ENHANCING INNOVATION PROCESSES AND PARTNERSHIPS

by

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Enhancing innovation process and partnership synthesis paper

1. Introduction

What are innovation processes?
CIAT's Rural Innovation Institute defines rural innovation as "the process by which various stakeholders generate, adapt or adopt novel ideas, approaches, technologies or ways of organizing, to improve on- and off-farm activities, so that the rural sector becomes more competitive in a sustainable manner" (CIAT, 2003). This process builds farmers' capacity to learn about knowledge intensive processes and biological and ecological complexities and can create a sustained, collective capacity for innovation focused on improving livelihoods and the management of natural resources. To support these processes, institutional changes are also needed in the management and funding of formal sector research and development to encourage this paradigm shift, to build new partnerships and to avoid business-as-usual in the formal sector. This enhanced capacity for innovation benefits rural people 's ability to demand and use science to develop technology for improving their livelihoods, and it spills over into and benefits rural people's initiatives for change in other sectors such as health, education, governance and social order

Enabling innovation requires a versatile approach to working with communities that centers on several related elements, which have emerged from experience and analysis. Innovation processes require farmer experimentation, social and human capital formation, access to information, leadership and entrepreneurship to develop new technologies, products and markets and ways of organizing, as well as policies and institutional arrangements which catalyze and enable innovativeness. The key components of innovation processes can be summarized as:

1. Farmer experimentation: The active involvement of end-users in research design and development enables researchers and stakeholders to understand local farming systems and the larger context within which they exist, to incorporate local knowledge into technology innovation, and to develop locally appropriate solutions. A hallmark of farmer participatory research (FPR) approaches is the link it establishes between the formal and local research systems (Ashby et al., 2000).
2. Strengthening human capital, which involves enhancing farmers' knowledge and understanding processes. There is growing evidence that building rural people's capacities to innovate is probably more important than just involving them in developing the technology. Enhancing farmers' technical skills and research capabilities, and involving them as decision-makers in the technology development,

should result in interventions that are more responsive to their priorities, needs and constraints.

3. Social capital: Innovative collective action by rural communities with substantial social capital is an essential condition for enabling innovation. Various studies show that strengthening group working processes and enhancing social capital is an important asset that can provide a variety of supportive mechanisms for enhancing rural livelihoods. At the community level, strengthening the social capital of rural communities and their organizational capacity is critical for horizontal and vertical linkages among communities, and between communities and rural service providers.
4. Enhancing access to information and linking local or indigenous knowledge to scientific knowledge are major resources in supporting innovation processes. A key issue is to understand how best rural innovation can be enhanced through supporting experimentation with effective combinations of local knowledge systems and formal scientific knowledge.
5. Strengthening partnerships and sharing roles and responsibilities across the research-for-development continuum is an important part of managing innovation processes. Building strategic partnerships allows us to decentralize control over the research agenda and permits a much broader set of stakeholders to become involved in research and the technology innovation process.
6. Scaling up innovation processes leads to "more quality benefits to more people over a wider geographic area more quickly, more equitably and more lastingly" (IIRR, 2000). Scaling up implies increasing the impact of an innovation or intervention to its logical or appropriate level, and also reaching larger numbers of people (Gonsalves, 2001). This definition also reflects the concern with quality of the impact in terms of sustainability and equity.
7. Strengthening changes in formal sector institutions to support innovation processes. It is important to integrate mechanisms that can influence policy making so that critical success factors for rural innovation are maximized, and bottlenecks overcome. This requires strategies that use information produced by research to influence policy and enhances key rural innovation processes and outcomes.

This synthesis paper provides an overview of papers submitted under the 'Enhancing Innovation Process and Partnership' theme. We organize our synthesis around each of the key elements identified as being fundamental to good practice for "enabling Innovation". We have summarized the papers accepted under each element with detailed lessons learned. The lessons and critical issues are then synthesized to develop conclusions, key implications for national research institutes such as NARO and a section on limitations and challenges.

What is participation?

There is strong evidence that involving farmers/end-users as decision-makers in the technology design and development process can lead to the development of appropriate technology and may increase the probability of adoption among the intended users. These participatory research and learning approaches are fast gaining recognition as a strategy for empowering poor farming families to articulate their priorities and to participate as decision-makers in the R&D processes. However, important questions that arise are: What is participation? Should all research be participatory? Is there good vs. bad participation? What is the optimum level of participation?

Conceptual framework

To understand the quality of participation that can be applied in research for development processes we apply a conceptual framework based on Johnson, et al. (2002) that links the typology of participation (Lilja and Ashby, 1999) to the different types of participatory approaches outlined by Biggs and Farrington (1991). Lilja and Ashby (2002) argue that the expected impacts of incorporating stakeholder participation in research are dependent on the stage at which stakeholders (especially farmers as end-users) are involved in the technology development process. They developed a typology of participation which defines the two decision-makers as "scientists" and "farmers." In their definition "farmers" is a generic term representing end-users and the term "scientists" is used to describe outside agencies, the extension system or formal R&D agencies. An important premise underlying the typology of participation is that differences in who makes a decision (between the "farmer" and "scientist") will result in different decisions being made and in different types of impact on the innovation process. Farmers can be involved in the technology development process in any of the three stages of innovation process (design, testing and diffusion). In each of these stages different decisions related to technology options are made. For example, in the design stage decisions on opportunities and problems, and prioritization of research options and potential solutions are made. In the testing stage, testing and comparing possible solutions is conducted. During this stage decisions are made about what type of experimentation and how different stakeholders will be involved. The final stage is diffusion, which involves dissemination of results and building the capacity for implementation of recommended solutions among future users. This stage leads to full or partial adoption (if necessary after further adaptation by users), or to no adoption.

In order to understand the balance of power in a participatory process, a critical question is to find out who makes the decisions at each stage of the technology development process between "scientists" and "farmers." Biggs and Farrington (1991) define five different types of participatory approaches depending on who makes the decisions at each stage in the innovation process. The different types are detailed below:

- Conventional (non-participatory): Scientists make the decisions alone without organized communication with farmers.
- Consultative (functional participation): Scientists make the decisions alone, but with organized communication with farmers. Scientists know about farmers' opinions, preferences and priorities through organized one-way communication with them. Scientists may or may not let this information affect their decision.
- Collaborative (empowering participation): The decision is shared between farmers and scientists, and involves organized communication among them. Scientists and farmers know about one another's opinions, preferences and priorities through organized two-way communication. The decisions are made jointly; neither scientists nor farmers make them on their own. No party has a right to revoke the shared decision.
- Collegial (empowering participation): Farmers make the decisions collectively in a group process or through individual farmers who are involved in organized communication with scientists. Farmers know about scientists' opinions, preferences, proposals and priorities through organized two-way communication. Farmers may or may not let this information affect their decision.
- Farmer experimentation: Farmers make the decisions individually or in a group without organized communication with scientists.

Why does it matter who makes the decisions?

Lilja and Ashby (2002) argue that farmer participation at different stages of innovation can have different impact on the technology or innovation design, as well as, on the potential adoption or acceptance among the intended users. If scientists make all the key decisions without farmer participation in the early stage of an innovation process, farmers cannot influence many features of the innovation that are of most interest to them. Their participation in planning and setting goals will help focus research more directly towards farmers' priority needs, thus reducing time to conclusion, improving the efficiency of the process and reducing the likelihood that the technologies being developed are ultimately unacceptable to farmers. There is evidence (Douthwaite, et al., 2002; Johnson, et al., 2002) that farmer participation at different design stages may steer research into completely unanticipated directions or may identify different priorities different beneficiaries.

We maintain that farmer participation, together with a broadening of research for development partnerships, can harness additional and much-needed expertise and resources to solving practical problems and reaching a greater number of beneficiaries, while eventually allowing the formal research sector to reallocate resources towards strategic research that addresses the problems that need to be faced in the future.

Farmer participatory research approaches

Farmer participatory research (FPR) draws heavily from earlier models developed to work with rural communities, such as the farming systems research and extension (FSR&E) of the 1970's. These approaches to farmer innovation and agricultural research received widespread recognition with the publishing of the "Farmer First" (Chambers, 1989) and later "Beyond Farmer First" (Chambers, 1994). The term 'farmer participatory research' is used to define a diverse group of research-related approaches where farmers and rural communities are involved at different stages in the research process (Okali et al., 1994; Selener, 1997). In practice, the term FPR is used interchangeably with other terms such as participatory technology development (PTD) or farmer experimentation (FE) approaches. It is now widely accepted that farmer participatory research may have wider applications for improving rural livelihoods in complex and diverse low potential areas where a "systems" approach is critical for the analysis and improvement of the production systems (Chambers and Jiggins, 1986; Okali et al., 1994).

This section reviews different participatory approaches that have been used to involve farmers or end-users in the technology design and development process. The approaches are divided into: (1) Approaches for priority setting; (2) Approaches for farmer experimentation; (3) Approaches to extension; (4) Successful examples of impacts.

2. Approaches and methods being applied to meet various objectives

2.1 Approaches for priority setting

The manual of Tripp and Woolley (1989) has long been a standard reference manual for priority setting in on-farm research; following a clearly outlined farming systems approach, this methodology has been widely adopted in the intervening years. The planning stages are described as: identifying problems that limit the productivity of a farming system; ranking the problems; identifying their causes and analyzing interactions among problems and causes; identifying possible solutions; and evaluating those solutions. ISNAR long advised an analogous approach for setting priorities at the broader level of national or zonal agricultural research, in which local concerns should be harmonized with national policies and objectives; many NARIs have followed this, if often in a less exhaustive and data-demanding manner.

A Ugandan example is given by Grimaud et al. (2004), who identified research activities for dairy sector development in Mbarara. These authors describe a participatory rural appraisal (PRA) by researchers of the main dairy farming systems in the study area and a rapid questionnaire survey of a random sample of farms. From these results, researchers deduced a farm classification (typology) based on three "poles": the farmer (status and activities), the herd (composition and use) and the environmental conditions (feeding system, housing conditions, moving). Researchers assessed needs for each production system and proposed interventions that would meet the requirements of producers. Research priorities included basic biological relationships (e.g. the importance of genetic variation in growth rates of Ankole calves) and understanding the system (e.g. possible health implications for people). Although Grimaud et al. comment that the identification of interventions can be made by local experts based on a participatory interview of farmers, the farmers' opinions do not come through as an essential element in this approach. Thus the reliance upon researcher measurements required an 18-month period of farm visits before constraints and interventions could be identified.

Variation among farms and farmers almost always needs to be faced. As commented by Mburu and Macharia (2004), “Diversity exists in soil management because different soil types often require different management regimes. Even when farmers are in the same area and managing the same type of soils they may do so differently, because they are faced with different social and economic conditions.” In this Kenyan case of re-orienting the research priorities of a regional research center, the research team was constituted to be interdisciplinary -- bringing together specializations in farm management, socio-economics, animal science, agronomy and crop physiology, land-use and soil fertility – so as to take a holistic approach to farming systems. The team also emphasized participation of stakeholders -- farmers, extension staff, researchers and local administration personnel.

A critical improvement on the usual practice was the holding of farmers’ meetings at which PRA results were used with soil maps, farmer-drawn matrices and group discussions to “jog the memories” of both men and women. Identifying farm types, using farm observations, semi-structured interviews, farm sketches and a household survey facilitated the identification and ranking of soil management problems, causes and opportunities for each farm type. Information was then verified by transect walks along a route selected by farmers, government extension staff and the research team (allowing observations on soils, land use and management practices), supported by a formal interview with a selected number of farmers. An unusual strength of their approach was the use of a farmer-led evaluation of the process itself.

In this case, farmers themselves identified the set of criteria used to determine whether soil and water management was good or bad -- recognizing that soil and water management level is determined by access to and ownership of resources. In small groups guided by a facilitator – another key ingredient -- farmers in each management category identified the main problems using problem-causal trees and ranked the corresponding opportunities.

Mburu and Macharia (2004) summarize well: “Learning and sharing with the farmers in a participatory manner helped to converge local technical knowledge with the outsiders’ knowledge. Making sense of the data through pair-wise ranking and wealth ranking was important in identification, analysis and prioritization of constraints and opportunities. Screening of prioritized options on the basis of economic competitiveness, their contribution to social equity and appropriateness to environment conservation led to identification of relevant research issues.” Gender analysis took into account the different perspectives of male and female farmers: for example, acquiring cash and labor for soil fertility interventions would be tackled by men through farm produce sales and adoption of implements respectively, and by women through group activities.

Soam (2004) describes an analytic hierarchy process (AHP) that employs multiple criteria based on trade offs and the relative importance of criteria and research alternatives as perceived by various stakeholders. Farmers screened alternative objectives, criteria were identified jointly, but both objectives and criteria were evaluated by the scientists on the grounds that they have to carry research under their constraints, opportunities and policies. The strongest element of the AHP method seemed to be in stimulating group discussion to incorporate farmers’ knowledge, resources and expectations. Another variant is to apply congruence analysis to allocate research resources in proportion to the relative value of a production system or product.

Lessons learnt

In drawing out best practices, we need to remember that the term “PRA” is overused and has come to mean little – because the devil is in the detail of the methodology as it is applied. Of the three priority-setting papers reviewed, only Soams draws specific attention to the risk of suppression of farmers' opinion by the scientists' opinion. Full participation of farmers in setting research priorities is even more important as system complexity increases – for example, time and costs in setting initial priorities might have been reduced considerably in the Ugandan dairy case.

Instead of a general blanket technological recommendation, even if honed to each farm type, a basket of options should normally be the aim of initial priority setting, with some interventions ready for extension and further confidence-building with farmers and others emerging as items in the new research agenda. Pair-wise comparisons are useful both in ensuring rigor and in encouraging shared decision-making with communities. The criticism that the method is time-consuming and tiresome can be reduced by short-listing the criteria, and the researchable options, at the farmers' level, followed by a two-stage process of design and evaluation.

A good practice would be to use early and highly participatory setting of some priorities and thereby allow R&D activities to proceed quickly, with researchers and farmers continuing to interact and define or refine other priorities over the subsequent couple of years. Getting more quickly to the stage of testing a few interventions of interest to farmers is particularly important because their expectations of a new and more productive relationship with researchers are likely to be raised by the priority setting activities.

2.2 Farmer experimentation

The active involvement of end-users in the design and development of technologies enables researchers and stakeholders to examine and understand the local farming systems and the larger context within which they exist, to incorporate local knowledge into technology innovation, and to develop locally appropriate solutions. The examples that for follow show how various projects have endeavored to involve end-users in the technology design and development process.

Sanginga et al. (2004) outline an integrated approach for demand-driven and market-orientated agricultural research and rural agro-enterprise development. Termed Enabling Rural Innovation (ERI), this approach offers a practical framework to link farmer participatory research and market research in a way that empowers farmers to better manage their resources and offers them prospects of an upward spiral out of poverty. ERI uses participatory processes to build the capacities of farmers' groups and rural communities in marginal areas to identify and evaluate their market opportunities, develop profitable agroenterprises, intensify production through experimentation, while sustaining the resource base upon which their livelihoods depend. The approach emphasizes integrating scientific expertise with farmer knowledge, and strengthening social organization and entrepreneurial organizations through effective partnership between research, development and rural communities. As part of the strengthening of human and social capital, ERI encompasses effective and proactive strategies for promoting gender and equity into accessing market opportunities and improved technologies, and in the distribution of additional incomes and other benefits.

A unique aspect of ERI is that the approach links the management community assets (natural, human, social, physical and financial) to production, post-harvest handling and marketing in a resource-to-consumption (R-to-C) framework. The R-to-C system (for more details see Kaaria and Ashby, 2001) expands conventional production-to-consumption or commodity chain approaches by explicitly basing decisions on what productive activities to engage in and the combination of community assets that will best meet the dual needs of household food production and income generation.

Brummett et al. (2004) provide a realistic alternative to traditional technology development and transfer that has been utilized by the WorldFish Center to integrate pond fish culture into farming systems in Malawi and Cameroon. This aims to create joint learning exercises whereby research is driven by real problems, extension delivers clear messages and farmers get the technology they need. Farmers, extension agents and researchers get together at the end of the season to present, compare and discuss findings, in preparation for another cycle of research. The approach, called the Farmer Scientist Research Partnership (for details see Brummett & Noble 1995), involves: (1) The Research-Extension Team (RET) model using a research scientist to guide joint learning exercises (participatory research projects) undertaken by farmers and extension agents working together. (2) Resource flow diagramming (RFD) to characterize the farms in terms of their resource base and show the movement of resources around the farm and into the surrounding economy. (3) The theoretical farming system model created during the re-drawing session is used by farmers and researchers as a guide for conducting applied experiments both on-farm and on the experiment station. (4) A monitoring and evaluation tool, RESTORE, is used to assess farming systems transformation and longer-term ecological, capacity and economic development of farms and farmers.

Danda and Lewa (2004) present an example of an empowering approach drawn from Kenya's Agricultural Technology and Information Response Initiative (ATIRI), which was started in response to low adoption of technologies developed by the Kenya Agricultural Research Institute (KARI) and other research organizations in the country. The initiative links stakeholders in the research to extension continuum, including farmers, community based organizations, NGOs, extension and in some cases the private sector. The approach attempts to link farmers' priorities, opportunities and challenges with the available technologies. This contrasts with the other models in that technologies and knowledge are extended to communities according to diagnosis of problems by farmers in conjunction with research teams, and discussion of possible intervention strategies with the guidance of research teams. The initiative is supported by an elaborate monitoring and evaluation at the institutional level, with various steering committees responsible for assessing the progress of farmer groups and community based organizations that have benefited from the grants.

Mubiru et al. (2004) share experiences of the Soils and Soil Fertility Management Programme (SSFMP) of Uganda's National Agricultural Research Organization (NARO) and its partners to illustrate the variety of participatory approaches they have used. The approaches reviewed include participatory on-farm trials/demonstrations, Farmer Field Schools (FFS), Participatory Development Communication (PDC) and Participatory Learning and Action Research (PLAR). Participatory on-farm research (POFR)/ demonstration has three components, the diagnostic component to understand the farm and its environment as well as the farmers' goals, challenges, and opportunities; the experimental component involves designing appropriate innovations and testing under real farm conditions; and the monitoring and evaluation component, and analyzing the causes of non-adoption (see Mutsaers *et al.,* 1997 for details). Farmer Field Schools (FFS) aim to empower farmers to be technical experts on major aspects of crop and livestock production, improve the farmer decision-making capacity and stimulate local innovation (Braun *et al*., 2000). Additionally, the integration of farmer experiences and knowledge with research and extension stimulates technology adaptation and adoption. A school curriculum is designed to provide basic agro-ecological knowledge and skills but in a participatory manner so that farmer experiences are integrated in the learning process. The schools are coordinated by a facilitator who meets with the farmers regularly (at least once a week) in the farmers' communal gardens. The PLAR approach uses PRA tools to allow farmers to identify their agricultural production and socio-economic opportunities and challenges; farmers then identify their soil fertility management classes and constraints to good management; and, finally, farmers design experiments to test and evaluate various options to improve soil fertility management. The PDC approach underscores communication as a tool for development and entails several mechanisms for disseminating information among various stakeholders, applying PRA methods to identify agricultural production and socio-economic opportunities and challenges; from these challenges, community groups are formed and facilitated to develop participatory action plans that define communication needs, objectives, activities to achieve the objectives, and a tool to execute the activities.

Snapp et al. (2004) present a case study from southern Africa of the mother and baby (MB) trial design to improve maize-based system productivity through legume intensification. This participatory approach is an upstream methodology designed to improve the flow of information between farmers and researchers about technology performance and appropriateness under farmer conditions. The trial design consists of two types -- mother and baby trials. The mother trial is researcher-designed and conforms to scientific requirements for publishable data and analysis. A baby trial consists of a single replicate of one or more technologies from the mother trial. A single farmer manages each baby trial on his or her own land. A typical implementation of the methodology would include a single mother trial and numerous baby trials within a village. The MB trial methodology has three goals: (1) To generate data on which to assess technology performance under realistic farmer conditions. (2) To complement the agronomic trial data with farmers' assessments of the adoption potential of technologies; this information helps researchers understand how the technologies fit into farmers' broader farming and livelihood strategies. (3) To encourage farmers to participate actively in the trials and stimulate farmer experimentation with, and adoption of, new technologies and practices. MB trials attempt to address market linkages and seed multiplication issues as a strategy for scaling up the impacts.

Ssewannyana and Rees (2004) present a new method based on the three livestock improvement sub-projects funded by COARD project where farmers were fully involved in all activities and played central roles in the improvement programs. The three sub-projects followed five main areas: (i) Setting the benchmarks, which involves capturing data on the socio-demography of households (land size, family size, level of education, marital status of household head), data on livestock (types, numbers, management, animal health, marketing and indigenous technical knowledge) and feed resource bases. (ii) Trainings using experiential learning where discussions, dialogues and sharing experiences were key features. (ii) Implementation modalities where farmers were fully involved in the development of the improved animal breeds – from planning, designing, implementation, monitoring and evaluation. (iv) Sustainability, which is achieved by an emphasis on the formation of Farmer Breeder Associations with elected executive committees with written constitutions and registration certificates from the relevant government organs. (v) Networking among breeders associations, SAARI and the National Animal Genetic Resources Center and Data Bank (NAGRC&DB).

NARO's COARD project (Rees et al., 2004b – see also Section 3 and 7) assesses the type and quality of participation found during subsequent implementation of COARD's research sub-projects. They found that the type and quality of participation varied considerably – roughly three-quarters were classified as contractual or collaborative participation, and only a quarter as collegiate. The authors state that "Internationally supported NGOs seem to have the highest capacity for proposal writing and implementing collegiate-style, participatory type projects, but generally have to out-source technical expertise. Many NARO staff also have good capacity for proposal writing and implementing participatory type projects that can be classified as collaborative or contractual. Local NGOs and local government extension staff seem to have least experience with proposal writing and participatory approaches. Most, but not all, university-led proposals received were extractive in nature, with farmers' roles seen as testing solutions designed by university staff." Internationally supported NGOs also seemed to have the highest capacity for partnership rather than individualistic approaches to projects. The Nepal case frankly reports that research scientists and reviewers are "still largely entrenched in the old supply-driven technology generation paradigm that sees technologies being delivered to a grateful extension service, who then instruct willing farmers on what they should be doing."

Lessons learnt

At the beginning of this section, we argue that the point at which farmers or end-users are involved in the technology design process will influence the results of the project. So for example, when farmers are involved in priority setting, it is more likely that technology development will respond to the needs and priorities of the community. When farmers and end-users have a collaborative or collegial relationship with scientists and are involved in all stages of the technology development process -- from design to diffusion with a strong capacity building component -- then this leads to empowerment. However, when farmers and scientists are involved in a consultative relationship in which scientists make the decisions and the initial priorities, a functional type of participation is the likely mode. One of the challenges with the functional type of participatory approaches, , is that project objective and activities are usually already well defined by the time the project is implemented so the scope for farmer influence is limited to providing information on how technologies work on farm, on assessments and rankings, and can be useful in selecting technologies for future testing.

In considering what is best practice for technology innovation, an important issue raised by two of the papers is the aspect of linking research to markets. Experience shows that smallholder farmers key concern is not only agricultural productivity and household food consumption, but also increasingly better market access. Once farmers are able to produce enough, then accessing markets to sell surplus becomes an important concern. Therefore, it becomes critical to enhance the ability of smallholder, resource-poor farmers to access market opportunities and their links to markets.

An additional factor noted was the limited use of gender-sensitive participatory approaches, and therefore limitations in addressing the specific needs of small holders, especially women and the poor. The issue of social and gender differences is clearly highlighted in the paper by Sanginga et al. (2004). While in their review of the PLAR approach Mubiru et al. (2004) mention wealth differences and its effect on testing of soil fertility management options. If end-users such as women and the poorest are brought into the research process at a very late stage, particularly to evaluate technologies that have already been developed and are ready for dissemination, such technologies are often inappropriate for the needs of the poor and women.

2.3 Participatory approach to extension

The two main objectives of research are to generate knowledge and disseminate/adapt that knowledge so that it can be applied. In the last few decades, a lot of research by both national and international research institutions has culminated in new knowledge and new technologies that have potential to increase agricultural production but without translation into increased production and improved livelihoods for the intended beneficiaries. Some of the impediments have been lack of awareness of the new technologies by the intended beneficiaries, low adoption due to inadequate practical applicability and feasibility of the technologies, and low capacity of the intended beneficiaries to adopt them.

The role of extension is to provide a bridge between these technologies and new knowledge and the intended beneficiaries by creating awareness of their existence, providing the necessary information in a way that is easily understood and applicable, and generally assisting them to implement and adapt these technologies to their local situations. Up to the late 1980s, the most common method of disseminating results and technologies was the training and visit system. However with declining resources to national agricultural extension systems, this expensive and inflexible approach has been generally dropped. A myriad of participatory extension approaches have been tried, such as the Farmer Field Schools, the PEA approach, the client oriented approach, farmer-to-farmer extension and the demand driven approach. The papers in this section describe and give results of several attempts to understand and use some of these approaches.

The ATIRI initiative of Kenya
The ATIRI project in Kenya (Danda and Lewa, 2004; see also section 2.2) invites groups of farmers to write proposals to KARI to utilize any of the technologies that KARI has developed. The farmers are assisted to do this by scientists, extension officers, NGOs and/or CBOs. KARI gives farmer groups a grant to purchase the technology, inputs required to implement the technology and to pay for technical services. The initiative has assisted the institute to reach large numbers of farmers within a relatively short time with their technologies and services. The grant has removed the financial constraints usually associated with non-adoption of new and improved technologies by farmers. The formation of groups has created entry points for other service providers such as NGOs, private sector, and micro-finance institutions that enhance farmer access to other services.

This initiative makes several assumptions. One is that farmers will prioritize their problems and appropriately match these problems or constraints with the available technologies. This is a big assumption considering that farmer groups may not have information on the full range of available options or the knowledge of which options are most suited to solving their problems or constraints. The other main assumption is that the NGOs and government extension have adequate capacity to support farmer groups in problem diagnosis, proposal development, management of funds, monitoring and evaluation, and other skills that the farmers need to implement these technologies. In practice, the capacity of the NGOs and CBOs as well as other service providers need to be strengthened for them to effectively support farmers. The paper makes a good attempt of documenting the achievements and impacts of the initiative at the levels of research, extension, farmer group and community. These are, however, at the very basic (activity) level of what was done, with little information on results or outcomes that would measure the impact in a more robust way. Linking this to the later issue of monitoring and evaluation, it would be critical to try and measure impact from the perspectives of the farmer groups themselves and the community based organizations.

Sinja et al. (2004) focus their work on identifying characteristics that influence farmer-to-farmer extension. The role of farmer-to-farmer extension has been appreciated for a long time, because there is ample evidence in literature that farmers get much of their information on various aspects of their lives from their peers. Arising from this fact, studies have been carried out to understand farmer-to-farmer extension, what contributes to this and how effective it is, and what kind of messages are suited to this form of extension. This paper looks at the farmer and farm characteristics that influence farmer-to-farmer extension of fodder technologies in Kenya. They discuss factors such as the age of the farmer, education, distances to markets and off-farm income, and using a Tobit model analyze their significance in influencing whether farmers pass on technologies and information to other farmers.

The paper does not mention or analyze the social networks that exist in communities and have a great influence on how farmers share and exchange information and technologies. Typically, farmers share information and materials with their kin, extended families, and friends -- social interactions within communities that may largely explain farmer to farmer extension irrespective of distances to markets, farmer’s age or education. The type information shared by farmers is also crucial to analyze so as to understand whether some information types are passed on to other farmers more than others, why this is so and whether these can be supplemented by external information sources. The modes of passing technologies and information by farmers are varied: they may sell technologies such as seed but give information free; they may sell technologies to neighbors but give the same free to relatives or friends; others may sell both information and technologies. These modes of passing information have a bearing on the members of the community that have access to these technologies: if they are passed on by sale, poorer members of the community may not have effective access.

A major reason that has been advanced for non-adoption of improved technologies by farmers is the nature of the technology recommendations that are given to them by both researchers and extension officers includes; how easy the technology is to implement, what are its requirements for implementation, whether the technology is in conflict with previous recommendations for this or other technologies amongst others. The paper by Ramaru et al. (2004) on facilitating linkages between farmers and other service/input providers provides useful insights into participatory processes that can yield multiple benefits for smallholder farmers, including access not only to technologies but also to other services such as inputs. This, as the authors argue, requires great organizational capacity on the part of the farmers, a capacity that does not just happen but requires facilitation by intermediaries such as extension officers or NGOs.

Mutimba (2004) in their paper on extending soil and water conservation technologies assess outcomes of soil and water conservation extension messages using student projects at the Department of Agricultural Extension Education in Makerere University. The paper has crucial findings that those planning and carrying out farmer extension should be concerned about and address. In this example, incorrect diagnosis of farmer problems led to inappropriate recommendations on soil and water conservation -- such as erosion control while the key constraints were related to soil fertility. This raises the issue of whether researchers and extension recommend what farmers actually need based on their resources, or just recommend what they themselves have information and knowledge about their pet subjects. The applicability or feasibility of the recommendation given to farmers is also brought into question in this paper. For the most common recommendations for soil and water conservation, farmers did not have the resources to implement them and, as a result, they implemented them partially or not at all due to scarcity of resources for the recommended technologies. Mutimba (2004) argues that recommendations, such as mulching, would lead to more serious environmental concerns than those supposedly being addressed by the research -- since the materials for mulching would have been obtained from the already degraded wetlands.

Multiple and sometimes conflicting recommendations for the same technologies from different sources, or conflicting recommendations from different technologies, makes it very difficult to assess whether farmers have followed correct technological specifications -- or indeed whether they have the correct information. Measuring the effectiveness of these extension recommendations is very difficult.

2.4 Successful examples of impact

More and more often, agricultural research projects are experiencing a shift away from centralized, biophysical technology-led top down approaches towards more decentralized participatory approaches, which are flexible and iterative. Agricultural research is less and less about generating finished technologies (high yielding varieties, fertilizer recommendations) but is becoming more concerned about reaching resource poor farmers and other stakeholders, and building their capacity to adapt to changing conditions. An important component of any innovation process is therefore to demonstrate the extent to which it creates positive impacts to the livelihoods of poor people, or result in improving the performance and effectiveness of agricultural research and development organizations.

Nina et al (2001) distinguished three broad types of impacts: technology impacts, process impacts, and cost impacts. More recently, IDRC introduced the concept of outcome mapping to capture behavioral and institutional changes brought about to project boundary partners. Technology impacts are related to direct benefits of the technology or innovation been promoted, and the direct benefits to its users. These are referred to in a range of terms, for example, adoption rates, incomes, yields increase, or productivity changes. Increasingly innovation system approaches are being promoted as part of co-learning processes relating to the building of farmers and stakeholders capacity to innovate and conduct experiments, leading to the impacts of human and social capital benefits from participation. Johnson et al. (2002) argue that these process type impacts relate to the types of approaches and occur as a result of the participation itself rather than as a result of the technologies developed via participatory research methods. Process impacts are often qualitative impacts relating to the empowerment function and capacity building of an innovation system. They include impact assessment systems which look beyond the technical indicators of agricultural research (such as yields, resistance to pests and diseases), and other socio-economic indicators (adoption rates, income, cost-benefits), to focus attention on the process of participation, their outcomes and impacts.

Most papers in this theme demonstrate that the use of innovative research and development methods has resulted in considerable technology impacts. Brumett et al. (2004) show that in areas where participatory research approaches to aquaculture have been tested, typical adoption rates by farmers reached 86%, with about 76% of farmers adopting more than one technology. The number of farmer groups has also expanded significantly reaching more than 225 farmers from the original 34 farmers practicing aquaculture. Similarly, Odogola et al. (2004) demonstrate that the institutional building approach to micro-credit initiative attained a 250% increase in community membership from 163 persons to 471 persons in four years. The accumulated membership savings also rose eleven fold to over 15 millions UShs. In Soroti, some 192 farmer field schools (FFS) involving over 4800 farmers have been established and trained in various agricultural technologies and management practices.

Friss-Hansen and Kodoido (2004) show that members of FFS and NAADS groups have significantly higher levels of technology use and adoption compared to other farmers. Similar findings are reported by Kayobo and Laker-Ojok (2004) who found that the LIFE project has resulted in significant achievement and higher adoption rates of a range of recommended agricultural technologies. Participating farmers generally reported higher incomes, increased food availability, and improved ability of poor households to send their children to schools, improve their housing conditions and meet other livelihood requirements (Odogola et al., 2004).

Lessons learnt

Some papers report evidence of farmers' priorities influencing the FFS program to include in their curricula other livelihood aspects beyond agriculture that have impacts on their livelihoods. The FFS curricula now include HIV/AIDS awareness, nutrition and hygiene, reproductive and family health care, business management, etc. This multi-dimensional approach has led to strong partnerships between NAADS and other government departments, NGOs and other rural service providers. It was also observed that, gradually, the emphasis in determining research objectives and programs is gradually shifting from formal research systems, to more consultative and collaborative processes where farmers have a greater role to participate in research planning and early testing and evaluation of technologies. However, there is little evidence in the papers on the impacts of the innovation on research and development organizations, and on boundary partners in terms of changes in their organizational practices and behaviors. Sanginga et al. (2004) give examples of changes in partner organizations as a result of collaborative research on enabling rural innovation in Africa.

One missing component of impact assessment in all the papers is outcome mapping. Outcome mapping means a detailed description of the changes in the behavior relationships, activities and actions of stakeholders that can be logically linked although not necessarily caused by a project, a program or a development actor (Earl et al., 2001). It seeks to characterize and assess the contribution made by stakeholders and development partners, projects or organizations to the achievement of specific outcomes. Another important concern is the assessment of the distributional impacts of innovation, especially on gender, power relations, and poverty.

Most studies expressed the limitations of current approaches to address issues of gender, equity and sustainability. Friss-Hansen and Kodoido (2004) observed that although both NAADS and the FFS approach advocate equity and a pro-poor focus, the poorer sections of the population (women, elderly, poor) have been excluded and have not benefited.

Another aspect that is not covered by the papers is the impact of participation on research organizations' costs. This is important because a criticism of participatory approaches is that the process is slow and increases costs of doing research. On the hand, proponents of participatory approaches argue that involving end-users reduces research costs to formal research organizations because research roles are shared and borne by the various stakeholders. These papers do not analyze cost impacts of the innovation. Aspects of building farmer knowledge and capacity are also addressed in Section 5 below.

3. Building farmers' knowledge and understanding of processes

The combination of scientific and local knowledge systems has been studied extensively over the last two decades in an attempt to see how research knowledge can be targeted to better address local needs, rather than following the one-solution-fits-all approach (Altieri, 1990; Barrios et al., 1994; Walker et al., 1995; Sandor and Furbee, 1996). The use of participatory methods to evaluate technology options with farmers or to include farmer criteria for taste, color, etc in breeding programs is well documented. Rural populations are facing the threat of increased poverty and further land degradation unless increased resources or knowledge generate adequate income and opportunities to overcome soil degradation. The two examples presented to this conference cover aspects of linking knowledge systems for genetic diversity and participatory land use management to address these constraints.

The first paper (Mulumba et al, 2004) undertook to identify and understand the best practices for conservation of rare banana landraces in Uganda's semi-arid area and showed that farmers are actively conserving this diversity within their communities but that climate change, increasing land pressure and cultural changes are affecting their ability to do so. It was difficult to see if the management practices identified were really related to the different varieties or if farmers just invested more time and, therefore, used more management practices, on the more commercial and food security varieties rather than targeting management practices specifically to conserve a variety.

It would have been very useful in the study if the varieties that were wanted by the communities were identified, the most important characteristics of each and, from the community's perspective, what warranted conservation. The approach taken of identifying the amount grown of each variety and then correlating this to how they were managed did not allow this to be done and has therefore missed the opportunity to develop a more participatory approach that could have elicited key steps in ensuring genetic diversity related to land management.

Gowing et al. (2004) aimed to develop a methodology for integrating scientific soil survey products with indigenous knowledge surveys for improved decision making. The research highlighted the importance of a systematic and iterative exploration of indigenous knowledge, which must extend beyond the level of rapid rural appraisal and include several different techniques of cross-validation of interpretations of indigenous soil classification systems to avoid premature conclusions being drawn. In many studies, the first impression from comparing scientific and local knowledge soil maps is that farmers' knowledge of soils is inconsistent and unreliable, but experience gained through research in this paper and others shows that much of the apparent variation derives from the method of investigation. For example, in Uganda, it became clear that an apparently dominant soil type (*Eitela*) was in fact a land-use term and deeper communication with farmers led them to abandon the term and propose more specific soil names.

The type of question and approach taken largely determine the outcome and quality of the integration. Determining a local soil classification does not mean asking questions about soils *per se*: for example, plant species have been used extensively as indicators for determining the fertility status of soil (for example, Barrios et al., 2001).

This research is now being used as a starting point for the development of a practical field-based survey procedure. This combined approach offers a possible solution to the time and cost constraint inherent in detailed soil analysis and scientific soil survey. New approaches need new tools, and researchers and extension staff would need to learn new skills to allow them to explore local knowledge without imposing their own conceptions.

4. Access and use of information

Adoption of improved germplasm and technology options has also been hindered for many years by the lack of coherent and delivered messages through extension services. This has been caused by a range of factors, from lack of information reaching extension agents to the wrong messages being delivered. Therefore strong linkages between farmers, extension services and research are critical to speed up information flows and diffusion of technologies. As Uganda's national agricultural research and dissemination systems embrace the principles of farmer-demand for services (both technology and development), there is clearly a need to harmonize the demand and the supply sides of information dissemination and communications (NAADS, 2003).

One of the main problems facing dissemination is the format and information contained in the dissemination materials. Generally extension materials are the results of scientific research and therefore contain mainly technical considerations and often lack key information that farmers need to be able to make informed decisions on adoption and adaptation. Some of these gaps, identified by Pound et al. (2004) are the economic viability of a technology, the risk involved, the resources required to adopt the technology (land, labor, capital, materials, skills), the local availability of inputs, mechanisms for realizing the benefits of technologies at a group level, and the availability and characteristics of local and distant markets. In addition, markets and post-harvest issues, gender roles, economic benefit, risk, group organization and effective use of locally available inputs, are all examples of information that farmers need but have little access to at present.

NAADS and the Uganda experience

A key challenge for NAADS is to ensure that private service providers have access to and use up-to-date information and information that addresses these gaps. A key concept adopted throughout NARO's Client-oriented Agricultural Research & Dissemination (COARD) Project was "effective and planned communication is paramount at all stages in the production, testing, adaptation and delivery of agricultural services, whether a physical technology or a management practice" (Rees et al., 2004a).

Two research projects reported here from Uganda address these needs: the COARD Project (Rees et al., 2004a) and the "Linking demand and supply of agricultural information (Linking)" (Pound et al. 2004) and some of their findings and those of others involved in their work are reported here (see also, Agwaru et al., 2004; Mubangizi et al., 2004). The linking project piloted in Tororo and Arua Districts identified available research and extension information, against farmer information demands, and designed an on-farm adaptive research process to generate the missing information on data such as economic benefits, risk assessment, labor considerations, input availability and markets. Comprehensive, user-friendly extension materials are then produced, incorporating the technical and socio-economic information required by extension service providers and farmers. Rees et al. (2004a), sharing the experiences of COARD, focused more on 'end-users information, media preferences and needs, and scientists' and intermediary-users' communications practices and abilities were reviewed and strengthened.

Rees et al. (2004b) identified a considerable number of agencies involved in the production and sharing of information and concluded that some coordination of packaging and dissemination of research outputs is necessary. Just as most research services should be based on farmer-demand, the production of information materials on particular technologies, and the media in which they are produced, should also be based on farmer-demand to the extent possible.

Translation of research results
Butterworth et al. (2004) discuss the main challenges in the dissemination of research outputs based on experiences from the 'Linking' project where existing research reports were translated into extension materials that could easily be used by intermediary organizations and final end users. They outlined the process used and where farmers prioritize their constraints, and a team of scientists then tried to match these constraints with research that has already been done and translate this into fact sheets that can be used by farmers and intermediary organizations.

Butterworth et al. concluded that this process was very time consuming, some research findings lacked clarity, while others lacked information that is useful to farmers or illustrations that could more easily be understood by farmers. Various reasons are advanced for this state of affairs: the relatively short project time that does not allow research teams to develop more appropriate dissemination material, the lack of a dissemination component in projects and lack of feedback. The paper contrasts the methodology used with that of COARD, where a group of scientists and extensionists came together with the backing of artists and graphic designers to develop extension materials (Rees et al.). The 'Linking' and COARD projects therefore set up a cross-institutional (NAADS, NARO Outreach Partnership Initiative, ARIS, COARD, MUK, IITA, CIAT, "Linking" Project) Working Group, which has developed and tested a set of headings that capture the different types of information that farmers need.

Private sector providers
In a study by Mubangizi et al. (2004), almost all the 43 private sector providers (PSPs) were male, educated up to diploma level but having minimal working experience. PSPs get information from school/college notes, books, radios, manuals, newspapers, district departments and research institutes, using manuals perceived to be the most important in both districts. There seems to be no deliberate efforts by information sources to target PSPs, while information quality assurance is lacking and/or haphazard. Constraints of private service providers in accessing and processing technical agricultural information were reported to include lack of resources, no and/or limited information sharing among PSPs and public extension staff, inadequate amount of information, unavailability of internet and difficulty in translating the information from English.

Some of the main findings of these papers are:

- All approaches were unable to meet the interests of the very poor, as information dissemination was not disaggregated by wealth and tended to focus on a "one solution serves all" approach that appears to take first priority in technology dissemination (Agwaru et al. 2004)
- Reviews of farmers' information networks by wealth-disaggregated farmer groups in Soroti & Lira districts emphasized the lower access of poorer compared to wealthier

farmers to government and non-government extension workers, agri-business sources and to print media (Rees et al. 2004a)
- Local markets and middlemen were important sources of information by farmers in urban areas, but less so in remote areas - 29% of groups in remote areas mentioned local markets as a source of agricultural information compared to over 50% in semi-rural and urban areas. Churches and schools were more important as information sources in remote areas, compared to more urban settings (Rees et al. 2004a)
- The most frequent source of agricultural information for farmers was based around their social networks, i.e. easily accessible family, neighbors and friends (Rees et al. 2004a).
- Men gave higher weight to radio and extension than women did, suggesting unequal access to these media between men & women (Rees et al. 2004a)
- Little marketing information was currently available to farmers, and a considerable demand for this was expressed (Pound et al. 2004).

Getting the priorities of the community clear so that the right information is given to them is of paramount information. Community priority setting therefore needs to be rigorous and take into account information needs of different groupings within the community -- the resource poor, the women, the youth, etc. One of the strong points repeated in these papers is that information on technologies needs to be accompanied by other information on the requirements for the implementation of the technology -- such as the cost of implementation, labor requirements and expected benefits, all of which are important in assessing its feasibility and practicality. One has to be cautious, however, as these elements may change according to location, adaptation of the technology, etc.

5. Scaling up

Scaling up the impacts of agricultural research outputs has become the center of much recent debate within research and development (R&D) organizations. This concern has arisen in the context of growing concern that R&D has not demonstrated its ability to benefit large numbers of poor people across wide areas within sensible time frames. Other concerns with scaling up include: Increasing pressure from donors and civil society that money spent in R&D must brings about lasting impact on the lives of the rural poor. Many donors are demanding that the R&D projects they finance show increased impact, to ensure maximum benefits from reduced financial support to agricultural R&D. The recognition that many relevant technologies and approaches are not achieving their full potential impact because of low levels of adoption has lead to greater emphasis on the effectiveness of research to produce adoptable technological options.

This section draws heavily from Menter et al. (2002) because there were limited case studies focusing on scaling-up in the papers reviewed. This paper summarizes the key strategies that are critical to scaling-up the impacts of Research and Development outputs.

- Incorporating scaling up considerations into project planning
- Building capacity
- Information and learning
- Building linkages
- Engaging in policy dialogue
- Sustaining the process (funding)
- Developing an appropriate extension process to disseminate research outputs

5.1 Incorporating scaling up considerations into project planning

A key strategy for scaling e impact of research, scaling up must be considered from the beginning of the research and planning process. This implies building scaling up strategies into the technology development process and including them in project proposals can ensure that these considerations are given full attention throughout the life of the project. Experiences show that scaling up can be increased if key opportunities and challenges are identified at an early stage, thereby allowing key channels for scaling up research activities and development outcomes to be identified and to form an integral part of the technology/methodology development process.

Capacity building
In order for complex innovations such as a soil nutrient management tool to be adapted and applied in a variety of different contexts, those involved need to have a good understanding of the knowledge and principles underlying the innovation. This implies rigorous capacity building of staff in local institutions and building the adaptive capacity mentioned above, within local institutions and local communities. This process often occurs implicitly in participatory research process, but needs to be made explicit in scaling up.

Capacity building is an important strategy especially in the implementation and exit stage to internalize new ideas within communities, and institutions. Additionally, for farmers to be able to participate in technology innovation process and to demand technologies and other extension services, their capacity will need to be increased. Capacity in local organization, group formation, literacy skills, monitoring and evaluation are crucial if participatory extension is going to succeed. For interventions and innovations to be owned by farmers, they need to feel that they are part of these interventions -- this can only happen if their capacity to participate is enhanced. Capacity building is also crucial to create a critical mass of people with skills and expertise in supporting innovation processes. It also involves building the capacity of scientific personnel and the institutional systems to sustain and replicate the process.

Information and learning
There is need for systematic monitoring and evaluation systems at both community and institutional level to provide a credible evidence of impact. For group based and other participatory extension systems, there is need for strong local level monitoring and evaluation systems that will allow these groups, communities or CBOs to monitor and evaluate their progress, to learn and to adjust their activities accordingly. Monitoring and evaluation at community, farmer group or CBO level is also very empowering as communities become able to monitor through their community or group action plans, collect information that they need to make decisions, analyze this information and use it for making decisions. An institutional monitoring and evaluation system is not enough to serve the farmer groups and other grassroots organizations, although an institutional monitoring and evaluation system is also needed to recognize farmers' views on what they are seeking so that impact is measured from both the institutions' as well as from the farmers' perspectives. Additionally, effective impact assessment is necessary in order to learn from and gain credibility on effectiveness and extent of impact of innovations and to provide validated evidence to influence decision-makers at different levels.

Engaging in policy dialogue
Engaging policy makers in an active dialogue throughout the project process is crucial for gathering support for innovations and projects, and for creating the right institutional environment for innovations to be scaled up. Policy-makers should be consulted at an early stage of the research project so as to shape the overall project design, and additionally through regular reviews of the project or at other development discussions. This type of dialogue is necessary to convince managers and encourage the changes within the institutional structure necessary to overcome the institutional barriers to change.

Translating research outputs to extension messages
Most scientists, after years of research effort, package their results in project reports, annual reports and other reports that are not accessible to their intended end users or beneficiaries. Information in these research reports is sometimes not specific and does not give recommendations on how the technologies should be implemented by end users. Packaging this information in ways that are accessible and can be used by the intended end users can greatly increase the adoption and use of new and improved technologies. Projects should have both research and end user dissemination as key outputs, planned from the start and with enough funds and time allocated for the dissemination component.

Understanding the extension process
More research is needed to understand extension processes. Different extension systems have been used to pass information and technologies to farmers, including farmer-to-farmer extension, group based extension and participatory extension. Robust and more vigorous research needs to be done to understand and learn from these processes, to define what type of technologies are suited to what type of extension methods, whether some of these methods are more exclusive than inclusive of those that most need the information and technologies.

Doing extension right
Getting the problems and the solutions right
Proper problem diagnosis is a key step in extension. If the problem is not correctly diagnosed, then the recommendations will also not be right. Teams of research and extension officers and farmers should do problem diagnosis so that farmers diagnose the problems with full information provided by the researchers. It is only with full information that farmers will be able to participate in the participatory extension process.

Achieving a re-orientation of extension
For a long time the training and visit system was the main extension method in most African countries. To carry out this method, extension officers were trained to be teachers and their main role was to teach farmers new methods of farming. With the advent of new research and extension approaches aiming at stimulating innovation, the role of the extension officer is now changing from one of a teacher to a facilitator. This changing role, however, often is not reflected in the educational institutions that are responsible for training extension officers – a notable exception being the SAFE initiative at Makerere and other universities in this region. Extension education needs to take into account this changing role in order to equip extension officers with skills that they require in order to fit into this role; such skills include facilitation, participatory approaches and social extension.

5.2 Micro-credit
Access to credit to support the intensification of agriculture and scaling-up of impacts, while long a major theme in rural development in Asia and Latin America, is increasingly being reported as a limiting factor in Africa because of the current encouragement for market-orientation among smallholder farmers. Traditionally, some small farmers have drawn on local, informal sharing arrangements such as women's saving groups, while formal credit sources (those supervised by official bodies) have generally been available only to a prosperous minority able to develop acceptable business plans and to put up enough collateral to secure a bank loan. Semi-formal

A preliminary regional study (Anandajayasekeram et al. 2001) by the Farm-level Applied Research Program for Smallholder Farmers in East and Southern Africa (Farmesa) indicated that informal micro-credit for lending to smallholder farmers or entrepreneurs were "predominantly supply-led, often originating from external donors or government rather than from local savings in the rural economy and charged interest rates below the market rates" or even interest-free, and hence were unsustainable. Odogola et al. (2004) report on a case study in two Ugandan districts where, after identifying demand and the critical need to catalyze a savings culture and foster community-based capacity, the Farmesa partnership launched a sensitization exercise among farmers immediately followed by rigorous training in business analysis and planning.

Though experience elsewhere indicated an ideal size of a community credit association as consisting of 25-35 members, the high demand for participation in other Farmesa project activities in Uganda led to formation of groups of 50-70 persons. These same groups were later taken on to form community micro-credit associations that managed funds and received constant training for its members. Over the last 6 years, membership has risen 250% to 471 persons, notably with slightly more than half being women. The calculations show that average per person savings have risen from about UGX 8550 (US$5) to UGX 32,500 (US$16), with a current loan portfolio at about three times this level and total beneficiaries nearing 2,000. Success was reported also in terms of 90% to 95% repayment rates, impact on livelihoods and reduced household and community quarrelling.

Best practices for this form of savings-led credit scheme are generally similar to those for other forms of community-based organization – formation of small homogeneous groups of 5-7 persons whose members share common interests whose social capital serves as the mutual collateral for group lending; establishing a constitution and elected leadership at the level of the larger community group; full inclusion of women (who proved to be more trusted as treasurers); the development of business plans; building self-regulated procedures for loan request, committee approval and funds disbursement; participatory decision-making and transparency; agreement upon a commercially viable interest rate (15% per crop season or 30% per year); good links with district and other authorities (including formal registration) – and supported at each step by the provision of plenty of training in relevant skills.

It is laudable that projects such as Farmesa and the African Highlands Initiative (AHI) encourage NARS scientists to carry out action research – and not simply studies – into micro-credit as a development issue. The effects of improved credit access upon adoption of technologies in Uganda, and whether the commercial credit sector will start to become attracted to investing in smallholder agro-enterprises, has yet to be seen.

6. Partnerships and capacity building

Partnerships

NARO’s experience in partnership formation is that partnerships take time to be consolidated. Quickly and loosely formed partnerships tend to depend on personalities, and disintegrate when the effective person leaves. It is important that stakeholders intending to go into partnerships first define a common goal and objectives, identify areas of conflict and/or duplication, and recognize the strength, weaknesses and expectations of each stakeholder. Special effort must be made to facilitate partnership formation for NARO. This may imply a partnership desk that (among other things) encourages the signing of MoUs, and organizes workshops with partners to identify points of convergence. Enhancement of innovation processes and partnerships is key to linking technology uses to technology developers, and agro-production to consumption. It is also an important component in NARO’s research agenda (linking all five themes): this is the theme that will help maintain the right focus on actors, process and product.

Greater attention needs to be given to FPR practice in the training of agricultural professionals, and experienced individuals need to be retained and included in field teams. Current trends in agricultural development emphasize innovation systems and agri-food systems, and knowledge development and dissemination perspectives. This requires systematic networks of partners with good feedback mechanisms. Partnerships are characterized by sharing of roles, resulting in increased synergy in technology development and dissemination. Working and learning together encourages the evolution of networks that enhance the flow of quality information. Partnerships also increase innovativeness by trying new and alternative ways of doing things and by amalgamating scientific technologies with farmer innovations.

Global reforms have led to the redefinition of the role of government in research and increased decentralization of research activities. In Uganda the NARS reform calls for separation of research services delivery from financing, and for increased market responsiveness and client orientation. NARO has now adopted an integrated research and development approach that addresses the whole production to consumption continuum from understanding people to linking producers to markets and policies. This means increased stakeholder participation and requires strong linkages and partnerships.

The effectiveness and relevance of different partners and partnership arrangements is determined, to some degree, by the type of partnerships and the way the stakeholders relate to one another. Effective partnerships may be formed with other public institutions, private sector community based organizations, non-governmental organizations and individual farmers such partnerships may also have international and regional linkages. A partnership should be an alliance among partners who agree to address a common goal, with people who are able to work together and share resources, risks and benefits. They should be willing and have mechanisms for reviewing -- and if need be revising -- their relationships and agreements. Following is a synthesis of two papers submitted for IAR4D.

Prasad et al. (2004), reporting on a multi-stakeholder partnership through participatory research in rice breeding and seed dissemination, make good points demonstrates some qualities of good partnerships including private, public institutions and community/individual farmers. Outstanding are (1) the multi-stakeholder partnerships among Donors (DFID, Rockefeller foundation), Public institutions (Research centre and University), NGOs, Individual farmers and Private sector (in seed multiplication); and (2) the global outlook (north-south partnership) shown in the collaboration between University of Wales in UK and a local (Indian) university and research centre. Other good characteristics were: that the initiators had a common goal with a poverty focus and fair gender consideration; high level of participation of different partners reduced the gap between technology development and dissemination; NGO played a big role in technology dissemination; and good links between scientists and end users.

There were some obvious weaknesses as well. The partnership was formed on basis of a common need, and when the need is satisfied the partnerships may disintegrate. The partnerships were not bound by any form of agreement, and partners may not feel bound to the arrangement. The roles and obligations of each partner should have been defined. Furthermore any references to scaling up/out referred to the technology and not to the partnership. This clearly indicates that partnerships are means to a desired output -- they are context/situation based, their evolution may depend on the mutual benefits, and if the benefits are insignificant or not obvious some partners may feel that they are only being used by others.

The biggest challenge was maintaining the interest of the private sector: any partnership that will not result in financial gain will not interest them. Other partners need to keep this in mind. The private sector may also want to exploit other partners if they monopolize the supply side (e.g. seed multiplication in this case). Other partners should have a contingency plan or be innovative enough to go round the problem.

Nagawa et al. (2004) report a partnership for soil erosion management in Bundibugyo district, Uganda, between local government, a public research institute (FORRI), an international research organization and the community. However the real partnership is between the local government and the World Agroforestry Centre (ICRAF) who are bound by a memorandum of understanding. The partnership is demand driven in that the Bundibugyo local government requested ICRAFs help; as in the above case of rice, others were collaborators. All partners participated in stakeholder identification and in planning -- important for scaling out at a later stage. The increased use of participatory methods was a key factor drawing the community into the partnership.

The team had a well defined common goal which addressed the needs of the community. The core partners endeavored to build capacity of collaborators and this would ensure sustainability. The weakness is that the core partners assumed that the communities were partners by virtue of their interest in the research issue. However, this only makes them transitory participants. Both of the above cases dwelt on the problems to be solved and paid little attention to strengthening the partnerships.

While farmers of different categories can be expected to have their own expectations, scientists' training and knowledge tends to lead them to another set -- and Soam (2004) pointed out that in public institutions mismatch of these is quite common. Planning is therefore no substitute for intuition, experience and intelligence. Exploring the biases of researchers in their use of criteria for selecting among interventions in an Indian case study, Soam concluded that local researchers are the best judges and those most likely to give credence to farmers' preferences, although researchers working elsewhere can also make useful contributions, especially for scaling up – but only if these "outsiders" are sufficiently knowledgeable and experienced and if provided with relevant information from the field sites. Greater attention needs to be given to FPR practice in the training of agricultural professionals, and experienced individuals need to be retained and included in field teams.

Capacity building

The issue of building the human and social capital of all participants in Research for Development calls for targeted training so that the research-extension-farmer linkages required can be developed and maintained. Sayer & Campbell (2001) concluded that sustained improvements to the livelihoods of poor tropical farmers require a different type of research, aimed at enhancing the capacity of the rural people to adapt to changing conditions, rather than at delivering 'finished' technologies. Clearly, farmers and communities need to be empowered to solve their own problems, and access technologies through methods that emphasize active participation and innovation (Hellin and Higmann, 2001; Sayer and Campbell, 2001). Two good examples of this are reported by Daane ad Booth (2004) and Sharma (2004).

Daane and Booth (2004) summarize the experiences of the International Centre for development oriented Research in Agriculture (ICRA), the Netherlands, who in response to changing demands and expectations placed upon agricultural and rural development professionals and institutions have designed a tailored capacity building program. All of ICRA's learning programs are designed to guide interdisciplinary and inter-institutional, multi-stakeholders teams through a process of solving a jointly identified complex problem that cannot be effectively addressed without collective action of all concerned. This requires a serious commitment of partners and annual 28-week "core" learning programs, which includes a 13-week fieldwork reflects this. Due to increasing demand for their trainings they are now developing a Global Partnership Strategy linked to research and training institutions in the South. This is illustrated with an on-going collaborative initiative with NARO and Makerere University in Uganda and efforts to expand the approach to other countries of the region and to build up a sub-regional, networked capability in capacity building is targeted.

An alternative approach was used in a project based training of scientists to give research scientists the skills they required in assessing clients' needs, and screening existing technologies against social equity, economic competitiveness and environmental sustainability (Sharma, 2004). Similarly to Daane and Booth (2004), practical use of these new skills was made with partners in the field and used to develop research questions and research projects.

Strengthening social capital
It is interesting to note that the experiential farmer learning approach used in FFS and NAADS has enabled farmers to engage in demand driven agricultural services, and thereby contribute to the success of NAADS in Soroti district. This observation concurs with earlier findings by Hagmann et al. (1999) and Sanginga et al. (2001) who found that increased knowledge and understanding gained through group approaches strengthens farmers' confidence and ability to choose between options, develop and adapt appropriate solutions to their circumstances. It is argued that group approach is more effective as it promotes collective learning and exchanges that occur in group settings (Hagmann et al., 1999; Heinrich, 1993), and ensures that more people participate. Working with group may reduce the cost of delivering services and technologies to many farmers, thus making research more cost-effective, and relevant to the needs of different categories of farmers. Given the diversity and complexity of farmers' needs, the more people participate in the research process, the better the benefits should be. Kayobyo and Laker-Ojock (2004) also observed that farmers develop their capacities faster when organized into groups, and when these groups involve a significant number of women. The capacity of micro-credit associations has also grown significantly to the extent that members are now accessing much bigger loans and able to invest in more profitable enterprises, creating employments in their communities. The FFS approach has resulted in a number of process impacts, such as, enhancing bargaining power of farmers, stronger leadership, increased capacity to manage resources, including grants, and access to funding opportunities. Second-order associations for micro-credit, and second generation groups have been formed reinforcing the culture of savings and loan repayment in rural communities.

7. Approaches to funding of R&D

Competitive agricultural technology funds
Organizational and institutional change is needed in the formal R&D sector if new, demand-driven partnerships are to be output-oriented and more accountable to end-users. Competitive agricultural technology funds (CATFs) are currently seen as a promising way to encourage these objectives. Two broadly similar examples are critically reviewed in excellent papers on NARO's COARD project (Rees et al., 2004b – see also Section 3 above) and from the longer-established National Agricultural Research and Development Fund (NARDF) in Nepal (Sutherland et al.).

COARD's broad stakeholder committee has reviewed 590 applications and approved 43 for funding; 39 sub-projects had been funded, involving over 50 Government offices and 40 CSOs, with over 3,400 farmers. All funded sub-projects are collaborative efforts of several organizations, 23 of which were led by NARO scientists, 11 by NGOs, and 5 by government organizations – confirming, not too surprisingly, the growing orientation of the NARI towards client-oriented research but also indicating progress towards the (often elusive) concept of a truly multi-institutional "NARS". It would be useful to explore what measures could further develop the overall NARS and its linkages. Even though local companies and entrepreneurs found little to attract them in the project or in new and untested technologies, the reach of the sub-projects represents a substantial mobilization of additional capacity for agricultural development in the region with only modest physical resources.

Increasing stakeholder involvement in decision-making and management in COARD started with broad consultation and led eventually to a management committee that included representatives of district-level public extension, the revised public extension system "NAADS", NGOs, the private sector and farmers organizations, as well as NARO, Makerere

University and a national representative. Representatives of government bodies were appointed, while others were elected through an "Electoral College" by secret vote, with NARO acting as observer only. Sutherland makes the point that CATFs are likely to be most useful where the available pool of R&D institutions and especially of researchers is large; these conditions did not apply in either case study, and extra measures were taken by the Nepal case to develop a peer review group that was separate from research, while Rees et al. (2004b) suggest that establishing a management unit separate from the NARI that is executing many of the sub-projects would enhance credibility of the scheme.

Good practices by these case studies in ensuring transparency in decision making included scoring against merit criteria that had been previously discussed and agreed by the whole committee. Criteria should normally include consideration of prior studies of end-user demand or needs, poverty and gender orientations, environmental aspects, likelihood of successful outputs and impact, and the time frame. The use of cards minimized the risks of professionals dominating the inputs of farmer representatives on the COARD committee.

Efforts by COARD to ensure accountability to clients involved *ex ante* assessments of the likely impact of the project by beneficiaries and implementers, and using these assessments to develop monitoring indicators. It is not clear from this paper to what extent this was followed through in developing -- and then in applying -- indicators in a participatory monitoring and evaluation (PM&E) system; the intention appears to be there. Clearly one strength of the project has been the production of leaflets, brochures, manuals, posters, a video and audio cassette with participating farmers.

The Nepal Government's case appears to place more explicit emphasis upon improving research reach to the rural poor and socially excluded groups than the Uganda case, and upon enhancing the research capacity of both the public and private sectors through training in proposal writing, management and implementation of projects. The Uganda case identified problems in the relatively poor and very slow financial services by rural banks, the needs of farmer groups for help to understand accounting procedures, and difficulties in getting financial staff of big organizations to adapt their customary practices to accommodate those of other partners engaged in pluralistic service delivery. It would be useful to explore which stakeholders might best address each of these constraints.

As with many fashionable trends, however, CATFs that focus resources on short-term impact risk are becoming seen as panaceas. Sutherland et al. rightly draw attention to the desirability of addressing technology dissemination as an integral part of most technology development activities, rather than by developing a CATF to support a series of add-on sub-projects focused on dissemination. Other aspects of the institutional incentive systems besides a CATF need to reward researchers for a client orientation and impact creation. Long and varied experience within the regional research networks of ASARECA suggests that contractual and competitive modes of funding can be complementary: competitive funding is probably best practice in changing the way of doing business, and also allows a committee to identify transparently the most reliable partnerships for contractual arrangements that tend to have lower transaction costs and fewer delays. Eventually, the success of short-term CATFs is also likely to become dependent upon a supply of outputs from longer-term research, often on far-sighted yet more elusive topics, for which contractual arrangements may still be more appropriate. Foreign donors and governments beware!

8. Conclusions, limitations and challenges

After reviewing the submitted papers, from our own experiences and after reviewing the literature, we have drawn several conclusions and recommendations for how to enhance innovation systems and work in partnerships with other research and development actors for rural development.

We believe that serious attention to empowering farmers is indispensable to improving the relevance, effectiveness and efficiency of current research for development systems. Farmers of all kinds need to be integrated into these systems in ways that make most use of their potential skills and complementary contributions. Like other actors in the system, they will need support to attain their potential but achieving this will not be a panacea: upstream and on-station research will still be needed, arguably more than ever, once NGOs and farmers can take on more of the adaptive research that NARS researchers are now doing.

Greater attention is needed to understanding human and agroecological diversity. The implications for research programs on poverty alleviation, equity of benefits and gender issues most be addresses in research programs to enable targeting of research and development efforts,

Working with farmer groups generally is more cost-effective than working with individuals, provided that appropriate methods are used. Farmers' human and social capital needs to be assessed before outsiders assume that new groups should be formed, as working with established groups has more often than not proved to be more successful. Social capital also warrants further study generally, as it affects many aspects of empowerment and livelihoods. Farmers' organizations are growing in strength and importance, and could rapidly become valuable partners in innovation systems.

A market orientation in production needs to be implemented sensitively with respect to equity and gender issues. Women can become producers for the market, but may be interested in doing so with different enterprises than men. These differences must be captured and worked with by researchers. Women are better managers of micro-finance but can they maintain control of the resources and income associated with market orientation once their husbands see them earning some income?

Development and uptake pathways for a technology should be defined right from the start of a research project. However, dissemination should not be seen as an add-on activity after the research is completed, research projects will need careful phasing that includes the entire technology development to dissemination continuum and maybe longer periods of funding. The program budget needs to reflect these scaling-up and scaling-out activities, including monitoring and evaluation programs for measuring impact.

Ensuring that information from research is translated into forms useful for farmers and is conveyed effectively to the users should be integrated into every project and become the responsibility of every researcher and program leader. So much the better if a communication specialist is available to assist, but the lack of such a person should be no excuse. Validation and testing of these dissemination materials with development partners and farmers is also critical.

There needs to be awareness of the needs and limitations of a technology, and researchers need to be prepared to catalyze some initial arrangements through partner institutions rather than leaving this as a "policy" issue. For example, farmer access to inputs, including credit, may have profound implications for wide adoption of a technology, especially in a market-oriented environment.

We anticipate that the separation of roles between a NARI, a development agency and a farmer organization will become less distinct, due to farmers becoming better partners, as well as, to researchers and development agencies becoming concerned with and accountable for the development outcomes of their activities (rather than being concerned only with their immediate research outputs).

While NARI scientists need to be directly involved in scaling-out to nearby and similar sites in order to be sure of the robustness and the limitations of a technology, they need to seek out and work with development partners with whom they can scale-up and therefore achieve much wider impact.

Concern for outcomes will contribute to a more enabling environment for the creation of partnerships. However, the wider environment contains both competitive and complementary forces, and the successful institutions will be those that are ready to give up some control and share credit for success in order to achieve greater goals. Doing this will require good leadership, delegation of authority and skills in negotiation, plus a recognition by research managers that not all staff can do everything and that working in a development partnership is equal to on-station basic research in terms of delivering changes at the farm level.

Empowering farmers to reach their potential requires investment, which generally should be the responsibility of development agencies, formal extension, NGOs and, increasingly, of farmer organizations themselves. However, even many NGOs and their staff still have much to learn about how best to do this, and key NARS scientists have an important role in developing, monitoring, learning and promoting these processes.

Capacity building for understanding farming and social systems, collaborating with farmers and working across innovation systems is an urgent step. Biophysical scientists will need to "let go" of control of their technologies very much earlier, and recognize the strong and weak points of themselves and of their farmer partners. All scientists will need the ability to understand and work in teams with other disciplines, and many more scientists than at present need skills in communication and facilitation and other participatory tools. Skills building for assistant staff working most closely with farmers should not be overlooked, and is often more critical, and those staff will need more delegated authority to take joint decisions with farmers or allow farmers to take a decision.

NARIs will need more social scientists – especially those with sociology and anthropology training, rather than classical agricultural economists – and governments and universities will need to assess how to make agriculture more attractive to the large numbers of social scientists who, in most countries of the region, currently go into urban and health fields.

We anticipate that the demand for the products – more often prototype products – from strategic upstream research may actually increase as the effectiveness of the overall innovation system rises with increasing relevance of downstream research and identification of research needs from development and farmer group partners. So what will be the appropriate balance between adaptive on-farm and station/laboratory research? Success with farmer empowerment may enable NARS to refocus more on what they do best, particularly at the higher-technology end. NARS should also be able to devote more resources to solving longer-term and difficult problems, such as those natural resource management (NRM) challenges posed by global warming. As farmers become more important partners, however, researchers should have less recourse to trying to recreate carefully controlled farm conditions and devote more attention to working with the range of variation that characterizes much of African rain-fed agriculture (and making greater use of non-parametric methods of analysis).

Whether and which kind of small farmers will be able and willing to pay for information and research services is a large issue for the future. Policy decisions will need to take account of equity issues and ensure that returns to investment in information is seen, otherwise it will not be demanded and paid for.

However, institutional change is usually difficult, and nowhere more so than in the public sector. Institutional change needs its champions; and researchers typically respond best to relative freedom as to how they achieve the expected but well-defined outputs. Incentive systems for agricultural scientists remain problematic in many countries, yet developing and working within a dynamic innovation system demands retention of the best brains and the utilization of some of the accumulated experience to help guide field teams. The director who guides research, rather than administers it, should become a more common phenomenon.

9. References

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