CHAPTER 11

Theories and Strategies for Agricultural Development

> The process of agricultural growth itself has remained outside the concern of most development economists.
>
> — Yujiro Hayami and Vernon W. Ruttan[1]

THIS CHAPTER

1. Describes how the sources of agricultural growth tend to change as development occurs, and considers how theories of agricultural development have changed over time
2. Presents the theory of induced innovation as applied to agriculture and its implications for the types of technologies generated and for institutional change
3. Discusses how transactions costs and collective action may alter the direction of technical change, with implications for asset distribution

THEORIES of AGRICULTURAL DEVELOPMENT

We have discussed the importance of agricultural development for solving the world food-income-population problem. We have considered the nature and diversity of existing agricultural systems in developing nations. We now need to consider means for improving these systems to increase agriculture's contribution to human welfare. In this chapter, we provide an overview of agricultural development theories and strategies. In subsequent chapters we examine in more detail the individual components of the basic strategies outlined here. Our overriding concern is to identify strategies that facilitate growth with equity. We

[1] Yujiro Hayami and Vernon W. Ruttan, *Agricultural Development: An International Perspective* (Baltimore: Johns Hopkins University Press, 1985), p. 41.

explore why agricultural development has occurred in some countries and why it has not (or has proceeded very slowly) in others.

Many theories have been suggested to explain how the basic sources of growth (labor, natural resources, capital, increases in scale or specialization, improved efficiency, education, and technological progress) can be stimulated and combined to generate broad-based agricultural growth.[2] It is clear from historical experience that the relative importance of alternative sources of growth changes during the development process and has changed over time for the world as a whole. It is also clear that institutional arrangements such as marketing systems, price and credit policies, a well-functioning legal system, and transparently enforced property rights play an important role in stimulating or hindering development. Let's examine agricultural development theories and evidence to see what lessons they provide for operational strategies.

Expand the extensive and intensive margins

One means of generating increased agricultural production is to expand the use of land and labor resources. The development of agriculture in North America, South America, Australia, and other areas of the world during colonization was based on using new lands. In some cases indigenous labor was also exploited. The opening up of forests and jungles by local populations in parts of Africa, Latin America, and Asia provide additional examples of expanded resource use. Economists call this increased use of land and labor: *expanding the extensive margin*.

In many of these historical cases, surplus lands and labor were used to produce commodities for both local consumption and export. Reductions in transportation costs facilitated exports. In Thailand, for example, rice production increased sharply in the latter half of the nineteenth century, and much of the increased production went to export markets. In many colonies, exports of primary production were extracted for use in more developed countries, and often a large share of the benefits of these exports was not realized by the local countries but was transferred to the developed countries.

[2] Hayami and Ruttan (*Agricultural Development*) have characterized previous agricultural development theories into six basic approaches: (1) resource exploitation, (2) resource conservation, (3) location, (4) diffusion, (5) high-payoff input, and (6) induced innovation. The first part of the chapter draws heavily on their ideas.

Agriculture in Asia is intensive, even in hilly regions.

Agriculture in Asia is intensive even in hilly regions.

Expansion of unutilized land resources provides few opportunities for substantial growth in developing countries today. In areas of Latin America and Africa where additional land does exist, disease, insect, and soil problems prevent its use in agriculture. Abundant labor is available in many countries, and continued growth of the labor force will generate increases in total agricultural output. However, most growth in per-capita agricultural output will have to come from more *intensive* use of existing resources.

Many methods can be used to achieve more intensive resource use. Early efforts in England, Germany, and other European countries included more intensive crop rotations, green manuring, forage-livestock systems, drainage, and irrigation. In many developing countries, these same factors increased land productivity. Terracing is an effective means of conserving soil productivity in hilly areas of Asia. In the mountainous regions of Central America, grass strips have been used to create terrace-like structures that conserve soil and enhance productivity. Crop rotations are frequently used to enhance soil productivity and control pests. Hayami and Ruttan estimate that agricultural development based on similar types of "conservation" has been responsible for sustaining growth rates in agricultural production in the range of 1 percent per year in many countries, including developing countries, for long periods of time.[3]

[3] Hayami and Ruttan, *Agricultural Development*, p. 52.

While scientists are gaining additional knowledge of the technical and institutional considerations that can lower the cost of conservation efforts, population pressures are creating a need for better ways of sustaining the natural resource base. Hence, conservation is likely to play an increasingly important role in maintaining if not expanding agricultural production in the future.

Another means of intensifying agricultural production is to produce more crops per unit of time through altering cropping patterns or using shorter season varieties so that two and three crops can be produced per acres per year where one or two was produced before. Such production changes usually require scientific input to develop the required seeds, tools, or other inputs to make the double or triple cropping possible. Access to irrigation or surface water sources can facilitate this intensification.

Yet another means of intensification is through a process of diversification and production of higher-valued commodities. This means of intensification is likely to become more important as development proceeds and incomes grow, creating increased demand for higher-valued vegetables and meats. Intensity of production can be changed as well by improving transportation systems to bring higher-valued commodities to urban centers. It has long been recognized that the pattern and intensity of agricultural production vary in relation to the proximity of urban-industrial centers and to the quantity and quality of transportation.[4] Closeness to cities and transport matters because of differences in transportation and marketing costs, in effects on labor and capital markets, in the ease of obtaining new and more productive inputs, and in ease of information flows.

One implication of this ''location'' theory of agricultural development is that countries should encourage decentralized industrial development, particularly in the middle and late stages of development. During these stages, strong linkages between agriculture and markets for inputs (fertilizers and pesticides) and outputs can help stimulate the local economy. Developing nations should improve transportation infrastructure in rural areas.

Diffuse Existing Knowledge

Agricultural development can be stimulated by diffusing knowledge among farmers more rapidly within or across national borders. Existing

[4] Today, economists still draw on theories proposed by Heinrick Von Thunen (1783–1850), who studied the optimal intensity of farm enterprises in relation to their distance to urban areas.

technologies and economic knowledge can be transferred from the more progressive to the lagging farmers, thereby increasing productivity. This idea has provided part of the rationale for agricultural extension systems, particularly in farm management. Unfortunately, in some cases diffusion theory has led to unrealistic expectations of the size of potential productivity gains under the existing level of technology.

Diffusion theory also has led to attempts to directly transfer knowledge and technologies from more-developed to less-developed countries. More success has been achieved with transferring knowledge than with transferring agricultural technologies. Adoption of transferred technologies has been limited except where efforts have been made to adapt the technologies to the new setting.

Develop High-Payoff Inputs

More recent agricultural development theory builds on these earlier approaches but adds the important dimension that the process can be accelerated through provision of new and improved inputs and technologies (particularly improved seeds. fertilizers, pesticides, and irrigation systems). This approach, articulated by Schultz in *Transforming Traditional Agriculture,* is based on the idea discussed in Chapter 7 that farmers in traditional agriculture are rational and efficient given their current resources and technologies.[5] What these farmers need are new high-payoff inputs and technologies to increase their productivity.[6]

The need for high-payoff inputs has been widely accepted because of the success achieved by modern wheat, corn, and rice varieties beginning in the 1950s and 1960s. These varieties are highly responsive to fertilizer, pesticides, and water management and have resulted in substantial growth in agricultural output in many developing countries. Some have argued that the relative absence of these inputs has been one factor holding back agricultural development in Africa compared to other developing regions. The distributional or equity effects and environmental impacts of these inputs, however, have been the subject of much debate and are discussed in more detail in Chapter 12.

Hayami and Ruttan argue that the high-payoff input theory is incomplete because it fails to incorporate the mechanism that induces these new inputs and technologies to be produced in a country. The theory also fails to explain how economic conditions stimulate the development of public agricultural experiment stations and educational

[5] Theodore W. Schultz, *Transforming Traditional Agriculture* (New Haven: Yale University Press, 1964).

[6] Hayami and Ruttan have labeled Schultz's approach the "high-payoff input" model.

systems. It does not attempt to identify the process by which farmers organize collectively to develop public infrastructure such as irrigation and drainage systems. In the next section we explore the induced innovation theory proposed by Hayami and Ruttan to address these issues.

THEORY of INDUCED INNOVATION

Induced innovation theory helps explain the mechanism by which a society chooses an optimal path of technical and institutional change in agriculture.[7] The theory says that technical change in agriculture represents a response to changes in resource endowments and to growth in product demand. Changes in institutions are induced by changes in relative resource endowments and by technical change.[8]

Induced Technical Innovation

Technical change in agriculture can follow different paths. Technologies can be developed that facilitate the substitution of relatively abundant and low-cost factors of production for relatively scarce and high-cost factors. A rise in the price of one factor relative to others will induce technical change that reduces the use of that factor relative to others. For example, if the price of land goes up relative to labor and fertilizer, indicating that land is becoming relatively scarce, technologies such as improved seeds will be developed that can be combined with labor and fertilizer to increase production per unit of land.

This process of induced technical change is illustrated graphically in Figure 11-1. The range of possible technologies in time period 0 can be represented by what Hayami and Ruttan call the *innovation possibilities curve*, I_0*. The specific technology employed in that time period is represented by the isoquant I_0. Production occurs at point A with N_0 units of land and L_0 units of labor, the least-cost combination of those resources given the price ratio P_0. Now, if over time labor becomes more

[7] Induced innovation theory was developed originally by John R. Hicks, *Theory of Wages* (London: MacMillan and Co., 1932). Hayami and Ruttan during the 1960s were the first to apply the theory to agricultural development. Their underlying assumption is that technological and institutional changes are vital to agricultural development.

[8] Hayami and Ruttan (*Agricultural Development*, p. 94) define institutions as "the rules of society or of an organization that facilitate coordination among people by helping them form expectations which can reasonably hold in dealing with others. They reflect the conventions that have evolved in different societies regarding the behavior of individuals and groups relative to their own behavior and the behavior of others."

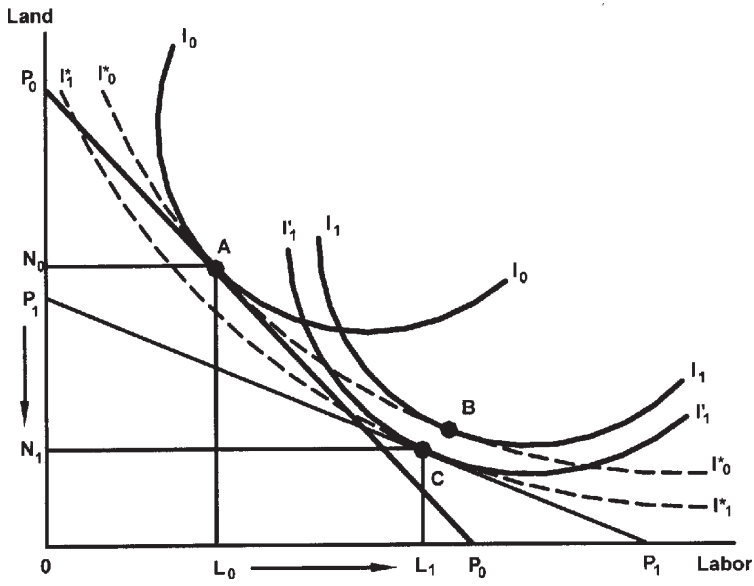

Figure 11-1. A model of induced technical change. If the ratio of the price of land to labor changes from P_o to P_1, incentives are created not only to substitute labor for land and to move from technology I_o at point A to technology I_1 at point B, but also to develop a new technology I'_o at point C. Innovation possibility curves I^*_o and I^*_1 represent the range of potential technologies that can be applied in period 0 and period 1. (*Source*: Hayami and Ruttan, *Agricultural Development.)*

abundant relative to land so that the price of labor is reduced relative to the price of land (the new price ratio is represented by P_1), incentives are created to adopt a more labor-intensive technology. If there were no technical change, production might occur at point B on isoquant I_1. However, the theory of induced innovation says that incentives are created not only to select a new technology from the current technology set (that is, move to point B on I_1), but also to develop new technologies to save scarce resources and use abundant resources more intensively. The new technology set is represented by the new innovation possibility curve I_1*. As the innovation possibility curve moves toward the origin, the same quantity can be produced at lower cost. Following the generation of this new technology set, farmers can adopt the new least-cost technology 1 and employ N_1 of land and L_1 of labor at point C.

Hayami and Ruttan compare the agricultural development histories of Japan and the United States to illustrate the validity of the theory. Japan experienced increasingly higher priced land compared to labor and stressed the development of biological technologies such as improved seeds and fertilizers. These technologies tend to save land and use labor more intensively. The United States, on the other hand, has approximately two times as much land per worker as does Japan. As the U.S. frontier was moved west, land became relatively abundant compared to labor, and the development of mechanical technologies that saved labor was stressed. The result was successful agricultural development in both countries, but agricultural output per worker is 10 times greater in the United States than in Japan while output per hectare is 10 times greater in Japan than in the United States.[9]

Changes in output price relative to an input price also can induce technical change, as illustrated in Figure 11-2. The curve u represents the range of current and possible production technologies in a given time period. Hayami and Ruttan call this the *meta production function*. Specific production technologies are represented by v_0 and v_1. At the initial fertilizer-output price ratio (P_0), producers use technology v_0 and produce at point A. If the price of fertilizer falls relative to the price of output (P_1), then incentives are created to move to point B on the existing technology. If the price ratio P_1 is expected to continue, farmers press scientists to develop a more fertilizer responsive variety, v_1, if it does not already exist. Farmers adopt the new variety and move to point C. In the long run, the meta production function itself may shift as more basic scientific advances are made.

Induced Institutional Change

Incentives are created for technical change, but where do these new technologies come from? How do farmers acquire them? What determines whether technologies are developed that are suitable for all farmers or only for *some* of the farmers? All of these questions are addressed by the theory of induced *institutional* change.

Farmers demand new technologies not only from private input suppliers but from the public sector as well. Hayami and Ruttan argue that public research scientists and administrators are guided by price

[9] Hayami and Ruttan, *Agricultural Development*. Many developing countries, particularly in Asia, are finding the Japanese path of technical change more appropriate than the U.S. path, given their relative resource endowments and the nature of changes in those endowments.

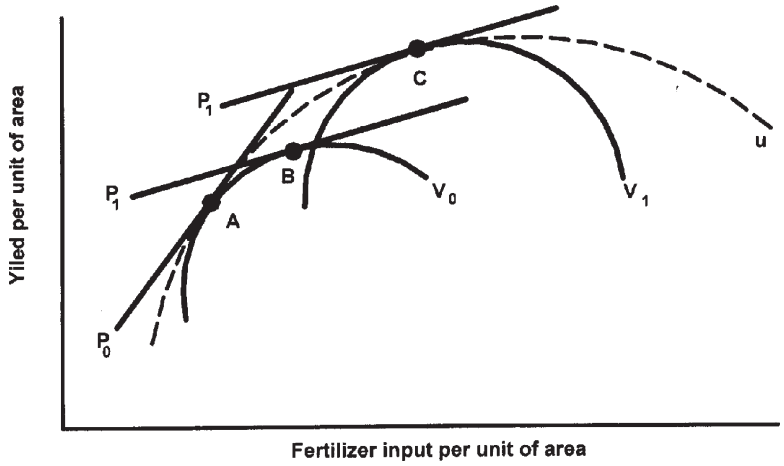

Figure 11-2. Shift in fertilizer response curve as price ratio changes. If the output/fertilizer price ratio changes from P_o to $P_{1'}$, incentives are created not only to apply more fertilizer and increase output from A to B using the traditional variety v_o, but to develop and adopt a new variety v_1 and to move to point C. Curve u represents the "envelope" of a series of available and potential crop varieties. (*Source*: Hayami and Ruttan, *Agricultural Development.*)

signals and by pressures from farmers. The more highly decentralized the research system, the more effectively these pressures work. Research systems that welcome and facilitate inputs from farmer groups and that engage in participatory planning and research are also more responsive. The development of the research systems themselves can be the result of pressures from farmers who are responding to market forces.

Induced innovation occurs not only in agriculture but in the economy as a whole. For example, as energy and gas prices rise, producers and consumers not only switch to existing, more energy-efficient vehicles, but press for new types of vehicles that are even more fuel saving. The public sector may also respond with laws that require more fuel-efficient cars.

Many other types of institutions (rules of society or organizations) affect technical change and agricultural development. The rights to land, marketing systems, government pricing and credit policies, and laws governing contracts are just a few. The theory of induced institutional

innovation recognizes that institutions can become obsolete and in need of adjustment over time. It says that new technologies and changes in relative resource endowments or price changes provide incentives for a society to demand new institutional arrangements (see Box 11-1 for an example).

Examples of institutional changes induced by technological change can be found in the shift from share tenure to more fixed-payment leases, which has occurred in several countries as new varieties and irrigation systems have increased yields while reducing risks.[10] An example of an institutional change due to a change in relative resource endowments is the switch from communally owned land to more private forms of property rights as population pressures increase land scarcity.

In some countries we observe what appear to be socially desirable institutional changes, technical changes, and relatively rapid and broad-based agricultural development. However, in others we observe what seems to be perverse institutional change, agricultural stagnation, or agricultural growth with the benefits received by only a small segment of the population. Of course many countries fall between these extremes or may move from one group to the other over time. Why do we see these differences in institutional changes that influence agricultural performance, and how do they relate to the theory of induced innovation? The answer lies partly with transactions costs and with the incentives for and effects of collective action by groups of people with common interests.

IMPLICATIONS of TRANSACTIONS COSTS and COLLECTIVE ACTION

The induced innovation theory presented above implicitly assumes well-functioning markets for all products and factors. Prices are assumed to convey all the relevant information to decision-makers, and resources are allocated efficiently and independently of the distribution of assets (such as land) in society. Price-responsive producers are assumed to possess knowledge about alternative technologies, and be able to lobby agricultural scientists to develop improved technologies to save scarce resources. Assuming no economies-of-scale in production, there is one optimal path for technological change.

[10] Share tenure is an arrangement whereby a farmer who is renting land pays the rent with a fixed percentage of the farmer's output.

BOX 11-1.
INDUCED INSTITUTIONAL INNOVATION in JAVA

In Java, customary rules have governed both land rights and labor exchange for many centuries. With traditional technologies, these rules have helped allocate resources so that subsistence levels of foods have been available to all village members. These communal institutions have been put under stress by modern technologies that increase the productivity of labor and the returns to landowners. These changes induce changes in the institutions governing resource allocation.

An example of an institutional innovation is the disappearance of the *bawon* rice harvesting system. This traditional system allowed everyone, whether they were from a particular village or not, to participate in the harvest and share the output. As population grew with traditional technologies, this purely open *bawon* system gradually evolved into various forms, some of which limited harvest rights to village residents, while others limited harvest rights to a set number of participants, or to people who were invited by the farmers.

The widespread diffusion of fertilizer-responsive rice varieties created sharply higher returns to harvest labor, and induced a remarkable change in harvest-contract institutions. One such innovation was the introduction of the *tebasan* system, in which standing crops are sold to middlemen who hire contract labor for harvesting and thus reduce the harvester's share while increasing returns to the landowners. Another institution is the *ceblokan* system, which limits harvesting rights to those workers who perform extra services such as transplanting and weeding without pay. A study shows that in a village where *ceblokan* was first adopted in 1964 by seven farmers, by 1978, 96 out of 100 farmers had adopted the system.

These innovations in harvest-labor institutional arrangements were largely spurred by increased incomes and higher wages accompanying technological innovation. Increased incomes and wages created incentives for farmers to change their labor-contracting system. These changes are now widespread in Java.

Source: Masao Kikuchi and Yujiro Hayami, "Changes in Rice Harvesting Contracts and Wages in Java," Chapter 6 in Hans P. Binswanger and Mark R. Rosenzweig, eds., *Contractual Arrangements, Employment and Wages in Rural Labor Markets in Asia* (New Haven, Conn.: Yale University Press, 1984).

Transactions Costs

Unfortunately, transactions costs affect both factor and product markets, creating the possibility of differing optimal paths of technical change and of institutional change, depending on farm size or other factors. Transactions costs refer to the costs of adjustment, of information, and of negotiating, monitoring, and enforcing contracts.[11] These costs arise because assets are fixed in certain uses in the short-run, because there is a lack of perfect information, because there are differences in the ability to use information, and because people are willing to benefit at the expense of others.[12]

The presence of transactions costs may mean, for example, that the cost of credit decreases as farm size increases, that labor costs per hectare increase as farm size increases (because of supervision costs), and the cost of land transactions declines as farm size increases. Therefore, as farm size grows, labor use per hectare may decline while machinery use per hectare and the demand for capital-intensive technologies may increase. Owners of large farms also maybe quicker to adopt new technologies, because they have fewer credit constraints affecting input purchases.

The presence of transactions costs means that the distribution of assets matters for the direction of technical and institutional change.[13] Because the demand for particular types of technical and institutional changes will vary by farm size, the potential is created for conflicting demands on the public sector. Politicians and other public servants respond to the demands of competing groups by considering their own personal gains and losses. Consequently, a change that would benefit society as a whole may not occur if a politician receives greater private gain from an interest group that does not want the change than from a group that does.

[11] A succinct discussion of transactions costs is found in Douglas C. North, "Institutions, Transactions Costs, and Economic Growth," *Economic Inquiry*, vol. 25, 1987.

[12] William J. Baumol — in "Williamson's The Economic Institutions of Capitalism" *(Rand Journal of Econometrics*, vol. 17, 1986, p. 280) — points out that if there were no fixed or sunk costs in land, capital, or people, resources could easily be transferred to optimal uses. If information were perfect or if people could always figure out how to design contracts to cover any contingency, fixed costs would not matter. If people did not try to profit at others' expense, contracts could be drawn loosely and adjustments made as conditions change.

[13] See Alain deJanvry, Marcel Fafchamps and Elisabeth Sadoulet, "Transaction Costs, Public Choice, and Induced Technological Innovations," in Bruce M. Koppel, ed., *Induced Innovation Theory and International Agricultural Development: A Reassessment* (Baltimore and London: Johns Hopkins University Press, 1995).

Collective Action

When producers of a commodity are few, economically powerful, and regionally concentrated, they may find it easier to act collectively to influence public decisions in their favor than if these conditions do not hold. Even if the conditions do not hold, if a commodity is very important in the diets of people in urban areas or if it earns substantial foreign exchange, the public sector still may act to help its producers. However, if producers are neither organized into a powerful collective lobby nor producing an important commodity for urban consumption or export, they will seldom receive public help such as new technologies. This fact may explain why peasant farmers with small land holdings are often neglected when agricultural research priorities are set.

Implications for Induced Innovation

The implications of transactions costs and collective action for the induced-innovation model presented earlier are illustrated in Figure 11-3. Changes in the underlying resource base for the country as a whole might imply that the least-cost path of technical change would occur in the direction of arrow Z (i.e., a path that would use relatively abundant labor and save relatively scarce land). Following path Z might be facilitated by the development of new labor-intensive, biologically-based technologies. However, if a few large-scale producers, due to the presence of transactions costs and collective action, were able to influence public officials so that technology I'_0 were to be developed rather than I'_1, then technical change might occur in the direction of arrow Y (perhaps through the development and adoption of capital-intensive, mechanically-based technologies) rather than arrow Z. Benefits to the large farmers would be maximized but overall economic efficiency gains might be reduced.

The concern over the existence of transactions costs and collective action is not just a concern over the distribution of the benefits of agricultural development. Rather, it is a concern that the rate of economic growth itself will be diminished as well. If, in the previous example, the farmers demanding path Y were few in numbers, and their total value of production compared to the farmers demanding path Z also was small, then the decision to develop technology along path Y would mean a growth rate below the country's potential.

Policy Implications

The above discussion illustrates that technological progress is important for agricultural development, but so too are institutional arrangements and information. Although the theory of induced innovation

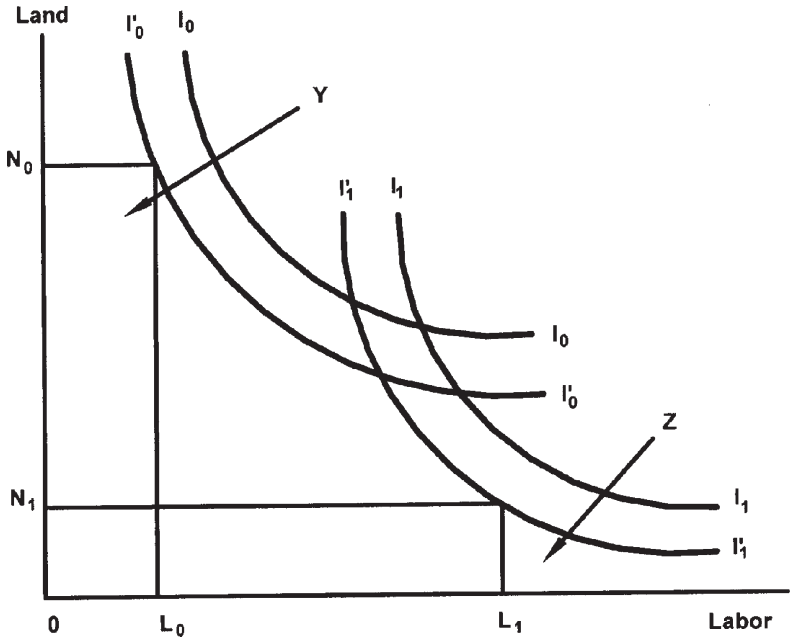

Figure 11-3. Induced technical innovation in the presence of transactions costs. The direction of technical change as dictated by changes in relative factor prices might call for cost-reducing path Z. However, transactions costs and collective action may create pressures to follow path Y, reducing the rate of overall economic growth.

provides an optimistic look at how market forces can work, almost like an invisible hand to stimulate technological and institutional change, the presence of transactions costs and collective action sound a cautionary note that there is an invisible foot out there eager to stomp on that hand. The reality that agricultural and overall economic development has progressed steadily in some countries while stagnating in others, demonstrates that development is neither automatic nor hopeless. An operational agricultural development strategy is needed that recognizes (a) the role that relative prices can play in guiding technical and institutional change, (b) that imperfect information and other transactions costs can sidetrack development unless domestic and international institutions are proactively developed to constrain inappropriate collective action. Inappropriate here is defined as actions that impose gross inefficiencies on the sector or that fail to meet the equity

Improved transportation to reduce transactions costs becomes critical as development proceeds.

goals of a society. In the sections below, several of these institutions are briefly mentioned; they are discussed more thoroughly in subsequent chapters.

Domestic institutions

Land, credit, pricing, marketing, and research policies are all critical to development and adoption of appropriate technologies and for agricultural development in general. Sources of agricultural growth change over time, and few countries today are able to achieve substantial production increases by expanding their land bases. In addition, land currently in production is being degraded in many countries due to population and other pressures on a fragile natural resource base. Ownership of land and other assets is highly unequal in many countries and fragmented in others. Hence one institutional component of an operational agricultural development strategy is to reexamine the arrangements governing land ownership and use and to make any needed adjustments.

Improved transportation, marketing, and communications systems also become critical as development proceeds. Lower transportation, marketing, and communications costs can reduce transactions costs and improve information flows, and thereby facilitate broad-based agricultural growth. Isolated regions tend to be poor regions.

Provision of high-payoff inputs and credit to finance their purchase are additional components of a successful agricultural development strategy. Farmers are rational and relatively efficient given their current resources. Consequently new inputs embodying improved technologies are needed to improve the productivity of farmers in developing countries. Research and technology-transfer policies can facilitate the development and adoption of these technologies. In addition, pricing policies should be designed so as not to discourage the use nor encourage the abuse of improved inputs.

Educational levels of farmers also must be increased to improve their ability to recognize the benefits of and to use the technologies. Education improves the capacity of people to assimilate and use information and thus can help reduce transactions costs.

Macroeconomic and International Institutions

Agricultural development is affected by macroeconomic and trade policies that arise outside the agricultural sector. The levels and types of taxes, spending, and government borrowing can dramatically influence farm prices and input costs. Exchange rates, or the value of the country's currency relative to currencies in other countries, can have major effects on domestic agricultural prices and trade.

In some countries, foreign debt repayments significantly constrain growth and reduce domestic consumption. Internationally influenced interest rates and prices vary substantially over short periods of time, adding an additional measure of unpredictability to debt levels and national incomes. International labor markets for agricultural scientists mean that high salaries draw some of the brightest and most educated scientists to more developed countries and international agencies. Foreign aid is a source of capital and technical assistance for some countries, but is often unreliable and usually comes with strings attached. Developing countries must carefully design macroeconomic and trade policies that do not discriminate against their agricultural sector if they expect it to grow.

Enlightened Self Interest

Any operational agricultural or economic development strategy must (1) recognize individual incentives; (2) consider the lack of perfect information; and (3) include institutional arrangements to offset externalities and other market imperfections. Individuals must feel it is in their self-interest before necessary institutional changes will occur.

Information is valuable, imperfect, and costly to acquire, and can exhibit economies of scale in acquisition. These attributes of information

provide the incentives and the means for some people to use the advantage they have from asset ownership, military power, or their willingness to engage in unscrupulous behavior to acquire information before others.

In fact, even if all assets were initially distributed equally, unless information were available equally to all or unless enforceable rules were instituted to constrain dishonest behavior, the willingness of some to gain "unfair" advantage would eventually lead to unequal distributions of assets. In primitive societies, information is basically available to all, and inappropriate activities are constrained by social and cultural norms. However, as societies become more complex concurrently with economic development, information becomes more imperfect and new institutions are needed to replace the rules that no longer constrain behavior.[14]

People must feel it is in their interest to design and enforce particular institutional changes, and they need to know the implications of those changes. Institutional change involves costs because some people benefit from current arrangements and will fight any change.

The following six suggestions might help lower the cost of institutional change through enlightened self-interest:

- First, in those countries where asset ownership has become so unequal that inefficiencies in property rights are retarding agricultural development, asset redistributions (particularly land) are needed, usually with compensation arrangements (so that the changes will in fact occur).
- Second, improvements in education, communications, and transportation can improve information flows and the ability of a large number of people in the country to act on information.
- Third, decentralized industrial growth should lower labor adjustment costs (and facilitate employment), reduce externalities associated with urban crowding, improve market performances in rural areas, and help stimulate agricultural growth.
- Fourth, social science research can help lower the cost of designing and examining the implications of alternative institutional changes affecting agriculture.
- Fifth, a government structure is needed that includes enforceable laws to protect citizens from each other and from the government itself. Government policies and regulations can also be used to reduce

[14] These ideas are similar to those expressed by North ("Institutions, Transactions Costs, and Economic Growth"), pp. 420–5. North notes that impersonal exchange with third-party enforcement is essential for economic growth. Third-party enforcement implies that legal institutions exist.

market failure. Well-functioning and transparent legal systems with independent judiciaries can help facilitate transition toward enhanced institutions.

- Sixth, improved and enforceable international laws and other institutions are needed to reduce incentives for international abuses of power

SUMMARY

Several theories of agricultural development have been proposed over time. Expansion or conservation of resources, diffusion, use of high-payoff inputs, and induced innovation are some of the major ones. Technical and institutional changes are key components of any operational agricultural development strategy. These changes can be induced by relative price changes resulting from change in resource endowments and product demand. Because of transactions costs, collective action, and the realities of human behavior, agricultural sectors may not follow an economically efficient development path. The distribution of assets has important implications in the presence of transactions costs and collective action. If land is unequally distributed, then, because of transactions costs, the demands (for technologies, inputs, policies, etc.) of one group of producers are likely to be very different from those of others. Collective action can then pull the development process from its optimal path. Institutional changes to improve information flows and constrain exploitive behavior can become critical to agricultural development.

IMPORTANT TERMS and CONCEPTS

Agricultural research and extension
Asset distribution
Asset fixity and adjustment costs
Communications
Compensation schemes
Diffusion theory
Enlightened self-interest
Externalities
High-payoff inputs
Induced institutional innovation
Induced technical innovation
Innovation possibilities curve
International factors
Invisible hand
Location theory
Macroeconomic factors
Market failure
Meta production functions
Perfect information
Resource conservation
Resource exploitation
Transactions costs

Looking Ahead

In this chapter we considered theories of agricultural development and suggested a broad framework for operational agricultural development strategies. In the following five chapters we consider sector-specific

means of generating particular technical and institutional changes to stimulate agricultural growth. In later chapters we consider macroeconomic and international factors. We begin in Chapter 12 by focusing on agricultural research and extension.

QUESTIONS for DISCUSSION

1 Contrast the resource exploitation, resource conservation, and diffusion theories of agricultural development.
2 Why is the resource exploitation theory of agricultural development less useful today than it was historically?
3 Why has the importance of resource conservation increased is recent years?
4 What are the limitations of the diffusion theory of agricultural development?
5 Why has the high-payoff input theory become widely accepted?
6 What criticisms do Hayami and Ruttan make of the high-payoff input theory?
7 Describe the theory of induced technological innovation. Be sure to identify both the importance of relative input price changes and changes in the relative prices of inputs to outputs.
8 Describe the induced institutional innovation theory.
9 Contrast transactions costs and collective actions.
10 What are the implications of transactions costs and collective action for institutional innovation?
11 What do we mean by the term *enlightened self-interest*?
12 How might information be made more accessible to farmers?
13 What are the implications of a grossly unequal asset ownership pattern for economic growth?
14 Why are improved international institutions needed for agricultural development?
15 Why does Japanese agriculture have much higher output per hectare than U.S. agriculture, but much lower output per worker?

RECOMMENDED READINGS

Hayami, Yujiro, and Vernon W. Ruttan, *Agricultural Development: An International Perspective* (Baltimore: Johns Hopkins University Press, 1985), Chapters 3 and 4.

Koppel, Bruce M., ed., *Induced Innovation Theory and International Agricultural Development: A Reassessment* (Baltimore and London: Johns Hopkins University Press, 1995).

North, Douglas, "Institutions, Transactions Costs, and Economic Growth," *Economic Inquiry,* vol. 25, 1987, pp. 415–228.