

# MECHANIZATION AND MAIZE

AGRICULTURE AND THE POLITICS  
OF TECHNOLOGY TRANSFER  
IN EAST AFRICA



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## *Abbreviations*

CGIAR	Consultative Group on International Agricultural Research
CIAT	International Center of Tropical Agriculture
CIMMYT	International Maize and Wheat Improvement Center
CIP	International Potato Center
EAFPRO	East African Agriculture and Forestry Research Organization
FAO	Food and Agriculture Organization
IAEA	International Atomic Energy Agency
IBPGR	International Board for Plant Genetic Resources
IBRD	International Bank for Reconstruction and Development (World Bank)
ICARDA	International Center for Agricultural Research in Dry Areas
ICP	Industry Cooperative Program (FAO)
ICRISAT	International Crops Research Institute for the Semi-Arid Tropics
IDA	International Development Agency (World Bank)
IDRC	International Development Research Center (Canada)
IFPRI	International Food Policy Research Institute (CGIAR)
IITA	International Institute of Tropical Agriculture
ILCA	International Livestock Center for Africa
ILO	International Labor Organization

ILRAD	International Laboratory for Research on Animal Diseases
IMF	International Monetary Fund
IRRI	International Rice Research Institute
ISNAR	International Service for National Agricultural Research (CGIAR)
ITDG	Intermediate Technology Development Group
MADO	Masai Agricultural Development Organization
MOA	Ministry of Agriculture (Kenya, Tanzania)
NDCA	National Development Credit Agency
OECD	Organization for Economic Cooperation and Development
<i>PWB</i>	<i>Programme of Work and Budget</i>
SRDP	Special Rural Development Program
TAC	Technical Advisory Committee (CGIAR)
TAMTU	Tanzanian Agricultural Machinery Testing Unit
TANU	Tanzanian African National Union
SIDA	Swedish International Development Agency
THS	Tractor Hire Service
UNDP	United Nations Development Program
UNRISD	United Nations Research Institute for Social Development
USAID	United States Agency for International Development
WARDA	West African Rice Development Association
WEP	World Employment Program (ILO)
WHO	World Health Organization
WOF	<i>The Work of the FAO</i>

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# CHAPTER I

## THE POLITICS OF TECHNOLOGY DEVELOPMENT AND TRANSFER

TECHNOLOGY IS POWER. Massive, sustained technological revolutions have internationalized commerce, reorganized agriculture, industrialized production, and given to contemporary society the new economic and institutional capabilities needed to sustain the process we know today as modernization. The sweeping nature of the changes with which modern technology has been associated explains in considerable measure why, despite disappointments and development setbacks, the Third World remains interested in the transfer of technology from the North to the South. Technology has not yet delivered the development cornucopia awaited by many in the Third World, but it is still widely identified as the resource most capable of transforming the basic structure of underdevelopment.

For better or worse, however, the power of technology is being interjected into processes of economic development in the Third World by political actors whose agenda for action is much broader and more complex than the technical mandates of the programs they support might suggest. The Third World state is the most prominent of these actors, but a multiplicity of international institutions participate as well. This has been perhaps especially the case in Africa. Colonialism left a legacy of scarce technological resources and extensive economic underdevelopment. At independence there were no technical capabilities available in the private sector—no group of highly educated technocrats, no middle class with the resources to invest in innovation, and very few institutions of higher learning and research with the ability to generate the knowledge necessary to support technological development. While the new African state also had very little technical expertise, capital, or institutional capa-

bilities in an absolute sense, relative to other internal, private actors and institutions, it had more. And, as importantly, it was the focal point for the investments of international aid agencies. International assistance had access to the technical resources necessary for African agricultural development, and on the eve of African independence offered to the new state the programs upon which national development efforts would depend.

This investigation presents an assessment of the impact of politics upon the development, diffusion, and adoption of new technology; the impact of technology upon the political institutions that develop and introduce it; and the way in which states and international organizations interact politically through the joint execution of technology projects. The theoretical focus of the study revolves around the interaction of technical and political forces, the major assumption being that to understand the importance of one, the other must also be considered. The empirical focus addresses the attempts of two East African states—Kenya and Tanzania—to integrate new agricultural technologies into peasant production via the resources of international assistance agencies. These countries are among the poorest in the Third World today, but they are also among those African states that have most vigorously attempted to develop their agricultural sectors.

Politics as a determinant of technical innovation and change has been little studied and generally undervalued. Both the African state and the international agencies that assist it in programs of technical change are primarily concerned with establishing their institutional authority. Neither is secure in its relationship to the larger social, economic, and political environment. One confronts a social order of great ethnic and economic heterogeneity, considerable poverty, and weak institutions. The other contends with an international system of halfheartedly committed states, ruthlessly competitive organizations, and small budgets. Neither can afford to be institutionally self-abnegating. The very fact of the necessity of state building in Africa and organizational expansion in the development assistance community goes a long way toward explaining the nature of technology transfer in Africa.

More importantly, this challenge of establishing permanent, stable institutions while carrying out programs of technology development and diffusion has been taken up by both organizations and states in markedly different ways. Kenya and Tanzania represent sharply contrasting ap-

proaches to the problems of political and economic development in Africa—one capitalist, the other socialist. Similarly, in some areas of international assistance, agencies have chosen to pursue a route of traditional multilateral aid; in others they have formed new international regimes. The choice of strategies in both instances—states and agencies—is indicative of how institutions define their constituencies of support and how ambitious an agenda of social and economic change they set themselves. These choices define the context for institutional development and for how technology will be developed and diffused. Most important of all, some ways of establishing the state or creating international institutions work better than others to facilitate technical change.

Technology is a powerful development resource, and while it can be subdued to political imperatives, it also makes many demands upon its environment for support and sustenance. This necessity of providing technology with certain requirements of development and adoption make it an independent as well as a dependent factor of analysis. The institutions that develop and diffuse technical resources ignore these technical requirements at the peril of undermining the important economic impacts of technical innovation. At the same time, because technology is such a powerful instrument of economic development, it offers political institutions a larger array of capabilities in respect to social transformation and institutional development.

As in the case of political institutions, what becomes particularly interesting about the power of technology is its highly discrete character. The independent power of technology to determine the success and failure of innovation and to structure the social and institutional environment of its development or introduction varies considerably depending upon a host of specific technical characteristics. The development of high-yielding varieties of maize and the introduction of tractors and other forms of agricultural mechanization made distinctively different demands for technical support and presented institutions with very different capabilities for greater social or political change. Thus, some technologies make better instruments for state building or organizational development than others.

Finally, this book is also about the nature of development assistance. International assistance is most frequently studied from the standpoint of internal organizational politics and the development of the United Na-

tions and Bretton Woods systems. When the implementation of projects is considered, it is done without full consideration of the national and international context in which the individual projects were themselves conceived and carried out. In the coming chapters I will trace the evolution of individual technology projects in order to reveal the way in which international institutional strategies of development overlap and interact with those on the national level. Understanding this relationship is crucial to a complete assessment of how assistance projects are actually born and how they grow to maturity, as well as to a full appreciation of where and why technology is successfully or unsuccessfully adopted.

The questions that will orient the assessment offered in the coming chapters embrace a duality of focus—politics and technology—as well as a concern with how the development assistance system as whole functions. Thus, in respect to politics as a determinant of technical change, I am interested in knowing when politics is an impediment to the successful development or adoption of new technology and when it is a facilitator; how particular state-building strategies or modes of international assistance organization result in different technological consequences; whether one actor as a manager of technological goods and services is more political than another. In respect to technology as a determinant of social and political change, I am interested in assessing when technology is able to impose its own design upon the society, the economy, and the institutions that utilize it; whether there are some technologies that are inherently more political than others; and how the particular characteristics of individual technologies inhibit or accelerate the objectives institutions pursue. And finally, in considering the nature of development assistance, I will assess when the state is able to subordinate the goals of international agencies to its own; when international aid agencies are most likely to prevail; and which kind of relationship between agencies and states most frequently accomplishes successful development assistance projects.

In this chapter I will locate agricultural technology in its system of technical support, and political institutions in their systems of social support. The power of technology to transform traditional economies and the power of political actors to establish their authority are both dependent upon the creation of environments receptive to their presence. It is, in fact, at the nexus of these two support systems that political actors carry

out their fiercest battles with technological power, and that technology's constituency is defined.

### Technology and Its System of Support

Technology offers African states and international agencies the power of economic development and resource creation, and thus the ability to accomplish many of the political as well as economic goals they set for themselves. But what kind of power is this? Is it an unqualified promise of greater wealth and welfare or are there strings attached, which as they are unraveled, reveal greater complexity? In respect to agricultural technology, there is considerable disagreement about this.

The most far-reaching technical change to have taken place in Third World agriculture has been the Green Revolution. The technology at issue is high-yielding varieties of important food crops—wheat, rice, and maize—but accompanying this technical innovation has been the adoption of modern chemical and mechanical technology. The debate on the Green Revolution is fundamentally concerned with questions of technological power. First, what kind of power does the technology exercise? Is it primarily technical and economic, or does it embrace social as well as economic organization? Second, to whose interests does technology speak? Does it act in the interests of society as a whole, or is it confined to more narrowly defined interest groups? And finally, is technology an entirely independent agent of economic or social change, or is it dependent upon other actors and forces? Those who celebrate the production successes of the new technology give very different answers to these questions than do those who are concerned with wider social and economic impacts. The crux of the argument, however, revolves around a major disagreement about technical systems of support.

The promoters of the Green Revolution identify the new technology as an extremely powerful agent of technical and economic development, a vehicle for the modernization of agriculture and thus for social progress and the interests of society as a whole.<sup>1</sup> Basically, the Third World farmer is seen to be an extremely efficient producer who knows very well how to allocate the scarce resources at his disposal.<sup>2</sup> The rate of return on the

investment of resources in Third World agriculture is so low, according to this argument, not because of an error on the part of the peasant cultivator, but because the resources available to him are not capable of generating greater agricultural surplus. Thus, the productivity problem with which the farmer struggles can only be solved with the addition to or improvement of the resources upon which he depends. Enter the development of improved and high-yielding varieties of new food crops and other technologies.

A great faith in farmer rationality and technical power is mirrored in the writings of all Green Revolutionaries, but they differ among themselves on the role they assign to other social forces. The establishment of technical institutions, agricultural research stations and agricultural extension that develop and distribute the new technology, would be most effectively triggered, according to one group of Green Revolution theorists, in response to a strong market demand for such services.<sup>3</sup> Given the circumstances within which Third World farmers operate, such a demand can be triggered if factor and product prices—the price of the resources in which the farmer invests and the price of food—reflect the real constraints and capabilities of the nation's agricultural economy.

A second group of Green Revolutionaries are not quite so certain that the market can perform these wonders on its own.<sup>4</sup> While not openly criticizing their predecessors, these commentators assume that the technology will be most effectively developed and diffused if public institutions self-consciously pursue a policy of technical development and extend the required economic supports to farmers who need them. They have less faith in the market but no less faith in the technology. As a consequence, they are more explicit about the programs and services institutions must create or facilitate to establish the context most conducive to technological revolution. Beyond the founding of effective research and extension, they suggest that new agricultural industries, adequate transport, technical education and farmer training, accessible credit and crop insurance, and other forms of economic and technical infrastructure be created to propel a genuine and extensive agricultural revolution. They are, in particular, concerned that if the technology were to reach only a few farmers, the overall structural transformation of Third World agrarian economies would be delayed. Such encapsulated technical change would impair the ability of Third World agriculture to keep up

with population growth and would limit the increase in economic welfare for which the new technology is responsible.

Critics of the Green Revolution, in contrast to the defenders and promoters of the technology, find that the power of the technology is not primarily technical and economic; that it is not acting in the interests of the society as a whole; and that, in many cases, its impact is controlled by other actors and forces.<sup>5</sup> Two primary explanations are offered for this pattern of social and economic development—one that concerns the nature of the technology, and one that investigates the nature of the society.

The technology itself is seen as a mixed blessing. The high-yielding varieties of Third World food crops, which are relatively inexpensive, are identified as a resource potentially available to a large number of peasant cultivators. They do not require sophisticated technical expertise and can be broken into a variety of units for sale and distribution. But, in many of the regions in which these seeds have been adopted, so have a number of other supportive technical inputs—from fertilizer to tractors, pesticides to irrigation—which are not quite as accessible to the small-scale landholder. This raises the cost of technical innovation considerably. In the case of irrigation the technology places the possibility of technical change entirely out of the range of poor, dry-land farmers, and in the case of both mechanization and irrigation, beyond the average small-scale cultivator.<sup>6</sup> In other words, for the richer and larger-scale farmer, the support base exists in the form of capital and a better infrastructure. For the poor farmer these supports are nonexistent, and technologies like tractors, if necessary for the cultivation of new varieties, make the entire technological package unrealistic.

Other critics emphasize that it is not the technology per se that is the source of the welfare problem, but social and economic relations that were already in place:

In analyzing the social and economic problems that have been associated with the spread of the new technology thus far, and which are discussed in this report, it is important to bear in mind that they are not inherent in the technology as such. Rather, they are the consequence of social imbalances and economic disparities that already exist, and are largely due to the fact that social policy and reform have not kept pace with the spread of the new technology.<sup>7</sup>



There is, in fact, a general consensus among critics of the new technology that inequities in the availability of land and capital channeled technical innovation into the hands of large- and medium-scale farmers, while missing small-scale landholders and the landless. Some peasants are unable, not unwilling, to adopt the new technology, because of their relative status in respect to other very important economic resources.

While in one respect the two sides of this debate are talking past one another—one group is more concerned with the policy mechanics of how to transfer the technology, the other with the potential impact—in another very important respect, they are walking around and puzzling about the same problem. Both sides implicitly agree that the power of technology development and transfer is a power that is highly contingent upon the existence of a requisite system of technical support. They disagree on which components of this system are most essential and why this is the case. In other words, some see considerable strings attached to the technical good itself and great complexity in the system of support, and others consider it to be a much simpler matter than this. The most optimistic are those defenders of the technology who argue that if markets operate properly, the technology will be a success and welfare secured. However, in fact, they are able to argue for a relatively small investment in the creation of a technical support system, because they do not believe that it is possible to orchestrate massive technological revolution. One simply cannot control, or provide for, all the necessary systemic supports. To quote from the work of one distinguished analyst, Yujiro Hayami;

It is a gigantic task to assist millions of peasants in traditional agriculture toward sustained growth in their resource productivity. Adequate technologies that are different for different ecological and factor-endowment conditions have to be developed. Needed inputs must be made available to the millions at the right time and place. Physical infrastructure must be publically provided for, since small farmers are unable to procure it individually.<sup>8</sup>

Hayami is not certain that the creation of large-scale systems of support for small-scale holders will work—not, at least, in the short run. So, he lives with the fact that for the time being a small elite will benefit from the technology's introduction. In contrast, an equally prominent critic of the