Influence of Property Rights and Collective Action on the Choice of Technology

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The technologies people use play a fundamental role in shaping the efficiency, equity, and environmental sustainability of natural resource management (NRM). However, improved agricultural and natural resource technologies are of little value unless they are judged to be appropriate by farmers and subsequently adopted. There are many factors constraining farmers' technology choices, but the lack of secure property rights has been commonly identified as an important barrier to adoption, particularly for longer-term investments in tree crops and improvements to natural resources.

For technologies and NRM practices that require farmers to make joint decisions and cooperate in their implementation, inadequate and ineffective institutions for managing collective activity can be a constraint to adoption. Property rights and collective action are also important in determining who benefits from productivity increases (equity), both directly by determining who can reap the benefits of improvements in factor productivity, and indirectly through their effects on land markets, access to credit, etc.

Factors Influencing Technology Choices

Infrastructure

Unless the appropriate physical, economic, and institutional information infrastructure is in place, farmers may be unable to acquire technological inputs or market their outputs. Roads, electricity, water supplies, availability of improved seeds and other key inputs, as well as access to market outlets, are considerations for technology adoption by farmers.

Information

Information is a critical dimension of technology choices. Farmers must know that new technologies exist and how these could help them in terms of improving yields and increasing profits. Effective extension services can accelerate information dissemination on the profitability and risks associated with new technologies.

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Risks

Farmers are more likely to take on risks associated with the adoption of a new technology if they have the capability and enough assets (i.e. risk-reducing options) to manage risks. These options may include livestock and crop diversification, inter-cropping, and plot scattering. Some of the risk-coping strategies may include use of savings or credit, storage, family support networks, and asset markets.

Wealth and Credit

Wealth provides a household with the option to acquire and use technologies. However, the lack of wealth need not be a constraint to technology adoption if households have access to credit and savings services.

Labor

Labor bottlenecks can be a significant constraint to the use of some technologies. Unless local labor markets are elastic, increases in demand for labor can raise seasonal wage rates and quickly dampen the profitability of new technologies, particularly for farms that require more than family labor alone. New cropping systems and technology may alter social relations, reduce labor requirements and exclude families from access to land resources between harvest and in field margins.

Access to credit and savings services allows farmers to purchase needed technological inputs.

Price Policy

The profitability of new technologies is affected by input and output prices, both of which are influenced by market fluctuations and government policies such as subsidies and support prices.

Environmental Conditions

Technologies may be unsuitable beyond the bounds of certain physical, socio-economic, cultural, and political environments. For example, agroecological conditions have prevented the use of high-yielding varieties (HYVs) in areas with low rainfall (and insufficient irrigation facilities), unfavorable micro-climates, and poor soils. Social biases toward technology arising from institutions and power structures can also preclude adoption. Cultural restrictions are a factor, too. In some regions of Africa and Asia, women are not allowed to plant trees and unable to participate in many agroforestry technologies.

Property Rights

Property rights provide the incentive and authority to make long-term investments. If there is a long time between investing in a new technology and getting the returns (e.g. planting a tree or terracing a field), farmers will not have the incentive to make the investment unless they have secure, long-term property rights. In many cases, tenants or those who are using the resource without full rights to it may even be prohibited from making such long-term investments. However, secure tenure does not necessarily mean full ownership or government-issued titles. Customary rights or long-term leases provide enough security for investment in many contexts.

Collective Action

In addition to joint investment in the purchase, construction, or maintenance of technologies, actions such as decision-making and implementation of rules to exploit (or refrain from exploiting) a resource; representing the group to outsiders; and mechanisms for sharing information and other resources are especially relevant for agriculture and natural resource management techniques.

Having group representatives to voice out concerns to outsiders is important in reaching common goals related to agriculture and natural resources management.

Linkages Between Property Rights and Collective Action

Collective action is often needed to uphold common, as well as private, property rights, and the adoption of large-scale technologies and NRM practices. Integrated pest management (IPM) practice, for example, requires substantial space to operate effectively, and hence is facilitated by collective action to coordinate its adoption.

Technology and Property Rights and Collective Action: A Two-Way Mapping

Well-defined and secure property rights to common pool resources are highly important for the poor, particularly poor women. Effective poverty alleviation strategies need to support common property regimes which enhance the production of common pool resources over the long-term and ensure fair distribution to more marginalized interest groups.

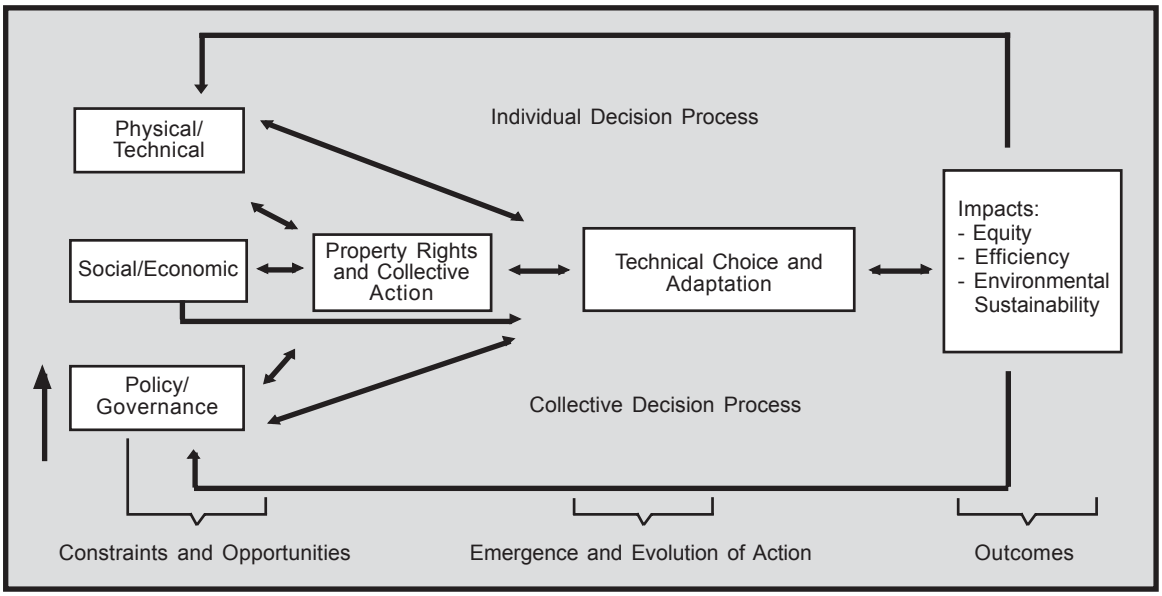

Figure 1. Conceptual Framework: Indirect Effects on Technology Adoption via Property Rights and Collective Action.

Figure 1 illustrates how other constraints interact with property rights and collective action to influence the decision to adopt a technology.

P*hysical/technical factors* affecting adoption include agro-climatic conditions (including risk) or infrastructure.

S*ocial and economic factors* include human capital (information), economic risk, social networks, wealth, credit availability, labor patterns, and social norms.

Policy and governance factors affecting adoption include pricing policies or legislation regarding resource use.

There is a two-way mapping between traditional constraints, on the one hand, and property rights and collective action, on the other, which subsequently influences choice of technology. Similarly, technologies and their adoption can stimulate institutional change. For example, the introduction of integrated pest management technologies has fostered increased levels of community and inter-community organization, and planting trees can strengthen tenure security. As Figure 1 indicates, property rights and collective action can also influence outcomes of efficiency, equity, and environmental sustainability. These factors then feed back on the environmental and institutional conditions, for example, through population growth or changes in the physical condition of the resource.

Implications for Efficiency, Equity, and Environmental Sustainability

Adoption of new technologies is not an end in itself, either for agricultural researchers, policymakers, or people who employ them in farming or for managing natural resources. Rather, the outcome of technological change should be evaluated in terms of the contribution to broader goals of sustainable development. Growth, poverty alleviation, and environmental sustainability form a "critical triangle" for development. Although there may be trade-offs between these three objectives, they are all necessary and interlinked.

The degree of tenure security within a community or among communities is not necessarily uniform. Wealth, power, and status are factors in determining one's tenure security and thus shape equity and environmental outcomes. Collective action becomes a critical component of tenure security in common property regimes, and a means of coordinating resource management across private holdings.

Greater control over resources tends to enhance men's influence over community power structures and wield political leverage with government officials and others responsible for technology distribution as well as infrastructure and market development.

The same is true for the wealthier strata of society. Technologies and their supporting infrastructure will therefore mainly reflect the interests of men who control the most substantial resources, unless a sufficient degree of collective action emerges. These actions should be capable of reshaping political outcomes so that government and other suppliers of technology and infrastructure intervene with policies to override these biases.

Greater integrated community participation in decision-making on the design, implementation and adaptation of technologies may not only ensure that the new technology does not disproportionately and inefficiently increase the workload of marginalized groups, but actually functions to reduce overall labor inputs.

Suggested Readings

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