ORIGINS AND PURPOSE OF THIS SOURCEBOOK

Consensus is developing about what is meant by “innovation” and “innovation system” (box O.1). The agricultural innovation system (AIS) approach has evolved from a concept into an entire subdiscipline, with principles of analysis and action; yet no detailed blueprint exists for making agricultural innovation happen at a given time, in a given place, for a given result. This sourcebook draws on the emerging principles of AIS analysis and action to help to identify, design, and implement the investments, approaches, and complementary interventions that appear most likely to strengthen innovation systems and promote agricultural innovation and equitable growth.

Although the sourcebook discusses why investments in AISs are becoming so important, it gives most of its attention to how specific approaches and practices can foster innovation in a range of contexts. Operationalizing an AIS approach requires a significant effort to collect and synthesize the diverse experiences with AISs. The information in this sourcebook derives from approaches that have been tested at different scales in different contexts. It emphasizes the lessons learned, benefits and impacts, implementation issues, and prospects for replicating or expanding successful practices. This information reflects the experiences and evolving understanding of numerous individuals and organizations concerned with agricultural innovation, including the World Bank. (For a complete list of the contributors, see the acknowledgments.)

The sourcebook is targeted to the key operational staff in international and regional development agencies and national governments who design and implement lending projects and to the practitioners who design thematic programs and technical assistance packages. The sourcebook is also an important resource for the research community and nongovernmental organizations (NGOs) and may be a useful reference for the private sector, farmer organizations, and individuals with an interest in agricultural innovation.

This overview begins with a discussion of why innovation is vital to agricultural development, how innovation occurs, and why complementary investments are needed to develop the capacity and enabling environment for agricultural innovation. It concludes with details on the sourcebook’s structure, a summary of the themes covered in each module, and a discussion of the cross-cutting themes treated throughout the sourcebook.

INNOVATION AND AGRICULTURAL DEVELOPMENT

Agricultural development enables agriculture and people to adapt rapidly when challenges occur and to respond readily when opportunities arise—as they inevitably will, because agriculture’s physical, social, and economic environment changes continually (box O.2). Some changes occur with unpredictable force and suddenness; since June 2010, for example, rapidly rising food prices have pushed about 44 million people into poverty, and another 10 percent rise in...
the food price index could impoverish 10 million more people. Food prices are expected to remain volatile for the foreseeable future.

Other changes emerge more gradually, but are no less significant. Agriculture is more vulnerable to the increasing effects of climate change than any other economic sector, and it uses almost 80 percent of the world’s freshwater—a vanishing resource in some parts of the world. A changing, less predictable, and more variable environment makes it imperative for the world’s farmers and fishers to adapt and experiment. They require more knowledge that contributes to sustainable, “green” growth—as well as a greater capacity to help develop such knowledge.

Like climatic variability, globalizing markets for agricultural products, far-reaching developments in technology, and equally transformative evolution in institutions (including new roles for the state, the private sector, and civil society) have also been altering agriculture’s social and economic landscape over the past few decades (World Bank 2007b). Agriculture increasingly occurs in a context where private entrepreneurs coordinate extensive value chains linking producers to consumers, sometimes across vast distances. A growing number of entrepreneurial smallholders are organizing to enter these value chains, but others struggle with the economic marginalization that comes from being excluded from such opportunities.

In this context, markets, urbanization, globalization, and a changing environment not only influence patterns of consumption, competition, and trade but also drive agricultural development and innovation far more than before. More providers of knowledge are on the scene, particularly from the private sector and civil society, and they interact in new ways to generate ideas or develop responses to changing agricultural conditions (World Bank 2006).
If farmers, agribusinesses, and even nations are to cope, compete, and thrive in the midst of changes of this magnitude, they must innovate continuously. Investments in public research and development (R&D), extension, education, and their links with one another have elicited high returns and pro-poor growth (World Bank 2007b), but these investments alone will not elicit innovation at the pace or on the scale required by the intensifying and proliferating challenges confronting agriculture.

HOW AGRICULTURAL INNOVATION OCCURS

Agricultural innovation typically arises through dynamic interaction among the multitude of actors involved in growing, processing, packaging, distributing, and consuming or otherwise using agricultural products. These actors represent quite disparate perspectives and skills, such as metrology, safety standards, molecular genetics, intellectual property, food chemistry, resource economics, logistics, slash-and-burn farming, land rights—the list is far too long to complete here.

For innovation to occur, interactions among these diverse stakeholders need to be open and to draw upon the most appropriate available knowledge. Aside from a strong capacity in R&D, the ability to innovate is often related to collective action, coordination, the exchange of knowledge among diverse actors, the incentives and resources available to form partnerships and develop businesses, and conditions that make it possible for farmers or entrepreneurs to use the innovations. Box O.3 provides examples of how innovation has occurred in agriculture.

Agricultural innovation systems

Research, education, and extension are usually not sufficient to bring knowledge, technologies, and services to farmers and smallholders. However, when linked to one another and supplemented by the policies, regulations, research, and social and financial services that enable the effective diffusion and adaptation of innovations, they can contribute significantly to the economic and social development of rural areas. Box O.3 provides examples of agricultural innovation and innovation processes.

Box O.3  Examples of Agricultural Innovation and Innovation Processes

The instances of agricultural innovation listed here came about in different ways. In some cases, markets heightened the pressure to innovate, and the private sector played a decisive role in driving the subsequent innovation. In others, public sector interventions, such as policy, R&D, and other incentives, drove the innovation process.

- Cassava-processing innovation system, Ghana. Research-led development and promotion of new cassava products with a private sector coalition.
- Cut flower innovation system, Colombia. Continuous innovation in response to changing markets, using licensed foreign technology and coordinated by an industry association.
- Medicinal plants innovation system, India. Mobilization of traditional and scientific knowledge for rural communities, coordinated by a foundation.
- Small-scale irrigation innovation system, Bangladesh. Promotion by a civil society organization of a low-cost pump to create markets; innovation by small-scale manufacturers with the design of pumps in response to local needs.
- Golden rice innovation system, global. Complex partnership of multinational companies, international agricultural research organizations, universities, and development foundations; complex but creative institutional arrangements over ownership; innovation targeted to poor (nutrient-deficient) users.
- Potato, Peru. Facilitation by an international research center of the development of new indigenous potato products with a coalition of researchers, smallholders, and multiple private actors (including supermarkets, traders, and restaurants).

In each case, the drivers of innovation and growth were different and the role of research and extension varied, but in all cases the actors used similar approaches to address their challenges and innovate. The challenges included meeting stringent quality standards, remaining competitive, responding to changing consumer tastes, and addressing technological problems.

The actors’ ability to improve their interactions and strengthen their links to one another proved crucial to their success. All of the cases illustrate the importance of taking collective action, having the benefit of facilitation and coordination by intermediaries, building a strong skill base, and creating an enabling environment for innovation to take place.

Sources: Adapted from Bernet, Thiele, and Zschocke 2006; Hall, Clark, and Naik 2007; World Bank 2006; A. Hall, personal communication; R. Rajalahti, personal communication.
and entrepreneurs and to get them to innovate. Innovation requires a much more interactive, dynamic, and ultimately flexible process in which the actors deal simultaneously with many conditions and complementary activities that go beyond the traditional domains of R&D and extension. These conditions and complementary interventions have not been consistently addressed to date; new, additional ways and means of doing so are needed.

An AIS approach looks at the multiple conditions and relationships that promote innovation in agriculture. It may offer a more flexible means of dealing with the varied conditions and contexts in which innovation must occur. It considers the diverse actors involved, their potential interactions, the role of informal practices in promoting innovation, and the agricultural policy context.

The AIS principles of analysis and action integrate the more traditional interventions (support for research, extension, and education and creation of links among research, extension, and farmers) with the other complementary interventions needed for innovation to take place. Such interventions include providing the professional skills, incentives, and resources to develop partnerships and businesses; improving knowledge flows; and ensuring that the conditions that enable actors to innovate are in place.

Figure O.1 presents a simplified conceptual framework for an AIS. The figure shows the main actors (typical agricultural knowledge and technology providers and users, as well as the bridging or intermediary institutions that facilitate their interaction); the potential interactions between actors; and the agricultural policies and informal institutions, attitudes, and practices that either support or hinder the process of innovation.

**EFFORTS TO STRENGTHEN KEY COMPONENTS OF THE INNOVATION SYSTEM**

Agricultural research, extension, education, and training are key components of an AIS. The following sections summarize approaches that have been used to strengthen these components, what they achieved, and continuing concerns.

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Figure O.1  An Agricultural Innovation System

Source: Modified from Rivera et al. n.d.
Agricultural research

A strong science and technology system—encompassing basic, strategic, and adaptive agricultural science as well as sciences outside agriculture—is widely regarded as contributing to innovation and sustainable, equitable agricultural development. Development cannot occur without knowledge, much of which must be generated and applied nationally and often more locally. For this reason, sustaining food production and rural livelihoods while reducing poverty depends to a great extent on how successfully knowledge is generated and applied in agriculture and on whether the capacity to produce such knowledge is improved.

Aside from budgetary constraints (Box O.4), many public research organizations face serious institutional constraints that inhibit their effectiveness, constrain their ability to attract funds, and ultimately prevent them from functioning as a major contributor to the innovation system. The main constraints associated with many national research organizations result from strong path-dependency in institutional development and slow institutional and policy change, such as the lack of consensus on a strategic vision, ineffective leadership and management, a continued emphasis on building centralized national agricultural research structures rather than on creating partnerships, the loss of highly qualified scientific staff, and weak links with and accountability to other actors involved in innovation processes (World Bank 2005).

Over the years, research organizations have attempted to address these various constraints. Most of these efforts have centered on shifting investments away from physical infrastructure, equipment, human resource development, and operating funds and toward improvements in the management of public research organizations—for example, through better planning, improved financial management, greater accountability, and more relevant programs for clients (developed with oversight from multistakeholder boards or through better research–extension linkages).

Box O.4 Trends in Financing Agricultural Science and Knowledge Systems

Global public investments in agricultural science, technology, and development have increased significantly over the years, rising from US$16 billion (reported in 1981) to US$23 billion in 2005 purchasing power parity dollars in 2000 (figures from Beintema and Elliott 2009; 2000 is the latest year for which comparable global data are available). The increase is somewhat deceptive, because it has been concentrated in just a handful of countries (Pardey et al. 2006). More recent data indicate that investments in science and technology continue to increase.

Government remains the largest contributor to public agricultural research, accounting for an average of 81 percent of funding (of more than 400 government agencies and nonprofit institutions in 53 developing countries sampled). Only 7 percent of funding is provided by donors as loans or grants. Funding supplied through internally generated funds, including contractual arrangements with private and public enterprises, on average accounts for 7 percent of the funding for public agricultural research. Nonprofit organizations, which collect about two-thirds of their funding from producer organizations and marketing boards, are also more active than government agencies at raising income from internally generated resources, which include contracts with private and public enterprises (26 percent).

The private sector spends an estimated US$16 billion (in 2005 purchasing power parity dollars) on agricultural research, equivalent to 41 percent of the global investment (public and private). Almost all of these private investments are made by companies pursuing agricultural R&D in high-income countries. In addition, several international research centers focus on agricultural R&D to produce international public goods.

Investments in R&D, including research and advisory services, have been the World Bank’s major strategy to improve agricultural productivity and innovation (World Bank 2009b). The World Bank alone invested US$4.9 billion (US$5.4 billion in real million dollars, 2010 = 100) into agricultural R&D and advisory services over the 20 years from 1990 to 2010. The World Bank’s annual commitments to agricultural research, extension, education, and training have ranged from US$100 million to US$800 million. The very low commitments by governments and donors to agricultural tertiary education since the early 1990s are an especially worrying trend (World Bank 2007a), because they imply that a capacity for innovation is not being sustained.

Sources: Author.
Much effort has focused on increasing client participation and on the financing and overall development of pluralistic agricultural knowledge and information systems (World Bank 2005). Table O.1 captures the main differences and changes in emphasis in World Bank investments to support innovation. Box O.5 describes recent reforms in agricultural research and extension organizations.

Approaches to international cooperation in agricultural R&D continue to change as well. Growing capacities in large national agricultural systems such as those of Brazil, China, 

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<th>Table O.1  Defining Features of the Three Main Frameworks Used to Promote and Invest in Knowledge in the Agriculture Sector</th>
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<td><strong>Defining feature</strong></td>
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<td><strong>Actors</strong></td>
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<td><strong>Outcome</strong></td>
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<td><strong>Organizing principle</strong></td>
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<td><strong>Role of policy</strong></td>
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<td><strong>Nature of capacity strengthening</strong></td>
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<th>Box O.5  Recent Reforms in Public Agricultural Research and Extension</th>
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<td>■ Increasing the participation of farmers, the private sector, and other stakeholders in research governing boards and advisory panels to attain real influence over research decisions and priorities. The participation of women farmers is particularly important, given their crucial role in rural production systems, the special constraints under which they operate (for example, time constraints), and their range of activities and enterprises, including marketing, processing, and food storage.</td>
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<td>■ Decentralizing research to bring scientists closer to clients and better focus research on local problems and opportunities.</td>
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<td>■ Decentralizing extension services to improve accountability to local users and facilitate clients’ “purchase” of research services and products that respond better to their needs. Matching-grant programs for farmer and community groups allow them to test and disseminate new technologies.</td>
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<td>■ Establishing competitive funding mechanisms that involve key stakeholders, especially users, in promoting demand-driven research, setting priorities, formulating projects, and screening proposals. Competitive funds have increased the role of universities in agricultural R&amp;D in some countries. Continuing challenges include limited engagement with the private sector, sustainability of funding, the bias against strategic R&amp;D, and the heavy transaction costs.</td>
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<tr>
<td>■ Promoting producer organizations to reach economies of scale in services and market activities, increase farmers’ ability to demand better services, and help producers to hold service providers accountable.</td>
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<td>■ Mixing public and private systems by enabling farmer organizations, NGOs, and public agencies to outsource advisory services, identify the “best fit” for the particular job, and recognize the private-good attributes of some extension services. For example, approaches based on public funding that involve local governments, the private sector, NGOs, and producer organizations in extension service delivery may be most relevant to subsistence farmers, whereas various forms of private cofinancing may be appropriate for commercial agriculture, extending to full privatization for some services.</td>
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extension services are shifting their focus and changing address. New models are more important than ever, because systems and social conditions they are expected to general principles but also on analyses of the specific farm- vant. New models need to be developed, based not only on is clear that no single extension model is universally rele- better links to markets.

Besides giving high priority to effectiveness, accountability, cost-effectiveness, and staff quality, research supported by the CGIAR will be based on the development of results-oriented research agendas directed toward signifi- cant and compelling challenges. The CGIAR will give particular attention to enabling effective partnerships, because the complexity of scientific advances, socioeconomic develop- ments, and environmental impacts, along with the higher costs associated with new lines of research, make partnerships essential for producing and delivering international public goods in agriculture. The CGIAR’s contribu- tion to agricultural development through research and knowledge management must be integrated with the wider development goals and activities of other actors, notably countries, international and regional development organi- zations, multilateral organizations, advanced research institu- tutes, and the private sector.

Agricultural extension and advisory services

Like R&D, agricultural extension and advisory services have passed through similar cycles of challenge and reform. The public services that dominate extension services are plagued by widespread problems: limited funding, insufficient technology, poorly trained staff, weak links to research, and limited farmer participation (World Bank 2005). Because previous approaches have been ineffective, most extension programs are moving away from centralized systems and trying to improve links with research and farmers (World Bank 2007b). Most programs widely acknowledge the need to build social capital among farmers, pay greater attention to the needs of women and youth, and facilitate better links to markets.

Despite widespread agreement on the need for change, it is clear that no single extension model is universally rele- vant. New models need to be developed, based not only on general principles but also on analyses of the specific farming systems and social conditions they are expected to address. New models are more important than ever, because extension services are shifting their focus and changing their roles to improve service provision and act as brokers to the more diverse set of clients seen in an AIS.

The role of information and communications technol- ogy (ICT) in producing and disseminating knowledge has expanded exponentially. ICTs offer striking opportunities to change how agricultural science, innovation, and development occur by enabling a variety of stakeholders to interact and collaborate in new ways to enhance the innovation process (box O.6).

Agricultural education and training

Education and training institutions are especially significant in an AIS because they develop human resources and at the same time serve as a source of knowledge and technology. The absence or decline of these institutions leaves a large gap in a country’s innovation capacity. Even so, government and donor investments in agricultural education and training (AET) have dropped to almost nothing since the early 1990s (World Bank 2008).

For AET, the primary constraint (among many) is that institutions have not kept pace with the labor market’s demand for knowledge and practical competencies, especially in agribusiness, business and program manage- ment, and the problem-solving and interpersonal skills crucial for actors to function in an AIS. Despite this poor performance, global experience shows that it is possible to build productive and financially sustainable education systems (World Bank 2007b). Besides the AET system in a number of developed countries (Denmark, Japan, the Netherlands, and the United States), developing countries such as India, Malaysia, Brazil, and the Philippines have established productive AET systems.

LIMITATIONS OF CURRENT INVESTMENTS FOR INCREASING INNOVATION IN AGRICULTURE

As shown in box O.4, investments in science and technology have been a steady component of most strategies to improve and maintain agricultural productivity. The high returns and pro-poor growth emerging from investments in public agricultural research, advisory services, and education reflect a growing spectrum of initiatives to improve the response to clients’ demands, work with farmer groups, communicate better with partners, and collaborate with the private sector. Yet efforts to strengthen research systems and increase the availability of knowledge have not necessarily increased innovation or the use of knowledge in agriculture (Rajalahiti, Woelcke, and Pehu 2005). As noted, complement- ary investments are needed to build the capacity for
innovation across the spectrum of actors in the AIS and to
develop an enabling environment for innovation to occur.

This sourcebook reviews and assesses experiences with
those complementary investments. It outlines the needs,
opportunities, and priorities for such investments and
offers specific tools and guidance to develop interventions
in different contexts. As emphasized in the next section—
which offers more detail on the sourcebook’s contents and
organization—this sourcebook reflects work in progress
and an evolving knowledge base. The emerging principles
it contains will change as practitioners learn and develop
creative new approaches to innovation for agricultural
development.

SOURCEBOOK MODULES

The content of this sourcebook is presented in line with the
project cycle or phased approach that practitioners use
(table O.2). Modules 1 through 4 discuss the main invest-
ments related to innovation capacity (coordination and
organization of stakeholders, agricultural education and
training, and research and advisory services). Module 5 is
concerned with the incentives and resources needed for
innovative partnerships and business development, and
module 6 describes complementary investments that create
a supportive environment for innovation. Module 7 pro-
vides information on assessing the AIS and identifying and
prioritizing prospective investments, based partly on what
has been learned from monitoring and evaluating similar
efforts. A glossary defines a range of terms related to agri-
culture, innovation, and development.

Each module generally has four parts:

1. The module overview introduces the theme (a particular
   area of investment), summarizes the major issues and
   investment options, and points readers to more detailed
   discussions and examples in the thematic notes and inno-
   vative activity profiles that follow the overview. The
   overview provides substantive contextual information for
each topic, including lessons from earlier approaches in

Box O.6  The Role of Information and Communications Technology in Knowledge Exchange and Innovation

For innovation to take place, effective bridging mech-
anisms are often needed to facilitate communication,
translation, and mediation across the boundaries
among the various actors in agricultural research and
development and between knowledge and action. Such
facilitating and bridging mechanisms can include diverse
innovation coordination mechanisms such as networks, associations, and extension services,
but also ICT.

ICTs offer the opportunity to improve knowledge
flows among knowledge producers, disseminators, and
users and, for example, among network partners; sup-
port the opening up of the research process to interac-
tion and more accessible knowledge use; and more
cost-effectively widen the participation of stakeholders
in the innovation and governance process. ICTs have
more often been associated with providing advanced
services to number crunching and data management,
geospatial applications, knowledge-based systems and
robotics, and improved farm equipment and processes,
but less often been considered for connecting diverse
innovation communities—whether at the local, sub-
sectoral, and national level.


ICTs that serve as information “collectors,” “ana-
lyzers,” “sharers,” and “disseminators” are already
positively affecting agricultural interventions in
developing countries. Affordable mobile applications,
in particular, provide linkages to previously isolated
actors: information on prices, good farming practices,
soil fertility, pest or disease outbreaks, and extreme
weather has expanded farmers’ opportunities to capi-
talize on markets, react to unfavorable agricultural
conditions more effectively, and better interact with
public service agents.

Satellite imagery and aerial photography have
increased the capacity of scientists, researchers, and
even insurance providers to study farm conditions in
remote areas and assess damage from climatic chal-
lenges like drought. Increasingly affordable technolo-
gies like radio frequency identification tags and other
wireless devices are improving livestock management,
allowing producers to monitor animal health and trace
animal products through the supply chain. A persist-
ent barrier to innovation, the lack of rural finance, is
also lifted by digital tools.

Sources:

...
national agricultural research systems and agricultural knowledge and information systems.

2. **Thematic notes** discuss technical and practical aspects of specific investment approaches and programs that have been tested and can be recommended (sometimes with provisos) for implementation and scaling up. The notes review the considerations, organizing principles, questions, performance indicators, and lessons that would guide the design and implementation of similar approaches or programs.

3. **Innovative activity profiles** describe the design and highlight innovative features of recent projects and activities related to the area of investment described in the module. The profiles pay close attention to features that contributed to success and that technical experts can adapt for their own operations. The activities and projects described here have not yet been sufficiently evaluated to be considered “good practice” in a range of settings, but they should be monitored closely for potential scaling up. Their purpose is to ignite the imagination of task managers and technical experts by providing possibilities to explore and adapt in projects.

4. **References and further reading** offer resources and additional information.

### Themes Covered in the Modules

Each sourcebook module covers a theme related to assessing and designing investments in a particular area integral to the AIS. The discussion that follows gives readers a broad idea of the content and concerns of the modules. The non-agricultural and cross-cutting issues treated in each module are presented as well.

**Building the capacity to innovate (Modules 1–4)**

For an innovation system to be effective, the capacity of its diverse actors must be built and strengthened; many actors will increasingly possess a special mix of skills that contribute to the AIS in particular ways. Stronger technical skills are very important, but they must be complemented with functional expertise, because the new ways of working within an AIS require a range of skills: scientific, technical, managerial, and entrepreneurial skills and skills and routines related to partnering, negotiating, building consensus, and learning.

**Coordination and collective action for agricultural innovation (Module 1).** Coordination and organization of stakeholders may serve many purposes, such as building coherence and setting consensus-based priorities, strengthening the sharing of knowledge and resources, strengthening collaboration through joint processes and products, and reducing transaction costs and reaching economies of scale in extension and market activities. Without organizations (or brokers) to address social and resource imbalances and transaction costs, prospects for participating in innovation processes and systems are limited, especially for poor people. Effective platforms help to organize stakeholders with different assets, knowledge, and experience.

Module 1 discusses the capacities and resources required to organize and coordinate stakeholders, providing examples and lessons from previous efforts. The corresponding areas of investment include innovation coordination bodies (which can be national, multisectoral, or specific to the agriculture sector), subsector or industry associations or networks, producer organizations, productive alliances, and self-help groups to foster innovation. A range of policies and institutions is also needed to support coordination and collective action at different levels of governance in the AIS.

**Agricultural education and training to support AIS (Module 2).** Agricultural innovation is a product of the capacity, resources, and interactions that are brought to
bear by actors from the wide range of fields related to food and agriculture. The capacity to generate new ideas, knowledge, technologies, processes, and forms of collaboration depends on an extensive array of skills—not only the expected technical, fiscal, and managerial competencies but also complementary skills in such areas as entrepreneurship, facilitation, conflict resolution, communications, contractual arrangements, and intellectual property rights. Universities, research institutes, and other learning institutions will have to reposition themselves to acquire and inculcate these skills. The critical functions of research, teaching, extension, and commercialization must be far more closely integrated. Module 2 reviews approaches to reorienting agricultural education and training to better serve the needs of a diverse cadre of AIS actors. The examples and lessons describe long-term reform processes, curriculum reform, technician training approaches, as well as on-the-job training.

**Incentives and resources for innovative partnerships and business development** (Module 5)

Economic change entails the transformation of knowledge into goods and services through partnerships and business enterprises. Strong links between knowledge and business development are a good indication of the vitality of an AIS. Partnerships for business development often require appropriate incentives to create such links, particularly to engage the private sector in R&D, technology transfer, and joint business activities (with producers). Module 5 provides lessons and examples of many potential interventions that promote private sector contributions to innovation either through service provision, technology commercialization, or other business-related innovation (through business support). The module describes key instruments for supporting technology commercialization (the establishment of technology transfer offices, incubators, and science parks); for supporting business (the provision of innovation funds, risk capital, and other resources to initiate and sustain novel partnerships); and for forming clusters, which enable stakeholders from a particular subsector or value chain to benefit from economies of scale, geographic proximity, and complementary public investments.

**Creating an enabling environment for agricultural innovation** (Module 6)

Farmers and entrepreneurs will not take the risk of innovating in unfavorable conditions. Researchers will not engage in long-term activities that are not aligned with the regulatory system (for example, researchers will not develop innovative plant-breeding processes if they cannot protect the resulting intellectual property). In many instances, innovation and business development do not occur without complementary investments to create a supportive environment. Module 6 discusses the roles of innovation policy and governance mechanisms, regulatory frameworks (for quality and safety,
intellectual property, and biosafety), and market development in fostering agricultural innovation. It also describes investments (in infrastructure or financial services, for example) that have synergistic effects with other instruments such as innovation funds. Given the resource limitations and numerous choices, investments in an enabling environment must be prioritized and sequenced with great care.

**Assessing, prioritizing, monitoring, and evaluating investments in agricultural innovation systems (Module 7)**

AIS investments must be specific to the context and respond to the stage of development in a particular country and agriculture sector, especially the AIS. Given that optimal human and financial resources are rarely available, an incremental approach is advisable. The scale of operations is also likely to vary from local or zonal to subsectoral or national. This variation requires investments to be assessed, prioritized, sequenced, and tailored to the needs, challenges, and resources that are present.

The identification and design of appropriate interventions begin with a good understanding of the level of development and the strengths and weaknesses of the AIS. The status of an AIS and its critical needs can be assessed in several ways and at several levels. Module 7 reviews and provides lessons and examples of tools for assessing AISs, such as AIS frameworks, organizational assessments, NetMap, and benchmarking.

Investments are prioritized based on the needs that are identified, but setting priorities is also a political process involving negotiation to build a consensus. Scoping and consultation can help stakeholders to develop a shared perspective on goals and challenges and to identify specific needs, opportunities, and priority interventions. These processes ideally engage a diverse group of stakeholders from within and outside the sector through platforms, committees, alliances, and scenario and foresight exercises.

Monitoring and evaluation (M&E) of an AIS are essential for assessment and prioritization, as they allow insights on impact and change. As technological, institutional, policy, and other innovations arise through interactions between networks of stakeholders in an innovation process, M&E should encompass quantifiable assessments (of economic benefits, productivity increases, and so on) and nonquantifiable assessments (of learning by doing, institutional reorganization, capacity building, and so on). This module reviews traditional and other methods that help practitioners to assess and understand learning processes, institutional change, changes in capacities, and other outcomes and to include the various stakeholders in the M&E process.

**Nonagricultural and cross-cutting issues**

Although the sourcebook focuses on innovation in agriculture, it draws on experience and lessons from other sectors, not least because so many “nonagricultural” issues impinge on agriculture and innovation. Such issues include rural finance, business development, innovation policies, and the governance of innovation, among others.

The sourcebook addresses three major cross-cutting themes—the role of the public and private sector, climate change, and gender—as appropriate (and when examples have been identified). These issues are briefly introduced in box O.7.

**THE SOURCEBOOK AS A LIVING DOCUMENT**

To the extent possible, the modules in this sourcebook reflect current knowledge and guidance for investments to support innovation systems in agriculture. Their content is based on the expert judgment of the authors and thematic specialists, as well as reviews by experienced specialists. Yet important gaps in knowledge remain, and new knowledge will emerge from approaches that are just now being devised and tested. For example, impact assessment methods and good M&E practices for an AIS are two areas in which much more knowledge is needed. Future iterations of this sourcebook will also benefit from additional examples of integrated AIS investments to strengthen innovation capacity in related areas such as education, research, advisory services, and brokering, among others.

This sourcebook is intended to be a living document that remains open to dialogue and new, imaginative approaches to innovation for agricultural development. Its primary home is not on the bookshelf but online (www.worldbank.org/ard/ais), where it will be updated and expanded as new experience is gained and new approaches and initiatives arise. The authors strongly encourage readers to update, verify, and offer feedback on the information here. Readers are encouraged to adapt key principles and relevant guidelines to their individual agricultural projects and programs—and to share the results widely.
1. In contrast to the CGIAR’s origins in the 1960s and 1970s as a mechanism for funding research divided largely along commodity and geographic lines. For more information on the change management process and on how the CGIAR has changed as agriculture, approaches to R&D, and approaches to funding R&D have changed, see www.cgiar.org.

**REFERENCES AND FURTHER READING**


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