Enhancing Technology Generation and Dissemination for Wider Uptake and Impact

There is an increasing pressure on water resources in sub-Saharan Africa due to unprecedented and competing demand for water among agriculture, ecosystem services, and other uses. Various technologies and practices have been developed in the region to increase the productivity of crop and livestock systems. These technologies and practices have failed to be adopted by the end-users, however, because the interventions were developed without considering the socioeconomic concerns of target communities, their systems, and their institutions. They commonly fail to respond to social preferences, indigenous knowledge, and local skills.

Participatory research proved to be effective in enabling small-scale farmers and local decision makers to identify and develop technologies, but adoption of interventions by the end-users at a wider scale remains challenging. Appropriate policies and institutions must be developed and local communities must be involved in decision-making (Gleick 2003, de Fraiture *et al.* 2007).

Challenges in targeting production systems and clients

- **Horizontal and geographic spread of technologies have been limited, even with facilitation of public institutions and NGOs.**
- **Technologies across agroecologies and social strata are inappropriate and spread of technologies and approaches that demand collective decision and policy support is limited (e.g., grazing land management).**
- **Production systems and socioeconomic categories have demanded diverse technological innovations and approaches to bring about immediate change.**
- **Production objectives among stakeholders vary–e.g., some households have concentrated on marketable livestock-related commodities, whereas others focus on food security and self-sufficiency.**
- **Resource-poor farmers, especially those far away from markets, have been facing difficult decisions over the use of scarce resources in their production systems.**
- **Decisions on the allocation of resources have often been made in association with immediate financial gains and food security, with limited assessment or appreciation of the impact of management decisions on other system components (e.g., feed production, soil fertility management).**
- **There has been a need to characterize, package and disseminate the technologies to various recommendation domains (agroecologies, cropping systems, cultural values, system niches and other system scenarios).**
- **Farmer-to-farmer dissemination of technologies through existing social networks–be they defined by area of residence, friendship, kinship, marriage, religion or other factors–has been a successful approach (Adamo 2001), although reach was limited.**
- **Production systems have differed in agroecology, socioeconomic and policy dimensions as well as institutional constraints and household priorities.**
- **Interaction with research and development also has varied from community to community.**

Identification of key entry points

Identification of key entry points is the initial action that is strategically applied to assure smooth and effective engagement with communities and institutions. Entry points are essential to build trust between the community and outside actors, arouse their interest and keep their spirits high. They have certain properties that lead to the desired objective of promoting 'win-win technologies' at farm and higher scales. These include various interventions in the form of attractive technologies, policies and incentives. The most apparent entry points, however, were often crop varieties, although farmers have slowly shifted their interest to water conservation measures and bund management that combined fruit trees and multipurpose forages.

Strategically, entry points must have certain properties that will lead to the desired objectives of promoting win-win technologies. They must be of high priority and must bring about a successful solution to a community problem; quick in bringing benefits, in particular, higher household income; and accessible to most households and easy to adopt.

Linking technologies in Ethiopia

By linking the entry point technologies with soil conservation (e.g. forage grasses and multipurpose trees), farmers in southern Ethiopia were able to get multiple benefits in the form of increased crop yield, livestock feed, and fuelwood. Further intensification was possible with more horticultural crops, production of fodder (grasses and leguminous trees and shrubs) for zero grazing, while serving soil conservation and other uses.

Promoting linked technologies

The term 'linked technologies' was coined to define interrelated technologies applied simultaneously at plot level to render multiple benefits and facilitate adoption of technologies. The research teams employed several participatory techniques to link individual technologies to foster visible farm benefits (Amede *et al.* 2006). Linking technologies facilitated change from a commodity orientation to a more holistic and systems approach, whereby farmers were in the forefront throughout technology development, dissemination and impact assessment. In general, the linked technology approach best enabled development workers, research organizations and recipient communities to jointly address poverty and natural resource degradation in a holistic manner. As farmers' interest gradually increased in adopting the simple entry-point technologies, the research teams created access to a wider range of, and more complex and linked, technologies (Figure 1).

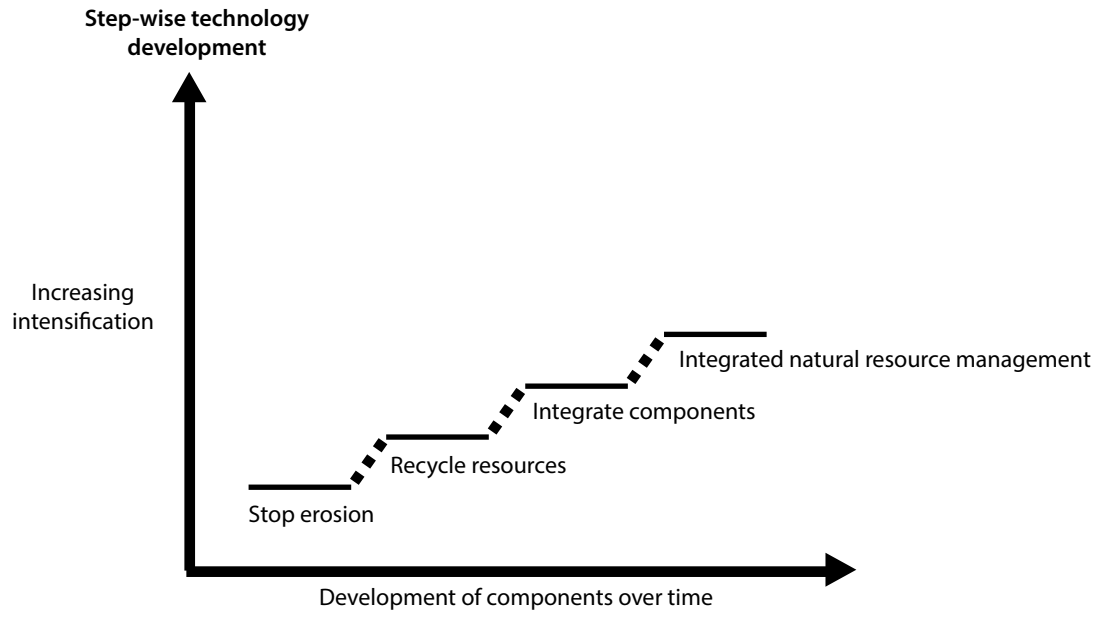

Figure 1. Step-wise integration of various technologies and approaches to improve natural resource management in the Ethiopian highlands (Amede* et al. *2006).

Strengthening linkages and partnerships

It is critical to create favorable linkage mechanisms among the actors to provide more options, other interventions and expertise. This is done through

- Holding periodic stakeholder meetings and workshops for feedback exchange and experience sharing to create a common understanding of visions, goals and objectives.
- Building genuine partnerships and linkages with farmers, related organizations and development actors facilitating dissemination.
- Stakeholder partnerships negotiated in such a way that all parties clearly understand and fulfill their responsibility and are committed to work together.
- A commodity approach, which requires that it be augmented with an integrated agroecosystem approach so that interrelated enterprises, heterogeneous circumstances and innovation systems can be taken into account. This requires an ability of development partners to analyze and work with systems.

Community facilitation

Facilitators with appropriate skills and experience are needed to organize actors and help their groups to function. This is critical to build social capital for managing communal resources. It is also an efficient tool to reach many farmers quickly. They help build capacity so they can make demands, manage themselves, participate in research and development (R&D) activities and have their own activities, considering resource status, wealth, age and other stratifications that might affect needs and priorities. Farmers are empowered and their ability to conduct their own experiments is improved. It is crucial to document farmers Indigenous Technical Knowle dge (ITK) and build upon it by the research and development agenda.

Supportive research and extension organisation

Creation of a favorable policy and a conducive working environment in research and extension systems plays a pivotal role in the internal and external efficiency of technology dissemination processes. This was demonstrated by the establishment of researcher-farmer-extension linkage steering groups at the Ethiopian Institute of Agricultural Research. The availability of adequate resources, coupled with good and visionary leadership, is thus needed for the execution of effective extension.

Local organizational capacity

Facilitation of farmer organizations help improve effective technology development and dissemination and collective action. A community change management approach is required for group facilitation in managing common natural resources (e.g. grazing land management). Organizing farmers into strong farmer research groups (FRGs) creates an entry point into the community for researchers, extension personnel and development staff to work closely together (Amede *et al.* 2006). Empowering the groups using participatory approaches is fundamental to

enable them to meaningfully participate. Moreover, working together requires patience and respect for the communities' social values and affairs. Farmer capacities are built through training, visits, and experience-sharing discussions, and general facilitation.

Basket of technological options

There is a need to ensure sustainability of technology used by improving access to and availability of multiple technological options (e.g., annual forages with various maturity periods). The technological options should be appropriate to the needs, interests and local conditions of the farmers. Involvement of end-users in the development of the technologies heightens the probability of appropriateness and, therefore, adoption.

Market orientation

Promotion of effective technology requires effective market orientation through research by farmers. Forage and water management interventions are linked to marketable livestock enterprises. There is a need to consider agencies and actors associated with markets as key stakeholders. Institutions help farmers identify market imperfections and incorporate the interests and priorities of stakeholders involved in marketing fields.

Conclusions

Current policies need to be adjusted to support technology generation and dissemination ensuring that large numbers of farmers have access and can use them. There is a need to foster supportive and conducive infrastructure and related policies to ensure that research, extension, and development outputs reach users. Similarly, the International Livestock Research Institute and the International Water Management Institute have recognized the need to make research more demand-driven and responsive to client needs by ensuring the participation of users in the process of agricultural technology development and through developing the capacity and confidence of those making the demands.

In general, principles and values inherent in supporting technology generation and dissemination may include

1. **Inclusiveness**. Different social groups of farmers should have equal access and opportunity to be part of research processes and participate in the decision-making process on communal and their own specific problems (problem differentiation).
2. **Monitoring to improve research and extension processes**. There is a need to continuously monitor progress at the farm and landscape levels, whether or not research is problem-driven or demand-oriented, and examine the relevance of research to the community to improve approaches and strategies so as to deliver technical options in a sustainable manner.

3. **Trust and value indigenous knowledge and skills:** Researchers and service providers should understand systems and farmers' situations, value farmers' knowledge, and trust in farmers' potentials and capabilities (e.g., that they are experts in their own situation). This calls for building genuine partnerships with farmers and other stakeholders.

4. **Build capacity for self reliance and empowerment:** There is a need to build farmers' capacity to manage their own affairs (self-reliance); improve stakeholder participation (dialogue, interactive, multiple ways); improve access to choice of technologies; create flexibility and options; improve quality of facilitation; develop a sense of joint ownership (role clarification, trust, transparency, confidence); and promote experiential learning–a way of learning-by-doing that is relevant to both researchers and farmers.

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