
Chapter 4

Issues in Technology Transfer

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Developing technologies suitable for Africa is only one step in helping increase food production. Those technologies also must be adapted and disseminated among the African people. This calls for successful technology transfer—another area where the United States has expertise to share. U.S. agriculture is vastly different from African agriculture, so U.S. involvement must be considered carefully. The technologies used will need to be different, as will the extension systems used to distribute them. The most effective technology transfer will be based on unique African social and agronomic conditions.

This chapter examines a number of important issues in the realm of technology transfer. For instance, should certain groups of people be identified for special assistance? How can women, the critical labor force in African food production, be integrated more effectively into the technology transfer process—including improved access to extension services and credit? And how can extension services in Africa be improved to meet producers current needs while preparing them for the future's even greater food demands?

Issue 6: The possibility of directing agricultural project assistance to meet the needs of specific target groups continues to be debated.

Preliminary Findings

- It is difficult to define explicitly and to divide the “poorest of the poor” into categories such as smallholders, landless, and urban or rural un/underemployed.
- Directing project assistance to specific target groups may alienate those other groups excluded and the national staff and donor representatives responsible for implementing projects.
- However, if women and other disadvantaged producers are not identified as groups that require additional technological assistance, project planning and implementation may ignore their problems and benefit them little.

- Both donors and African governments need improved definitions for low-resource producers and other categories of the poor.
- A low-resource producer is one who lacks access to natural resource, economic, and/or technological inputs to overcome constraints to increased food production.
- National development plans do not necessarily indicate African governments' commitment to low-resource producers.

Discussion

The magnitude of the problem seems overwhelming; substantial numbers of poor people exist in the developing countries. However, determining the number of people who lack sufficient income for adequate subsistence remains difficult. For example, the U.N. Food and Agriculture Organization and the World Bank provide different estimates of **450** million and 1.3 billion, respectively, as the number of people living below subsistence level in all developing countries (Eicher, Mar. 1984).

There is no question that Africa contains some of the world's most impoverished countries and people.

A few statistics provide stark evidence that Africans are the poorest of the world's poor. Three out of five are chronically malnourished. Twenty-two of the world's **36** poorest countries are in Africa. For every 1000 African children born, **120** will die before their first birthday. Eighty percent of the continent's population have no access to adequate health services and only one in four has safe water to drink. Africans die sooner (average age 49) and are less literate (only **36** percent) than in any other part of the world (Swift, 1984).

Other figures are equally disturbing. For example, Kenya and Ethiopia had 55 and 68 percent, respectively, of their 1975 populations below an income level sufficient to provide adequate nutrition (Chenery, 1979). The total number of poor is difficult to estimate, as are the relative num-

bers between countries. Compared with Tanzania, which has an annual per capita GNP of \$280, Chad, with only \$80 per capita, seems dismally poor. But Tanzania has an official inflation rate of 13 to 30 percent and scarce foreign exchange. Both of these factors severely affect the poorest 20 percent of the population. Zimbabwe, on the other hand, is classified as a middle income country with an average per capita GNP of \$850. But the country experiences large differences in income distribution. How can the poor of Zimbabwe be compared with those of Chad and Tanzania?

Economic development has many definitions and models. Concern about beneficiaries is common. "Trickle down" or "over" or "up" indicate perceived mechanisms for ensuring distribution of the returns from agricultural production. Some technological developments have been relatively class neutral. In Zimbabwe, introduction of the maize hybrid SR 52 was adopted by a large majority of small farmers (Eicher, 1984). Generally, however, research, economic, and extension institutions have developed and transferred technology, information, and benefits to relatively few farmers. Development assistance has not been directed toward the poorest of the African countries, either in total assistance (Lappé, 1980), or as agriculture, nutrition, and rural development assistance (U.S. AID, 1984). Some of the more disadvantaged smallholders lack reliable access to affordable land, credit, and labor and receive less development assistance than "progressive" farmers (Wortman and Cummings, 1978).

U.S. development assistance, since 1973, has been mandated to help the poorer segments of the rural population. However, given the present levels of development assistance and the project approach used by AID, difficult problems exist in assisting target groups. The problems include lack of target group definitions, unreliable data on these groups, and lack of sustainable and replicable agricultural development programs that will reach them (Tendler, 1982; Esman, 1978). In rural areas, for example, how do the "poorest of the poor" differ from smallholders or subsistence farmers? Are the "poorest of the poor" actually farmers or are they the landless rural inhabitants or migrants to the satellite communities of the larger urban areas? Are they seasonal farm la-

borers who supplement their income with other sources of income? Are they men or women or both? Are other strategies necessary for meeting the needs of the poor without natural resources versus the poor without money?

Differing opinions exist on the best methods for effectively reaching the poorer smallholders. Some specialists propose that development assistance directed towards the poor should be replaced with a more general production approach accepting the . . . necessity and the desirability of working with existing power structures and the most progressive and dynamic elements in the rural areas, hoping that over the long term, questions of income inequalities and other problems can be addressed as they emerge" (Morss and Morss, 1982). Attempts to target specific groups for development assistance may irritate donors and recipient governments and possibly lead to impractical projects with few long-term benefits (Morss and Morss, 1982). Another view assumes the failure of the target approach has been the inability to consider adequately the different categories of impoverished groups, the impacts of technology on them, and the suitable assistance programs that meet their articulated needs.

Commonly, agricultural development projects have implicitly assumed the existence of an economically homogeneous "peasantry," overlooking the class and income divisions which divide most rural populations.

The rural poor, while sharing a common poverty, are comprised of many social groups, differing in occupation, location, sex, status, and religion (Uphoff, et al., 1979).

It seems important that donors and host governments together determine the needs of various poor rural groups. Some groups of rural poor may not even be reached through agricultural development projects and may require other assistance approaches. Uphoff, Cohen, and Goldsmith (1979) and Esman (1978) identify five distinct groups of people in this category who have marginal or no access to land.

1. *Agricultural workers*: landless people who seasonally sell their labor to work on farms.

2. Non-agricultural workers: landless who are marginally in the formal economic sector or engage in informal economic activities.

3. Marginal tenant farmers: those landless or marginally landless who gain access to kind through contractual agreement with other farmers.

4. Marginal farmers: those who have title or customary rights to small or marginal farms. These farmers face production constraints due to a lack of water, credit, technology, markets, and good quality land.

5. Non-sedentary rural households: nomadic or semi-nomadic pastoralists and other migratory groups who lack recognition of their legitimate land rights and who face increasing natural and economic degradation of their land and water resources. Within this group there are several subgroups characterized by their access to and control of livestock,

Clearly, certain groups face special constraints because of their perceived social status. Women and ethnic minority groups of some countries especially face more severe problems with access to land, credit, suitable technology, and political forums.

Data on the number of landless in Africa are scarce. However, one study provides information which questions the assumption that there is abundant underused land of decent quality. Average figures indicate that 8 to 10 percent of rural Africa is landless and up to 30 percent of the rural population is near-landless (Esman, 1978).

Among the landless, refugees represent probably the poorest class of people in Africa. The exact number of people in this group is very difficult to determine because of their mobility and because famine and civil strife cause constantly shifting environmental, social, and political conditions. Refugee populations in several countries (e.g., Botswana and Somalia) have been settled and are involved in integrated rural development projects. Some settled populations have produced high agricultural returns. In Botswana, for example, two refugee communities have per hectare yields that are higher than contiguous areas (District Agricultural Officer, 1982). However, most refugee populations are composed of pastoralists

who are being forced to settle in refugee camps in marginally productive areas and to adapt to a new way of food production. It is unlikely that these groups will be able immediately to produce sufficient food for their own subsistence or for surplus.

Alternative approaches to project assistance might include increased emphasis on integrated rural development, increased levels of funding allocated to "grass roots" organizations, and increased program funding for research. Participants at the OTA workshop were concerned that a target approach toward groups of poor, outside the existing administrative structure, could not alleviate poor people's problems. Therefore, they advocated the more integrated approach to development. Concern exists, though, that the poor will be left out if there are no attempts to integrate them into national, regional, and local planning efforts.

Addressing common constraints of low-resource producers seems necessary. Eicher and Baker (1982) and others have defined "smallholders" to be those farmers who produce on 2 to 10 acres of land, use mostly family labor, till their land with mostly hand tools, and maintain a small capital stock. Esman (1978) adds that these marginal producers face severe constraints to increased food production. OTA's definition of low-resource producers incorporates the above characteristics of Eicher and Baker but adds that low-resource producers are those smallholders and herders who often face major constraints in their access to economic, natural, and technological resources. The farmer must face constraints such as access to reliable productive land, affordable credit, timely inputs, extension advice, draft power, agricultural training, decent producer prices, and seasonable labor. Migratory and semi-nomadic herders face constraints in access to livestock, reliably productive range, veterinary and extension services and management advice, reliable dry season watering points, and technologies on forage crops that will decrease dry season nutritional stress.

The consensus of the OTA workshop was that both African governments and donor agencies need to improve definitions for the target group

of low-resource producers, which represents the majority of constrained rural producers; determine the constraints that these producers face and reasonable interventions to overcome them; and ensure that this group is integrated into development program planning. Equally important remains the goal of meeting the needs of those poor who can only marginally be assisted by improved agricultural technologies, identifying ways to generate income and provide basic needs.

Issue 7: Women contribute significantly to food production in Africa, but have limited access to extension services, credit, and training.

Preliminary Findings

- The prevailing model of African agriculture contends that men are the farm managers. However, up to 33 percent of farm managers south of the Sahara are women, and in the remaining households, women do significant farm work.
- Women contribute substantial amounts of labor, capital, and management toward the production of Africa's food. Estimates of women's contribution range from 60 to 80 percent, although regional differences exist.
- In addition to their agricultural contribution, women also do most household chores, such as collecting firewood and water, cooking, repairing and maintaining the compounds, childcare, and marketing surplus garden crops.
- Women are as innovative as their male counterparts in adopting new technologies, yet they receive only a fraction of the services and have fewer contacts with extension staff.
- Women represent only a minute portion of the agricultural extension staffs. Because of cultural norms, male extension workers generally will not consult with women farmers in the household without the presence of an adult male family member, even if the woman is the farm manager.
- Most agricultural training programs for women do not stress agricultural production but tend to be oriented toward home extension.
- Women have little access to formal institutional credit because they usually lack the access to land, livestock, and other forms of collateral.
- Women hold few policy and managerial positions within agricultural ministries, especially those positions relating to animal and crop production, research, and field services.
- Community meetings are traditionally seen as a forum for men to discuss issues affecting the community and for government extension staff to discuss new agricultural strategies and project proposals. Women are almost always excluded from these meetings or are too busy to attend.
- Women usually are not included in planning projects intended to increase food production.

Discussion

This one they call 'farmer'; send in teachers to teach him to farm (while I'm out growing the food); lend him money for tractors and tillers (while I'm out growing the food); promise him fortunes if he'd only raise cotton (while I'm out growing the food); buy our land from him to add to your ranches (while I'm out growing the food) . . . No, I daren't stop working . . . and I won't abandon that thing I was born for: to make sure my children have food in their bellies (Taylor, 1984).

African women play a major role in food production. Women's labor and management contribute significantly to food production, with estimates ranging from 60 to 80 percent in many places (Boserup, 1970; Tinker, 1981). These figures may not include women's sizable livestock activities (McDowell, 1984). Furthermore, in most agricultural systems, it is difficult to distinguish between food and cash crops, since many cereal crops qualify as both. Women are expected to contribute work toward the production of cash crops, and their labor provides a significant proportion of the total agricultural component of Gross Domestic Product (GDP). Men, however, are generally the recipients of the income generated. Because of the extremely important role women play in agriculture, a more complete



Photo credit. World Bank Photo by Ray Witlin

African women contribute a substantial amount of the total labor to the production of food crops. Here, Senegalese women harvest sorghum.

knowledge of the constraints women face in agricultural production is necessary. Therefore, it is necessary to understand not only the agricultural responsibilities of women but also the intra-household dynamics.

In farming, men and women traditionally assume responsibilities for certain tasks. Social, cultural, economic, and environmental conditions usually are factors in the labor patterns of both rural men and women. Men generally clear, prepare, and plow the land, and women plant, weed, harvest, process, and store the food crops. However, there are many regional variations in this

model. It can not automatically be assumed that each household is a self-contained unit with all the household members cooperating and sharing responsibilities and management functions. More appropriately, a woman's role in food production could be considered as semi-autonomous with levels of cooperation among household members differing with each household (Gladwin, et al., 1984).

Cultural differences, demographic and socioeconomic conditions, and labor availability all produce variations in the general model. Some of these include situations where:

1. Some farm operations are shared by the members of the household. The division of labor might be dependent on such factors as seasonal availability and the value of cash crops relative to food crops. The pattern might follow that described above, but women might have to do some of the typically "male" tasks.
2. Women and men of the same household share the responsibility for a common field on which cash crops are grown, but the women produce food crops on separate fields. Presumably, the labor patterns will be similar to the general model, but the man probably will have control of the woman's labor and the cash returns from the crops. The woman usually will provide separate labor and management for the food crop field.
3. Women and men grow separate crops, either on common or on separate fields. For example, groundnuts and beans might be viewed as a woman's crop, while maize is a man's.
4. Women are the household heads and responsible for all the management and most of the labor (Spring, 1984).

The most typical model in pastoral and mixed agricultural systems has men responsible for the care of larger livestock (e.g., cattle) and women responsible for smaller ruminants (goats and sheep). Men are usually entitled to the returns from the sale of cattle and women are responsible for milking and allocation of the milk between the needs of the family and the herd (Hjort and Ostberg, 1978; Spencer, 1973). However, other patterns developed out of expediency include women sharing all livestock responsibilities with men, caring for different types of livestock (e.g., goats and sheep), doing different tasks than men with all the livestock, or taking care of all the livestock (Spring, 1984). Women, generally, cultivate the food crops for family consumption, especially in situations where the men are mostly absent tending herds (Spencer, 1965; Spencer, 1973; Gulliver, 1955).

Women usually handle most of the domestic chores, including the collection of firewood (for cooking) and water often from distant sources, cooking, cleaning, and childcare. A typical rural

women's day averages 13 to 15 hours and it is not unusual to see women hoeing with babies strapped to their backs.

Male migration to urban areas in search of employment adds to the burden imposed upon rural African women. With the male absent from the household the women must organize labor for land clearing and plowing and the management of cattle. Women also become *de facto* heads of household and farm managers. As Tinker notes:

Today between 25 and 33 percent of all households are *de facto* headed by a woman due to divorce, death, desertion, long-term migration, or because she never married. These female headed households constitute the poorest group in every country (Tinker, 1981).

In several countries, the figures are even higher: e.g., Botswana: 40-45 percent (Bond, 1974), Lesotho: 67 percent (Spring, 1984). However, this managerial role has not been recognized and women still are excluded from institutional involvement in agricultural planning, credit for production, access to *de facto* or *de jure* title to land, extension services, and farm production training. Instead, women generally receive traditional training in nutrition, health, home extension, and handicraft production.

Access to extension services is extremely important, but these systems frequently fail to contact women. For many social and political reasons, large amounts of agricultural information and services are directed toward the "progressive" male farmer (Berger, et al., 1984; Roling, et al., 1981). Extension agents are restricted by cultural norms from approaching female heads of household without a man present. They also receive few incentives for approaching women and poorer farmers who lack access to sufficient land and income to purchase agricultural inputs. The assumption is that this information will be disseminated from the "progressive" male farmers to household members and other farmers in the community, but quite often this is not the case (Fortmann, 1978).

In summary, the problems that women face regarding access to agricultural services are:

1. Male planners and extension staff view women as the domestic labor force in the

household who also provide agricultural labor; women are seen as “farmers’ wives” (Spring, et al., 1983).

2. Women have few channels for communicating their problems to local leaders or to government agricultural staff.
3. Most research information transferred by agricultural extension staff is aimed at those farmers who have capital for such practices as land clearing and plowing and introduction of mechanical planters, fertilizer, and grain-milling equipment. Usually only men are able to take advantage of these innovations. As a consequence, increased land under cultivation exacerbates the labor burden on women or eliminates some of women’s extra income-earning activities.
4. Limited research exists on methods to alleviate the production labor constraints of women (in hoeing, planting, weeding, harvesting, and processing), and few attempts have been made to disseminate information useful to women by institutionalized agricultural extension programs. Women receive fewer visits from extension agents than men do (Fortmann, 1978; Staudt, 1975; Spring, et al., 1983).
5. Women farmers are less likely than men to have sufficient income to purchase necessary agricultural inputs (Berger, et al., 1984).
6. Access to land is necessary for agricultural credit and for membership in most agricultural societies that distribute inputs, information, or technical assistance (Berger, et al., 1984; Moris, 1981; Schumacher, 1981).
7. Even though women tend to be as innovative as men (Fortmann, 1981; Staudt, 1975), seldom are they selected for farmer training courses. When they are, they are often too busy to attend or cannot organize childcare, or attend to find that only home economic courses in nutrition and family welfare are offered.

The OTA workshop participants and other experts find it is extremely important that the constraints rural African women face are addressed. The problems in reaching women are partly political and partly institutional. Political problems

such as access to land and participation in the decisionmaking process at the local, district, and national levels could be addressed by African governments if increasing the food contribution of female headed households is a priority. Several possible changes have been proposed that would contribute to assessing the needs of women farmers and provide services that they could use:

1. Recruitment of additional female extension staff. Extension staffs in most African countries are predominantly male. Men make up between 94 and 99.7 percent of the staff in those countries with more than 20 extension agents (Berger, et al., 1984). It is **assumed** that female extension staff will contact women more frequently than male staff. Therefore, priority could be placed on recruiting more female extension staff.
2. Training courses for all extension staff that explain the role of women in agriculture and that develop techniques designed to encourage the participation of women farmers in the delivery of extension services.
3. Introduction of village level women paraprofessionals to work with women farmers (Ministry of Agriculture, 1983).
4. Incentive systems for extension staff that encourage working with low-resource producers, especially women.
5. Ensure that women have access to credit, either by developing appropriate credit institutions or expanding indigenous credit societies.
6. Design village based programs aimed where women gather—e.g., at village water points.
7. Include women as beneficiaries of land reform or allocate them rights of use to land in traditional systems.
8. Ensure that farmer training courses stressing food production techniques are available to women on an equal basis with men.
9. Emphasize the use of farming systems research (FSR) to investigate the intrahousehold dynamics within farms. For each situation and condition, it is important to identify goals, decision criteria, and the context of the decisions for women (Gladwin, et al., 1984; Spring, 1984).



Photo credit: US. Agency for International Development

Many organizations have called for changes in agricultural extension systems to meet the needs of low-resource producers, especially women. One suggestion is to work with groups of people where they normally gather. Village water supplies, like this one in Niger, offer opportunities to reach women without disrupting their work activities.

Issue 8: Extension systems in Africa lack clear objectives and adequate structure for increasing food production.

Preliminary Findings

- Extension systems are in place in most African countries, but generally seem to be ineffective in transferring information between farmers and researchers.
- The objectives of extension programs commonly are confusing to the field staff or the farmers.
- Farmers often have inappropriate expectations of extension.
- African extension systems frequently have few technical innovations to propose to farmers as options to current technology because research-

ers and the extension service are in different ministries (or divisions) and usually coordinate poorly.

- Extension services generally have few subject specialists who can communicate effectively with both researchers and extension staff.
- Agricultural research and extension services commonly do not take into account the needs of low-resource farmers. Most planning and implementation have been centralized and the innovations introduced tend to be directed toward more “progressive” farmers.
- The U.S. research and extension model assumes that the existing technological base is under-productive and that technological innovations can increase farm productivity.

- The U.S. land grant model of agent/farmer interaction, which uses applied research, could be modified to suit specific country conditions in Africa.

Discussion

One institution directly involved in technology transfer is the agricultural extension service. On a day to day basis, staffs attempt to transfer information on available technologies and farming practices to farmers. The United States and many other donors have spent several billions of dollars on developing and strengthening extension systems (Watts and Claar, 1983). But these attempts have failed to contribute significantly to increases in food production or to reach the poorer segments of agricultural societies (Moris, 1981; Anthony, et al., 1979; Richardson, 1983). Some problems of African extension systems most frequently mentioned are inappropriate models, poorly defined goals and objectives, poor organization, inadequate human and financial resources, lack of suitable technology to extend, failure of agricultural ministries to identify target groups, loss of skilled field staff due to promotion, predominantly male staffs ignoring women producers, and the lack of remuneration, transportation, and respect for the field agents (Kellogg, 1983; McDowell, 1984; Moris, 1981; Spring, 1984).

The historical development of Africa determined the evolution of most extension systems. In Francophone Africa, the French extension model (sometimes combined with the U.S. land grant system) was based on a cash crop economy. The British introduced an extension system in East Africa and parts of West Africa designed to stimulate production of food and cash crops for the British market, even though the domestic British model for extension was based on food production (Watts and Claar, 1983). In each of these areas fragments of these models still remain and affect the objectives of the systems.

The model that the United States has been promoting in many areas of Africa is based on the U.S. land grant system of research, education, and outreach. Using this system, attempts have been made to transfer both international and national

research to "progressive" farmers and herders, assuming that the adoption of innovative agricultural techniques will be passed on to other low-resource producers. However, "[developing countries] have systems oriented to serving governmental needs. They stress things, not people. They are not client-centered and not well set up to reach small farmers, to create credibility or to transfer knowledge" (Watts and Claar, 1983).

Five general approaches to agricultural extension exist in Africa. They are: 1) the conventional or innovation-centered approach, based on a package of innovations to be distributed to individual farmers, usually the more "progressive" ones; 2) the commodity-focused approach, based on the promotion of a single cash crop and the inputs necessary for a timely harvest and a suitable remuneration for the producers; 3) community development-cum-extension approach, which integrates agricultural extension with other community development activities; 4) the "animation rurale" or extension techniques used to organize groups of producers to solicit needs and provide information relevant to those needs; and 5) the farmer-focused or the Training and Visit System approach, which emphasizes providing recommendations based on the circumstances of the farmer, regular in-service training for the extension agents, tightly scheduled visits to the farmers, and close supervision (Pickering, 1984).

Problems exist with each of these approaches. The conventional approach generally involves the introduction of relatively expensive technical packages of inputs. Because of the risk involved with the expense of the complete package, it is difficult for low-resource producers to adopt any of these innovations. Consequently, frustrated agents work mostly with the more "progressive" farmers who have the financial means to purchase the packages, and the majority of low-resource producers are excluded. Since the agents work almost exclusively with wealthier farmers or herders, perceived problems that require further attention of research institutes do not represent the problems of low-resource producers (Stavis, 1979).

The commodity approach obviously does little to promote the increased production of food

crops **as it** deals exclusively with the production **of** a single cash crop. It can be directed toward small holders, but as with the conventional system, the tendency generally requires expensive packages of innovations.

The “animation rurale” approach, by working with groups of producers, has the advantage of reaching more farmers and herders with limited staff. Not only does this allow the extension system to reduce costs but the technique provides a structure for optimizing economies of scale in some farm operations and gives them some control over the extension system (Stavis, 1979). The disadvantage some see is that local groups are difficult to form (Pickering, 1984). However, this problem often can be overcome by working with indigenous groups instead of introducing new ones.

The community development-cum-extension approach is criticized because it diffuses the extension efforts among too many activities and diminishes the impact that extension agents can have on introduction of agricultural technologies (Pickering, 1984). However, enough concern was expressed at the OTA workshop about agricultural development proceeding in a manner isolated from rural development to justify examining this approach.

Finally, the Training and Visit System (**TVS**) **approach represents the World Bank’s attempt to strengthen conventional extension systems.** Extension agents are being supported with in-service training, closer supervision, and infrastructural support. Also, they are relieved of many of their non-agricultural responsibilities. The system also is designed to ensure that extension supervisors work with a limited number of agents and that the agent/farmer contacts are regularly scheduled (Benor and Harrison, 1977). The system generally uses contact with individual producers but can be used for group extension activities. The advantage of the approach is that it strengthens existing systems and provides regular in-service training. The disadvantages are: 1) it requires a high level of recurrent costs that most African governments cannot afford and 2) by reinforcing existing systems, it may affect little the information flow to low-resource producers, may ignore

indigenous production techniques, and may continue to promote technological packages that are inappropriate to local social, environmental, and economic conditions.

OTA has developed several conditions for the successful transfer of technology (Box B). One necessary condition requires that both users and transfer agents be involved in the choosing, planning, and implementation of the technology so that it meets the actual needs of the user. This ensures a two-way educational process; the agent relating technical and institutional support information, and the farmer identifying constraints and needs. Generally, extension agents deliver the message or physical inputs to the community and measure the outputs. This organizational structure allows no opportunity for feedback from farmers to reach the researchers and assumes that the government agricultural hierarchy knows what is best for the farmers (Nobe, 1983; Moris, 1981).

Another equally important condition is that the technology be adapted to the users’ local biophysical and socioeconomic situations. This implies that extension systems not only have to introduce technologies that fit the local conditions but also must be sensitive to the existing farming systems and indigenous technologies. The extension system should be able to transfer information in both directions. The farmers’ problems need to be presented to agricultural researchers and policy staff, while the researchers need to present suggested improvements back to the farmers.

To reach low-resource producers effectively and increase food production, African governments and donor agencies must establish clear objectives for agricultural development, target group(s), and alternative structures for agricultural extension systems that assist in meeting objectives. An effective extension system should: 1) provide mechanisms for research/extension coordination, 2) establish clear terms of reference that rural people understand and support, 3) develop methods for understanding the constraints of and providing opportunities for low-resource producers, 4) identify indigenous agricultural technologies and determine their effectiveness, and 5) function on the premise that client participation is crucial.

Box B.—Conditions Necessary for Successful Technology Transfer

The OTA assessment on technologies to sustain tropical forest resources identified a number of necessary conditions for successful technology transfer. For most technologies, the lack of these conditions seems to be constraining wider adaptation and adoption:

- Technology is transferred most effectively by direct people-to-people actions. People who are to adapt and apply the technology need to learn it directly from people who have experience applying it.
- The technology needs to be adapted at the user's end to local biophysical and socioeconomic conditions.
- Well-qualified people with knowledge about the technology are needed on the source end of the transfer, and receptive, capable people are needed on the receiving end. These people maybe local transfer agents or they may be the end users.
- Another type of actor, the "facilitator," is also necessary. Facilitators understand the technology transfer process, including the market for the technology and its products and the political, social, and economic constraints and opportunities that affect all the other actors.
- Users and transfer agents should be involved in choosing the technologies and in planning and implementing the transfer process so that the technology and the transfer meet actual needs and are appropriate for the local situation.
- All parties involved-source, transfer agents, facilitators, and end users-must feel that they are winners and must, in-fact, be winners. Each actor's self interests should be identified at the start of the technology transfer process so that they can be addressed.
- Each participant must be aware of subsequent steps in the transfer process so his or her actions are appropriate to the late steps. This requires early definition of roles for each person involved.
- The environment for technology demonstrations should be similar to the environment that will exist during subsequent steps of the transfer process. Pilot transfer projects should not be unrealistically easy.
- The initial commitment of resources to the process should be sufficient to carry the technology transfer until it is self-supporting.
- The transfer process must include mechanisms through which all participants can contribute effectively to interim evaluations and improvements.

SOURCE U.S. Congress, Office of Technology Assessment, *Technologies to Sustain Tropical Forest Resources, Summary* (Washington, DC: U.S. Government Printing Office, March 1984).

[T]he fundamental problem lies not, as is commonly assumed, between researchers and extensionists . . . much more serious was a failure by both research and extension to perceive farmers' problems from the farmer's own perspective If research and extension are to offer useful recommendations to farmers, they must look at the whole farming system (Collinson, 1984).

A farming systems research (FSR) approach provides a methodology that has promise. Farming systems research is "an approach to agri-

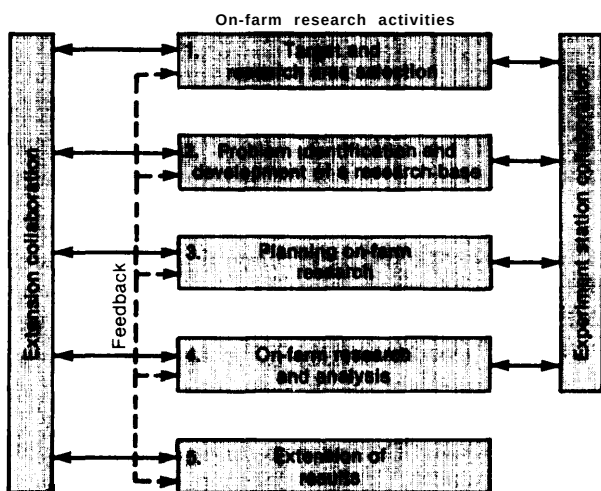
cultural research and development [of technology] that views the whole farm as a system" (Shaner, et al., 1982). The primary goal of FSR is to increase the productivity of the farming system given the complete range of societal goals and the constraints of the farming systems (Gilbert, et al., 1980). Characteristics of FSR include: 1) location-specific research, 2) development of improved technologies for a target group of farmers, 3) an interdisciplinary nature, 4) an iterative approach to technology development, 5) using the house-

hold as the management unit, and 6) farmer participation in the research development (CIMMYT Economics Staff, 1984; Shaner, 1983).

Figure 9 indicates this step-wise technological transfer process with sufficient feedback provisions to ensure the development of technologies appropriate to farmers' needs. **OTA workshop participants felt that FSR could be a very useful method for determining farmers' constraints and developing technologies** with the farmers (on their fields) instead of for them. However, since AID is questioning the cost-effectiveness of the approach, the OTA workshop participants felt that the approach needs to be simplified and needs to incorporate conventional extension systems in the process.

Agricultural extension remains ineffective in the identification of farmers' constraints and in supplying useful technology in response to these constraints. African governments could develop concise objectives that stress the need for farmer participation, coordination between researchers and extension, and alternative approaches for dealing with low-resource producers. However, even with more effective extension systems, one thing should be emphasized.

Figure 9.—integrating Farming Systems Research and Agricultural Extension for Technology Transfer



SOURCE: Willis W. Shaner, "Linking Extension with Farming Systems Research," In: *Knowledge Transfer in Developing Countries*, J. B. Claar and L. H. Watts (eds.), Proceedings of a Conference on International Extension, Steamboat Springs, CO, July 1983.

[Extension programs by themselves in the absence of land tenure reforms and vigorous, egalitarian input supply programs, should not be expected to reverse the trend toward concentration of assets in the rural society, or to save the small, poor, or inefficient farmer. They can, however, assure that the small farmer is not disadvantaged with regard to information (Stavis, 1979).

Issue 9: The lack of training and back-up support for extension field staff contributes to inadequate information transfer.

Preliminary Findings

- Physical constraints affecting extension agents have been lack of transportation, decent housing, in-service training, access to information, and remuneration/incentives for working in rural areas with few services.
- Extension agents sometimes act as input distributors instead of information disseminators.
- Field agents have been burdened with a substantial number of nonagriculturally related activities that limit extension work.
- The agent/farmer ratio remains low in most countries, which encourages a "progressive" farmer approach instead of a broader group approach.
- Inadequate numbers of well-trained field staff is a problem. The recruitment of field staff usually is biased toward urban residents with little farm experience. Excellent staff are promoted out of the field; no incentives are offered to continue working in rural areas.
- Overemphasis is placed on paper work instead of field accomplishments.
- Agricultural training institutes generally have taught extension staff individual farmer intervention techniques. Group extension activities usually are given low priority.
- In-service training is limited and does not provide opportunities for staff to provide feedback to trainers.

Discussion

Extension services, as with most institutions in Africa, suffer from weak human resources devel-

opment. Depending on the area, a typical extension agent is expected to communicate with between 100 and 800 farm families (Anthony, et al., 1979; Pickering, 1984). In addition, the agent also will have several nonagriculturally related tasks to accomplish. These include attending monthly agricultural meetings that may require several days of travel time, distributing agricultural inputs, monitoring credit collection, settling local disputes between farmers, and serving as a local government agricultural representative (Watts and Claar, 1983). These impositions on the staff serve

to limit motivation. Most extension agents live in fairly remote areas, lack adequate housing and transportation, receive low salaries compared with urban counterparts, are given inadequate technical information and moral support, receive little in-service training, and perceive limited potential for career advancement (Moris, 1981; Hyden, 1983; Watts and Claar, 1983).

As a result of the extended network and lack of support, an extension agent generally responds in at least two detrimental ways. One is that the



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Agricultural extension systems are generally weak and offer few incentives for staff to work in the more remote areas with low-resource producers, especially **women**. Here, an agricultural demonstrator shows male farmers of the Casamance region of Senegal how to use a single-furrow plow.

agent realizes the physical constraints (and the lack of incentives to operate otherwise) and limits the number of field visits to those farmers who are either immediately accessible or “progressive” enough to more readily accept government advice and/or inputs. The agent will also attend community meetings where contact with a larger body of farmers is possible. The other response is that a growing emphasis is placed on quantification of inputs and outputs to justify the extension agent’s existence. The agent then becomes a distributor of inputs, not an extension agent. Neither one of these responses results in an extension agent who communicates with target groups of farmers or who is an active disseminator of technology based on perceived and/or articulated farmers’ problems.

In the past several years, the World Bank initiated an extension support program that was designed to eliminate some of these problems. The program, called the Training and Visit System (TVS), strengthens the extension system by separating it from other conflicting responsibilities and through credibility-building support programs. Moris (1981) identifies other reform meas-

ures of the TVS as: assignment of a reasonable number of farm families to each agent, providing reasonable supervisor/agent ratios, identification of innovations that will have an immediate impact, intensive in-service training on a scheduled basis, provision of methods for the improvement of farm management before encouraging purchased inputs, developing contact links with research bodies, and providing sufficient transport and incentives for the contact staff.

The TVS deals with the credibility, institutional weakness, and incentive issues. Criticisms of the system are that: 1) it is based on the false assumption that exogenous technologies exist that are suitable for local ecological, social, and economical conditions, 2) it requires large recurrent budgets to operate, and 3) it does little to eliminate the male bias in extension systems. However, as others have indicated, the TVS does a great deal to strengthen the inadequate human resources component of extension systems. It could be evaluated further to determine its role in upgrading existing extension systems, especially with respect to FSR.