

Farmers

Most of the world's poor people earn their living from agriculture, so if we knew the economics of agriculture we would know much of the economics of being poor.

—Theodore W. Schultz, 1980

Farmers operate in the market, like other entrepreneurs. But markets in rural areas, and particularly agricultural markets, suffer especially from problems of information, inadequate competition, and weak enforcement of contracts. Building institutions that reduce transaction costs for farmers, therefore, can greatly improve the way agricultural markets operate. This is especially important for poverty reduction, because poor people are more likely to live in rural areas and make their living from agriculture-related activities (figure 2.1). Well-functioning agricultural markets also have important benefits for the rest of the economy. As agricultural productivity improves, farmers leave agriculture for more productive employment in industry and services, promoting overall growth.¹

Three particular challenges face policymakers building institutions for agricultural markets. First, agricultural activity is usually *geographically dispersed* and distant from major urban centers. A problem in providing rural credit, for example, is that formal providers of credit, such as banks, may find it costly to obtain information on geographically scattered small farmers. So interest rates on formal loans to small farmers, if loans are available at all, tend to be prohibitively high. Similarly, costs for judicial services and the marketing of produce can be high because of the distance between farms and major towns.² In all such cases, informal institutions serve as substitutes for formal institutions—

effectively in some environments, but as incomplete surrogates in others.

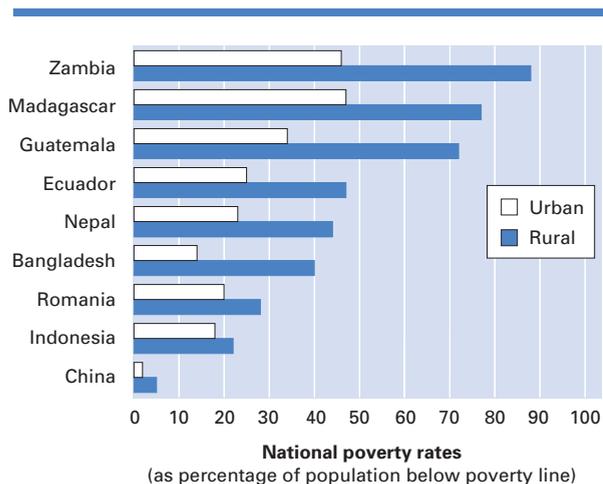
Second, farming in many countries has historically suffered from *urban bias* in public policy. For example, state marketing boards in several African countries resembled the systems used by the colonists to gather food during the Second World War.³ Both these systems subsidized urban consumers of food by requiring farmers to sell their output at less than the market price. Other examples of urban bias include overvalued exchange rates to make imports cheaper for urban consumers, excessive agricultural export taxes, and high effective rates of protection for domestic industries that provide agricultural inputs.

Public investment in infrastructure, education, and other services in rural areas also tends to be lower than in urban areas. Lower investment increases transaction costs in marketing, which can be a major institutional constraint to developing agricultural productivity. Public or private efforts to build specific institutions that ease information costs, such as grades and standards or market information systems, can help to boost agricultural development (box 2.1). Beyond physical access to markets, large segments of the rural population, and the rural poor in particular, often face considerable obstacles in accessing agricultural markets. This is because their relative lack of education can make some useful formal institutions, such as institutions for disseminating technological information, harder to access.

Third, agriculture is heavily dependent on *the vagaries of climate*. Poor farmers often rely on their own savings and the help of family and friends when floods or droughts strike. But these insurance mechanisms are



Figure 2.1
Poverty head counts, urban versus rural,
selected countries, 1990s



Note: National poverty lines are used, so results are not comparable across countries.

Source: World Bank data.

of little use when savings are meager or when the entire circle of family and friends suffers from the same disaster. Wealthier farmers and those in richer countries can purchase forms of disaster insurance and benefit from public subsidies when struck by adversities. These subsidies are costly for poorer economies, and markets for disaster insurance require an array of complementary institutions unavailable in most developing countries.

How can governments or communities build effective institutions to raise farmers' returns and lower their risk?⁴ This chapter addresses this question by drawing on evidence from successes and failures of institutional arrangements across countries. The interlinked institutions governing farmers' physical and financial assets—those for *land* and for *finance*—are particularly important. Secure and transferable rights to land stimulate income-generating investment and reduce uncertainties about future incomes. So do well-functioning rural financial institutions, which provide credit for both income-enhancing and risk-reducing investments and insurance. Institutions for generating and disseminating *agricultural technology* directly affect the yields and risk inherent in agricultural production.

In many countries, marketing problems are the biggest institutional constraints to increasing agricultural productivity. Connecting small, isolated communities into larger markets, and particularly into global markets, stimulates demand for farmers' output. This,

in turn, generates demand for inputs. The more open the market, the greater is the demand for effective formal institutions for farmers—from documented property rights in land to better access to credit.

Informal institutions and simplified procedures may be appropriate in situations where complementary formal institutions are absent or where the overall demand for agricultural output is low. In such cases the costs of complex formal institutions may be high compared with their benefits. For example, in areas where there is little competitive pressure on land, communal rights to land can be sufficient for tenure security. Formal titles may be more appropriate in situations where high demand for land gives rise to disputes over land and informal institutions can no longer resolve these disputes satisfactorily.

Innovation, often through experimentation, can identify techniques that overcome the inherent high transaction costs in rural areas. These can range from simple databases that permit technological information sharing among small farmers to improved enforcement mechanisms inherent in group-based lending.

This chapter concentrates on specific agricultural institutions, including land rights, rural financial institutions, and institutions that create and deliver agricultural technology. Many other critical issues that relate to agriculture are dealt with in other chapters of the Report—for example, openness to international trade in chapter 7 and water and electricity pricing in chapter 8—and in other Bank reports.⁵

Building more secure and transferable rural land institutions

Historically land was abundant and was held communally or could be obtained by any who laid first claim to it. But as population grew, land in many parts of the world—specifically, agricultural land—became more scarce, until its relative scarcity raised its value. As land became more important as a productive asset, it moved into individual or family ownership. With private property came the need to prove ownership. Even in ancient Egypt and Mesopotamia, titles for land were important for land transactions (box 2.2).

Today the nature of property rights in agricultural land varies widely across countries. Both governments and communities have built institutions to define these rights. In some countries, such as Uzbekistan, the state owns all land. In China private ownership of land is also prohibited; government regulations allow private citizens to lease land legally for 15 years, although prac-

Box 2.1 Agricultural marketing institutions

When complex agricultural marketing arrangements in developing countries fail, it is usually because of the lack of effective supporting institutions. The state has a role to play in building better marketing institutions, but not through *state marketing bodies*, which have clearly been unable to balance conflicting state objectives, including credit provision, tax collection, and food security and price stability for urban consumers. Instead, the state can facilitate private marketing institutions, such as contract farming and cooperatives.

Contract farming arrangements, or “out-grower schemes,” are attractive for farmers in developing countries because they help small farmers access modern inputs, such as credit and seeds, and market their produce to domestic and international markets. These schemes range from agreements between individual traders and farmers, as in many Asian countries, to more formal systems in countries of Latin America, Central Europe, and East Asia. Even though the institution is private, governments can help build it in two ways: as information facilitator, helping to match small farmers with domestic traders and agrobusiness firms; and through complementary institutions, especially contract enforcement mechanisms (such as courts to resolve contractual disputes, or grades and standards).

Farmer cooperatives are more common in industrial countries than in the developing world, dominating the dairy sector in Finland, wheat in Canada, rice in Japan, and grain in Argentina. By tackling the problems caused by the relative smallness of individual farmers, cooperatives can be very successful in dealing with both information asymmetries and competitive power versus purchasers. They do this through collective action, pooling resources and lowering the unit costs of transactions. For marketing cooperatives in developing countries, the record has a clear lesson: governments should stop trying to impose “top-down” cooperative structures on farmers. Cooperatives such as Anand in Gujarat, India, or UGC in Mozambique have seen success because they are voluntary in nature, which helps mitigate some collective action problems, such as low effort by participants (a problem that has plagued state-led agricultural cooperatives). Also, they have experimented with context-specific institutional design, which has improved trust, transparency, and innovation.

Whatever the organization of marketing, purchasers can still incur high costs to verify the quality of goods they buy. Two institutions have evolved to meet these needs: grades and standards provide a greater level of certainty about the quality of produce, and market information systems provide information to farmers.

Because agricultural products have a vast array of characteristics, *grades* (classifications based upon quantifiable attributes) and *standards* (rules of measurement) are used to separate similar products into categories and describe them with consistent terminology. This evaluation system can significantly reduce information costs by allowing traders to contract “remotely” through commodity specification rather than through on-site visual inspection. But the benefits go beyond this. Because grades and standards can be independently certified, they facilitate access to credit, through the use of warehouse receipt schemes, inventory credit, and commodity exchanges. They can also expand the market by allowing price and quantity comparisons, and thus trade, across markets with common standards.

In the rice market in Japan, standards and grades were created when the spread of railroads began to link once-isolated mar-

kets. Throughout the world the expansion of trade between communities has created a similar demand for such standards and grades. Private merchants usually initiate standards. But as the volume of exchange increases, the importance of public intervention to promote the use and adaptation of standards increases.

International standards are often sponsored by larger farmers and firms in developing countries. These standards may promote overall exports. Yet smaller farmers who are currently involved in export markets may be left out of the process. The setting of high-level standards may raise their costs. These farmers have two options. First, they may reap part of the benefits of standardization, such as lower information costs, through the use of informal institutions that have evolved to mitigate informational problems (as with informal brokering arrangements in Ethiopia). Second, policymakers can reach out to enroll poor farmers in certification programs to integrate them into the wider agricultural markets, as is being done by Mayacert, a nongovernmental organization (NGO) operating in Guatemala.

Market information systems (MIS) generically describe dissemination networks of *public* data that provide information on agricultural markets. For farmers, knowledge of market information (such as the prevailing price of a commodity in key wholesale markets) can help them to plan their production, harvesting, and sales according to market demand. For traders, better information improves their ability to decide whether to hold products in storage or ship them to the most lucrative markets. In both cases MIS are of special use to smaller farmers or traders, who lack the scale economies to gather such information on their own account.

In most industrial countries, private agencies provide agricultural market information for a fee, while public agencies collect market data and make the information available free of charge. Given the high cost of collecting and disseminating such information in areas lacking standardization of quality and weights and adequate communication infrastructure, any user fees charged by private agencies are likely to be high. So the public sector has an important role in poorer countries.

Public sector MIS systems are not widespread—a survey of 120 developing countries identified only 53 such systems (Shepherd 1997). But they are usually barely functional. This is due to inadequate financing, inability of bureaucrats to collect reliable market information, and reluctance of traders to divulge information for fear of being taxed.

Nevertheless, several innovative strategies for effective dissemination of market information are being explored. For example, the government of Andhra Pradesh, India, makes prices of produce in different regional markets available on a website that is updated daily. Again, a major role for the public sector may be to help market participants improve their *own* information flows by expanding the availability of low-cost communication technology. For example, the exchange of market information in Ghana, the Philippines, and Bangladesh was boosted when governments made rural access a condition for granting licenses to mobile telephone companies. Consequently, market traders increasingly gather and convey information among themselves through the use of their own cellular telephones.

Source: Chaudhury and Banerji 2001, *World Development Report 2002* background paper.

Box 2.2**Early institutions of land ownership in Mesopotamia and Egypt**

From the dawn of agriculture around 10,000 years ago until a couple of centuries ago, land has been abundant relative to population in much of the world. Land in early times was usually owned, if at all, by the king or the temple. In Egypt the Pharaoh Menes (c. 3100 B.C.) carried around deeds certifying his ownership of all land, granted to him by the king of the gods. But private land ownership and land sales were also recorded. In Uruk (in southern Mesopotamia, c. 3000 B.C.), there are records of individuals who “owned” land, although titles did not exist—and tablets give information on the sale of this land.

Some of the earliest existing physical records of private landholdings date from the reign of Hammurabi (16th century B.C.), whose famous code also laid down specific circumstances under which the king would step in to resolve land disputes. In Hammurabi’s time, land assignments were delineated by pegs around the boundary, and a record of all landholdings was kept in the palace. By the third century B.C., it had become common for Egyptian landholders to keep a document of possession with themselves. By the time of the Sassanian era (A.D. 224 to 651), property ownership in Mesopotamia required a written deed, witnessed and then registered with the state.

Source: Powelson 1998.

tices differ across different localities. Similarly, although private ownership is forbidden in most Central Asian countries, some governments have developed well-defined and often-codified use rights to state property and have built organizations to administer them.⁶ Privately determined and ill-defined “squatters’ rights” constitute ownership and transferability of cultivated land for many small farmers in Latin America. Communities and tribes in many African countries have informal, individual use rights to communally owned property.⁷ Land tenure is transferable in most of South Asia, but uncertain institutional arrangements have resulted in clashes about ownership and the potential for government seizure of land, leading to insecurity in some areas.

Secure and transferable land rights can be provided by both informal and formal institutions. Such systems must provide information on who owns the land, who has a secured interest in the land, where land transactions are registered, and how to access this information. The community-defined ownership or use rights in parts of Africa, for example, perform these functions.

Box 2.3**Quilombos in Brazil: infrastructure, social change, and a new demand for land registration**

Until recently settlements known as *quilombos* have been hidden away in Brazil. Tucked away in geographically remote settings, these communities are inhabited by the descendants of runaway slaves. Their remoteness was originally an effort to avoid discovery and scrutiny by slave owners. Today the settlements are connected to the rest of Brazil and the world by new and improved road, river, and rail links. As a result the value of this land has grown for ranchers, mining companies, and land speculators, who have been attempting to take over some of the *quilombo* lands for development. Initially these efforts were relatively successful because *quilombo* inhabitants did not have formal titles. Since their ancestors had been illiterate, no documents testified to the existence of their communities, and all official records of slavery were officially destroyed in 1890.

Yet a government-sponsored effort is now under way to give *quilombo* dwellers legal title to ancestral lands. This process was eased by the adoption of a new constitution in Brazil in 1988, 100 years after slavery ended, which finally recognized the rights and status of descendants of runaway slaves. By 2000, 743 *quilombos*, some dating back to the 17th century, had been identified across Brazil and were seeking formal recognition of their status. There have been some attempts to expedite the titling process, such as accepting the oral testimony of the oldest residents as proof of settlement claims. Still, the process of regularization has not gone as fast as could be hoped, and the government is trying to accelerate it.

Source: Rohter 2001; Fundação Palmares 2000.

In many cases establishing formal titling is an unnecessary cost in the medium term. But formal property rights systems enforced by the state are needed to reduce land disputes where population growth or demand for agricultural produce leads to competitive pressures on land or where transactions with those outside the community are common. For example, the demand for formal individual property rights was stimulated in England by the demand for wool and thus for sheep. In Kenya the demand for formal land rights was triggered by the emerging global market for plantation crops, while in Thailand the cause was the internationalization of its market for rice following the 1826 Bowring Treaty. Better infrastructural services that connect remote lands to the market can also stimulate the demand for formal institutions to delineate and enforce property rights, as has been the case in Brazil (box 2.3).



Improving agricultural productivity through better land rights

Improved security of tenure can raise the expected returns from investment and ease credit constraints. This in turn can raise investment levels and productivity. Secure tenure to land helps assure investors that the returns to their investment will not be expropriated by government or private agents. Better land tenure also increases access to credit, since land can be used as collateral (discussed in chapter 4).

If land tenure is secure, a functioning land market that allows transfer of property from one owner (or a possessor of user rights) to another can help raise productivity by transferring land from less efficient cultivators to more efficient ones. This overall productivity gain, of course, is greater if there are functioning credit markets—otherwise the more efficient farmers would not be able to raise the capital needed for the purchase. Productivity increases also depend on sellers being able to engage in other income-generating activity. Several studies of China, one of the few countries that has experimented with allowing different systems of transfer rights across different provinces, have confirmed that higher levels of transferability were positively correlated with higher levels of farm investment.⁸

In many developing countries extensive regulation of land market transactions has meant that land markets seldom operate freely. Since transparency tends to be low and administrative capacity limited, these regulations also encourage corruption. Lowering these costs of land transactions may be of particular importance in parts of Asia, especially South Asia, where a flourishing land market could improve productivity by avoiding excessive fragmentation and subdivision of landholdings (box 2.4).

When are formal titling institutions needed?

Formal land titles can increase access to credit and raise investment in land. But these functions greatly depend on the broader institutional environment. Governments should embark on large-scale titling programs only where competitive pressures and potential disputes mean that community land tenure arrangements are ineffective.

Efforts to issue documented and registered land titles have gained prominence in recent years. In many cases, titles have formalized undocumented tenancy rights, which can range from long-established community- or tribe-based systems, as in the Brazilian *quilombos* exam-

Box 2.4

Examples of policy barriers to the operation of land markets

Even when land transfer is allowed by law, extensive regulation of transactions can frustrate the operation of the land market. The following barriers can be reduced by government actions.

Restrictions on land sales. Some countries prohibit land sales outright. In many transition countries land privatization has been accompanied by ceilings on sale prices and moratoriums on resales. Governments have indirectly restricted land sales by mandating that any land transaction has to be approved by a higher authority.

High sales costs. High transaction taxes or high fees can discourage land sales or drive them into the informal sector. In the Philippines and Vietnam the tax on land transactions is almost 20 percent of land value. Costs can also be high when lack of competition results in high fees for services associated with land sales.

Restrictions on land subdivision. Such restrictions have been established in former colonial environments to prevent the disintegration of large farms often formerly owned by colonialists, without any economic justification. For example, Zimbabwe continues to have these restrictions, while South Africa has just recently begun the process of repealing its regulation.

Restrictions on the use of land for collateral. Examples include Vietnam, where the value of land as collateral is limited by law and where foreign banks are not allowed to take land as security for credit. Also, creditors cannot own or exchange land use rights, and any land that is repossessed is auctioned off by the state. In Mexico banks can obtain the use right but not the ownership of land.

Lengthy land registration processes. In Mozambique there is a backlog of about 10,000 applications for land rights, which means long delays between receipt of an investment plan and eventual granting of the land right. In Cameroon the minimum amount of time it takes to register a plot is 15 months, and registration commonly takes between 2 and 7 years. In Peru the official adjudication process takes 43 months and 207 steps in 48 offices, although an expedited process is now being implemented in selected areas.

Source: Deininger 2001, *World Development Report 2002* background paper; de Soto 2000.

ple in box 2.3, to occupancy rights by squatters on land.⁹ Formal land titles have also been established during land privatization processes (as in the transition countries). As discussed in *World Development Report 2000/2001*, clearly defining land rights during land reforms is key to improving the lives of poor people—farmers and nonfarmers alike.¹⁰

But the financial and administrative costs of a formal land titling program are high. This raises the question of what types of institutions are needed, and when.



Formal land titles create secure and transferable property rights by providing better information. Informal land right systems are based on the knowledge of community members and neighbors. These individuals may know the quality of a piece of land, who truly owns it, and its precise physical demarcation. But outsiders to the community who want to buy land have little access to this information, and no way to ensure the reliability of the information they obtain. Formal land titles can help to remove this source of uncertainty. At the same time, by resolving ownership disputes, they can thwart arbitrary seizure. They also ensure that the price of the land more closely reflects its value rather than the added costs associated with verifying its ownership status and physical location.

Property owners may clearly demand the establishment of formal titling systems when informal systems become less effective. This usually occurs when land becomes relatively scarce and in dispute. Increased openness to other communities and competition in product markets—reflecting strong market demand for agricultural output—has often increased the demand for formal titles. In areas of new settlement or frontiers (as in Brazil), formal titles can enhance the security of agricultural ownership.¹¹ For 35,000 squatter families living on encroached forest reserve land in Thailand, a land reform project in the 1980s provided occupancy certificates that could be upgraded to full land titles. Since the 1980s the World Bank has been supporting land titling projects in Thailand. Studies have found that these efforts have encouraged significant productivity-increasing investments and greater access to credit. The Bank is continuing to work with the Thai government on a 20-year program to improve the land titling and administration system.¹²

In other situations community-based approaches offer a cheaper and effective alternative to formal institutions.¹³ The first situation occurs where buyers and sellers know each other at the local level and where there is strong peer pressure to avoid socially disruptive property disputes. In these cases the main source of demand for land is often from within the community; the community is strong and close-knit; there is consistency and continuity of community leadership; and any certificates of ownership issued by those in the community are accepted by others in the community. The second situation occurs where community arrangements are also legally valid and enforceable. Under Nigerian law, for instance, “customary tenure” is defined as those

systems administered by communities or their leaders. The great majority of these holdings are held under rights of inheritance derived ultimately from community membership—rights that are defensible in the local courts.¹⁴

The third situation arises where administrative and institutional shortcomings mean that formal titling does not result in more secure tenure than informal alternatives. The effectiveness of formal titles depends on the quality of the title—such as clarity—and respect for the law. National legislation for tenure reform has limited capacity to change behavior when indigenous arrangements on land persist.¹⁵

The fourth situation occurs where the benefit of formal titles is low because of failures in other agricultural institutions. That has been the case in Kenya, for example.¹⁶ If complementary markets for credit and for marketing of inputs do not work, then the first policy responses, given limited institutional or organizational resources, should be in those areas.

Available empirical evidence from studies on Asia and Latin America suggests a positive relationship between tenure security and investment. For example, studies for the Brazilian frontier found formal titles increased productivity by providing clear information about ownership rights in undeveloped areas.¹⁷

Land titles can also improve access to credit. But titles alone are not sufficient—cross-country experience suggests that the difference has been the existence of complementary institutions. In Thailand the existence of formal land titles has facilitated the flow of both formal and informal credit (box 2.5). Moreover, increased investments in titled land raised its value and improved access to credit.¹⁸

At the same time, studies have generally found that formal titles have little effect on access to and use of credit in very poor regions in Africa, India, and some parts of Latin America (box 2.6). Two related factors explain this finding. First, complementary formal credit institutions may not be widely available. A study of two villages in southern India found that transferable land rights had little effect on credit, probably for this reason.¹⁹ Land titles alone may not lower the high costs of enforcement and of managing very small loans that formal lenders deal with in lending to small farmers. For instance, a study for Paraguay found that the effect of formal titles on credit varied strongly with size. Smaller producers holding fewer than 20 hectares were excluded from the credit market.²⁰ Second, the lack of



Box 2.5 Informal collateral transactions using land titles in Thailand

While formal title documents for rural land can facilitate credit transactions, the costs of registering liens can be high, and the process can be time-consuming. Therefore, lien registration may not be compatible with loan transactions of relatively smaller amounts or short duration. Alternative arrangements have emerged, however, that take advantage of the value-enhancing effects of titles on collateral while avoiding the high transaction costs of formal lien registration. In Thailand in the 1980s a study found that borrowers sign a power-of-attorney authorization to a lawyer representing the lender (typically a trust of local businessmen) and leave the title document with the attorney. The cost of foreclosure in such a case is low, and the risk to the lender is reduced considerably. This procedure screens out borrowers with overly risky projects at a very low transaction cost compared with a formal registration of lien. While these arrangements have been documented for Thailand, they are likely to exist in many other regions of the world where the transaction costs of registering formal liens are high.

Source: Siamwalla and others 1990.

other complementary formal institutions, specifically enforcement mechanisms, makes a difference. In Kenya, for instance, where banks were prevented from foreclosing on property used as collateral, a study found that banks did not make loans to farmers despite the existence of formal titles.²¹

Building effective institutions for the land market

Formal land market institutions include land registries, titling services, and land mapping. In building these institutions, three characteristics should be kept in mind: clear definition and sound administration of property rights; simple mechanisms for identifying and transferring property rights; and thorough compilation of land titles and free access to this information.²² Although this discussion focuses on rural land markets, most of the lessons hold for urban markets as well.²³

Clear definition and sound administration. A land registry, where titling information is filed, helps to solve the central problem of information on property rights. Many of the functions of a land registry can be performed by the private sector. But the government has a role in ensuring that the registry provides comprehensive ownership evidence to the public at low cost. For this, it has to enact land registration laws that define

Box 2.6 Do indigenous land rights constrain agricultural investment and productivity in Africa?

Most African farmers still hold their land under indigenous, customary, or communal land tenure systems. In the traditional African society, the household, the village, and the kin group provided insurance against risks, access to informal credit, and security. Lineage rules of inheritance helped to enforce intergenerational transfers. The threat of sanctions, which included exclusion from the social structure and its benefits, was the major instrument of enforcement of the rules. Even where households have become geographically dispersed, the common inheritance of land in the village and the social support system of the traditional society continue to bind them together.

In the past such land tenure systems were thought to provide insufficient tenure security to induce farmers to make necessary investments in land (World Bank 1974; Harrison 1987). But research has shown that such systems can be effective. The evidence from rain-fed cropping areas suggests that indigenous tenure systems have been flexible and responsive to changing economic circumstances (Place and Hazell 1993; Bruce and Migot-Adholla 1994). Harrison (1990) found that smallholders in Zimbabwe, despite not having private title to their land, have achieved rapidly increasing maize yields and that their productive performance is not inferior to that of the biggest commercial farmers in the country. Migot-Adholla and others (1994a) found similar results for Ghana.

Source: Bruce and Migot-Adholla 1994; Collier and Gunning 1999; Soludo 2001, *World Development Report 2002* background paper.

rules for original adjudication of registered title, establish if and how provisional rights can be registered, and stipulate how these rights subsequently mature. The government also needs to establish an authority (which can be public or private) to ensure the impartial maintenance of land registers, to determine the nature of these registries, and to delineate the method by which a register for the whole jurisdiction is to be compiled and subsequent transactions are to be recorded.

Clearly defined land parcels need to be based on credible land surveys. Otherwise, increasing land disputes—the resolution of which, given the overworked judicial systems in many developing countries, usually takes a long time—can undermine the fundamental aim of land registries. In Indonesia, for example, land disputes account for 65 percent of all court matters.

Administration of the surveys has to address two concerns. First, survey standards should be commensurate with the country's (and region's) level of economic



development. In Zambia, for instance, standards require the same degree of survey precision for office blocks in the capital as for 5,000-hectare farms in sparsely populated areas.²⁴ In poorer countries, more comprehensive survey coverage of land boundaries at a lower level of precision and cost (using neighboring parcels and landmarks) may be preferable to a low level of coverage at a high level of precision (say, satellite-aided mapping). Second, there needs to be an adequate supply of survey professionals, so that the land registration process is not unnecessarily lengthy. In Zambia, for instance, supply restrictions by the tightly knit association of surveyors meant that there were only seven qualified surveyors in the entire country in 1994. Indonesia, Malaysia, and the Philippines have also reported similar restrictions and lack of surveying capacity.²⁵ Pressure by media groups, civil society, and government to ease such anticompetitive behavior could yield results.

Simplicity of identification and transfer. In practice, establishing formal land rights can be a lengthy and cumbersome process. There are simple ways to ease this. One is to convert occupancy rights into full title. In Mozambique, for instance, land rights are granted to cultivators based on actual occupation for the last 10 years. Oral testimony is sufficient to support land ownership claims, and communities can request formal titles at any point. Similarly, oral testimony is being accepted in many cases of formalizing the *quilombos* in Brazil (see box 2.3). Suffering from a backlog of land disputes in the regular court system, Mexico established specialized agrarian courts (box 2.7). The admission of oral evidence and a degree of decentralization have made such courts accessible to the poor at reasonable cost.

Computerization can also simplify the identification and transfer process (as in the example of Andhra Pradesh, India, given in box 1.8). Although the initial investments in technology can be large, they can have high payoffs in speeding up land transactions in densely populated areas. Tax payments can also be used as a proof of possession that can eventually be converted into ownership. This mechanism also provides an incentive for landowners to pay taxes. Finally, transferability of land rights can be eased by reducing regulation-induced costs of transactions (see box 2.4).

Thorough compilation and free access to titling information. Incomplete land registries, where certain land plots are not part of the information base, are a common feature of developing countries. A combination of

Box 2.7

A transparent and accessible institutional framework for granting land rights in Mexico

Mexico established a special institutional infrastructure for granting land rights, which has three elements: (a) an ombudsman's office to supervise the regularization of land ownership; (b) a system of special courts to attend to the large number of existing land conflicts (and provide an opportunity for quick appeal of any irregularities occurring during the regularization process); and (c) a modern registry to record land rights that had been established to ensure that they could be used in commercial transactions.

Beneficiaries agree that the program has increased tenure security, and evaluations have demonstrated the positive impact it has had on the functioning of land markets. This transparent and accessible institutional framework has also improved governance in areas that were hitherto dominated by local cliques and party bosses.

Source: Deininger 2001, *World Development Report 2002* background paper.

technical, administrative, and legal impediments may cause this problem. For example, in Indonesia and Madagascar a lack of coordination between the legal and the fiscal cadastre, or official register of land ownership, prevents the government from knowing how much land it owns.

Land registries that are not publicly accessible raise the cost of transactions. In Tajikistan and several other countries of the former Soviet Union bureaucratic intermediaries are needed because the land registries are closed to the public. In other countries, such as Indonesia, there is separate title recording, which requires extensive cross-referencing between the legal and fiscal systems. This separation affects not only the speed of access (which can be eased by computerization), but also the integrity of the system.

Experimentation through pilot projects helps identify institutions effective for a given context. An example comes from Côte d'Ivoire, where the World Bank is working with the authorities on the Plan Foncier Rural. A pilot project helped to develop the methodology for the systematic clarification and certification of rural land tenure. Mapping and documentation of land rights is carried out by the professional team, accompanied by the land user or owner, neighbors, and village chiefs, moving from field to field within a village area. Any disputes that arise are settled by the entire entourage on the spot. When mapping and documenta-



tion of ownership and user rights are completed, the information is made publicly available so that claimants can openly register disagreements. If no conflicting claims to a parcel have been made within three months, the tenure status is considered satisfied.²⁶

Building effective and accessible rural financial institutions

One study of the rural environment states that

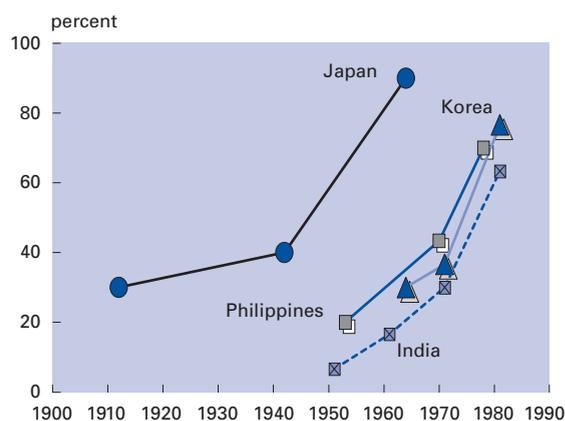
Few banks would even consider making agricultural loans, and those who did charged extremely high interest rates. Rural credit was fertile ground for the loan sharks, and year after year, farmers turned over their crops to help pay exorbitant interest charges on loans made to keep their farms operating. Should a crop fail, the chances of a farmer extricating himself and his family from a loan shark's clutches were virtually non-existent.²⁷

This study was depicting the situation in rural North Carolina in the United States in the early 20th century. The description could apply just as accurately to many developing countries today, where formal institutions such as commercial banks have relatively little incentive to offer services to rural clientele.

Over time, formal credit provision has increased in rural areas of industrial and some developing countries (figure 2.2 shows the evolution for some Asian countries). Increasing prosperity among farmers; better rural infrastructure; integration of the urban and rural financial systems; and the development of complementary institutions such as formal credit histories or collateral systems for rural borrowers, which lower the costs of lending, have all contributed to this increased access to formal credit (chapter 4).²⁸ In some countries, specific rural credit institutions such as cooperative banks and credit unions have also been successfully developed. But the provision of crop insurance for farmers has had mixed results even in industrial countries.²⁹

In industrial countries today, specialized commercial institutions for offering credit, such as microcredit organizations and agricultural development banks, are relatively rare. As markets became more integrated, non-specialized commercial banks began to supply credit to agriculture, supplanting both informal credit institutions and specialized agricultural banks. The financial viability of many of the formal specialized agricultural banks, such as France's Credit Agricole and

Figure 2.2
Evolution of formal institutional borrowing of farm households, selected Asian countries



Source: Desai and Mellor 1993.

Indonesia's Bank Rakyat Indonesia, was improved by pooling agricultural risks with nonagricultural ones. The broader development of financial markets (chapter 4) and the development of complementary institutions such as those for enforcing contracts are also important for this process.

But in many developing countries, effective and accessible formal rural financial institutions are still rare—largely because of the lack of complementary institutions. Accessing finance is particularly difficult for poor farmers. To address this problem, policymakers initially created financial institutions that were specific to the agricultural sector, without much success.

Developing countries have often relied on transplants of rural and agricultural credit institutions that have been successful in the United States, Western Europe, and Japan. Among them are various forms of cooperatives (often adapted from the German *Raiffeisen* model), post office deposit schemes, and state marketing agencies that provided credit. French colonies in Africa built specialized agricultural banks based on the original design of the *Credit Agricole*. Latin American countries have often used lessons from the historical experience of the United States to set up public and cooperative farm credit systems.³⁰

By the late 1980s, most of these institutions had clearly failed. Part of the problem was specific—transplants were not suited to country circumstances. But

other issues also contributed. Urban bias policies, repressive financial policies, and loan targeting to narrow interest groups reduced the financial viability of banks lending to rural sectors. Debt relief programs also raised effective costs for lenders.

As a result, informal financial institutions still dominate in most poorer countries and for poorer farmers. In the mid-1990s, 81 percent of rural borrowing in Nepal was from informal sources, while farmers in Nigeria received 30 percent of their loans from informal moneylenders and 40 percent from *esusu* clubs (cooperative credit arrangements).³¹

Within countries, informal sources of credit are disproportionately used by poorer farmers. Data from Nepal in the 1990s show that 97.5 percent of those with per capita consumption below 2,000 rupees (the very poorest rural group) borrowed from informal sources. No rural borrowers with per capita consumption above 50,000 rupees borrowed informally.³² Surveys from India and Pakistan show similar results.³³ In Thailand a study found that nonborrowers and those who borrowed exclusively from the informal sector tended to have fewer assets as well as lower incomes. Only the largest farmers borrowed from commercial banks as well as some farmers associations, and informal loans were also smaller in size.³⁴

But the mix between different types of informal lenders has changed with the increased commercialization of agriculture.³⁵ In India, Pakistan, and the Philippines studies report that crop loans from moneylenders and landlords have been replaced by loans from “commission agents,” or traders, who advance credit to buy inputs against a promise that the farmer will sell the produce through them at harvest.³⁶ These arrangements are usually better for the poorer farmers because they provide access to otherwise unavailable input and marketing arrangements (see box 2.1).

Improving rural lending institutions

Information and enforcement issues are fundamental problems faced by both informal and formal lenders in agriculture. Lenders overcome these problems through a range of institutional mechanisms, which can be “secured” or “unsecured” (table 2.1).

Secured loans, offered in exchange for some collateral, are the preferred option for most formal lenders in rural areas because such loans automatically lower information and enforcement costs.³⁷ Assessing the value of collateral and selling the collateral in case of default can be costly. But in environments with overall

Table 2.1
Types of rural lending institutions

Type of loan	Informal institutions	Formal institutions
<i>Secured</i>	Pawnbrokers Moneylenders who take possession of land titles Labor-pawning institutions	Commercial banks Rural development banks Government credit programs Mortgaged credit from traders (sellers of inputs)
<i>Unsecured</i>	Moneylenders Credit from traders (purchasers of output) Credit from traders (sellers of inputs) Friends and family Savings groups (including ROSCAs, ASCRAs, and chit funds) Labor-bonding institutions	Some credit unions Credit cooperatives Farmers' associations Nonbank financial institutions (e.g., insurance companies) Microcredit groups

Note: ROSCAs are rotating savings and credit associations; ASCRAs are accumulated savings and credit associations. Labor pawning, a historical artifact, involved offering a family member's labor as security. Labor pawning was prevalent in precolonial West Africa (Austin and Sugihara 1993).

weak formal institutions, these costs are still cheaper than the costs of gathering credit information about many small and scattered borrowers or of attempting to enforce a contract through an inadequate legal system.

Building effective systems for secured transactions can promote the development of formal rural financial institutions (chapter 4). In some developing countries, the use of formally collateralized loans is quite limited. Land cannot be used as collateral if legal claims, such as laws limiting “ownership” of seized land to use rights only, are not clear. In some developing countries many assets, such as warehouse receipts or inventory credit, are still not recognized as collateral. Indian law explicitly recognizes warehouse receipts as title documents, but there is no such recognition in Ghanaian law. One way around this enforcement problem is to use movable property as collateral—it can be given to the creditor to hold.

Collateralized loans tend to be given mostly to larger farmers in developing countries. For the lender, such farmers usually have two advantages over poorer and

smaller counterparts. First, collateral is easily available—their property rights over land are more likely to be formally registered, and they are more likely to have movable property of high value. Second, because loan amounts are larger, the lender's unit cost of processing the loan or using the formal judicial system for enforcement are lower.

Poorer farmers often rely on *unsecured loans* from both formal and informal sources. Rural credit institutions in developing countries, whether formal or informal, gather information about the borrower's reputation by word of mouth. These institutions are usually localized and have easy access to information. A study for Thailand, for example, found that informal lenders are often the shopkeepers in the village because the store acts as a center for village gossip and thus information.³⁸ Some formal institutions, such as credit unions and cooperatives, also tend to be localized and can use past credit history with the institution itself as the main guide for future lending.

Formal and informal lenders, and large and small rural borrowers, interact in complex ways in financial markets in developing countries. Formal lenders such as commercial banks lend directly to the larger farmers and traders for their personal use. But they may also make wholesale loans to traders, who then act as informal lenders, making retail loans in smaller amounts to small farmers and middlemen (box 2.8).

How can rural lending institutions be improved? Experimenting with context-specific institutional design and using new technology to reduce costs are two promising avenues.

The design of new rural lending institutions can be improved by incorporating innovations based on the successful elements of informal institutions and formal interventions. Social and peer pressures, which are particularly effective enforcement mechanisms in informal lending, can contribute to the success of formal rural credit programs in weak institutional environments.³⁹ Newer microcredit institutions, including those backed by the World Bank and other donors, have adapted many of the same mechanisms for inducing repayment.⁴⁰ Some nongovernmental organizations (NGOs) are also trying to emulate informal lenders by serving as a bridge between banks and poor borrowing groups. MYRADA in southern India acts as such an intermediary, aiming to help borrowing groups deal directly with the banks after a few loan cycles.

Successful rural finance institutions cannot always be transplanted from one socioeconomic environment

Box 2.8

The intersection of formal and informal lending: marketing agents in the Philippines

Rice marketers in the Philippines—paddy traders, rice millers, wholesalers, and retailers—act as moneylenders primarily to establish a claim over the farmers' produce and to ensure that they are part of the trading chain. A key to their success as credit intermediaries is that in the absence of sufficient resources of their own, the rice marketers borrow much of their lendable capital (80 percent in one survey) from formal financial institutions. The traders' intimate knowledge of and close contact with the farmers and subsidiary traders ensure that information and enforcement costs are low and that repayment rates are high. Moreover, the rice marketers are a good risk for formal institutions because they have a good history of repayment and the size of their loans is relatively large. These informal rural lenders may also use banks as places to keep their savings.

Source: Floro and Ray 1997.

to another. Experimentation around a basic institutional form has been a good way to identify successful institutions. So thriving microfinance institutions around the world differ in operational details. Innovations on different aspects, such as the targeted group and the repayment periods, have been altered to suit the characteristics of different countries.

Giving incentives to loan officers, and rebating a small part of the loan for early repayment, the Unit Desas, part of Bank Rakyat Indonesia (BRI-UD), improved the repayment rate (to 92.5 percent in 1995).⁴¹ Successfully experimenting with its institutional form, such as the size and composition of its "solidarity groups" of borrowers, BancoSol in Bolivia has grown from a subsidized lending program operated by an NGO to a self-sustaining commercial bank. Learning from successive experiments about how to adapt credit delivery to the local context and farmer needs, an Albanian rural credit program funded by the World Bank grew from offering small-scale credit in seven village credit funds in 1992 to a full-scale rural development project supporting hundreds of village credit funds by 1995 and a follow-up microcredit project since 1999.⁴²

Experimentation helps to understand the impact of a rural finance institution. For example, an element of the Grameen Bank's programs is the requirement that borrowers repay their loans in small installments according to a rigid (weekly) schedule.⁴³ Imposing a regular repayment schedule can be costly, however. It re-

duces the attractiveness of long-gestation projects, such as those in agriculture, and helps to explain why informal lenders appear to thrive even in villages where microfinance programs are active.⁴⁴

Technological innovations can also help credit provision. First, the continuing extension of credit-rating services to rural areas brings the promise of eventual integration of urban and rural banking, as has occurred in industrial countries. So far, such information intermediaries are developing mostly in middle-income countries, such as Argentina.⁴⁵ “Meta-information intermediaries” are also being developed. These rate financial intermediaries themselves rather than their clients, the first step in the development of credit reference bureaus. Further, they offer financial information in a standardized format. The Micro-Banking Standards Project, funded by the Consultative Group to Assist the Poorest, has recently collected, analyzed, and published data on the financial status of participating microfinance organizations.⁴⁶ Micro-Rate, a private credit-rating agency that specializes in evaluating micro-lenders, offers a similar service.⁴⁷

Second, information technology can reduce transaction costs for both state and private actors. For example, Compartamos, a Mexican NGO, has started giving its field staff inexpensive handheld computers to record data, thereby reducing paperwork and speeding synchronization of data. This has allowed field staff to access and update records far more easily.⁴⁸

Some institutional designs tailored to poor rural areas have been successful. Small minimum balance requirements and liquid savings products are attractive to rural borrowers. In such schemes offered by some rural banks in Asia and Latin America, lenders offset high unit costs by having interest rates increase with the account balance. Administrative costs can also be lowered by maintaining lean field offices and offering efficiency bonuses to motivate staff to be more productive.⁴⁹

Many of the elements explaining the successes of institutions such as the BRI-UD in Indonesia and the Bank for Agriculture and Agricultural Cooperatives in Thailand can be found in any successful institution.⁵⁰ These include simplicity in financial contracts, transparency in operations, and integration across markets. Operational autonomy and freedom from political interference are critical for providing the institutions with the freedom to experiment with the terms and types of financial products offered.⁵¹ Moreover, successful rural financial institutions tend to be large, usually serving millions of households. This allows them to reduce

transaction costs and risks by realizing economies of scale and diversifying their portfolios.⁵²

The most successful institutions began by financing mainly nonfarm activities and started making agricultural loans only after they had grown into mature institutions. A striking aspect of successful rural financial institutions is that they all operate in relatively densely populated rural areas.⁵³ Geographic density reduces costs of transactions and makes it feasible, for example, for SafeSave in Bangladesh to send out staff to collect savings from its members on a daily basis.⁵⁴ Thus there is a question whether these designs can exist in sparsely populated countries.

Developing rural savings institutions

Besides access to credit, safe and liquid *savings* instruments are vital for farmers' well-being. In the absence of loans, savings are the only resource for investments. They also provide “self-insurance” against the periodic shocks to income common to agriculture, as farmers add to savings in good times and draw on their savings when times are difficult. Market women in rural parts of western Africa often save their daily earnings by giving them to *susu* men (itinerant savings collectors). The fact that the depositors are willing to pay the deposit taker a fee suggests that there is a demand for safekeeping institutions.

Savings institutions in rural societies are still informal, and savings are often not in financial assets. Rural households in developing countries save in physical assets such as livestock and jewelry. This does not always provide security because these assets may not hold their value in bad times. The success of such a strategy also depends on the level of development of the market for that asset (box 2.9).

The development of formal rural savings institutions, as with rural credit institutions, is inhibited by high costs of operation. Governments have attempted to provide savings facilities in rural areas. But these efforts, on average, have failed to cover their administrative costs. Even some of the fast-growing microfinance programs have relied on external agencies or governments for their sources of funds. The only major exception has been BRI-UD in Indonesia, but here the flow of savings has been from the rural sector to the urban sector.⁵⁵

Insuring against risk in agriculture

Agricultural risk is considerable and covariant—usually all borrowers in an area are affected similarly. These problems are compounded by information problems,

which are especially large in developing countries. For crop insurers, specific events such as floods or a locust attack are verifiable, and thus these risks are insurable. But when the yield on an insured crop is reported to be lower than expected, the reasons can be many and are difficult to untangle, and the true value of output is hard to verify. Insurance also provides incentives for fraud or “moral hazard” (low effort or investment by the farmer).

As a result, formal insurance mechanisms for agricultural households are difficult to implement even in richer countries. Unsuccessful attempts to offer generalized crop insurance in developing countries have contributed to the decline of agricultural banks.⁵⁶

In both industrial and developing countries, premiums collected in general agricultural insurance schemes have never been enough to offset the indemnities paid out to farmers (figure 2.3). The situation is clearly worse when high administrative costs are added to the costs related to monitoring the insured. These schemes have historically needed significant government subsidies to stay operational.

Narrowly focused “named-peril” schemes are the only agricultural insurance mechanisms that have functioned without large government subsidies; they have succeeded precisely because they minimize the potential for deception by farmers and do not depend on the farmers’ actions or investment. In industrial countries today, agricultural insurance is offered only as event insurance, for example against hail or floods—risks whose occurrence is relatively easy to monitor. In the United States, named-peril plans are the only mechanisms offered by private insurers without government subsidies.⁵⁷

If general crop yield insurance is to be provided in developing countries, it is likely to require subsidies, even if administrative costs are kept at a minimum. A 1995 study of a general crop insurance scheme in India confirmed that it offered considerable subsidies.⁵⁸

Given the limited availability of formal insurance for farmers in developing countries, most insurance arrangements are informal.⁵⁹ A study of northern Nigerian villages found that credit contracts were dependent on the nature and amount of shocks affecting borrowers, with lenders bundling credit and insurance.⁶⁰

“Social insurance” agreements between members of a village stipulate that those who are better off once crops are harvested and sold are required to make transfers to the needy. Sometimes, as when individuals have an incentive to leave the community, enforcing this agreement so that these transfers actually occur can be

Box 2.9

Livestock as savings: contrasting evidence from India and Burkina Faso

Faced with risky environments, rural households often rely on the sale of assets to smooth consumption in the face of income shocks. The main assets that farm households possess are productive assets, in the form of land or livestock. Unlike land, livestock is portable and may offer a useful way for households to buffer against production shocks. In an influential article, Rosenzweig and Wolpin (1993) presented evidence that the sale of livestock, notably bullocks, is used as a consumption-smoothing device by rural households in India. The market for bullock sales and purchases is well integrated regionally, with 60 percent of bullock sales in the sample villages taking place with buyers outside the village. As a consequence, bullock prices do not seem to vary with village-specific production shocks, an important consideration for choosing an asset that one might have to sell in bad times.

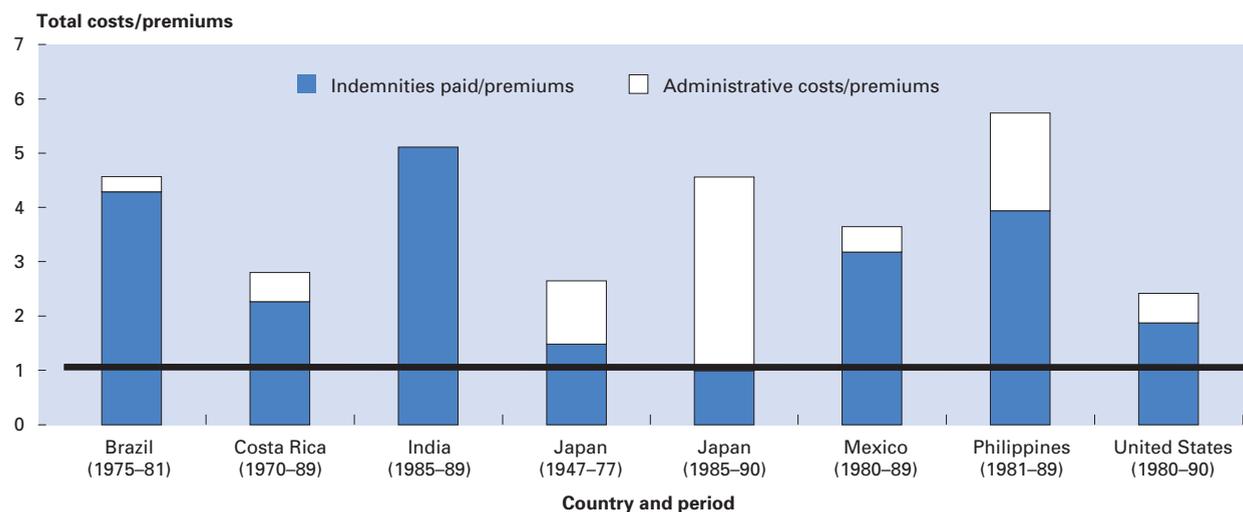
An interesting contrast is provided by Fafchamps, Udry, and Czukas (1998), who examined livestock sales and purchases in Burkina Faso and found very little evidence of a similar phenomenon. What explains the difference in these two sets of findings? Livestock markets in rural Burkina Faso, which is much less densely populated than India, are less integrated. Furthermore, the more widespread the agricultural shock (in the case of Burkina Faso, the study period included a drought that affected large parts of the country), the more contemporaneous are household decisions to sell livestock, and the lower the efficacy of sales in smoothing consumption.

difficult (chapter 9). Village-based mutual insurance is also limited because the main sources of risk affect the entire community. Informal insurance arrangements thus face a difficult tradeoff. The very factors that make these informal risk-sharing mechanisms work—geographic proximity and social ties—also limit participants’ ability to diversify as a way to lower risk.⁶¹

Building effective institutions for agricultural technology and innovation

Two centuries ago, Thomas Malthus argued that the world would exhaust its food supplies because population grew geometrically but agricultural production grew arithmetically. Technological change has proved Malthus wrong. Agricultural innovations—such as high-yielding seeds, herbicides, fertilizers, agricultural machinery, and resource management techniques—allowed food production growth to outpace population growth. One of the fastest ways to increase agricultural productivity rapidly is the adoption of new agricultural technologies. Rapid productivity growth boosts farmer incomes and helps farmers manage risk.

Figure 2.3
Financial performance of generalized agricultural insurance programs



Note: The height of the bars indicates the sum of indemnities and administrative costs as a ratio to premiums collected. For premiums to fully cover costs, this ratio should not exceed one. The figure for India does not include the 1989 rabi season, and data for administrative costs are not available. For Japan data are for paddy only, and administration cost data are based on 1989 only. For Mexico figures are for crop insurance only.
 Source: Hazell 1992.

The Green Revolution in South Asia during the 1960s and 1970s illustrates the benefits of agricultural technology. During the Green Revolution small farmers dramatically increased their productivity by adopting high-yielding rice and wheat varieties and using complementary inputs of irrigation and fertilizer. The Green Revolution also generated secondary income effects for landless households.⁶² More generally, new technologies have more than doubled global crop yields over the last four decades.⁶³ Between 1965 and 2000 productivity gains in output per hectare of cereal crops averaged 71 percent globally.⁶⁴

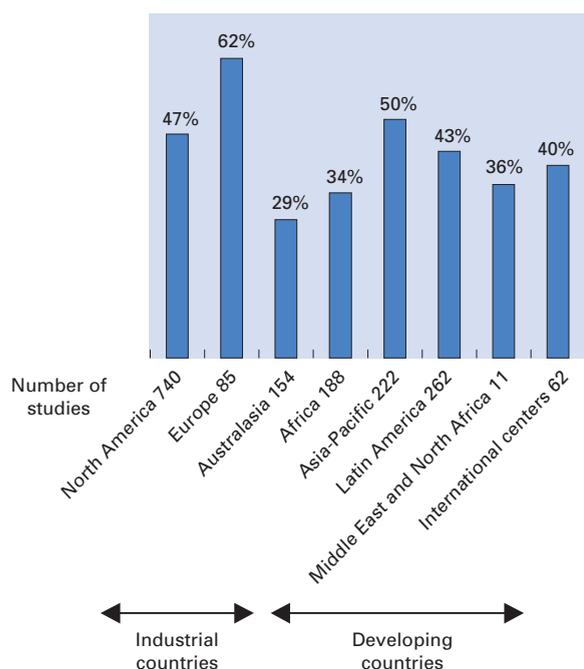
Research to develop agricultural technologies, as well as extension services to deliver them, generate high social rates of return across regions—usually more than 30 percent (figure 2.4).⁶⁵ Newer irrigation management techniques, as well as seeds resistant to drought and to pests, have helped to reduce risk. Finally, as discussed in *World Development Report 2000/2001*, numerous studies show that the poor benefit from advances in agricultural technologies, not only through reduced risk, but also through increased demand for their labor and lower food prices.

Many agricultural technologies have characteristics of public goods. That is, they may be at least partially

nonrival (one person's use does not lower another person's benefit from it) and nonexcludable—a person who does not pay for the product can still receive it (table 2.2). Private firms will not supply goods and services based on these technologies because they cannot restrict the benefits from the technologies to only those who paid for them. Farmers may not pay for marketing information, for example, if they are able to receive it free from friends and peers. One study in the United States estimated that between 1975 and 1990 private returns to seed companies were only 10 percent of social returns for nonhybrid seeds.⁶⁶

These problems are compounded by the large externalities associated with new agricultural technologies. For example, a farmer may impose a negative externality on his neighbors by failing to vaccinate his livestock against a disease that then spreads to their herds. Conversely, natural resource management techniques produce positive externalities by protecting the quality of resources for future generations. As the Green Revolution showed, adopting new agricultural technology has significant positive externalities for the rural poor. Finally, the lengthy time needed to develop new technologies and the uncertain payoffs can lead to less private research than would be socially desirable.

Figure 2.4
Median rates of return on agriculture research and extension by region



Note: Rates of return include private and social returns on investment for both extension and research programs between 1953 and 1998.
 Source: Alston and others 2000.

Taken together, these characteristics of agricultural technology suggest a need for at least some public involvement in the development and delivery of agricultural technologies. The question is, to what extent and in what form?

Public institutions that have provided agricultural technology are under pressure to reform. Fiscal pressures and criticism for inefficiencies have slowed financial support for public institutions in many countries. Moreover, technological shocks, such as the advent of new biotechnologies, and global movements to strengthen intellectual property rights have focused attention on the role of the private sector in developing agricultural technologies. Liberalization of entry into agricultural research and extension services, as well as increased competition, have strengthened existing institutions and led to innovative institutional designs. Better information sharing between providers and users of technology—often through decentralization and through international arrangements among technology providers—has also improved institutional quality.

International experience has shown that for private goods technologies such as machinery and biotechnology for commercial farms, research and extension services can be left to the private sector. Public involvement is required only for public goods, such as knowledge-based technologies, and where there are strong market failures and externality effects (such as the secondary effects of technology for poor households). Yet even in these cases, public involvement does not necessarily translate into public provision or monopoly. Moreover, in research there are potentially large payoffs from regional collaborations among several countries—particularly for smaller and poorer countries, where research capacity is low and markets are small.

Delivering existing agricultural technologies to farmers

One of the primary barriers to the adoption of new agricultural technology is lack of knowledge.⁶⁷ Extension services are an institution aimed at filling this gap. Another major barrier is overregulation of agricultural technology transfer. This section discusses these two factors.

Extension services. The main functions of extension services are twofold: to inform farmers of new products and techniques, and to gather and transfer information from farmers to other participants. This includes collecting feedback on farmer needs as input for research priorities, and learning techniques from one farmer and sharing them with others, for example, irrigation techniques.

In the 1950s and 1960s large-scale extension systems emerged when governments throughout the world invested heavily in services for delivering new agricultural technologies.⁶⁸ Estimates show that public sources provide 81 percent of total extension services, with universities, parastatals, and NGOs accounting for 12 percent, and the private sector accounting for only 5 percent. Most of the private sector extension services are provided in industrial countries.⁶⁹

The benefits of extension services are enormous—more than 80 empirical studies have demonstrated that extension services generate rates of return averaging more than 60 percent.⁷⁰ Numerous other studies show that extension services substantially improve technology adoption rates, awareness, and productivity.⁷¹ These returns are not only for dissemination of sophisticated technologies. Information sharing on rural technology,



Table 2.2
Where will the private sector invest in agricultural technologies?

Type of good	Public good	Common pool	Toll	Private
<i>Features</i>	Nonexcludable and nonrival	Rival but not excludable	Excludable but nonrival	Excludable and rival
<i>Examples</i>	<ul style="list-style-type: none"> ■ Weather forecasts ■ Market information ■ Livestock management techniques ■ Fertilizer application schedules ■ Natural resource management techniques 	<ul style="list-style-type: none"> ■ Self-pollinated seed varieties ■ Shared fishery, common pasture management techniques 	<ul style="list-style-type: none"> ■ Soil analysis ■ Farm management computer programs ■ Training courses and private consultation in farm management and production practices 	<ul style="list-style-type: none"> ■ Hybrid seeds ■ Biotechnology products (for example, inputs and seeds) ■ Fertilizers, chemicals ■ Agricultural machinery ■ Veterinary supplies
<i>Likelihood of private provision</i>	Very low	Low	Higher	High

Source: Umali-Deininger 1997; World Bank 2000a.

including simple innovations for the poor and illiterate, can have a substantial impact on productivity (box 2.10).

Despite these successes public extension services have been criticized for being inefficient, ineffective, and poorly targeted. In Kenya, for example, an evaluation in 2000 found that government extension services supported by the World Bank did not meet farmer needs and were targeted toward groups that had a low marginal impact on overall productivity.⁷² A 1997 World Bank review of 31 extension projects revealed pervasive problems of inadequate client orientation, weak human resource capacity, and low levels of government commitment.⁷³

Some of the problems in public extension services originate from external factors, such as lack of political commitment and dependence on complementary policies. Another problem is that public extension providers are not always made accountable for their actions, and the capacity to manage large and complex extension schemes is limited.⁷⁴ Three main types of institutional reform for improving extension services are discussed here—*decentralization*, *privatization*, and *separation of funding from execution*. Each reform consists of a different combination of public and private involvement. Other important techniques include more participatory approaches and increased use of the media (chapter 10).⁷⁵

While keeping both service delivery and funding within the public ambit, several countries have *decen-*

tralized public extension institutions. This strategy involves transferring responsibility for administrative, fiscal, and political decisions from central to local or regional authorities—usually to government agents but potentially to community groups. By bringing decision-making closer to clients, decentralization can increase information flows, build local capacity, and improve accountability. This in turn can improve efficiency, service quality, and access. After the decentralization of extension in Colombia, costs per farmer fell 10 percent, the area covered by extension services tripled, and the number of beneficiaries more than doubled.⁷⁶

Despite its potential, decentralization of extension services presents three major challenges. A national framework is required to avoid confusion of responsibilities between administrative levels and wide variations in quality. Also, decentralization should not apply uniformly to all extension functions. Some activities, such as policy development, highly specialized technical support, and market information services (in which there are more significant economies of scale), can be conducted more efficiently by centralized authorities. Finally, local governments may lack capacity to implement these new institutional responsibilities. (For example, in the Philippines inadequate linkages between research and extension services were exacerbated by decentralization.)⁷⁷

A second strategy is the *privatization of public extension services*. The private sector is likely to invest in dis-

Box 2.10**Creating an information-sharing network for the poor: SRISTI in India**

In Gujarat, India, a seven-year-old NGO, SRISTI, has pioneered a pathbreaking way for poor farmers to tap into the innovations of their compatriots in the 5,500 villages scattered across the state. Volunteer workers armed with laptop computers travel from village to village searching for low-cost innovations that can improve the earning power or quality of life for poor villagers. Innovations covered in the SRISTI database include an eminently affordable (less than \$10) shoulder-carried pump that can be used to spray the small fields that most poor farmers cultivate and a small stopper that, when attached to rope-and-pulley systems in wells, allows women to rest during the fatiguing process of drawing water. These innovations are catalogued in a database and then circulated through a quarterly newsletter. Work is under way to disseminate the database on-line, with villagers retrieving information through kiosks. To improve access for the illiterate, the kiosks can provide data through a voice interface. By directly addressing the informational constraint faced by dispersed rural communities, SRISTI has a tangible impact on easing the burden of poverty for its constituents.

Source: Slater 2000.

semination of goods where knowledge is embodied in the technology itself—for example, in hybrid seeds. The private sector is also better able to extract a return from extension services in commercial farming, even for technologies with public goods characteristics. As illustrated in Argentine dairy farming, private agroprocessing and marketing firms that contract with farmers may provide extension services for knowledge-based technologies as well as for private goods (box 2.11).

Privatization of extension services has enhanced competition and helped develop more effective institutions. For example, partial privatization in the Netherlands reduced overhead expenditure by 50 percent and increased farmer satisfaction ratings by 40 percent.⁷⁸ Commercial providers are not the only solution. Institutions for collective action such as farmers' associations have played a central role in delivering extension services—as in the Central African Republic in the early 1970s.⁷⁹ Complete privatization, however, can lead to underprovision of public goods or make extension services unaffordable for small and subsistence farmers, as was the case in Chile in the 1970s.⁸⁰

Separating *public provision of extension with private funding* usually involves charging farmers a fee to cover

Box 2.11**Private sector extension services in Argentina**

During the 1970s the productivity of Argentine dairy farming was seriously hampered by poor cattle nutrition and poor farm hygiene. Faced with unstable supply and quality problems, the two largest dairy processors—Santa Fe–Cordoba United Cooperatives (SANCOR) and La Serenisima—established extension services for their suppliers. SANCOR's program included financing for agronomist technical assistance, farm visits, artificial insemination services, and accelerated heifer-rearing programs. By 1990, 120 farmers' groups were participating in the program, and each group had assumed responsibility for the cost of technical assistance. La Serenisima created 25 extension branch offices, each of which provided technical assistance to groups of up to 25 medium-to-large-scale farmers. La Serenisima's program also made extensive use of press and broadcasting media to inform farmers of livestock management techniques.

The results of these private extension efforts were extremely positive. Although the number of dairy farms supplying SANCOR decreased by 24 percent, milk production increased by 15 percent between 1976 and 1985. Milk production for La Serenisima jumped by almost 50 percent despite a 6 percent decrease in dairy farm areas of suppliers.

Source: Umali-Deininger 1997; World Bank 1989a.

a portion of the cost of the extension service and has the obvious benefit of cost recovery. This type of institutional design may also increase competition by encouraging alternative providers to enter the extension market. Moreover, the fee payment increases the accountability of service providers to farmers. An innovative approach in Nicaragua that introduced paid extension services significantly improved cost-effectiveness and led to a more responsive service. Even poor farmers purchased extension services.⁸¹

The separation of funding from execution can also take the form of *private provision with public funding*. The main advantage of this separation is to stimulate competition among private sector providers to improve efficiency and service quality. Contracting private providers in specific functions of extension has proved a successful reform strategy in countries ranging from Estonia to Madagascar. In Nicaragua the government has financed extension services by issuing to farmers vouchers for extension services that could be redeemed with either private or publicly provided extension.⁸²

Deregulation of input markets. Institutional obstacles often restrict the delivery of new technology. Although



most industrial countries have liberalized agricultural technology markets, governments in developing countries tend to overregulate the transfer of agricultural technologies. This is particularly the case in seed markets, but it also applies in markets for machinery, fertilizers, low-risk pesticides, and feed mix.⁸³ Overregulation is of special concern in developing countries, since it creates opportunities for corruption in less transparent environments and may hinder innovation.

Several types of barriers are applied. First, many developing countries restrict competition, by limiting channels for the introduction of inputs to parastatal monopolies or by controlling market entry. Second, governments have introduced complex systems for testing, approval, and release of new varieties. In particular, compulsory registration and certification of seed varieties, often designed on the basis of public seed-breeding programs, are unsuited to testing seeds from private plant-breeding programs.⁸⁴ Finally, key channels for technology transfer, such as trade, technology licensing, and foreign direct investment, are often restricted in developing countries.

Removal of various regulatory barriers and introduction of more flexible standards encourages greater private sector participation in both research and distribution. A powerful illustration of these effects took place in Turkey during the 1980s, when deregulation of the government seed production and sales monopoly (supported by the World Bank) significantly increased introduction of new seed technologies. As a result the returns to maize yields increased by 50 percent and income per hectare rose by \$153—equivalent to an annual net economic gain of \$79 million.⁸⁵ Similar examples exist in the deregulation of agricultural machinery markets in Bangladesh, seed markets in Peru, and agricultural input markets in Zimbabwe.⁸⁶

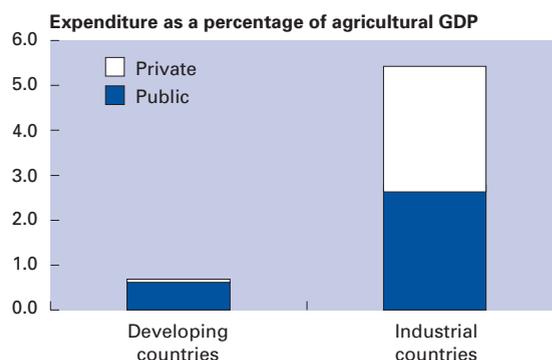
Besides reducing import and entry barriers to agricultural technologies, competition and information flows are stimulated by (a) introducing voluntary seed certification systems, supported by incentives for certification and enforcing strict disclosure laws for information on seeds and other agricultural inputs; (b) introducing voluntary seed varietal registration or, as an interim measure, introducing automatic registration for seeds approved in selected other countries; and (c) maintaining only those regulations that address genuine public health and environmental externality concerns, but not on the grounds of protecting farmers from potential misinformation.

Developing new technologies for agriculture in developing countries

Research to develop agricultural products presents fundamental institutional challenges. First, it is often long-term and risky and can require significant human resource capacity. Also, agricultural technologies often have public goods characteristics and generate externalities. Third, there is a tension between economies of scale in research and development (R&D) and the need for location-specific technologies. The existence of economies of scale in R&D suggests that research activities should be concentrated. But many agricultural products must be tailored to local conditions, such as climatic and soil conditions—a fact that suggests a need for fragmentation in research. For example, frost-resistant wheat developed for Canadian farmers is of little value to farmers in Sudan. This effect is compounded by the information gaps between researchers and users, which suggests that research institutes need to have effective communication with end users, often through physical proximity.

In developing countries, the demand for location-specific technologies may be too small to attract private sector investment, as evidenced by the lower levels of such investment (both absolute and relative to gross domestic product) in developing countries (figure 2.5).⁸⁷ Similarly, patterns of research expenditure indicate that most private R&D on agricultural seed focuses on development products with longer shelf life, herbicide resistance, and greater suitability for mass production

Figure 2.5
Agricultural research intensity, public and private, 1993



Source: Pardey and Beintema 2001.



techniques. In contrast, developing country priorities are often greater nutritional content and robustness.⁸⁸ With some exceptions, notably in research for export crops, the private sector invests little in adapting technologies to local conditions or refining agricultural resource management techniques in developing countries. These are areas of high social returns.⁸⁹

Location-specific technologies for developing countries are more likely to require public intervention and local research or adaptation. Three main institutions affect innovation in agriculture: intellectual property rights, agricultural research institutions, and competitive grants and negotiated contracts.⁹⁰

Intellectual property rights and private sector research. Intellectual property rights (IPRs) protect the rents from innovation by regulating replication. R&D costs of developing some agricultural technologies are high compared with technologies in some other industries. For example, it is estimated that new plant protection chemicals cost more than \$150 million to develop.⁹¹ Also, private firms are less able to appropriate the returns from agricultural technologies than from those in many other industries. In agriculture, products can be readily imitated through reverse engineering, or seeds can be bred and resold.

Yet much of the empirical evidence on the benefits of IPRs is inconclusive (see chapter 7 and *World Development Report 1998/1999*). Critics note that numerous agricultural inventions were made without the protection of IPRs, even for private goods. Also, the protection conferred by IPRs is highly limited for some technologies—it would be difficult for a technology producer to enforce IPRs against a heterogeneous group of small farmers who save and replant seeds for their own use. Because of this, private sector investment has concentrated more on seeds with built-in protection for intellectual property. Examples include genetically transformed seeds that will not germinate after the first crop and hybrid seed technology that increases yields and resistance by combining varieties so that the seeds do not breed true and subsequent crops do not perform as well.

The lack of empirical evidence on the benefits of IPRs and the problems with their enforcement raise questions about whether IPRs create value. A more serious concern is that IPRs may impose substantial costs on developing countries. IPRs balance the need to create incentives for innovation with the need to ensure fair access to new technologies. If IPRs are excessively

strong, they can reduce access to agricultural inventions by increasing prices, as documented by various studies, and can potentially enable restrictive business practices.⁹² In this scenario, poorer farmers in developing countries will not have access to wealth-enhancing opportunities because they will be unable to afford new technologies. Furthermore, technology development could be hindered when new products are dependent on many other IPRs, raising the costs of innovation. The genetically modified “golden rice,” which has the potential to alleviate vitamin A deficiency, a major cause of blindness and immune dysfunction in poorer countries, is reported to be developed with technologies protected by up to 70 patents from 31 different organizations.

Two main strategies can help ensure that IPRs maintain incentives for innovation but do not restrict access to new agricultural technologies in developing countries. The first strategy concerns the type of IPR system that is implemented. Under the 1994 Trade-Related Aspects of Intellectual Property Rights Agreement (TRIPS), which sets minimum standards for IPRs in member countries of the World Trade Organization, two types of plant variety protection systems are permitted—patent protection, or a *sui generis* system (meaning a design unique to the context).⁹³

The difference between these two options is vast. Under a *sui generis* system, farmers can replant seeds saved from a previous crop, but under a patent system they are generally prohibited from doing that. Similarly, a *sui generis* system allows breeders to use seeds freely as they research new plant varieties; a patent usually forbids such use. By choosing the option of a *sui generis* system over patents, therefore, countries can help to maximize farmer and breeder access to new plant varieties. Argentina, Chile, and Uruguay are examples of countries that have already successfully implemented *sui generis* systems with clauses to help protect farmers' access to plant varieties.

The second strategy being followed is to build the capacity to manage intellectual property. This approach is also relevant for public research institutes in industrial countries, where intellectual property has required these institutions to invest in resources, appropriate policies, and systems to manage it. In developing countries, managing intellectual property includes seeking partnerships and development assistance from private technology producers.



Some successful examples of capacity building exist. The Kenyan Agriculture Research Institute (KARI) and Monsanto established a partnership to develop virus-resistant sweet potatoes, with Monsanto providing royalty-free licensing of intellectual property, direct funding, basic research components, and technical assistance for KARI to develop and test the product in preparation for its release in 2002.⁹⁴ In Mexico a multinational corporation contracted to sell intellectual property to large-scale farmers in the lowlands but donated the technology to small, poor farmers in the highlands. In both cases, the private firms enhanced their public relations image at little opportunity cost, since neither Kenyan nor highland Mexican farmers would have purchased the technologies without the donation.

The potential of these arrangements is limited, however, because they apply almost exclusively to segments of markets, such as marginal farming areas or markets in small and poor countries, that would not support a private sector return. The arrangements also require significant negotiating power and are highly unlikely to be sustained if farmers develop the capacity to pay for technologies.

Public research institutions. Agricultural technology markets in developing countries often cannot support private sector returns, even with IPRs, and there are public goods and externality effects. So some level of public sector involvement is required. One such form of involvement is public agricultural research institutes. Currently, national agricultural research institutes (NARIs) account for a large share of agricultural research activity in almost every country and yield high returns on investment (see figure 2.5).

Despite this record, public research institutes are under pressure to reform. They have been criticized for stifling competition by crowding out efforts of the commercial sector. Furthermore, two types of information asymmetries—those among public research institutes themselves and between the institute and the farmer—have caused waste. One study revealed that 40 percent of African wheat-breeding programs would have generated higher returns by screening and adapting foreign wheat varieties rather than by locally breeding new varieties. Open information sharing could help build better institutions. Public research institutions have also faced widespread criticism for lacking information on farmer needs and the incentives to respond to those needs.⁹⁵

These pressures for institutional reform are reinforced by a global slowdown in rates of public agricultural research investment over the last two decades.⁹⁶ Some NARIs have faced drastic cuts; in Russia, for example, funding for some agricultural research institutes plummeted by more than 50 percent during the 1990s.⁹⁷

Two strategies have proved effective in addressing the competition and informational problems facing many public research institutions. These are to clarify the public research mandate, and to introduce mechanisms for information sharing among stakeholders in research.

Under the first strategy, specific priorities and responsibilities for the public sector, based upon public goods and externalities issues, are identified. Key areas for public sector research include plant breeding for crops and environments that are overlooked by the private sector but that will generate social returns, and public research where the primary products are information and advice, such as resource management techniques and prebreeding products.⁹⁸ Malaysia, Zimbabwe, and the Maghreb countries are all examples where NARIs are refocusing on smallholders rather than commercial market needs for these reasons.⁹⁹ By contrast, refocusing on commercial markets in China weakened public agricultural research output and productivity.¹⁰⁰

The second strategy is to build more effective institutions through open information sharing. Several institutional changes can help address information gaps between technology developers and farmers. For example, farmer representation on governance committees can help to ensure that information on farmer needs is incorporated in research. Successful examples exist in Mali and Zimbabwe. Another approach involves farmers in testing and adapting new products. This helps to refine technologies that meet user needs and can also increase awareness and therefore dissemination of new technologies. For example, farmer testing was a factor in the rapid adoption of the West African Rice Development Association's drought-resistant rice varieties in Guinea.¹⁰¹

Strengthening the links between extension and research services is another way to improve information flows to researchers about farmers' needs and to farmers about new technologies (box 2.12). Research-extension links have, however, had a mixed record of success. In China a pilot scheme to establish research-



Box 2.12**Increasing information flows between farmers and researchers in Ghana**

Historically, different government ministries in Ghana were responsible for agricultural research and extension services. In the late 1990s efforts began to strengthen these linkages. Liaison committees composed of research and extension workers were established in each major agroecological zone. Each committee was charged with producing joint plans for research and extension activities and for conducting joint training sessions, field visits, and on-farm trials. Already, evaluations show that these organizational links have led to more collaboration and information sharing between research and extension, although at a cost of time-consuming meetings and with problems of low monitoring capacity.

Source: World Bank 2000a.

extension centers enhanced information sharing between researchers and farmers. By contrast, a 1997 evaluation of research-extension links in Bangladesh found no change in the responsiveness of researchers to user needs.¹⁰² More successful ventures have provided research and extension staffs with incentives to work together to solve farmers' problems.¹⁰³

User financing for public research can also help to improve information flows between farmers and researchers. User contributions reinforce the implicit contract between public researchers and users, which encourages greater participation in research by farmers, as well as a more client-oriented approach by researchers. This strategy also allows diversification of funding sources.

Another fundamental reform is to make NARIs more autonomous, removing them from direct government control and placing them under new autonomous legal frameworks, with an independent governance structure and more administrative flexibility. Creating autonomous agencies can help to improve information flows by facilitating greater stakeholder participation, both in management decisionmaking and in funding of agricultural research. Autonomous NARIs in some Latin American countries have evolved to resemble private corporations more than government agencies.¹⁰⁴ In practice, however, autonomy rarely achieves the flexibility and stakeholder representation it aims for, largely because of political pressure and flawed implementation (chapter 5).¹⁰⁵

Box 2.13**International spillovers and the CGIAR**

The Consultative Group on International Agricultural Research (CGIAR) exemplifies an institutional mechanism for encouraging international spillovers. The system was established in 1971 under the leadership of the World Bank in response to widespread concern about food security. The 16 research centers of the CGIAR are trustees of more than 600,000 samples of genetic resources—the largest collection in the world. By enabling free public and private access to these resources, the CGIAR system helps ensure that the benefits from these genetic resources are shared across the world. More than 50 percent of wheat varieties and 30 percent of maize varieties released in developing countries are direct transfers from the CGIAR system—and these figures have doubled over the last 20 years as a result of CGIAR efforts. The influence of CGIAR is even greater when local adaptations of technologies originating from the CGIAR system are considered. Approximately 30 percent of new rice, wheat, and maize varieties released in developing countries are adapted to local conditions from CGIAR parent varieties. Partnerships with national agricultural research institutes are also proving fruitful: research collaboration between CIMMYT, a CGIAR center, and South Africa resulted in maize varieties for poor farmers with 30 to 50 percent higher yields.

Source: Byerlee and Traxler 2001; CGIAR 2001.

Finally, sharing information on existing technologies among NARIs generates ideas and improves institutional quality. Public research institutions should focus more on adapting existing foreign technologies to local conditions rather than duplicating existing technologies, as in the wheat-breeding example mentioned above.¹⁰⁶ Promising developments in this direction are the recent initiatives to establish consortiums and contracting arrangements between NARIs and international research agencies, such as the Consultative Group on International Agricultural Research (CGIAR) (box 2.13).

These cooperative arrangements are especially needed for technology development for countries without the human, physical, and financial capacity for research. Through information sharing, research capacity is leveraged rather than built. Spillovers from international research in those agricultural technologies that are global public goods have been shown to benefit both developing and industrial countries. One study estimated that returns from planting or adapting CGIAR wheat varieties are worth more than \$3 billion for the United States alone.¹⁰⁷



Competitive grant funds and contracting. Just as the separation of public funding from public provision offers benefits by enhancing competition in agricultural extension, so it does in agricultural research—competition helps build better institutions.¹⁰⁸ Competitive grant funds (CGFs) achieve this competition in research by separating the execution of technology development from the funding and determination of research priorities. Allocation of funds to research providers is made on a competitive basis by requesting and reviewing research proposals.

In most developing countries CGFs are relatively new, but they are becoming increasingly popular as a means of allocating public funds. This is particularly so in Latin America, where the availability of research suppliers has enabled substantial increases in funds channeled through competitive grant processes. In the United States, where CGFs have operated for decades, one-sixth of public funding for agricultural research is distributed through competitive grants.¹⁰⁹

A central advantage of CGFs is that they stimulate competition in innovative activity. Competitive grants allow allocation of resources to the most efficient technology developers and encourage higher-quality research through competition within the private and public sectors. Furthermore, CGFs can be structured to foster open information sharing. For example, requiring joint proposals from providers encourages economies of scale and scope in innovative activity. Adopting demand-driven agendas that require beneficiaries to participate in the design of funded projects increases the relevance of research, as in the case of the Association for Strengthening Agricultural Research in East and Central Africa. Adoption of new technologies can be accelerated by financing joint research and extension projects, as has occurred in Latin America. Finally, CGFs may also encourage more stability in funding by pooling resources from different government departments or industry sources. That is the case in Australia, where multiple government departments and farmers' associations contribute to CGFs.

Experience has shown three main lessons regarding the use of CGFs. First, CGFs should complement, rather than replace, core funding through regular block grants. It is difficult to meet long-term core research needs of many agricultural technologies through CGFs, which, in order to promote competition, are short term in nature (usually three years).¹¹⁰ Even for long-term core research needs, however, efficiency gains can be re-

alized by shifting block grants away from government research institutes to negotiated long-term contracts between public funding institutions and private and public researchers. Although this strategy is still relatively uncommon in practice, Australia and Senegal are examples of countries that are experimenting with such negotiated contracts.¹¹¹

Second, where there are relatively few research providers—as is often the case in small and poor countries—the potential benefits from introducing competition through CGFs are obviously limited. CGFs entail significant fixed administrative costs, reaching up to 20 percent of funds in smaller countries. Objective peer review of grant applications also becomes difficult in countries with small numbers of researchers. Approximately 40 developing countries employ fewer than 25 researchers, and 95 employ fewer than 200 researchers.¹¹² To overcome these challenges, some countries are beginning to experiment with regional CGFs, such as FONTAGRO in Latin America, which was established to encourage greater competition and more innovative and higher-quality research, facilitate open exchange of information and technology, and build research capacity in the region. A similar example exists in East and Central Africa, and there are plans to establish a CGF for West and Central Africa.

Finally, experience has shown that CGFs are better able to reduce information gaps between farmers and researchers and meet user needs if they have an independent governance body that is representative of stakeholders, including public sector, scientific, and farmers' representatives. Although direct representation of a heterogeneous group of smallholder farmers on CGF selection boards is difficult, intermediary organizations may help to substitute for farmer participation. For example, to promote demand-driven research, the agricultural research center VBKVK in Udaipur, India, requires NGOs that work closely with farmers to participate on the selection boards of CGFs.

Conclusions

Farmers in developing countries can benefit from institutional change that allows them to undertake high-return activities and investments. With the majority of the world's poor living in rural areas and directly or indirectly deriving their incomes from agriculture, such productivity increases can translate into a reduction in poverty for many. Agriculture is still an important economic sector in many of the world's poorest countries,



and a more productive farming sector would also boost overall growth.

The sections in this chapter have outlined a range of institutional options to improve productivity—analyzing those reforms that do not work, as well as those that do. Access to markets, local or global, is an important factor affecting demand for market-supporting institutions and the forces for further change in domestic markets. The benefits from many institutional forms relative to the costs increase when demand for agricultural products rises. For example, the relative costs of collective action by private farmers should decline as the opportunities for gain increase. Marketing institutions such as agricultural cooperatives or standards arise in response to such potential gains. Policymakers have a role in connecting markets, but also in facilitating information sharing on initiatives in other countries. The need to replace existing informal agricultural institutions with more formal alternatives depends on the demand for them and on the existence of supporting institutions.

When building institutions, it is critical to keep in mind how institutions can complement each other. Formal land titles are more likely to yield benefits in

terms of greater investment if there are also credit institutions, formal registries, and courts to enforce titles efficiently. But credit for poor farmers is affected by their ability to use their assets as collateral as well as by the overall growth of the financial sector. Demand for credit, demand for marketing institutions, and demand for formal titles are also linked to access to new technology and the opportunities it provides for income-increasing investments. A mix of public and private initiatives will be needed to meet the needs of developing countries in terms of diffusion of existing technologies and development of new ones. Taking advantage of the flexibility inherent in TRIPS is also important for developing countries.

Before concentrating efforts on a particular institution, policymakers need to think about the most important constraints for a given context. Often, initial efforts can lead to the buildup of pressures for further change—if the right constraints are identified. As countries and communities grow and change, the types of institutions that work change. Encouraging and being receptive to innovative designs, particularly in poor areas, is essential.

