodies and other forms of organizing actors (either individuals or organizations) are becoming increasingly important owing to the challenges imposed by globalization, emerging technologies, the increasing complexity of science, new forms of innovation, and global issues such as climate change, access to clean water, and poverty reduction. These bodies do not necessarily belong to the public sector but often have links to the highest levels of government (vertical coordination). Interaction and coordination increasingly are promoted and supported by different agents at the specific level in which they operate. Almost any agent can coordinate an innovation process if it has the personal, financial, and social resources to do so.

Over the years, formal and informal structures that coordinate actors within and between different levels of the

AIS have emerged in almost every country. Informal organizations (for example, innovation networks or value chains)⁷ are increasingly recognized as important sources of innovation, because they complement and bond to formal organizations through a dense web of personal relations (Hakansson and Ford 2002; Robinson and Flora 2003; Christensen, Anthony, and Roth 2004; Vuylsteke and van Huylenbroeck 2008).

Formal organizations, such as a firm or a national research council, have a leadership structure defined in by-laws. Formal, dedicated structures with set agendas do not guarantee that actors are coordinated effectively, however. Informal organizations lack formal structures but possess all the other features of organizations, such as shared cultures and communication codes, governance structures, incentives, and routines. Informal organizations have coordinators or leaders (Simon 1981) who emerge from the organization's internal dynamics, the relative strength of the partners, and the socioeconomic environment. For example, individual smallholders negotiate with buyers from a disadvantaged position, but they may gain bargaining strength when they organize themselves, even if their organization does not have legal status. Without the organization, leadership in the value chain rests with the buyers; with the organization, farmers can better influence the chain (Hellin, Lundy, and Meijer 2009).

Interaction and coordination may be strengthened by creating new organizations or strengthening existing ones (see the discussion on building innovation capabilities). Both approaches have different challenges. Table 1.1 summarizes the main types of coordinating bodies and/or organizations that operate at different levels of the AIS. Given the diversity of coordinating bodies, organizations, instruments, and the roles they play⁸ (discussed next), it is important that decision makers at the highest level, such as ministers or donors, avoid—to the extent possible—imposing particular approaches and allow the catalyzing actors to search for the best instruments for the particular processes they coordinate.

AT THE MACRO LEVEL (NATIONAL). Several countries have embarked on improving overall innovation system governance at the national level. Governance concerns the mechanisms by which decisions are made in an organization, whether public, private, or nonprofit. Governance has several dimensions, including power, culture, incentives, leadership, and coordination. In the governance of a national innovation system, special attention is given to the systems and practices for setting priorities and agendas, designing and implementing policies, and obtaining

knowledge about their impacts. Some developed countries (Finland and the Republic of Korea are examples) have set up national science and/or innovation councils at the highest possible level. These councils engage ministers (such as the prime minister and finance minister) and representatives from universities, public research organizations, and industry in developing policy guidelines and facilitate coherence, consensus building, and coordination throughout the system. Similarly, several countries (Chile, the Netherlands, South Africa, Thailand, and the United Kingdom are examples) have created science and technology councils or other organizations, consisting of public and private research organizations, private firms, funding agencies, sectoral organizations, and farmer organizations to proactively promote coordination in the innovation system.⁹

A thematic note (module 6, TN 2) discusses the role of innovation system governance in greater detail, offering examples and guidelines on actors, structures (such as councils), and capacities needed for good governance. Thailand's National Innovation Agency is discussed in box 1.4 as an example of the challenges, objectives, evolving functions, and learning associated with innovation system governance.

AT THE MESO LEVEL (SECTORAL, REGIONAL, OR PROVINCIAL). At the AIS level, governance has been improved by creating formal but effective spaces for dialogue at different levels of the AIS, building up the actors' organizations and their capabilities, and improving formal and informal regulations (intellectual property rights regimes, the judiciary system, customs, and markets) that reduce transaction costs associated with interaction and collaboration. These governance systems typically aim at improving participation of stakeholders from producers to consumers; improving transparency and openness associated with decision making on funding and priorities; improving responsiveness and accountability to stakeholders; facilitating consensus building and coherence of policies, strategies, and activities; and building a strategic vision (Hartwich, Alexaki, and Baptista 2007).

Most efforts to coordinate innovation at the higher levels of the agriculture sector have centered on establishing formal apex *research councils*. In several countries—examples include Australia, Brazil, Ghana, India (box 1.11 in TN 1), and Mexico—these formal research councils or forums assist the government in designing and implementing agricultural research policies, setting priorities and agendas, coordinating the division of labor; managing large parts of public budgets for research, monitoring and evaluating

Table I.1 Examples of Coordinating Bodies, Potential Participants, and the Levels at Which They Operate

Structure	Actors that participate in the coordination	Type of coordination	Countries where it can be found	Examples of coordinating bodies
<i>Macro (national) level</i>				
Councils of ministers or advisory councils to the president or ministries (through policies and regulations)	Ministries, science councils, public bodies, private firms, farmers, farmer organizations, NGOs	Spontaneous when actors follow the rules; formal when ministries coordinate policy making	Canada, Finland, Rep. of Korea	Research and Innovation Council, Finland, http://www.aka.fi/en-gb/A/Science-in-society/Strategic-Centres-for-Science-Technology-and-Innovation/Background-to-CSTIs/ ; National Innovation Agency, Thailand, www.nia.org.th
Science and innovation councils	Public and private research, private firms, funding agencies, sectoral and farmer organizations	Formal and informal	Brazil, Chile, European Union, Finland, India, Mexico, South Africa, United States	Consejo Nacional de Ciencia y Tecnología, Mexico, http://www.conacyt.gob.mx/Paginas/default.aspx
<i>Meso (sectoral, regional, or provincial) level</i>				
Agricultural science/research councils	Mostly public, but the newer types with public, private, farmer, civil society participation	Formal and informal	Australia, Austria, Bangladesh, India, Netherlands, Norway	Indian Council of Agricultural Research, www.icar.org.in ; Latin American and Caribbean Consortium to Support Cassava Research and Development; Australia Rural Research and Development Council, www.daff.gov.au/agriculture-food/innovation/council ; Bioconnect, Netherlands, www.bioconnect.nl
Coordinating bodies (for several sectors or specialized in the agriculture sector)	Public and private research, private firms, funding agencies, sectoral and farmer organizations	Formal and informal	Argentina, Australia, Chile, Mexico, Netherlands, Thailand, United Kingdom	Asociación Argentina de Productores de Siembra Directa, www.aapresid.org.ar ; Fundación para la Innovación Agraria, Chile, www.fia.cl ; Medicinal Herbs Board/Association, India
<i>Micro (farmer) level</i>				
Innovation networks	Private firms, farmers, farmer organizations, NGOs, funding agencies, researchers	Informal	All countries	Papa Andina, International Potato Center, www.papandina.org ; Bioconnect, Netherlands, www.bioconnect.nl
Value chains	Private firms, farmers, farmer organizations, NGOs	Informal	All countries	Numerous examples exist; no specific example is given here
Product marketing organizations	Private firms, farmers, farmer organizations	Formal	Colombia, Israel, Kenya, New Zealand	Federación Nacional de Cafeteros de Colombia, www.cafedecolombia.com ; Fresh Produce Exporters Association of Kenya, www.fpeak.org
Public-private partnerships	Private firms, farmers, farmer organizations, research organizations	Formal	Almost all countries	Bioceres, Instituto Nacional de Tecnología Agropecuaria, Argentina; http://www.bioceres.com.ar/trigo_biointa/trigo_b_regalias.html
Innovation parks	Private firms, research organizations	Formal and informal	Almost all countries	Waikato Innovation Park, New Zealand, www.innovationwaikato.co.nz
Incubators	Private firms, farmers, farmer organizations, research organizations	Formal and informal	Almost all countries	International Crops Research Institute for the Semi-Arid Tropics, Agribusiness Incubator, India, www.agri-sciencepark.icrisat.org

Source: Authors.

Box 1.4 Thailand's National Innovation Agency

Thailand's National Innovation Agency (NIA), established in 2003, supports the development of innovations to enhance national competitiveness and gives significant attention to agriculture and other biological sciences. Operating under the overall policy guidance of the Ministry of Science and Technology, in 2009 NIA had a budget of about US\$10.8 million. NIA is unusual in that it offers direct financial support to private companies for innovation-related projects. In 2009, it supported 98 "innovation projects" initiated by private companies. The agency essentially shares the investment risks associated with innovative, knowledge-driven businesses through technical and financial mechanisms. NIA's main strategies are the following:

- *Upgrade innovation capability*, with a focus on bio-business, energy and environment, and design and branding. NIA encourages the development of start-ups and supports commercialization of research.
- *Promote innovation culture* within organizations of all types. NIA operates an innovation management course for executives, National Innovation Awards, an innovation ambassador scheme, an Innovation Acquisition Service, and a Technology Licensing Office.

Sources: Wyn Ellis, personal communication; NIA, www.nia.or.th; Brimble and Doner 2007; Intarakumnerd, Chairatana, and Tangchitpiboon 2002.

- *Build up the national innovation system*. Although NIA is in an ideal position to propose measures to enhance policy coherence across ministries, its portfolio suggests that it focuses more on discrete and disguised subsidies for firm-level innovation.

One challenge is that NIA's definition of its role as "coordinating industrial clusters both at policy and operational levels, promoting innovation culture, and building up innovation systems, with a broader aim to transform Thailand into an innovation-driven economy" appears to overlap with the mandates of the newly established Office of Science, Technology, and Innovation (STI), the National Economic and Social Development Board, National Science and Technology Development Agency, and Office for SME Promotion. Of particular note is the government's assignment of the mandate to draft Thailand's 10-year science, technology, and innovation policy to the STI rather than the NIA. In 2010 the NIA was upgraded by government decree from a project within the Ministry of Science and Technology to a public organization. Its new board comprises representatives from key government agencies as well as the private sector, and it is currently chaired by the executive chairman of Bangkok Bank.

research programs, and often coordinating and creating improved links between public agricultural research and extension organizations. Research may also be coordinated at the regional level (IAP 5 presents an example related to cassava). However, the effectiveness of these councils varies greatly. Many have a narrow representation of stakeholders, consisting primarily of ministerial representatives or researchers, and their research prioritization is not necessarily consultative or does not rely on rigorous evidence. They often have little influence on the policy process and how research is conducted. For further details, see TN 1.

Given the predominance of national innovation councils and agricultural research councils, there are few "true" *agricultural innovation councils*, mandated to coordinate and prioritize investments in agricultural innovation. Notable

exceptions include the Australia Agriculture and Rural Development Council (box 1.10 in TN 1) and Chile's Fundación para la Innovación Agraria (FIA, Agricultural Innovation Foundation; IAP 3).

As few countries have national councils specifically mandated to coordinate agents in the AIS, most agricultural innovation is coordinated at the subsectoral level via *product marketing companies and associations*, such as the Fresh Produce Exporters Association of Kenya (box 1.5) and the Colombian Coffee Growers' Federation, or *farmer-managed foundations*, such as Mexico's Produce Foundations (IAP 2).

Marketing or commodity boards were the first type of coordinating bodies to be created and have been common in both developed and developing countries for many

Box 1.5 Fresh Produce Exporters Association of Kenya: A Sectoral Coordinating Body

Horticulture is the fastest-growing agriculture subsector in Kenya, earning roughly US\$1 billion in 2010. The Fresh Produce Exporters Association of Kenya (FPEAK), established in 1975, serves as the premier trade association representing growers, exporters, and service providers in the subsector (fresh cut flowers, fruits, and vegetables). FPEAK is part of a larger Kenya Horticulture Council formed in 2007 through a merger between the Kenya Flower Council and FPEAK. The Kenya Horticulture Council's role is to enhance the effectiveness and efficiency of resource use and service delivery to Kenya's horticultural industry.

FPEAK provides a focal and coordination point for the horticulture export industry. A recognized partner of the leading agricultural legislation, certification, and research bodies and development partners in Kenya, it provides technical and marketing information and training, acts as an information center, and runs active lobbying and advocacy programs to enhance the sector's competitiveness.

FPEAK structure. FPEAK is registered as a company limited by guarantee. Its elected board of directors consists of members actively engaged in the export business. The FPEAK secretariat is responsible for administrative functions and providing services to members. FPEAK operates independently of and receives support from partners.

Who qualifies to be a member? To become an ordinary member, an exporter must have been in business

for six months. Affiliate membership is open to firms and/or individuals serving the industry. These include airlines, consultants, certification bodies, input suppliers such as seed suppliers, packaging manufacturers, chemical companies, and clearing and forwarding firms.

What are FPEAK's strategic goals and activities?

- FPEAK has developed and implemented the protocol for Kenya Good Agricultural Practices (Kenya-GAP), against which growers can be audited and certified, a process that has involved wide stakeholder consultation.
- FPEAK's information service disseminates news on technical issues, trade, official regulations, and market requirements.
- FPEAK receives trade inquiries from overseas buyers and passes them on to members.
- FPEAK offers training programs by specialists. For example, farmers, including smallholders, are trained in GAP and standards compliance in partnership with exporters who are members of the association.
- FPEAK agronomists visit members' farms and production sites upon request to advise on readiness for compliance, in particular to Kenya-GAP and GLOBAL GAP (which sets voluntary standards for the certification of agricultural products).
- FPEAK coordinates members' participation in trade events and assesses emerging markets.

Source: FPEAK, www.fpeak.org.

decades. After the wave of deregulation in the 1980s, many developing countries abolished or privatized marketing boards, but several public marketing boards remain. There is no generally agreed definition of a commodity board. Usually they are formal bodies in which different actors involved in the production, transformation, and marketing of a product discuss issues of mutual interest and sometimes regulate their activities. They may also finance or implement supporting activities such as managing research (either in their own institutes or by contracting external researchers), implementing generic advertising campaigns, and proposing legislation related to a product. In some cases, they also regulate production. Commodity boards are

a diverse group of organizations representing an array of goals, structures, and challenges. Examples include India's National Dairy Development Board (box 1.6), the New Zealand Dairy Board, Kenya Tea Board, Ghana Cocoa Board, and the Colombian Coffee Growers' Federation.

AT THE MICRO LEVEL (ORGANIZING FARMERS). At the micro level, farmers form local producer organizations or join private firms and other actors in innovation networks and value chains. Farmer organizations are joined only by producers who seek solutions to particular production or commercial problems (TN 4).¹⁰ The creation of new organizations for small-scale farmers, especially cooperatives,

Box 1.6 Indian National Dairy Development Board

The Indian National Dairy Development Board (NDDB) was set up in 1965 by Parliament as a national institution governed by a board of directors to promote, finance, and support producer-owned and -controlled dairy organizations and support national policies favoring their growth. The board's work and scope expanded under Operation Flood, a program supported by the World Bank from 1970 to 1996. NDDB places dairy development in the hands of milk producers and the professionals they employ to manage their cooperatives. The board also promotes other commodity-based cooperatives and allied industries. The government tasked NDDB with preparing a National Dairy Plan for meeting a projected demand for about 180 million tons of milk by 2021–22. The plan is being implemented with World Bank support.

In 2009, India's 1.3 million village dairy cooperatives federated into 177 milk unions and 15 federations, which procured an average 25.1 million liters of milk every day. In 2010, 13.9 million farmers were members of village dairy cooperatives. The following are the NDDB's main areas of focus:

- Support cattle and buffalo breeding, animal health programs, and biotechnology research to improve milk productivity.
- Add value by testing and transferring product, process, and equipment technologies as well as services for analysis of dairy products and milk quality sampling.

- Create self-reliant and professionally managed cooperative institutions, responsive to members' economic and social expectations, through cooperative development and governance programs to strengthen capacities of the primary members, management committee members, staff of village Dairy Cooperative Societies, and the professionals and elected boards of Milk Producers' Cooperative Unions. Women's Development and Leadership Development Programs are a central activity.
- Technical and professional skills training at Regional Demonstration and Training Centers of NDDB, Union Training Centers, and the Mansingh Institute of Technology. Programs are designed for dairy cooperative boards, chief executives, managers, field staff, and workers.
- Technical assistance and engineering inputs for clients such as milk producers' and oilseed growers' cooperative unions and federations and central and state government. Services offered by NDDB-qualified engineers include setting up and standardizing dairy plants, chilling centers, automatic bulk milk vending systems, cattle feed plants, and infrastructure for agro-based industry projects.

NDDB's coordination role has come in for some criticism. Although the board is strengthening cooperative dairies, which supply about 70 percent of marketed processed milk, it has not improved the capacity of the informal dairy sector, based on village vendors, which produces some 80 percent of the milk in India.

Sources: <http://www.nddb.org>; Rasheed Sulaiman, personal communication.

has had mixed results (TN 2). Many were initiated by external agents such as NGOs or research institutes. When the new organizations ran into financial problems, the inclination was to provide them with additional support. This intervention isolated them from potential partners and, in some cases, from markets, creating a vicious cycle of dependence on funders (Hellin, Lundy, and Meijer 2009). Additionally, when organizations responded to the objectives of their funders or were captured by elites, they provided little benefit to the intended beneficiaries. New organizations tended to benefit their stakeholders mostly when the organizations could adapt their objectives and

operating routines in response to unforeseen needs and opportunities, especially unexpected market and social developments; could participate actively in networks of specialized actors; and could try several institutional arrangements and routines until they found a configuration that enabled them to fulfill their mission (Ekboir et al. 2009; TN 4 and IAP 2).

Coordination of actors in the AIS at the meso and micro levels can also be strengthened by creating self-help groups, such as farmer groups (IAPs 1 and 4). Through the creation of rural productive alliances, which bring commercial buyers together with producer organizations,

small-scale producers tap into vital resources for reaching important markets (IAP 6).

Farmers may form regional associations to conduct applied research (like the regional associations of no-till farmers in Brazil, described in IAP 1), provide services, lobby decision makers, or influence the agenda of public research institutes (like the Mexican Produce Foundations described in IAP 2). Sectoral organizations that facilitate market access to large numbers of small-scale farmers by setting standards, providing technical and financial assistance, and consolidating their output are another common form of coordination at the subsectoral level (TN 1).

Innovation networks are groups of agents (including farmers, private firms, and possibly researchers and farmer organizations) that voluntarily coordinate their actions and contribute knowledge and other resources to develop jointly or improve a social or economic process or product. The membership of innovation networks changes often in response to new challenges or opportunities (see TN 2, particularly on the Papa Andina network). In contrast, *value chains* are networks with a commercial focus, one actor (a supermarket or broker, for example) that “organizes” and commands the chain, and a relatively narrow, stable membership. The strengths of value chains often result from the development of organizational innovations (especially the coordination of actors along the chain) that enable the creation of new business models (see TN 1 and IAP 6).

The importance of *innovation brokers* is increasingly recognized. Innovation brokers are teams of specialists that combine a strong background in science with knowledge of business, marketing, and/or the creation of innovation networks. Innovation brokers support linkages among actors in the AIS and help farmer organizations and private firms to manage research and innovation projects. They teach courses on the management of innovation, assess the actors’ innovation capabilities, propose actions to strengthen them, and may accompany the implementation of the recommendations. Innovation brokers may also help governments and donors to develop their own innovation capabilities and to explore new instruments to foster innovation. NGOs, specialized service providers, or public organizations (including research or educational institutions) can play this role.

Building innovation capabilities in coordinating bodies and organizations

Given the challenges of developing new organizations, it may be more feasible to strengthen organizations that

already exist. Collaboration can be reinforced by transforming the actors so that they can contribute better to innovation processes. For example, collaboration with foreign agroprocessing and trading companies to expose the agriculture sector to different business cultures and provide access to new markets has been very effective. Another effective strategy is to visit other innovators (whether local, domestic, or foreign), especially when the visitors have strong innovation capabilities and the visits are part of a program to share the information with other innovators at home. Virtual platforms have also been useful when actors in the AIS have the capabilities to use them. Innovation brokers can help marginalized groups to develop these capabilities.

Whether one establishes new or strengthens existing organizations to support coordination, *innovation capabilities* are essential (box 1.1). Innovation capabilities depend both on individual traits (creativity, for example) and on collective factors, such as collective learning mechanisms and organizational cultures. *In other words, innovation capabilities depend not only on innovative individuals but also on internal features of the organization, especially incentives, cultures, organizational spaces for experimentation, coordinating structures, and collective action* (box 1.7).

Innovation capabilities cannot be bought or built easily, and their development requires important investments and strong leadership over long periods, as exemplified by Whirlpool, a company that transformed itself from selling commoditized appliances in mature markets to generating a stream of breakthrough innovations that multiplied the company’s revenue 20 times in just three years (box 1.7). Given the complexity and major investments required for such a large set of interventions, it is unlikely that many countries and donors will implement programs of similar scope, particularly in the case of agricultural innovations, which are often developed by networks of actors—that is, by organizations with very weak hierarchies.

Often, however, an external event or a few key interventions can trigger a virtuous cycle that builds up innovation capabilities (box 1.8). Innovation capabilities should be built within organizations (farmer organizations, civil society organizations, and private firms), in innovation brokers, in supporting organizations (such as research institutes and ministries), and in the enabling environment. Programs to broaden organizational capabilities should be adapted to particular configurations of actors, problems to be solved, and socioeconomic and institutional environments.

Building organizational capabilities for innovation is particularly challenging for several reasons. First, the main

Box 1.7 A Traditional Company in a Mature Sector Builds Innovation Capabilities

Instilling innovation as a core competence at Whirlpool took a massive, broad-based effort over several years, involving major changes to leader accountability and development, cultural values, resource allocation, knowledge management, rewards and recognition systems, and a whole host of other management practices and policies.

Here are just a few examples of these changes:

- The appointment of vice presidents of innovation at both the global and regional level.
- The creation of large, cross-functional “innovation teams” in each region employed solely in the search for breakthrough ideas.
- The introduction of a companywide training program aimed at developing and distributing the mind-set and skills of innovation.
- The appointment of more than 600 part-time “innovation mentors” and 25 full-time “innovation consultants,” who act as highly skilled advisers to new project development teams around the world.
- The creation of “innovation boards” in each region and each major business unit, made up of senior staff who meet monthly not just to review ideas and projects, set goals, and allocate resources but to oversee the continuing innovation capability-building process.
- The organization of big communication events called Innovation Days, where innovation teams showcase their ideas to other Whirlpool people, the media, and even Wall Street analysts. Sometimes these events are also held in suburban shopping malls as a way of collecting feedback and additional ideas from potential users.
- The creation of a comprehensive set of metrics to continually measure the company’s innovation performance as well as its progress in embedding innovation as a core competence.
- The establishment of a sophisticated IT [information technology] infrastructure called Innovation E-Space, which integrates all of Whirlpool’s people into the innovation effort and allows them to track progress on innovation activities across the corporation.

Source: Quoted directly from Skarzynski and Gibson 2008, 7.

Box 1.8 Actions to Build Organizational Capabilities

- Assess the main organizations in the AIS, analyzing at least three issues: whether each organization is necessary, what capabilities it needs to fulfill its mission, and how those capabilities can be built.
- Introduce new incentives so that existing organizations, especially public research institutes and universities, can better innovate and integrate into innovation networks (see the remaining points and modules 2 and 4).
- Create awareness among decision makers of the importance and nature of organizational capabilities and of the need for sustained efforts to build them.
- Implement training and mentoring programs on the management of agricultural innovation; tailor these programs to the specific needs of important stakeholders, including top managers, directors, policy makers, funders, and field staff.
- Create multistakeholder forums to discuss innovation policies and programs.
- Promote the emergence of innovation brokers and new types of interactions for innovation, such as public-private partnerships or innovation networks (module 3).
- Explore new models of extension to promote organizational innovations (module 3).
- Support organizations that seek to provide services such as farmer-led research, extension, credit, and the provision of inputs in rural areas (module 3).
- Support exchanges between foreign and domestic organizations.

Source: Authors.

factors that influence organizational capabilities are not well understood. Second, organizations are strongly conservative (Christensen, Anthony, and Roth 2004), especially public organizations that operate under the rules of the civil service. Third, because interventions to build a capacity to innovate must suit the particular needs of each organization, the design and implementation of projects to achieve this goal require that the implementing agencies themselves possess strong capabilities to innovate.

KEY POLICY ISSUES

The key policy issues surrounding the organization of actors for innovation—the need for coordination, collective action, and stronger innovation capabilities—concern the kinds of institutions needed to foster innovation, the roles of the organizations involved (including reforms or actions that help organizations and marginalized groups to participate more fully), and the sustainability of innovation programs.

Institutional and enabling considerations

An enabling environment (module 6) is a prerequisite for effective coordination and is developed more easily when governments, donors, and the other actors in the AIS have a clear understanding of innovation processes. When such processes are financed by governments or donors, the latter often try to influence the process; governments may also resent having to negotiate policies and priorities with other actors. Finally, coordination is more effective when laws, regulations, and interventions by external stakeholders (especially governments and donors) facilitate transparency and accountability to all stakeholders in the innovation process.

Roles of the private and public sectors and civil society

The private sector has been and is expected to continue being the source of most innovations (Fagerberg 2005). For commercial agriculture in particular, the private sector will likely continue to lead innovation, including organizing value chains and developing agricultural equipment and inputs. To develop these innovations, private firms organize networks with farmers, traders, and eventually strong research teams (TN 1). Usually these teams have been located in developed countries, but a few strong teams from developing countries have also participated. Public research and extension agents have coordinated the emergence of

innovation networks, but mostly in exceptional cases. The private sector or nimble NGOs are better equipped to coordinate the development and diffusion of technical and commercial innovations that adapt to rapidly changing technical or economic conditions, such as value chains for high-value products, or environmental innovations that require collective action, such as the management of water resources or forests.

The public sector (including the central, provincial, and local governments) can support innovation by (1) setting up an institutional environment conducive to innovation, including regulations, sanitary services, and intellectual property regimes; (2) financing programs to support innovation, including support for coordination of actors, support for venture and angel funds, financing research and extension embedded in innovation programs, and strengthening innovation capabilities; (3) allowing innovators to experiment with alternative approaches to achieve the project's goals; and (4) building up the infrastructure, especially transportation networks and public research and extension institutions.

The nonprofit sector should coordinate innovation processes that open opportunities for marginalized groups and represent their interests in policy dialogues. Public organizations may feel threatened when nonpublic actors assume a leading role in fostering innovation and try to change how public organizations interact with the AIS. Social responsibility may induce private actors to create organizations to develop innovations without commercial value, like projects with environmental or poverty alleviation goals, but the public sector will continue to have a major responsibility in these areas.

Reform of research and educational organizations

Given the organizational inertias that characterize public institutions, policy makers should carefully assess whether to invest in (1) transforming traditional organizations, (2) supporting existing actors, or (3) creating new institutions that complement traditional ones. The reform of public research and educational organizations should start by identifying the roles they should play, considering that others in the AIS also produce technical and scientific information. It is necessary to understand how public agricultural research institutions can complement private research and innovation (for example, a public institution can study relatively unknown plant varieties and develop new material with useful traits that private seed companies can then use in their breeding programs). Once the roles

have been defined, the resources needed to fulfill the new mandates must be identified—especially investments in physical, human, and social capital—and plans must be prepared to attain those resources. Finally, new incentives must be defined for managers and researchers so that they can better integrate into innovation processes. For example, the incentives should not prioritize scientific publications over interactions with actors in the AIS or the generation of other types of scientific output, such as new agronomic recommendations; additionally, the incentives should allow researchers to develop long-term research programs. A complementary approach is to provide resources and incentives directly to innovative researchers and professors so that they can join innovation networks. This approach somewhat resembles the awarding of funds directly to researchers, a process that can have the unintended consequence of bypassing their institutes' formal resource allocation structures.

Social and local considerations, including gender and equity

Because innovation capabilities, physical assets, and power are not distributed equally, the best-endowed actors can benefit the most from emerging opportunities. In hierarchical societies in which coordination must include social leaders, greater coordination can award even more power to dominant local groups or individuals. Local conditions, especially cultural issues, similarly influence coordination. Some cultures forbid interaction between certain ethnic groups, but simply forcing them to interact directly may not be as effective as acting through intermediaries.

Even though social marginalization is a key aspect of poverty, it is difficult to create and sustain coordination organizations that include marginalized actors, especially women and landless farmers. Such organizations are often opposed by civil servants, politicians, middlemen, or wealthier farmers who see their power challenged (World Bank 2009). Affirmative action measures, reinforced by disincentives for wealthier actors, help to reduce gender and income disparities in coordination organizations and can include the following:

- Fostering the emergence of organizations of women and poor households, such as those used in microfinance programs.
- Setting aside seats on boards of organizations for representatives of marginalized groups and ensuring that

the representatives possess the skills (literacy, for example) to participate. Often capacity building is needed as well to prevent the most powerful stakeholders from capturing coordinating organizations (World Bank 2009).

- Fostering the emergence of networks that focus on innovations appropriate for marginalized populations, such as the no-till package developed in Ghana (IAP 1) (Ekboir, Boa, and Dankyi 2002).
- At a more general level, institutionalizing gender and pro-poor policies and planning functions in governments, projects, and organizations, and opening women and disadvantaged farmers' desks to guide practitioners in mainstreaming affirmative action in planning, budgeting, and implementation.

Sustainability of innovation programs

Actors can coordinate spontaneously in response to a need or opportunity, or they may be induced by specific public policies and programs. It is easier to strengthen forms of coordination that have survived for a certain period, because the actors involved have solved many of the barriers to collective action. Existing organizations, especially informal ones, can profit greatly from programs that build their capabilities and link them with other actors in the AIS. Forms of coordination imposed by external partners usually command more resources but often are less sustainable. They run a greater risk of becoming only formal structures and may lose their autonomy and effectiveness. Failure rates are high in new organizations because collectively agreed rules must be defined and effectively enforced. In some cases, the transaction costs of establishing an organization outweigh the benefits, especially in markets with low transaction costs, such as those for undifferentiated commodities (Hellin, Lundy, and Meijer 2009).

For an organization to be sustainable, its stakeholders must develop organizational capabilities and have incentives to contribute to the common effort. They must effectively influence the organizations they participate in, and they must also perceive the benefits of participation. When this happens, stakeholders often invest their financial and political capital to ensure the programs' continuity. These conditions apply not only to organizations at the “base” of the AIS (such as farmer organizations or value chains) but also to organizations seeking to coordinate the AIS at the “top,” such as research councils or innovation brokers.

NEW DIRECTIONS, PRIORITIES, AND REQUIREMENTS FOR INVESTMENT

As discussed, agricultural innovation may be coordinated by strengthening existing individuals and organizations or by setting up entirely new actors and organizations. The common denominator of these approaches is the need to provide incentives, apply appropriate instruments, and build innovation and organizational capabilities. Because effective collaboration among innovators is so difficult to implement, however, it is likely that new types of organizations will need to be supported, as described next.

Improving governance of the AIS

A number of factors impinge on the efficiency of governance in a national innovation system¹¹ in general and an AIS in particular—in other words, on the extent to which policy processes have the greatest effect with a given use of resources (OECD 2005). The evidence indicates that efficient governance depends on certain qualities, which include the following:

- *Legitimacy.* The policy actors and approaches adopted in policy processes have to be appropriate and widely accepted for the tasks at hand.
- *Coherence.* The strands of innovation policy and associated policy instruments must fit together.
- *Stability.* Innovation requires sufficiently stable framework conditions, institutions, and policy.
- *Adaptive ability.* As the environment for innovation and innovation itself keeps evolving, governance actors need to be able to adapt.
- *Ability to steer and give direction.* A related capability is the governance system's ability to provide direction to actors and steer the innovation system as a whole. This capacity requires commitment and leadership by policy makers at the highest level.

Governance of the AIS can be improved by creating formal but effective spaces for dialogue at different levels of the AIS (local, sectoral, and national), building actors' organizations and their capabilities, and improving formal and informal regulations that reduce transaction costs (such as intellectual property rights regimes, the judiciary system, customs, and markets). At higher levels of the AIS, investment is needed to establish and strengthen effective and responsive coordinating bodies for agricultural innovation, such as innovation councils and subsector-specific bodies that can contribute to collective identification of opportunities and challenges and

help to align and allocate limited resources to key innovation issues (see details in TN 1). IAP 5 describes a regional approach to coordinate innovation actors in the cassava subsector, particularly researchers. IAP 3 focuses on the Foundation for Agricultural Innovation (Fundación para la Innovación Agraria, FIA), a ministry-affiliated foundation with independent governance that coordinates and incentivizes agricultural innovation in Chile.

Farmer and nonprofit organizations respond mostly to their funders, whose interests may not coincide with the needs of local stakeholders, especially if they are marginalized groups like women or landless rural households. It is important to provide some means for these groups to influence the AIS. Possibilities include arrangements for ensuring good governance and accountability and for training managers and members about their respective roles in their organizations and in the AIS. It is also important to keep external interventions in NGOs and civil society organizations to a minimum, allowing them to evolve as needed.

The rise of networks

TN 2 in this module examines the nature and dynamics of innovation networks, which are becoming more prevalent as the complexity of innovations grows and rapid economic and technological change forces agents to innovate at a faster pace. Innovation networks have developed important technical, commercial, and organizational innovations that have had major economic and social impacts. IAP 1 reviews the emergence and evolution of the innovation networks that developed no-till technologies for small-scale farmers in South America and Ghana. Where they have been adopted widely, these technologies have increased farmers' incomes, reduced food insecurity, diminished labor requirements for the production of staples, allowed poor rural households to engage in new income-generating activities, and enhanced the sustainability of agriculture in marginal and well-endowed areas. Although programs to diffuse no-till have been documented in more than 60 countries, massive adoption has occurred only in the handful of regions where diverse actors formed innovation networks to develop organizational and technical innovations adapted to local conditions.

Innovation brokers: promising, but challenging to implement

Innovation brokers can play a valuable role in an AIS. Several types have evolved, but few have survived without

support from governments or donors (Klerkx and Leeuwis 2008).¹² Innovation brokering services are affected by severe information uncertainties. Individual actors cannot know the commitment and the capabilities of potential partners in advance. A conflict of interest may exist if the funders' requirements do not coincide with the needs of the other actors in the AIS. Giving the funds to users to pay for the brokering services may reduce the conflict, but effective controls are needed to make sure that funds are used appropriately and that actors follow the brokers' recommendations. Similarly, users often do not know the nature and quality of services offered by innovation brokers. They are reluctant to pay for services that are difficult to define beforehand and highly uncertain.

Organizing around value chains

Small-scale farmers' access to modern marketing chains, often organized by supermarkets, is analyzed in TN 3. Chains provide more stable incomes and sometimes higher profits for their adherents, but participating in chains requires commercial and technical skills. Recent research has found that in the long term few smallholders can survive in these chains as suppliers; only the more affluent smallholders, better endowed with natural resources, infrastructure, access to credit, and social capital, tend to participate. Despite poor rural households' limited access to the markets supported by modern value chains, the chains can bring important benefits to rural economies by creating many permanent and temporary positions on the farm and in associated services such as input supply, sorting and packaging, and transport. More dynamic local economies also create small business opportunities, such as food stalls and professional services. As mentioned, rural productive alliances, which are economic agreements between commercial buyers and formally organized producer organizations, enable small-scale producers to reach those markets. The agreements create favorable conditions and incentives for buyers and smallholders to establish mutually beneficial and sustainable relationships (IAP 6).

Supporting farmer organizations and self-help groups

Farmer organizations can participate in the financing, development, and diffusion of innovations, manage public and private funds and programs for innovation, collaborate in the design of innovation policies, coordinate other actors in the AIS, and influence research and extension

organizations. TN 4 reviews the conditions that help farmer organizations to emerge and consolidate. It gives particular attention to the technical and market conditions that make farmer organizations a more effective means of coordinating AIS actors than other institutional arrangements, such as value chains and innovation networks. It also reviews factors that reinforce farmers' ownership and sustain their organizations.

IAP 2 examines the emergence and evolution of Mexico's Produce Foundations, which are civil society organizations that influence the design and implementation of research and innovation policies and programs. Soon after the federal government created the foundations in 1996, a few farmers pushed for their foundations to be independent of the government; they succeeded, and the remainder eventually followed suit. The foundations created a coordinating office that interacts with the government and promotes organizational learning. The experience in Mexico shows how a number of interacting factors support successful organization building. IAP 2 also analyzes the interplay between deliberate strategies to build organizations and strategies that emerge organically from the innovation process.

IAP 4 describes another form of organization—highly federated self-help groups for the poor established by the Society for Elimination of Rural Poverty in Andhra Pradesh. Each tier in the organization of self-help groups functions as a financial intermediary and provides specialized services to members (and other stakeholder groups) in a variety of sectors.

Building capabilities for coordination among individuals and organizations

As noted, building capabilities for coordination requires strong leadership and sustained, major investments. Investments can encompass support for physical, human, and social capital (basic education; management and entrepreneurial skills; learning to participate in social, innovation, and economic networks; and development of financial capacity), short- and long-term consultancies, formal courses, long-term mentoring, support for innovation brokers, the creation of dedicated bodies (innovation councils or programs to fund innovation), and the transformation of public universities and research and extension organizations (discussed in box 1.8). Transforming public universities and research and extension organizations is particularly problematic but not impossible. Employees have job security, governments are reluctant to pay locally competitive

academic salaries that exceed civil servants' salaries, and it is challenging to hire good, experienced professionals to work under difficult conditions (Davis, Ekboir, and Spielman 2008).¹³ In response to these challenges, many countries have created new public organizations with different conditions and adequate working resources. Alternatively, investments could create the conditions to induce the best employees of existing organizations to participate in innovation networks regardless of their institutional association. Another major problem that hampers efforts to build capacity for coordination in developing countries is the frequent rotation of capable civil servants. A major effort should be made to build the capabilities of nonpublic organizations, including political parties, private firms, and civil society and farmer organizations, so that they can influence the policy dialogue despite changes in government.

Organizing around a common vision of major issues

Coordination is facilitated when potential partners share a common vision of their problems and opportunities. This vision can be created through foresight exercises, studies and consultancies, gathering and processing of technological and market intelligence, sectoral dialogues, and inter-ministerial committees. Because the common vision needs to be updated in response to technical, social, and economic change, these activities must be implemented periodically and include a broad array of stakeholders, not just those directly linked to the processes being analyzed (Skarzynski and Gibson 2008).

Setting agendas and priorities

Priorities for collaboration should be defined with participatory approaches and updated periodically, but not too often, which would disrupt the development of trust required for effective collaboration and implementation of long-term activities. Investments should also build the capabilities of all stakeholders so that they can participate actively in innovation processes with which they may be unfamiliar, such as policy design or the boards of research organizations.

MONITORING AND EVALUATING INVESTMENTS AND SCALING UP

The impact of organizational innovations on the AIS is notoriously difficult to measure, owing to the complex

dynamics of innovation. Not only does every AIS have many actors with differing goals, but the outcomes of their formal or informal cooperation may not appear until many years have passed. Another issue in assessing outcomes is that monitoring and evaluation can be used for different, often conflicting, purposes, like learning and accountability.

Although it is difficult to define valid indicators for monitoring organizational innovations and their impacts, two principles are valuable to consider. *First, the monitoring system should be a learning tool.* When a project is defined, several critical assumptions are made, representing an explicit or implicit theory of how stakeholders' behaviors are expected to change over the project's life. The monitoring system should be designed to (1) test these assumptions early in the project's life and adjust the interventions if the assumptions are proved wrong, (2) identify unforeseen problems or opportunities as early as possible in the project's life (Spitzer 2007), and (3) measure changes in stakeholders' behaviors and provide feedback to stakeholders so that they can learn faster.

Second, many indicators, especially those intended to measure ill-defined processes such as organizational innovations, cannot be measured quantitatively. In such cases, qualitative indicators, such as stakeholders' opinions, are appropriate measures that can be tracked with specially designed techniques (such as Likert or rating scales).

The monitoring system should also cover at least four areas:

- *Organizational strengthening.* Assess the organization's ability to improve its governance, culture, and finances and expand its membership.
- *Organizational learning.* Assess the organization's ability to perform its normal activities better.
- *Exploration of new instruments to fulfill the organization's mandate.* Assess the organization's ability to search for new ways to reach its objectives or to define new objectives.
- *Changes in the AIS according to the underlying theory of change.* Assess the responses of the actors involved directly or indirectly in the project, especially the evolution of their interactions.

Finally, some potential indicators of organizational innovation are listed in table 1.2, along with their corresponding sources of information.

Table 1.2 Indicators of Organizational Innovation

Indicator	Source of information or tools
<i>Process indicators</i>	
1. Leveraged investments: additional time and resources invested by the organizations' members in joint activities	Surveys of value chains Surveys of innovation networks
2. Consolidation of innovation networks and value chains	Case studies Surveys of partners in innovation networks and value chains
3. Improvements in the innovation capabilities of farmer organizations (for example, changes in governance, learning routines, and experimentation)	Case studies Surveys of members, stakeholder interviews
4. Changes in the resources invested in building organizational capabilities	Review of public programs, survey of funders
5. Number of programs and resources invested in organizational innovation	Review of public programs, survey of funders
6. Number and types of innovation programs targeted to marginalized groups	Review of public programs, survey of funders
<i>Output indicators</i>	
7. New products or processes introduced by actors in the organization (or by the organization itself)	Surveys of the organization's stakeholders
8. Strength of the value chains (volume marketed, additional income generated, number of farmers benefiting directly, number of rural jobs created)	Surveys of supermarkets, brokers, wholesalers, farmers Trade statistics
9. Changes in value chains, especially in the number of intermediaries, their relative strength, and other institutional changes (from stakeholder platforms and other methods)	Surveys of supermarkets, brokers, wholesalers, farmers Trade statistics
10. New partnerships created (number, diversity, types, goals, achievements)	Review of programs that foster the creation of organizations for innovation Participatory rural appraisal Surveys of actors in the AIS
11. Expansion of the networks (such as the number and type of partners, effectiveness, innovations adopted)	Surveys of innovation networks, stakeholder interviews
12. Changes in curricula that prepare professionals in organizational innovation	Case studies Surveys of educational organizations
<i>Outcome indicators</i>	
13. Number of partnerships that survived after three years	Surveys of partnerships
14. Changes in the participation of farmer organizations in innovation processes	Case studies Surveys of partners in decision-making processes Stakeholder interviews
15. Improvement in the condition of marginalized groups (women and landless farmers) thanks to their participation in innovation programs	Case studies Surveys of partners in decision-making processes Stakeholder interviews
16. Changes in the performance of value chains after three years	Surveys of supermarkets, brokers, wholesalers, farmers Trade statistics
17. Changes in asset ownership and market participation induced by organizational innovations after three years	Case studies Surveys of farmers and other stakeholders in innovation processes

Source: Authors.