PARTICIPATORY AGRICULTURAL RESEARCH PROCESSES IN EASTERN AND CENTRAL ETHIOPIA: USING FARMERS' SOCIAL NETWORKS AS ENTRY POINTS

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PREFACE

The development of participatory research methods and support for their refinement and application by national research institutions has long been a key activity of the Centro Internacional de Agriculture Tropical (CIAT). This emphasis, in Africa as in Latin America, arose from the conviction that building a more effective and sustainable formal research sector depends upon establishing real partnerships with farmers. This paper examines, from both farmer and researcher perspectives, many of the processes surrounding the conceptualization and implementation of participatory research activities that are community based.

The study was carried out jointly by CIAT and the Melkassa Agricultural Research Center of the Ethiopian Agricultural Research Organization (EARO). We worked with communities in Central Ethiopia under the Participatory Research for Improved Agroecosystem Management (PRIAM) Project. A component study on the development of simple ox-drawn equipment for intensifying a monocropping system makes an excellent success story of participatory approaches. At the same time, the observations on social capital and the conclusions on strengths and potential pitfalls of working with farmer research groups will be startling for some, and deserve to be read by researchers, NGOs and development agencies across the region.

Disseminating results from significant research is an activity of the Pan-African Bean Research Alliance (PABRA) that serves to stimulate, focus and coordinate research efforts on common bean, the systems within which it is produced and the people who grow and consume it. PABRA is coordinated by CIAT in collaboration with two interdependent sub-regional networks of national programmes: the Eastern and Central Africa Bean Research Network (ECABREN) and the Southern Africa Bean Research Network (SABRN). Two other series complement this Occasional Publications Series: Workshop Proceedings and Reprints.

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The farmers of Boffa and Wolechiti, and the chairpersons and members of the farmer research groups in both villages, are the centerpiece of this study. They shared so much of their agricultural experience and their insights into relationships that it is difficult to express adequately our appreciation for their patience. To Ato Sisay Tekleselasie, a special thank you!

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Participatory Agricultural Research Processes in Eastern and Central Ethiopia: Using Farmers' Social Networks as Entry Points for PR Activities

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Introduction

Farmer participatory research (FPR) is an approach that enables and encourages farmers to take charge of the agricultural research process that is meant to improve and sustain their livelihoods. This paper examines, from both farmer and researcher perspectives, many of the processes surrounding the conceptualization and implementation of participatory research (PR) activities that are community based. In particular, I explore the issues involved in the formation of farmer research groups (FRGs) as a catalyst for community-based PR.

Findings from research conducted with the Participatory Research for Improved Agroecosystem Management (PRIAM) Project in Central Ethiopia suggest that farmers should initiate the formation of FRGs based on local forms of social organization and not exclusively with "communities". Research agendas seeking to work exclusively with "communities" that demonstrate high levels of social capital may effectively marginalize the poorest and most vulnerable groups of rural people. In central Ethiopia, farmers are not organized according to community structures and institutions, but rather participate in multiple and overlapping social networks that cross many communities in a given geographical area. High levels of social trust and commitment typically characterize farmers' social networks, and through these social units farmers share knowledge, resources, and technologies. I argue that tapping into these local forms of social capital will enable researchers to build more effective linkages with local knowledge systems and enhance the meaningfulness of local peoples' participation in research. It will more effectively integrate different social categories of people into research and development initiatives, target the networks through which farmers disseminate technologies, and in the long-term sustain locally driven and relevant activities of research and development.

PRIAM

The International Center for Tropical Agriculture (CIAT) initiated the PRIAM Project in 1997 with financial support from the Rockefeller Foundation. The first phase (1997-1999) objectives were to:

1. Implement community-based PR projects in several countries in eastern Africa in collaboration with National Agricultural Research Systems (NARSs), Ministries of Agriculture (MOAs), Departments of Extension, and nongovernmental organizations (NGOs);
2. Facilitate the institutionalization of PR approaches within collaborating NAROs, MOAs, Extension Departments, and NGOs; and
3. Refine and develop methods for different stages of the PR process, including Characterization and Diagnosis, Planning and Experimentation, Monitoring and Evaluation, Information and Technology Dissemination, and Analysis of Experience.

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The PRIAM Project is currently working with national and regional agricultural research institutions in four communities in central and eastern Ethiopia (in addition to sites elsewhere in eastern Africa) and entering its fourth year with more diversified sources of funding through the Eastern and Central Africa Bean Research Network (ECABREN). The International Development Research Center (IDRC) of Canada provided funding for the supporting research activity reported here in order to analyze and document the research and extension experiences of participating communities and research institutions and to support continuing activities within the PRIAM Project in Ethiopia. This joint research activity with the Ethiopian Agricultural Research Organization (EARO) particularly emphasized understanding farmer response to the project, and farmer experimentation and diffusion of new technologies. The idea was to verify and demonstrate the utility of the PRIAM approach and to provide valuable information on farmer experimentation and diffusion mechanisms to several target groups—including PRIAM teams in six countries and a wider audience of researchers involved in community-based PR in Africa.

Research Objectives

The specific objectives of this supporting research activity were to:

1. Assess farmers' capacity to analyze their experiences with new technologies and processes connected with participatory technology development (PTD);
2. Investigate and analyze the multiple ways in which farmers experiment with and adapt new technologies, and assess how the PRIAM approach supports farmer experimentation;
3. Examine the factors that contribute to problems and successes in the functioning of farmer research groups (FRGs);
4. Analyze the implications of class and gender differences for participation in PR activities, farmer experimentation, and technology diffusion; and
5. Examine the social relations, networks, and institutions through which farmers donate, exchange, loan, and sell new technologies to other farmers within and across communities.

The research work focused primarily on the PRIAM sites at Boffa and Wolencheti managed by the Melkassa Agricultural Research Center (MARC). Field visits were also made to the PRIAM sites at Ararso managed by the Alemaya University (AU) and at Surakoyo managed by Awassa Regional Research Center, and to the PR site at Gununo managed by the Areka Regional Research Center under the auspices of the African Highlands Initiative (AHI).

Research Methodology

To explore the experiences of farmers and researchers with the PR process in the context of the PRIAM Project, the methodology involved a primarily qualitative approach. This drew upon a diversity of qualitative social science research methods as a way of examining a range of issues and themes associated with the process.

Focus group discussions provided an initial introduction to the participating farmers at the Boffa and Wolencheti sites and to their experiences within the PR process. Group discussions were organized to examine many of the social, cultural, and economic dimensions of the farming system, and household livelihoods. The discussions explored, in substantial depth, the dynamics and meaning of local social relations (such as gender, class, and kinship), both within and across households and communities. They also explored how such relations shape the farming system, the ways in which farmers negotiate and secure access to productive resources (such as land and labor), and new agricultural technologies.

Semi-structured interviews with PRIAM farmers formed the basis of the qualitative research approach and were carried out at the Boffa and Wolencheti project sites, and to a lesser extent at Ararso (AU), Surakoyo (Awassa), and Gununo (Areka). These interviews were used to examine a diversity of issues including:

- Background to the on-farm experimentation process,
- Impact of new technologies on the farming system,
- Household livelihoods,
- Household and community relations,
- Social networks and institutions in which different farmers participate and invest, and
- How such relations provide local channels of information and technology diffusion.

Self-evaluations of FRGs were developed to enable farmers at Boffa and Wolencheti to analyze their own experiences as FRG members (and as participants in the PRIAM Project), and to evaluate the strengths and weaknesses they experienced within the PR process.

Wealth-ranking exercises were conducted to examine local concepts and categories of wealth. The same wealth-ranking method was later modified to assess the impact of the PRIAM approach (and new project technologies more specifically) on the wealth of participating farmers. This was assessed in relation to community members outside the formal PRIAM process over time and on the changing relations of power between rich and poor within participating communities in the PRIAM context.

In the latter stages of the research, a technology diffusion mapping exercise was organized to trace and map out the social relationships, networks, and institutions through which PRIAM farmers donate, exchange, loan, and sell new technologies to other farmers locally and within neighboring communities and *woredas* (districts).

Participatory Technology Development Put Into Practice

We can define PTD as activities of research and development that are aimed at, or result in, a change in an existing technology in a way that its users (in our case mainly farmers) consider desirable. These activities are carried out by networks in which the technology's users play an active role. The PTD process interactively and collaboratively brings together the knowledge and research capacity of farmers and their communities with that of scientific research institutions to identify, generate, test, apply, and diffuse new technologies and practices (Engel et al. 1991:9). In PTD, unlike earlier PR paradigms (such as farming systems research), participation implies that farmers to a significant extent can identify and implement their own solutions to meet their specific needs. In PTD, research activities are chosen based on their relevance to, and the interest of, different farmers and build on their own knowledge of the farming system and experience with local technologies (Haverkort 1991:6). As such, the role of researchers within PTD is less that of directing or controlling the research agenda than of supporting farmer interests and initiatives. Thus the PTD goal is not only to develop locally adapted, improved technologies, but also to improve farmer experimental capacities and to empower social groups' greater access to, and control over, resources and decision making within development research as a means of ensuring its sustainability.

The process of participatory technology development under PRIAM

The PTD process in the PRIAM communities around Nazreth began with the building of cooperative relationships between PRIAM researchers from MARC, district-level development agents (DAs), and farmers from participating communities as the core PTD network. At the initial stage of PRIAM work at MARC, the PRIAM research team consisted of several research scientists from the lowland pulses and maize commodity programs, and from the agricultural engineering, agronomy, pathology, and agricultural economics departments. Until very recently however, most PRIAM researchers at MARC have participated less over time with only the agricultural engineer continuing his work under PRIAM. The PRIAM teams at Awassa and Areka Research Centers and the AU have experienced greater success in forming and maintaining multi-disciplinary research teams under PRIAM.

At each project site, PRIAM researchers and DAs formed FRGs through which relationships were built between PRIAM farmers as a starting point in the PTD process. The FRG members were selected based on their interest and willingness to participate in on-farm research and, to a lesser extent, their ability to participate in terms of resource access (land, labor, etc.). At the time of FRG formation, no attempt was made to identify and include different categories of farmers - or user groups - (based on wealth and other social and economic axes of difference). The purpose of establishing FRGs within participating communities was to facilitate the PTD process at community level. The FRGs were and are expected to act as the focal point of on-farm experimentation, monitoring and evaluation of on-farm trials, and information and technology dissemination within the community. The formation of FRGs was also seen to have the potential of building farmer capacity to influence research agendas and act collectively through the development or consolidation of community networks.

The PRIAM project began, in 1997, with activities aimed at developing with farmers an agroecological profile of the project sites (including soil types, rainfall patterns, cropping system, and indigenous technical knowledge of local agroecology etc.). However, little effort was put into enhancing researcher understanding of the social and cultural dimensions of farmer livelihoods and community/social organization (because of a lack of social science experience and expertise at MARC). A series of discussions followed between PRIAM researchers and farmers to identify and prioritize farmers’ problems (Table 1) and research interests.

Table 1. Identified and prioritized problems of farmers participating in the Participatory Research for Improved Agroecosystem Management (PRIAM) Project, with potential innovations and technologies identified.

Problems identified and prioritized	Potential innovations/technologies identified
1. Soil moisture stress	• improved farm implements for moisture conserving • short-cycle varieties • tillage practices that harvest moisture
Poor availability of high-yielding and different-maturing classes of varieties	• testing of different varieties suited to local agroecological conditions
2. Poor soil fertility	• crop rotation • farmyard manure and inorganic fertilizer • compost
3. Weeds	• improved tillage practices • use of inter-row weeder • herbicides
4. Livestock health problems	• use of, and research into, indigenous herbal medicines • veterinary services
5. Lack of portable water	• development of water resources such as deep wells and ponds
6. Soil erosion	• contour plowing • tie ridging • terracing • afforestation
7. Pests and diseases	• use of botanical plants that have pesticidal properties • storage hygiene • mixing of other crops with teff • pesticide use
8. Shortage of cultivatable land	• renting land • inter-cropping • sharing available land (common lands)
9. Poor availability and high cost of pesticides	• subsidies • use of botanicals • crop rotation
10. Shortage of animal feed	• testing different forage legumes and multi-purpose fodder trees

SOURCE: Adapted from Adugna and Tesfaye (1999).

On-farm experimentation with new technologies under PRIAM

Farmers have engaged in a diversity of on-farm experimentation based on their identification and prioritization of researchable problems, and the technical expertise of PRIAM researchers. In this way they have tested (and continue to test) the performance of improved varieties, cropping methods, and agricultural implements against that of local counterpart technologies where the local ones acts as controls.

The PRIAM researchers and farmers have worked together to plan, design, and implement on-farm trials and monitoring and evaluation protocols that would meet the needs and interests of both parties. The PRIAM farmers typically experiment with a new technology over multiple seasons to analyze its performance under changing (or variable) climatic conditions.

Over the last 4 years, experimenting farmers at PRIAM sites in central and eastern Ethiopia have implemented variety trials on teff, maize, beans, sorghum, wheat, barley, and sweet potato. After 3 years of variety trials, and based on their own criteria, farmers have selected varieties with various characteristics including early maturity, drought and/or heavy rain tolerance, high yield, pest resistance, and a desirable appearance and taste. Selected varieties are now being multiplied by some PRIAM farmers at the project sites and shared with farmers within the community and neighboring villages.

In addition to variety trials, PRIAM farmers in the Ararso Peasant Association (with AU) are implementing on-farm experiments to address:

- Soil fertility management issues (e.g., composting, use of farmyard manure, intercropping with nitrogen-fixing legumes, multipurpose forage and pasture crops, and multipurpose trees);
- Crop protection/pest management (e.g., testing Lantana, Datura, carbofuran insecticide, and pepper tree to control sorghum stalk borer);
- Livestock health (e.g., veterinary services and livestock monitoring, and multipurpose forage and pasture crops to improve quality of livestock feeds); and
- Reforestation (e.g., dissemination of *Leucaena leucocephala*, *Sesbania sesban*, and *Eucalyptus saligna* seedlings).

Compared to other PRIAM sites in Ethiopia, the AU has experienced the greatest success in implementing an integrated approach to PR despite the lack of a functioning multidisciplinary team.

Implement technology

One of the most impressive series of on-farm experiments is that designed to test the performance of improved agricultural implements developed by researchers from the National Agricultural Mechanization Research Center (NAMREC) at MARC in collaboration with farmers from the two participating communities near Nazreth. Since 1996, farmers at the two Nazreth project sites have performed on-farm trials to test and compare the performance of five different agricultural implements with the indigenous *maresha* or ox-drawn wooden plow in this farming system based on animal traction. Examples are given below.

The moldboard plow

This is designed to cut deeper into and invert the soil. Farmers find that it improves water infiltration into the soil, enables deeper root penetration and nutrient uptake, controls weeds, and incorporates crop residues into the soil thereby dramatically increasing soil fertility. Through on-farm experimentation, use of the moldboard plow was found to increase grain yield by 50% to 100%.

The winged plow
This is designed to plow a farmer's field without inverting the soil and thus reduces soil moisture loss to evaporation. Farmers in dry areas have found this implement useful for moisture conservation through *Nish Kebera* (an indigenous water harvesting technique).

The inter-row weeder
Compared to manual weeding, this tool dramatically reduces the time and labor required for regular weeding activities, provided that row planting is also practiced (the traditional system is broadcast seeding). Given that women to varying degrees play a role in weeding planted fields, the introduction of the weeder may have long-term impacts on the gender division of farm labor. In turn, this may impact on the extent to which women play a role in decision making in farm management and can claim a portion of farm income in return for the contribution of their labor. A great benefit of both the winged plow and the inter-row weeder is that they require significantly less draft power and can be pulled by a single ox or a pair of donkeys. This is an incredibly valuable feature given that the shortage of oxen and oxen feed are major production constraints in the area.

The tie-ridger
This tool forms a series of basins to check run-off and improve rainfall infiltration in cultivated fields thereby increasing soil moisture and reducing soil erosion and nutrient loss.

The row planter
According to experimenting farmers, this tool saves time and labor, more evenly distributes and conserves seed and fertilizer, and has been found to be exceptionally useful in the intercropping of beans or forage crops in maize or sorghum fields. Using the row planter, farmers in participating communities have also been experimenting with the comparative benefits of open and closed furrow planting under different rainfall conditions. Farmers have opted to experiment with different implements depending on the types of crops grown, the local soil type, the specific production constraints experienced, and the specific practices, preferences, and interests of individual farmers.

Variations on the *maresha* plow
On-farm experimentation of new agricultural implements has met with remarkable success in participating communities largely because the implements were developed and designed as attachments to the indigenous *maresha* plow used by farmers throughout Ethiopia for centuries. The experience of farmers and researchers alike has been that the development of the new implements derived from indigenous farm implements and practices simplifies the training required by farmers to operate and test the implements on-farm. It makes possible the dissemination of new information, skills, and *maresha*-based technologies from farmer to farmer. Farmers more readily accept and adopt these technologies because they are familiar, have a relatively low cost, save labor time, conserve seed, and dramatically improve farmers' yields.

Over the course of the experimentation process, the implement technologies in particular have gone through several stages of development based on farmers' experiences with their use and on the feedback given to PRIAM researchers of how they may be improved to better meet farmers' needs and interests. The indigenous knowledge of PRIAM farmers related to the local climate, the nature and characteristics of their soils, the growth behavior of locally used crops, and the indigenous *maresha* plow has made important contributions to the development of the implements. More specifically, it has contributed to how they are used (i.e., farming practices) on-farm. The next section presents the development of the row planter as a detailed case study in order to examine in-depth the "process" of PTD.

Case study in participatory technology development: The row planter

To understand why farmers do, or do not, accept and adopt technologies we must examine the processes through which they are developed. Often, agricultural scientists develop technologies on-station, with little consideration of the agroecological, economic, social, and cultural realities of the end-users (in our case, small-scale farmers), and little, if any, farmer participation in the process. The result, in many cases, is the development of technologies that do not address farmer needs and interests and which, for the most part, are not readily adopted. This case study shows how important farmer participation is in all dimensions of the technology development process. Farmer participation improves not only the acceptability and adoption of technologies, but also builds the capacity of farmers' networks and institutions to develop and sustain their own research and development agendas.

In 1995, engineers from NAMREC at MARC designed the first row planter as an attachment to the indigenous *maresha* plow to enable farmers to plow and plant crops in rows (as opposed to broadcasting). Although the row planter had been tested extensively on-station, the PRIAM Project gave researchers the opportunity and support to collaborate with farmers in the area to test and further develop the technology under farmers' field conditions and livelihood constraints.

The original row planter was first brought to the field in 1996 after a farmer from the Wolencheti Peasant Association had expressed interest in testing the technology after he had visited MARC to observe the new technologies being developed. Because the original row planter was designed for local sorghum and maize varieties (each crop has its own seed distribution plate based on seed size and application rate), the farmer began by experimenting with the tool to sow local sorghum and maize that season. Throughout the crop season researchers spent considerable time with him observing and evaluating the tool's performance in his field. At the end of the first season, the experimenting farmer gave considerable feedback to researchers including the request that researchers develop a new seed distribution plate for *fandisha*, a "popcorn" variety of maize. (The seed size of *fandisha* is smaller than local maize and larger than local sorghum and thus required a new seed plate for optimum seed distribution.) In the same season, researchers developed a seed distribution plate for *fandisha* that farmers quickly tested and approved.

In the same season, the experimenting farmer experienced a serious problem in the operation of the row planter that would demand researcher attention. The seed distribution outlets were positioned at the back and the fertilizer distribution outlets at the front of the planter in order to distribute fertilizer ahead of seed. During the planting of both sorghum and maize, the farmer reported that the fertilizer distribution outlets were becoming clogged with mud as the planter moved forward through the soil. In 1997, most PRIAM farmers confirmed this finding that caused the release and application of fertilizer below optimal levels and thereby affected overall crop quality and yield. In 1997, PRIAM farmers recommended modification of the planter's design to overcome this shortcoming. In the same year, and in response to farmers' feedback, PRIAM researchers redesigned the row planter. On the original implement, two fertilizer distribution outlets were located at the front and two seed distribution outlets at the rear. To reduce mud clogging, researchers modified the planter by having only one outlet each for seed and fertilizer distribution and moving the fertilizer outlet from the front to a position beside the seed distribution outlet at the back of the planter (Figure 1).

Figure 1. Modifications made to row planter to avoid mud clogging in the fertilizer distribution outlets.

In 1997, the modified row planter was taken back to PRIAM farmers for continued experimentation. All reported that the modifications made by researchers dramatically reduced mud clogging in the distribution outlets of the planter, allowing optimal distribution of both seed and fertilizer on the farm. It is crucial to note that during on-station testing of the row planter, researchers had not encountered problems associated with mud clogging within the fertilizer distribution outlets. This was because they were testing the planter on sandy soil types with properties very different from the heavy "*shakete*" clay soils found in the Wolencheti area. Moreover, researchers were using a modified version of the indigenous *maresha* plow (unlike that used by farmers in the area) to test the row planter on-station that, again, accounted for results unlike those experienced in farmers' fields. According to the PRIAM researcher responsible for the row planter's development, farmer participation in the technology development process has produced new adaptations of the implement that make it more locally appropriate than its predecessor.

At the end of 1997, PRIAM farmers expressed an interest in testing the row planter with crop varieties under experimentation within PRIAM. Farmers advised researchers that in order to use the implement with new maize and bean varieties (such as Awassa 511 and Katumani maize varieties, and Awash 1 bean variety) they would require new seed distribution plates for each. By the beginning of the 1998 *maher* season, researchers had developed and distributed new seed distribution plates for multiple improved maize and bean varieties.

During field discussions between researchers and farmers it was decided, however, that the entire seed distribution mechanism of the row planter would need to be redesigned to enable farmers to use the implement for bean planting. According to experimenting farmers, the hopper, or seed compartment, of the row planter was too small for bean seed, given that the rate of bean seed application was much higher than that of maize and sorghum. As a result, farmers expressed concern that the seed compartment would become exhausted too quickly– (and so would require greater labor in refilling) during the planting of bean. In response to these concerns and recommendations, PRIAM researchers redesigned the seed distribution mechanism in the row planter to make it adaptable to bean (and other kinds of seed with different seed application rates) by developing adjustable seed/fertilizer distribution compartments. Today, farmers can manually adjust the size of the distribution compartments to accommodate a diversity of crops and varieties (Figure 2). The ability to plant beans in rows has recently led to increased interest and experimenting with the intercropping of bean with maize, a system not formerly known in this area.

A. Original row planter: Non-adjustable seed compartments.

B. Adjustable seed compartment in first position: Planting sorghum.

C. Adjustable seed compartment in second position: Planting maize.

D Adjustable seed compartment in third position: Planting bean.

Figure 2. Modifications made to the row planter: Adjustable seed compartments to enable farmers to plant different crops and varieties.

Based on these and other on-farm experiences and recommendations by PRIAM farmers, each of the improved agricultural implements has gone through several stages of development over the last 4 project years. Farmers and researchers continue to work collaboratively to adapt and improve the row planter and other implements to meet farmers' specific needs and interests.

Once again, according to PRIAM researchers, had the experiences and indigenous knowledge of farmers not been identified and integrated into research, such technological improvements to the row planter would not have been realized. The PTD at the Nazreth sites has been an iterative process that has depended upon a strong sense of collaboration and exchange of ideas and expertise between researcher and farmer. The PTD process, according to researchers and farmers alike, demonstrates that the best solutions in technology development often come from farmers who have first-hand experience with the field operation and maintenance of implements. This process has, in turn, resulted in the development of technologies that are more appropriate and adaptive to local agroecological and production systems, and hence more sustainable than the standardized, and highly mechanized, farming technologies.

The impact of new technologies on farmers' livelihoods

Interviews with PRIAM farmers revealed some economic and social impacts of involvement in the PR process and, more specifically, access to and experimentation with new technologies. Wealth-ranking exercises in September and October 1999 provided considerable quantitative information regarding the impact of the PR process on the wealth and livelihoods of PRIAM farmers. During wealth ranking exercises in Worka (Wolencheti Peasant Association) and Kachachule (Boffa Peasant Association) villages, respondents were asked to rank all village members into locally defined categories of wealth. Once the rankings were completed, respondents were instructed to locate all PRIAM farmers within each wealth category. Respondents were then asked to rank PRIAM farmers again, this time based on their position within local wealth categories in 1996 – before the introduction of the PRIAM Project (and new project technologies). According to the results of the wealth-ranking exercises, between the years 1996 and 1999 most PRIAM farmers have jumped, on the average, two wealth categories out of five. In Worka village, for example, 83% of PRIAM farmers shifted at least one wealth category with 67% of those jumping two or more wealth groupings in only three seasons (see Appendices 1a and 1b). Both participating and non-participating farmers report that, as a result of on-farm experimentation with new technologies, PRIAM farmers were able to dramatically increase crop yields and seasonal incomes. With this additional farm income, they have been able to purchase more oxen, increase their landholdings, increase their level of investment in farm production (purchase of inputs etc.), and improve household food security and overall household livelihoods. The new wealth and status of PRIAM farmers has resulted in new categories and concepts of wealth defined on the basis of participation and access to technology under PRIAM, and in growing disparities between rich and poor within the community. The PRIAM farmers share a distinct social and economic status vis-à-vis other community members not only because they are now wealthier than most of their neighbors, but also because as a group they have strong relationships with PRIAM researchers, local extension agents, and NGOs active in the community. This situation elevates the social and political status of PRIAM farmers setting them apart from the body of their community.

The often-dramatic increases in household wealth created by new project technology raises several questions about the impact of new income levels on domestic budgeting arrangements and intra-household social/gender relations. During an interview with the wife of a PRIAM farmer in Wolencheti, it was clear that higher farm incomes under PRIAM did not have a wholly positive impact on the household. In households in Wolencheti and Boffa, women, as wives, do not have the power to control or allocate farm income and in most cases do not generate an income of their own. Instead, their husbands give them small allowances from farm income or permit them to take and sell small amounts of grain to purchase food and supplies for the household. Increases in farm incomes have led to wives making new demands for greater amounts of money to meet household needs. In most cases, women request only the same percentage of farm income that they had received in the past. However, in some cases such requests can produce conflict between husbands and wives. One wife, for example, claims that her husband refuses to increase her household allowance despite the dramatic increase in his farm income and increased investment in farm production over the last three seasons. In reaction to her husband's refusal, she regularly pilfers grain from the household silos and sells it at local markets to secure the money needed to improve household food security and livelihoods. In some cases, greater farm income may give rise to a renegotiation of gender resource rights and responsibilities within the household. In others, more negatively, they may increase conjugal conflict over domestic budgeting arrangements.

Determining the extent to which this is likely to be a trend within PRIAM communities in Ethiopia is difficult. In Wolencheti and Boffa, husbands are typically present during interviews with women. Thus difficulties ensue in discussing issues related to household income and domestic budgeting, and relationships between husbands and wives. In such situations, women commonly refer to social norms rather than the specific experiences of their households and will not speak negatively about their husbands. When sensitive questions are asked, husbands tend to take over the interview process and redirect the discussion. This certainly reflects the way in which gender relations of power shape the interview process and the kinds of results documented.

Household budgetary responsibilities can be, for example, how decisions about income allocation are made, how additional income is used, and who has the right to access and control such income.) How husbands and wives struggle over and renegotiate these responsibilities may have particular implications for communities (and PRIAM sites) where both women and men are actively engaged in agriculture. This is the case in Kenya and Uganda, but in marked contrast to most of Ethiopia. Researchers need to examine such potential impacts during local monitoring and evaluation activities, although considerable time must be given toward developing trust and familiarity between researchers, farmers, and other household members.

Farmer Research Groups in the Participatory Research Process

Farmer research groups were formed in 1997 under PRIAM to coordinate the PR activities in participating communities and to act as a linkage between PRIAM researchers and the community (inspired by the Local Agricultural Research Committees [CIAL] approach in Latin America, see Ashby et al. [1995]). According to researchers and farmers, the objectives of the FRGs are to:

- Conduct on-farm research with new technologies,
- Facilitate researcher/farmer contacts,

- Monitor and evaluate on-farm trials and report the results of on-farm experimentation to PRIAM researchers on the basis of consensus,
- Disseminate information and skills (through farmer-to-farmer training) to community members outside the formal research process,
- Disseminate project technologies to community members outside the formal research process (distributing the benefits of research to the community), and
- Catalyze community development initiatives.

Essentially, the FRGs are the center or focal point of PRIAM research activities at village level. As members of the groups, participating farmers are responsible not only for on-farm experimentation, but also for a range of social/community-based activities (such as dissemination of information and technologies) where the FRG is seen as a crucial linkage between PRIAM researchers and the whole community. As such, PRIAM researchers were interested to analyze, with PRIAM farmers, the functioning and performance of the FRGs in terms of their ability to meet group objectives, group leadership, cohesiveness, and problem-solving capacities, and their relationship with the formal research system and their community. Using a participatory evaluation tool (see Appendices 2a and 2b), FRG members conducted a self-evaluation of their group. To ensure that community members had a voice in this process, community members also participated in an evaluation of the FRG. It was hoped that information obtained through FRG self-evaluations would illustrate their effectiveness in, and contribution to, PR processes and would provide lessons to other PRIAM Project sites in the region working within and through FRGs.

The FRG evaluation exercises proved a crucial research activity not only to identify the strengths and achievements of the groups, but also to recognize the difficulties encountered in their day-to-day activities and management and the opportunities they present within the PR process.

Achievements of farmer research groups

The findings of the FRG self-evaluations at the Boffa and Wolencheti PRIAM sites reveal several key strengths related to the performance of each farmer group. The strengths identified include the:

- Development of a collaborative and productive relationship with PRIAM researchers and extension personnel;
- Design and implementation of on-farm variety and implements trials producing high quality research results;
- Organization of monitoring and evaluation activities (e.g., Farmer Field Days that enable group members to work collectively to identify and solve problems in trial design and implementation, improve experimentation practices, monitor and evaluate trials of all PRIAM farmers, and decide, as a group, new research directions);
- Dissemination of improved technologies across many communities in their district; and
- Collective pursuit of new research and development opportunities (e.g., local seed enterprises).

The findings indicate that strong FRG leadership is crucial to forming and maintaining a cohesive farmer's group with consistent and creative objectives and that is energetic in realizing these goals. According to FRG members, the organization of farmers into groups (whether locally or externally initiated) has greatly enhanced the relationship and degree of collaboration between experimenting farmers and PRIAM researchers. From the perspective of members, such organizations can potentially transform the research process from a consultative to a more collaborative or collegial mode of farmer participation in agricultural research by strengthening the voice and negotiating power of farmers vis-à-vis the formal research and extension systems.

Relations between farmer research groups and the community

Although the FRGs at both Wolencheti and Boffa have experienced measurable success in understanding and carrying out the technical components of their mandate (on-farm trials, monitoring and evaluation, etc.), a principal shortcoming has been their lack of communication and collaboration with their communities. Most community members at the PRIAM sites claim that they have not been treated as legitimate stakeholders in the PRIAM Project. Community members cited the following examples as indicators of lack of community involvement in the PRIAM Project:

- Community members were not involved in nominating and electing FRG members (researchers and extension personnel selected PRIAM farmers);
- Community members were not involved in decision making concerning the identification and prioritization of research problems, monitoring and evaluation of on-farm trials, etc.;
- At no time in the project have community members been given feedback on the project, research results, or future research directions by either the FRG or PRIAM researchers (e.g., no community meetings were held, researchers did not visit non-participating farmers); and
- Most community members have had no access to, or use of, new technologies being tested on-farm by PRIAM farmers.

Similar to the experiences of a number of CIALs (local agricultural research committees) in Latin America (Ashby et al. 2000), the FRGs in Central Ethiopia are strongly criticized by community members as being elitist. Many community members in Boffa, for example, charged that FRG members are “hiding knowledge” and trying to retain control of project resources (e.g., technologies) instead of sharing with the community. Although in some situations relations between FRGs and communities may be improved with better facilitation and monitoring by research and extension personnel, in certain social and cultural settings the approach itself may be the problem. During the self-evaluation exercises, FRG members indicated that they were unclear about their roles and responsibilities vis-à-vis their communities under the PRIAM Project. According to both FRG and community members alike, the reasons for this difficulty are three-fold.

1. At the outset of the project (or at any time since) the FRGs and PRIAM researchers did not define protocols for community participation in any stage of the project.
2. People in the project area do not think, work, or organize themselves as a “community” in the context of their daily lives. No community-based mechanisms or local institutions exist that organize or tie people together materially or symbolically to a village, or that form the basis of community-based action, because the “community”, as such, is not a locally recognized, or meaningful, unit of social organization.
3. People in the project area belong to multiple and overlapping social networks that intersect within and across many communities, and farmers share project information and technologies through these networks (see Appendix 3c).

The FRG evaluations conducted with group and community members revealed this important shortcoming and future challenge. Both indicated, for example, that without specific local or externally developed mechanisms for community participation at different stages of a project's cycle, the several segments of a host community are likely to be marginalized from the research process and its benefits.

People within the project areas suggest that <u>the most effective FRGs are likely to be those that are farmer-initiated and built upon local forms (or concepts) of social organization.</u> (For example, identifying local social networks and institutions as entry points into a village and bringing farmers together through these local forms of social organization.) Now CIAT is promoting a PR approach that creates the space within which farmers may (or may not) organize themselves (based on local forms of social organization) rather than initiating the formation of an FRG from the outside. Such an approach is more "participatory" and "bottom-up" in nature and will be more likely to sustain locally driven research initiatives in the long-term.

Farmers' Networks and Social Capital: Examining Technology Diffusion

Having identified to some extent the complexity of local social organization, we sought to examine further the kinds of social relationships, networks, and institutions through which new technologies have diffused, and the extent of technology diffusion (social, spatial) under PRIAM.

Throughout the research period, we spoke with people about the kinds of social relationships, networks, and customary institutions that are active and meaningful to farmers in the area, the kinds of functions these networks serve, and the opportunities they provide (e.g., social support and access to resources). Farmers were found to participate and invest in several local social networks including:

- Extended family/kinship relations,
- Exchange labor groups,
- Oxen and other resource-sharing relationships,
- Customary funeral institutions, and
- Customary friendship networks.

Each social network was found to offer different kinds of material and social support to members. We gathered considerable qualitative data related to the nature and significance of farmers' social networks. We then wanted to systematically track the flow of new project technologies both to demonstrate the extent of technology diffusion within the PR project and to gain more detailed information about the social networks through which new technologies are disseminated from farmer to farmer.

Specifically, we were looking for the following information:

- What social networks are significant as channels of diffusion of new technologies?
- Are technologies given as a gift, exchanged, loaned, and/or sold, and does the type of transaction depend on the type or meaningfulness of different social relationships or the kind of technology?
- Do farmers share technologies both at the intra- and inter-community levels (i.e., what is the extent of the spatial diffusion of technologies in the project area)?

To seek and effectively represent this kind of information we developed a technology diffusion mapping exercise (TDM) with PRIAM farmers to track technology diffusion through farmers' social networks (see Appendices 3a and 3b).

Reading farmers' maps

The findings of the TDM exercises support the third reason that FRG and community members gave for their difficulty in relations (see page 14).

The PRIAM farmers in Wolencheti and Boffa were found to share implements and improved seed technologies through several kinds of social relationships and networks, the most socially significant and meaningful of which is extended family, or kinship, relations. Farmers maintain close relationships with family residing in their own community and in neighboring (and often distant) villages. Similarly, farmers invest and participate in funeral associations, customary friendship networks, and resource-sharing (e.g., oxen) relationships through which they share new technologies. Membership in these networks overlaps considerably, and farmers' maps suggest that most sharing of improved implements and seed revolves around participation in group-based, on-farm activities (e.g., exchange labor groups made up of family and close friends). On-farm activities (such as group-based weeding and harvesting events) provide the most obvious and suitable occasion for sharing knowledge related to new technologies, and for the diffusion of technologies themselves, between close family and friends. Very high levels of mutual cooperation and trust typically characterize such relationships.

Farmers' maps also revealed that all rural people do not participate in, or have access to, the same kinds of social institutions and networks. Rural people interact within and across social categories and hierarchies. However, these categories often (although not exclusively) shape with whom an individual is likely to interact, work, share resources and technologies, and who they are likely to trust in the context of their daily lives. During our examination of farmers' social networks in Boffa and Wolencheti, we found that the kinds of social relationships in which people participate and invest depend in many cases on the gender, wealth, and age of different individuals. This, in turn, shapes patterns and processes of technology diffusion.

Gender

Women and men participate in different types of gender-based (segregated) social networks. Men in the participating communities belong to a variety of social networks whose membership is exclusively male. These fulfill a diversity of social functions and use several social and political spaces–(e.g., the Peasant Association meeting halls, drinking houses and other social establishments in town, and even the farm itself) identified as "men's spaces". Women also maintain their own gender-based social networks (e.g., *Baltina*, and women's extended family and friendship networks) that are mostly centered around the household and are organized to enable women to meet their own gender-specific roles, responsibilities, and strategic interests. According to men and women alike, women's social networks play a significant role in the dissemination of information about new technologies from woman to woman, with women passing on new information to their husbands and male kin. Because women play a very limited role in farm production and decision making in the participating communities, they did little by way of technology dissemination, as they had neither the experience with the technologies nor the decision-making power to share them with others.

At the PRIAM sites, men's social networks were principally responsible for technology dissemination.

Wealth

Social relations are also shaped by wealth and resource access. For example, farmers typically enter into oxen-sharing relationships with farmers of the same socioeconomic status and resource constraints as themselves. The dissemination of information, skills, and technologies through oxen- and other resource-sharing relationships has clear class dimensions and implications. Working through such relationships may constitute an effective strategy to ensure new technologies are reaching resource-poor farmers.

Age

Age also plays a significant role in the kinds of social relationships and networks to which people belong. Although men and women have friendships with individuals both older and younger than themselves, people commonly have closest social ties with those of about the same age and at the same stage in the household lifecycle. This is best demonstrated by the limited extent to which older PRIAM farmers disseminated technologies to their friends. Very few farmers over the age of 45 to 50 have shared technologies extensively. Although this may be partly attributed to ill health and physical abilities, it has much more to do with the kinds of social networks that elderly men in the PRIAM sites maintain. Elderly participants were asked why they had shared technologies with so few people in comparison to other PRIAM farmers. The elders reported that they had discussed the technologies (implements and varieties) with many of their "friends" and had encouraged them to borrow and test the technologies on their own fields. However, according to these farmers, few if any of their friends asked to access or use the technologies for on-farm testing. To understand the reason for this we asked respondents about their "friends". Among elderly PRIAM farmers, close friends were typically adult males over the age of 50 years. Members of these friendship networks spend much of their time in local drinking houses within their community, in neighboring villages, and/or in local towns where they share information and maintain a relatively leisurely lifestyle. In both participating communities few farmers over the age of 50 (especially those with adult male children) continued to manage their own farms, opting instead to transfer their land to their sons as a form of pre-inheritance gift. However, as the household head, they and not their sons participated in the PRIAM Project in name, if not in practice. Because their friends no longer farm themselves, few were interested in the improved technologies available and so did not request their use. In this way, age-based social networks play a significant role in shaping patterns of technology diffusion within the PRIAM Project.

Social relations and types of sharing

Farmers' maps demonstrated that technologies are diffused through local social networks using the following sharing mechanisms:

- Given as a gift (seed),
- Exchanged (improved seed exchanged for local seed material),
- Loaned (implements and sometimes seed), and
- Sold (seed).

How farmers share technology with others depends on their relationship to different recipients. In most cases, seed is given as a gift to extended family members and to close friends. At Wolencheti and Boffa, for example, seed is commonly given as a gift (often in large quantities averaging 20-25 kg) to the father of a man's wife. This gift is not a bridewealth obligation, but is seen as a powerful symbolic gesture (of sharing and recompense) between a man and his father-in-law. Seed is gifted in large quantities only to extended family, but may be given in smaller amounts (½ to 5 kg) to friends and neighbors, and to members of one's labor- and resource-sharing group during farm activities. Seed is also gifted to acquaintances or other distant relations when such individuals are perceived to be poor or "struggling". Several PRIAM farmers, for example, have given seed to aged widows and other women heads-of-household in their community whose lives are characterized by extreme vulnerability. Many PRIAM farmers reported rarely gifting seed to anyone (outside of family) who is thought to be wealthier than themselves because these farmers are financially or materially able to purchase the improved seed or exchange improved seed for local varieties.

A most common method of disseminating improved seed at the project sites is through exchange. While seed is given as a gift only to close relations, most PRIAM farmers are willing to exchange improved seed with the same quantity of a local variety with virtually anyone. Traders and consumers are not yet knowledgeable about differences between improved and local varieties, and so PRIAM farmers cannot sell improved seed at the market for a higher price than that of local varieties. Because PRIAM farmers are interested in disseminating improved varieties (to share the benefits of new varieties with their relations), they are willing to exchange improved with local varieties on an equal weight basis. Depending on household needs, PRIAM farmers either store the local grain for consumption or sell it at the market.

Less commonly, PRIAM farmers sell improved seed to friends, neighbors, and others. Seed is typically sold to individuals who are uninterested in exchanging their local grain, but prefer to pay for the improved seed. Seed is usually sold at the going market price for local grain (again to encourage the dissemination of improved varieties) although some PRIAM farmers are beginning to sell improved seed at higher prices (10%-15% above the market price of the local variety). A few PRIAM farmers have established community and cross-community farmer networks for the sale of improved seed. These networks represent business relationships where the price is negotiated between buyer and seller. A few farmers also sell improved seed to the local representatives of the Ministry of Agriculture and it is then distributed to farmers through the local extension system. Community members, however, typically find the price of improved seed sold by the MOA to be too high for most households to afford. Farmers' seed business networks are likely to constitute a more sustainable form of seed distribution system in the area.

Rethinking social capital: Farmer's social networks as entry points

More than anything else, farmers' TDMs reveal the complex and extensive nature of their social networks that crosscut many communities within an often large geographical area. As a result of migration and villagization schemes in Ethiopia, people have moved considerably from place to place over time. People therefore tend to participate in and maintain close relations with family and friends both locally and across substantial distances. Farmers indicated that they prioritize social ties based more on the quality of these relationships than on geographical proximity or community affinity or obligation. This helps explain the patterns of technology diffusion under PRIAM. The diffusion maps indicate that while PRIAM farmers do share technologies within their community they equally (if not more) commonly share both improved seed and implements with close family and friends in neighboring communities and in villages often over 20 km from their home. The diffusion maps, therefore, illustrate both the types of networks through which farmers disseminate technologies and the geographical/spatial extent of technology diffusion.

These findings raise several interesting questions about the concept of social capital—how it is defined, measured, and used within the context of PR approaches. Most recent literature related to social capital tends to operate on the implicit (and often explicit) assumption that social capital is to be found in "communities"—that communities either have or do not have varying levels of social capital. The reason for this has much to do with the integration of concepts of social capital into "community-based" approaches to research and development intervention. Where "communities" are not strong, is there necessarily no social capital between people? The most common definition of social capital in fact does not make specific reference to communities as all, but regards it as:

> ***"features of social organization, such as networks, norms, and social trust that facilitate coordination and cooperation for mutual benefit" (Putman 1993).***

Within the PRIAM Project sites, "communities" as such may not have strong levels of social capital. However, rural people participate and invest in a diversity of social networks that are characterized by high levels of social trust and provide a social framework that makes coordination, cooperation, and mutual assistance possible. These networks are rich in social capital.

The point is not to argue against community-based approaches entirely, but rather to highlight the importance and usefulness of exploring other bases of social organization that may provide strategic and effective entry points for different kinds of research and development intervention and improve the quality and sustainability of our work. The research described here suggests that a more socially and culturally sensitive, and a more sustainable, approach is likely to be one that explores the different manifestations of social capital among rural people in order to identify the range of local networks that could be used as potential entry points for different research activities (see Sikana 1995).

This approach will better ensure that we reach as many rural people—and categories of rural people—as possible, are sensitive to and work within local social and cultural realities, and are effective and sustainable in the long-term. Using local social networks and institutions, rather than communities, as entry points will improve the quality of our research in several ways.

- More effective partnerships can be built between formal science and local knowledge (working in collaboration with farmers' existing social networks through which knowledge is generated, used, maintained, and shared).
- The level and meaningfulness of local peoples' participation in research can be enhanced by working within and through local social relations rather than imposing potentially inappropriate constructs ("the community") and forming "farmer groups" that are not cognizant of, sensitive to, or adequately reflect, the nature of such relations.
- Different categories of people (defined on the basis of wealth, gender, age, and other axes of difference) can be more effectively integrated (rather than marginalized) into research and development initiatives.

- Networks can be targeted through which farmers disseminate technologies within and across communities thereby dramatically improving the "reach" of a project and new technologies.
- The capacity of local people can be strengthened to lobby and negotiate their individual and collective interests, on their own terms, within the formal research and extension systems.

Based on the findings of this research, and supported by the work of Sikana (1995) in Tanzania, partnerships with farmers' networks and institutions are more likely to be effective groupings to work and communicate with, and are more likely to sustain research and development initiatives following a project's completion.

References

Adugna W, Tesfaye A. 1999. Participatory research at Nazreth, Ethiopia. In: Farley C, ed. Participatory research for improved agro-ecosystem management: Proceedings of a synthesis workshop, Nazreth, Ethiopia, 17-21 Aug 1998. Network on Bean Research in Africa, Workshop Series, no. 38. CIAT, Kampala, Uganda.

Ashby J, Gracia T, Guerrero M del Pilar, Quiros CA, Roa JI, Beltran JA. 1995. Institutionalizing farmer participation in adaptive technology testing with the 'CIAL'. Agricultural Research and Extension (AgREN) Paper No. 57, July. Overseas Development Administration (ODA), UK.

Ashby JA, Braun AR, Gracia T, Guerrero M del Pilar, Hernandez LA, Quiros CA and Roa JI. 2000. Investing in farmers as researchers: Experience with local agricultural research committees in Latin America. CIAT Publication no. 318. CIAT, Cali, Colombia.

Engel P, Haverkort B, Jiggins J. 1991. Concepts and activities. In: Participatory technology development in sustainable agriculture: A compilation on ILEIA articles, selected bibliography. Information Center for Low External Input and sustainable Agriculture (ILEIA), Neths.

Feldstein HS, Jiggins J. 1994. Tools for the field: Methodologies handbook for gender analysis in agriculture. Kumarian Press, CT.

Gibbon M, Pokhrel D. 1999. Social network mapping. PLA Notes No. 36.

Haverkort B. 1991. Farmers' experiments and participatory technology development. In: Haverkort B, van der Kamp J, Waters-Bayer A, eds. Joining farmers' experiments: Experiences in participatory technology development. Intermediate Technology, UK.

Putnam RD. 1993. The prosperous community: Social capital and public life. In: The American Prospect, no.13, Spring.

Sikana P. 1995. The participatory training consultancy on the assessment and identification of formal and customary village institutions. Unpublished paper for the Government of Tanzania, under assignment from the Overseas Development Administration (ODA), UK.

Weller-Molongua C, Knapp J. 1995. Social network mapping. In: Slocum R, ed. Power, process, and participation: Tools for change. Intermediate Technology, UK.

Appendix 1a. Location of Farmer Participatory Research (FPR) Farmers in Local Wealth Categories, Wolencheti Peasant Association, Ethiopia.

Farmer wealth category	Farmer type[a]		
	FPR	Non-participating	Total
Category 1 – Poorest – "Beggars": May not have received land from the Peasant Association – landless. If they have land, they own no oxen and so cannot plow/farm their own land. Contract out their land to wealthier farmers in the community. Enter into sharecropping arrangements or hire out their labor on others' farms.	3 (18.7%)	26 (31.7%)	29
Category 2 - Very poor: Own only one ox. Can farm at least a portion of their land by engaging in *Mekanajo*[b]. May still contract out a portion of their land to wealthier farmers locally. Not considered independent or stable households – vulnerable.	2 (12.5%)	19 (23.2%)	21
Category 3 - Poor but independent: Own a pair of oxen and so can plow/farm all their land. Do not need to contract out their land to others. Can hire labor and purchase inputs. Considered "independent" (do not need to borrow or beg from others).	4 (25%)	16 (19.5%)	20
Category 4 - Secure or wealthy: Own two pair of oxen. Own other property (livestock). Can contract out (or accumulate) additional land for farming. Have better yields, food, and secure income. Have higher level of investment in farm management (inputs, labor etc.).	6 (37.5%)	17 (20.7%)	23
Category 5 - Wealthiest – "Moneylenders" Own more than two pair of oxen. Have accumulated large land holdings through contractual arrangements. Hire labor for most farming activities. Have a savings account at a bank and often a second home in town.	1 (6.25)	4 (4.9%)	5
Total (no)	16	82	98

a. % of ? Numbers are rounded.
b. Oxen-sharing relationship typically between two men who each own only one ox.

Appendix 1b. Location of Farmer Participatory Research (FPR) Farmers in Local Wealth Categories, Boffa Peasant Association, Ethiopia.

Farmer wealth category	Farmer type		
	FPR	Non-participating	Total
Category 1 – Poorest and landless – "Beggars": Did not receive land from the Peasant Association (PA) during state redistribution scheme (typically young farmers not of majority age to receive land at time of redistribution). Own no oxen. Work as sharecroppers or hire out their labor on the farms of wealthier farmers. Must "beg" relatives and friends for money, food, and other needs. Not able to negotiate loans from wealthier farmers to contract land. Extremely vulnerable households.	2 (14.3%)	15 (18.5%)	17
Category 2 - Very poor – "Resource poor": Own no oxen but have land through membership in the PA. Can contract out a portion of their land to wealthier farmers and farm a portion through sharecropping (laborer brings oxen to plow in exchange for percentage of harvest). Cannot feed their families through the entire year.	4 (28.6%)	29 (35.8%)	33
Category 3 - Poor – "Struggling", but able to farm: Have land and a single ox. Can plow their land by *Mekanajo*[a] (some may still contract out some land to others). Still cannot afford most agricultural inputs and hired labor. Plant mostly maize and beans that require little comparative investment. Struggle to feed their families because production levels are often low.	4 (28.6%)	6 (7.4%)	10
Category 4 – Secure or independent: Own a pair of oxen and other property (livestock). Do not need to contract out any of their land to others. Can hire daily and often one seasonal/permanent laborer. Have a higher level of investment in farm management (inputs, labor). Plant a diversity of crops (consumption and market sale).	3 (21.4%)	22 (27.2%)	25
Category 5 - Wealthy Own two pair of oxen. Able to accumulate land through contractual arrangements with poor farmers. Hire labor for most farming activities. Can properly store and sell farm production at market when price is good.	1 (7.1%)	6 (7.4%)	7
Category 6 – Very wealthy – "Moneylenders" not "Farmers" Own three or more pair of oxen. Accumulate large landholding through contractual arrangements with poor farmers. Can lend money to poor farmers. Have no problem purchasing inputs and hire permanent labor to manage farm. Able to feed their family throughout the year; send all children to school.	0 (0%)	3 (3.7%)	3
Total (no)	14	81	95

a. Oxen-sharing relationship typically between two men who each own only one ox.

Appendix 2a. Farmer Research Group Participatory Evaluation Tool

Following preliminary group discussions in August 1999, a group meeting was organized with the farmer research groups (FRGs) in Boffa and Wolencheti participating communities in January 2000 where the FRGs performed a group self-evaluation. The self-evaluations began with FRG members discussing and documenting the group objectives, as they understood them. Objectives raised and analyzed by the FRGs included the:

- Performance of on-farm research with new technologies,
- Monitoring and evaluation of on-farm trials and reporting their results to PRIAM researchers,
- Dissemination of information and project technologies to farmers outside the formal research process (distributing the benefits of research to the community), and
- Promotion of community development by acting as a bridge between PRIAM researchers and the community.

Participatory logframe as self-evaluation tool

A standard logframe was modified and used as a participatory monitoring and evaluation tool to help FRG members analyze their ability to meet each group objective and identify potential strategies to improve the FRG ability to meet its objectives in the future (Appendix 2b). The FRG members first discussed the activities undertaken to meet a specific objective. For example, under the monitoring and evaluation objective, members discussed how annual Farmer Field Days help them work collectively to identify and solve problems in trial design and implementation, improve experimentation practices, monitor and evaluate trials, and make decisions about new research areas and interests. Members then discussed the constraints the group encountered in meeting this objective (e.g., low participation of some FRG members in annual farmer field days was identified as a key constraint). Based on this information, members evaluated their overall success to date in meeting that objective and proposed strategies (e.g., new activities and ways of mitigating specific constraints) to improve their ability to meet each objective in the short- and long-term.

After group members had completed the logframe, other issues related to FRG functioning and performance were identified and discussed. Farmers evaluated the effectiveness and efficiency of the group's leadership (including the FRG chairman and committee), the group's cohesiveness and problem-solving capacities, the benefits and drawbacks of group formation and action, the relationship between the FRG and PRIAM researchers, and the relationship between the FRG and the community. The evaluation was concluded with a discussion of what each member, and the group as a collective, envisioned for the future in terms of the FRG's potential role in research and community-based development.

Using the same tool as a starting point for discussion, evaluations of FRG activities and performance were also conducted with non-participating farmers, that is, community members outside the formal PR process. The PRIAM researchers were interested in the experiences and perceptions of non-participating farmers/community members and how they would evaluate their local FRG in terms of effectiveness and the extent to which such groups have met their objectives (e.g., to disseminate information and technologies to community members). It was hoped that including community members in the evaluation exercise would provide useful information about FRG-community relations and potential ways of improving PR processes. Above all, including non-participating farmers in the evaluation process was meant to encourage community participation and the sharing of experience.

Appendix 2b. Farmer Research Group (FRG) Self-Evaluation Exercise Using a Participatory Logframe: Wolencheti FRG.

FRG objectives	Activities	Constraints	Evaluation	Proposed strategy
To conduct research and experiments using new technologies (seed varieties, implements, etc.)	On-farm trials for last 3 years to test performance of new technologies in comparison to local practices and technologies.	Shortage of new technologies that affect methods of experimentation, extent of trials and results. Climatic variation. Oxen and labor.	Trials have been highly successful. Adoption rate of new technologies high. Technologies improved incomes and livelihoods.	Need to make technologies available to all farmers through the market. Need for more diverse kinds of trials.
To monitor and evaluate experiments / technologies	Farmer field days (FFDs) 1/yr. Planning and evaluation meetings at Melkassa (2/yr).	Inconsistent participation of members (lack of time, interest?).	FFDs and planning and evaluation meetings at the Melkassa Agricultural Research Center are excellent opportunities for monitoring and evaluation.	Greater participation by the Participatory Research for Improved Agroecosystem Management researchers needed.
To disseminate new technologies to other members of the community	Farmer-to-farmer sharing of new implements and dissemination of seed to friends and family. No specific activities or local mechanisms in place to disseminate new technologies.	Shortage of implements. Willingness to share implements and seed of new varieties with others. Short planting time during initial rains makes sharing implements difficult. Members tend to sell or use all their seed.	Technology dissemination is high especially across communities. However, many community members claim they do not have access.	Organize small farmer groups (4-5) to share technologies (and training) between FRG and community members. Researchers should monitor FRG to ensure sharing of technologies.
To promote/ facilitate community development	No specific activities or initiatives in place to encourage community development.	Community not involved in project. Insufficient linkages between FRG and community. No mechanisms for community participation.	Only FPR farmers are being developed – the community has not benefited from this project.	The community needs to play a greater role in all stages of the project cycle and in decision making. Community meetings.

Appendix 3a. Technology Diffusion Mapping (TDM)

Technology diffusion mapping is a blend of several participatory research tools including resource flow analysis (Feldstein and Jiggins 1994) and social network analysis (Weller-Molongua and Knapp 1995, Gibbon and Pokhrel 1999). This is because none of these tools, individually, could generate the kinds of information required to track and represent the diffusion of technologies through farmers' social networks.

Of the 25 (or so) experimenting farmers at each of the PRIAM Project sites, we selected 10 from each site to participate in the TDM exercise. Before starting the mapping exercise with participants we used a small questionnaire to gather and organize some preliminary data. Questions included the number of seasons the farmer had participated in the PRIAM Project, what technologies the participant has tested on-farm and whether or not s/he has reliable access to these technologies, and the year that the participant received each technology from PRIAM researchers. The questionnaire also included a chart to track the people with whom the participant shared each technology including information about the relation between the recipient and the participant, where each recipient lives in relation to the participant (e.g., neighboring village), the basis on which technologies were shared (e.g., gift, exchange, loan, or sale), and so on. This provided extensive well-organized data to work from in constructing the diffusion maps.

Farmers used a large piece of paper and several colored markers to draw a map, but if they are uncomfortable working with these materials, the map can also be drawn on the ground. We tried to avoid instructing farmers on how the maps "should" look, leaving it up to participants to conceptualize how to draw them. Most PRIAM farmers began their maps by drawing their household at the center of the paper. Using the questionnaire as a guide, we asked participants to locate and draw the home of each person with whom they shared a specific technology (or technologies) both within their own community and in neighboring villages. If participants indicated that an individual lived in a neighboring community, we asked for the village name and the distance between his home and the neighboring village (expressed either in km or walking time). Beside the home of each recipient indicated on the map, participants often wrote their relationship to the recipient (e.g., father, brother, friend, or exchange labor group member). Using different styles and colors of lines the participant could illustrate what technology was shared with each individual/household and what was the basis of sharing (e.g., gift, exchange, loan, or sale). The completed map illustrates the flow of new technologies to all individuals with whom a participant shared said technologies (see Appendix 3b). The diffusion map produced by farmers can then be used as the basis for a discussion of patterns of technology sharing and how such patterns are shaped by local social relations.

Technology diffusion mapping: A participatory monitoring and evaluation tool

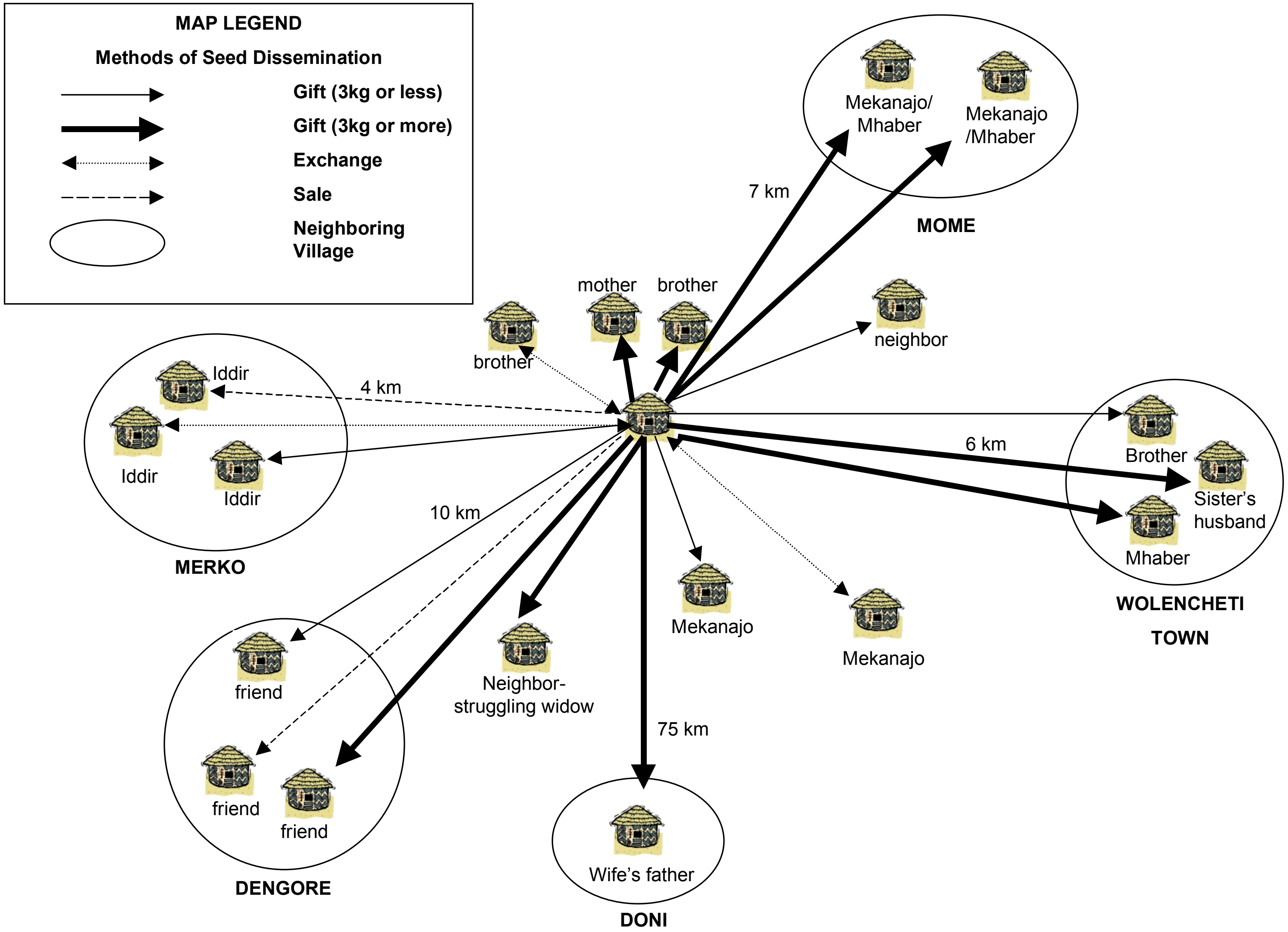
The most impressive aspect of conducting the TDM exercises with PRIAM farmers was their level of interest and enthusiasm in the research activity. Participants found the activity simple to understand and were interested in tracing their dissemination activities and learning about the dissemination patterns of their peers. Moreover, the TDM exercise was something that farmers could do themselves with little or no interference from researchers. Participants found TDM a stimulating exercise that demonstrated the obvious impact that farmers have had on the participatory research process through the diffusion of new technologies. Many farmers wished to keep the maps once copies were made for our analysis both because the maps constituted a source of pride in their achievements as project participants and because many of them wished to continue tracking their own technology dissemination activities in the future.

The TDM exercise may constitute an efficient and effective participatory monitoring and evaluation tool that farmers can use to document, analyze, and report information related to the diffusion of new technologies over time and space. Because farmers are most familiar with their own social networks and dissemination activities it would be easier and far less resource-intensive for farmers, rather than researchers, to take responsibility for such diffusion studies provided that farmers have the interest, commitment, and capacity to organize and implement such a research activity.

Technology diffusion mapping as a diagnostic tool: Social capital assessment

TDM may also be used as a diagnostic or rapid appraisal technique to identify and analyze the social relationships, networks, and institutions to which different people belong and the function that each performs in terms of local resource sharing and other forms of mutual aid and coordinating collective action. In this way, the TDM exercise can be used as a type of social capital assessment tool to identify local networks and institutions that may provide strategic entry points for different kinds of participatory research and development activities.

Appendix 3b. Technology Diffusion / Social Network Mapping: Simplified Sample from Worka Village



Appendix 3c. Farmers' Social Networks in Central Ethiopia.

Social network	Membership	Function / Role	Reach	Contribution to dissemination[a]
Kinship	Immediate and extended family members across many villages and districts.	Extended family is the basis of most forms of social support and mutual aid among rural people. The members, as part of a complex web of rights, responsibilities, and obligations, share resources such as labor, land, oxen, and money, and provide other kinds of social and material support.	Membership crosses many villages. Geographical coverage of kin relations often exceeds 30 km.	√√√√ Sharing of resources, including information and technologies, is extremely common among extended family members. All PRIAM farmers indicated that they prioritized these relations above all others in terms of sharing of technologies.
Iddir	An institution of about 100-200 adult men (heads of households) from many neighboring villages. Members are typically connected socially either through extended family or close friendships. Membership is consistent over time.	A social/cultural institution of men responsible for the preparation and burial of the deceased during funeral ceremonies. Each member household contributes an annual amount of money. In exchange, the Iddir provides families with the necessary material support to cover funeral costs and to ensure the household's security in the short term.	Membership in Iddir, although localized around one or two communities often includes several neighboring villages.	√√ Iddir members share technologies among themselves. However, Iddir membership overlaps with other social networks and technologies are typically diffused through these smaller networks.
Baltina	Women (wives of Iddir members).	A social/cultural institution of women responsible for preparing food and drink during funeral ceremonies. Also an important source of social and material support/mutual aid among women (e.g., widows).	Same as Iddir.	√ Women's social networks are an important source of information dissemination on the performance and benefits of new technologies. Information is then passed on to husbands and other male family members.
Mhaber	People who share close friendships. Men and women participate in separate (gender-specific) Mhaber networks.	During the religious holidays of each month, Mhaber members meet at one another's homes for food and drink. This is an important and symbolically significant network.	Friendship networks cross multiple neighboring communities.	√√√ An important source of information dissemination during holiday gatherings, and technologies shared extensively among the closest of these members.
Jiggi / Dabo	6-10 male relatives and close friends. Group membership is typically consistent across seasons.	Exchange labor or group labor networks. At critical times in farm season, one man initiates a labor group by calling his closest friends and male kin. This group works together on each other's farms for the remainder of the season.	Labor groups made up of farmers from 2-3 local communities whose farms are neighboring.	√√√√ Common means of information and technology diffusion during on-farm work. Members gain information on the use and benefits of technologies first hand and are able to monitor their progress over the course of a farm season. Technologies shared upon request.
Mekanajo	Two male relatives or close friends. Membership tends to be relatively consistent over time.	Oxen-sharing relationship typically between two men who each own only one ox. Sharing enables participants to plow their fields.	Individually each such group has poor reach because consists of only two farmers.	√√√ Common means of information and technology diffusion (especially for improved implements) during on-farm work.
Equb	Small group of 3-5 (or more) family or close friends. Membership changes over time.	Rotating credit and savings groups.	Typically localized around one or two neighboring villages.	Have little or no role in the dissemination of technologies.

a. Contribution to dissemination √ = little to √√√√ = a lot.