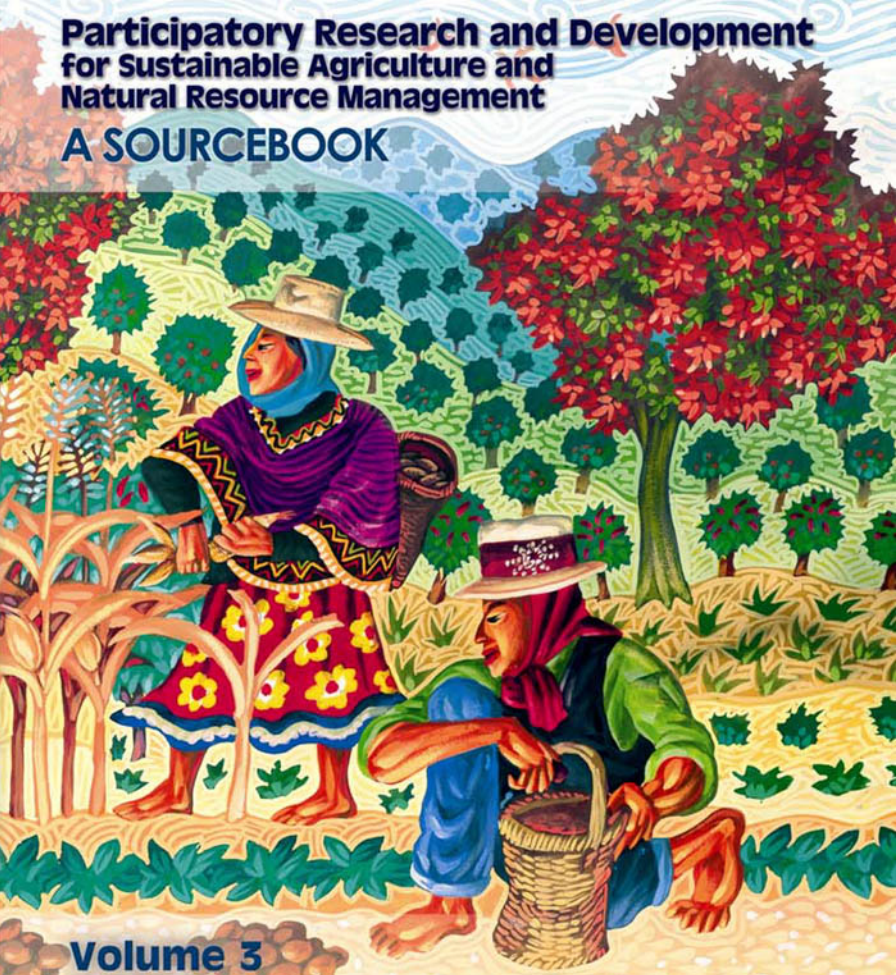
Participatory Research and Development for Sustainable Agriculture and Natural Resource Management

A SOURCEBOOK



Volume 3

DOING

Participatory Research and Development

Participatory Research and Development

for Sustainable Agriculture and Natural Resource Management

A SOURCEBOOK

VOLUME 3: Doing Participatory Research and Development

Edited by

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INTERNATIONAL DEVELOPMENT RESEARCH CENTRE (IDRC)

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Participatory Research and Development: A Sourcebook Overview

The Changing Agenda of Agricultural Research and Development

Agricultural research and development has traditionally focused on meeting the challenge of feeding the world's hungry population. Central to this agenda is the need to increase agricultural production through the introduction of technologies and support services for improving farm yield.

Following the successes of the Green Revolution in the 1960s and 1970s, newer challenges to agricultural research and development have emerged, such as:

- Promoting more equitable distribution of benefits resulting from dramatic improvements in agricultural production.
- Sustaining productivity gains through better management of natural resources supporting agriculture.
- Shifting the focus of research and development interventions to less favorable environments and low-input agricultural systems.
- Strengthening the capacity of local farming communities to continuously learn and experiment ways of improving their agricultural livelihoods.
- Building synergy between technological change and the socio-economic, cultural and political dimensions of agricultural innovation.

Key Themes in Post-Green Revolution Agricultural Research and Development

- Pro-poor targeting
- Conservation and sustainable use of natural resources
- Development of uplands and other less-favored areas
- Local governance, decentralization and citizens' rights
- Equity for women and other marginalized socio-economic groups
- Trade globalization and supply chains
- Migration and rural-urban dynamics
- Property rights and collective action
- Agriculture and human health
- Multi-stakeholder partnerships
- Local capacity development
- Organizational learning and change

In seeking to address these emerging challenges, the dominant transfer-of-technology paradigm has proven inadequate for managing more complex second-generation issues such as: diverse biophysical environments, multiple livelihood goals, rapid changes in local and global economies, expanded range of stakeholders over agriculture and natural resources, and drastic decline in resource investment for the formal research and development sector.

The Changing View of Research and Development

Global experiences now show that the changing agenda requires new ways of thinking about and doing research and development. Fundamental to this emerging paradigm shift is reassessing the traditional notion of research and development as a process primarily concerned with generating and transferring modern technology to passive end-users. Instead, research and development is now widely seen as a learning process that:

- Encompasses a diverse set of activities for generating, sharing, exchanging, utilizing knowledge.
- Results in a wide range of knowledge products, from technological to socio-institutional.
- Builds synergy between local capacities, resources and innovations.
- Draws upon diverse sources of knowledge, from local systems to global science.
- Provides decision-support tools and information that enable various types of users to make strategic choices and actions.
- Requires a holistic perspective of both the biophysical and social spheres in agriculture and natural resource management.

These new perspectives suggest that research and development can no longer be the exclusive domain of scientists, but rather a joint process requiring the participation of a wider range of actors, users or stakeholders. More importantly, it redefines the role of local people from being merely recipients and beneficiaries to actors who influence and provide key inputs to the process.

Participatory Research and Development (PR&D)

In reconceptualizing the research and development process, there has been a growing interest in the use of participatory approaches in the natural resource management, agriculture and rural livelihoods sectors. These have included: participatory rural appraisal, farmer participatory research, participatory technology development, participatory action research, participatory learning and action, gender and stakeholder analysis, community-based natural resource management, and sustainable livelihoods approach.

These diverse yet interrelated approaches collectively represent participatory research and development (PR&D) – as a pool of concepts, practices, norms and attitudes that enable people to enhance their knowledge for sustainable agriculture and natural resource management. Its underlying goal is to seek wider and meaningful participation of user groups in the process of investigating and seeking improvements in local situations, needs and opportunities.

PR&D has partly evolved from efforts to improve technology development and dissemination. However, field experiences show that innovations for improving agriculture and natural resource management need to address not only the technological but also the socio-cultural, political, economic dimensions such as: community structures, gender, collective action, property rights, land tenure, power relations, policy and governance.

Participatory approaches are envisioned to help agricultural R&D: 1) respond to problems, needs and opportunities identified by users; 2) identify and evaluate technology options that build on local knowledge and resources; 3) ensure that technical innovations are appropriate for local socio-economic, cultural and political contexts; and 4) promote wider sharing and use of agricultural innovations. In contrast to the linear process of technology generation-transfer-utilization in conventional approaches, PR&D encompasses a broader set of phases and activities including:

- ***Assessment and diagnosis*:** situation analysis, needs and opportunities assessment, problem diagnosis, documentation and characterization.
- ***Experimenting with technology options:*** joint agenda setting for experimentation, technology development and evaluation, integration of technology components and piloting.
- ***Sustaining local innovation:*** institutionalizing social and political mechanisms, facilitating multi-perspective negotiation and conflict management, community mobilization and action, local capacity development, strengthening local partnerships.
- ***Dissemination and scaling up:*** development of learning and extension mechanisms, information support to macro-policy development, promoting networking and horizontal linkages.
- ***Managing PR&D:*** project development, resource mobilization, data management, monitoring and evaluation, PR&D capacity development.

In practice, PR&D is generally distinguished by key elements such as: sensitivity to users' perspectives, linkage between scientific and local knowledge, interdisciplinary mode, multi-agency collaboration, problem- and impact-driven research and development objectives, and livelihood systems framework.

Promoting and Developing Capacity for PR&D

While there is growing interest in PR&D, it remains widely perceived as incompatible with accepted norms and practices in the mainstream research community. In the field, PR&D demands a set of knowledge, attitude and skills that go beyond the typical human and organizational capacities under top-down research and development paradigms.

In addition, the value adding potential of participatory approaches have yet to be fully explored by research and development practitioners. There remains a major

need to document empirical cases and to systematically assess impact of PR&D. Similarly, there is still limited understanding on PR&D's complementary role to more conventional research approaches, and on maintaining effective linkage with mainstream science to facilitate local innovation processes.

Nonetheless, participatory approaches are gradually gaining ground across the institutional landscape – from research and academic organizations to non-government organizations (NGOs), development agencies, and local government units. To further promote and develop capacities for PR&D, it is necessary to create more opportunities for information exchange, training and networking among the growing number of practitioners and organizations seeking to explore the value-adding potential of PR&D. Among its key challenges are:

- ***Synthesis:*** Reviewing diverse PR&D experiences to identify field-tested concepts and practices for wider sharing and adaptation.
- ***Capacity development:*** Developing PR&D capacities of field practitioners and their organizations such as through training, information services, networking and development of protocols.
- ***Establishing support mechanisms for capacity development:*** Sustaining capacity development through institutionalized, locally-driven support mechanisms.
- ***Integration:*** Creating opportunities and a supportive environment for introducing PR&D in mainstream agriculture and natural resource management programs.

The PR&D Sourcebook

The development of this sourcebook supports wider initiatives in promoting easy access to systematized information on field-tested PR&D concepts and practices among field practitioners and their organizations. It addresses the need to facilitate sharing and use of the expanding knowledge on PR&D by:

1) Identifying and consolidating field-tested PR&D concepts and practices relevant to managing natural resources for agriculture and rural livelihood, drawn from experiences of practitioners and organizations around the world.

2) Repackaging, simplifying and adapting information through the production of a sourcebook on PR&D.

3) Distributing and promoting the use of the sourcebook, including its derived products, particularly in developing countries where access to PR&D information resources is limited.

The primary target users of the sourcebook are field-based research practitioners in developing countries seeking to learn and apply PR&D in their respective programs and organizations. They may have technical or social science backgrounds but share a common interest in using PR&D's general knowledge base. They are involved in research activities dealing with interrelated issues in natural resource management, agriculture and rural livelihoods.

As a whole, the sourcebook is envisioned to provide general reference and comprehensive overview on PR&D. In showcasing the rich, diverse perspectives on PR&D, the sourcebook is characterized by the following salient elements:

- Emphasis on information applicable to ***research- and development-oriented activities,*** complementing existing publications/materials that primarily focus on the use of participatory methods for extension, learning and community mobilization.

- Broad topical coverage of the ***research and development process.*** As an introductory guide on PR&D, it provides general orientation to various phases or types of activities that are specifically covered by existing method- and/or tool-specific publications.

- Focus on the application of PR&D within the framework of ***conservation and sustainable use of natural resources.*** It consists of papers that share field experiences associated with natural resources being used in agriculture and rural livelihoods and/or agriculture and rural livelihoods that consciously maintain long-term productivity of the resource base.

- An integrated ***socio-technical perspective*** that takes into account both the social/human and technological dimensions of innovation required for natural resource management, sustainable agriculture and rural livelihoods.

- ***Cross-cutting perspective*** of PR&D applications, encompassing various types of natural resources, agricultural activities and rural livelihoods; this comparative mode of presenting information complements existing publications that are specific to sub-categories of PR&D applications.

- Conscious effort to seek out papers dealing with ***lesser known projects/ organizations*** in developing countries, especially PR&D experiences that have not been (widely) published.

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User's Guide

The main purpose of this sourcebook is to inspire and guide aspiring and new practitioners of Participatory Research and Development (PR&D) to learn, reflect and constantly refine the way they work. The primary target users are field-based researchers in developing countries involved in activities dealing with the interrelated issues of natural resource management, agriculture and rural livelihoods. They may have technical or social science backgrounds but share a common interest in drawing on the PR&D knowledge base.

The sourcebook is intended to enhance access to systematized information on field-tested PR&D concepts and practices among field practitioners and their organizations. It responds to demands for wider sharing and dissemination of the expanding knowledge on PR&D by:

1) identifying and consolidating field-tested PR&D concepts and practices relevant to managing natural resources for agriculture and rural livelihood, drawn from experiences of practitioners and organizations around the world;

2) synthesizing, condensing and simplifying available information; and

3) promoting and improving availability of information particularly in developing countries where access to PR&D information resources is limited.

As a whole, the sourcebook is envisioned as a general reference and comprehensive overview, showcasing the rich diversity of perspectives on PR&D. The sourcebook is characterized by the following salient elements:

- Emphasis on information applicable to research and development-oriented activities, complementing existing publications that primarily focus on the use of participatory methods for extension, learning and community mobilization.

- Broad topical coverage of the research and development process. As an introductory guide to PR&D, it provides general orientation to the phases or types of activities that are specifically covered by existing method- and/or tool-specific publications.

- Focus on the application of PR&D within the framework of conservation and sustainable use of natural resources. It consists of papers on field experiences associated with natural resources use in agriculture and rural livelihoods and/or agriculture and rural livelihoods that consciously maintain long-term productivity of the resource base.

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- Cross-cutting perspective of PR&D applications, encompassing various types of natural resources, agricultural activities and rural livelihoods; this comparative mode of presenting information complements existing publications that are specific to sub-categories of PR&D applications.

- A conscious effort to seek out papers dealing with lesser known projects and organizations in developing countries, especially PR&D experiences that have not been (widely) published.

Sourcebook Structure

The printed version of the sourcebook consists of three volumes and each volume has several sections. The first volume on **Understanding PR&D** is devoted to overview papers; key concepts; and emerging approaches and frameworks. The second volume on **Enabling PR&D** includes papers on capacity development; strengthening institutions and organizations; networking and partnerships; policy, governance and scaling up. The final volume on **Doing PR&D** focuses on technology development, facilitation of local institutions; and organization of communities and stakeholder groups

The following more detailed framework was used by the advisory committee for assigning papers to one of the three volumes.

Understanding PR&D	Enabling PR&D	Doing PR&D
❑ history/evolution of approaches ❑ description of approaches ❑ definition of concepts ❑ explanation of concepts ❑ interpretation of concepts (cases illustrating concepts) ❑ reasons for doing PR&D	❑ institutionalization ❑ institutions and organizations ❑ policy support ❑ capacity development ❑ resource mobilization ❑ curriculum development ❑ partnerships and networking ❑ organizational change ❑ interdisciplinarity	❑ monitoring and evaluation ❑ organizational frameworks ❑ implementing organizations ❑ case examples of PR&D processes (assessment, experimentation, innovation) ❑ experiences with PR&D methods and tools ❑ PR&D research management ❑ learning from other sectors ❑ data analysis and management

Sourcebook Development Process

The development of the sourcebook can be divided into three phases: 1) planning, 2) drafting and 3) refinement, production and distribution.

An international advisory committee and an UPWARD-led working group were formed to oversee the development of the sourcebook. The identification of candidate papers for inclusion in the sourcebook and the commissioning of new papers from invited contributors received special attention during this first phase. To gather a diverse range of materials from a variety of institutions and individuals, announcements were sent to different journals, newsletters, websites and e-groups. Once an adequate range of draft materials was identified, a first outline for the sourcebook was developed by the UPWARD working group and reviewed by the advisory committee. The working group and advisory committee also developed guidelines for the development of the sourcebook.

The second phase focused on the development of a first draft of the paper contributions. The UPWARD working group carried out a preliminary screening and many of these materials consisted of existing papers written for different purposes and audiences. Specific suggestions on how to repackage papers were developed by the working group. This was followed by a "writeshop" where papers were repackaged to shorten and refocus them on key messages relevant to participatory research and development. Some papers were merged, and others were split into several shorter pieces. When topic gaps were identified a special effort was made to search for papers or to solicit new contributions. The writeshop involved the UPWARD working group, editors, artists and layout specialists. After the writeshop, repackaged papers were sent back to the original authors for their feedback and comments. These comments guided the production staff in the development of second drafts. At the end of this process, each member of the advisory committee was provided with a copy of the full manuscript for review.

The final phase covered the refinement, production and distribution of the sourcebook. The advisory committee met with the UPWARD working group, editors, and with representatives of collaborating and donor institutions. The structure of the sourcebook was refined, each paper was reviewed and new gaps in the compilation were identified. Each member of the advisory committee took responsibility for identifying and inviting authors to develop specific papers to fill the gaps. These new submissions were forwarded to the UPWARD working group for repackaging and finalization. Out of the 155 paper contributions screened, 79 papers are included in this final compilation. A camera-ready copy of the sourcebook was prepared for final printing.

It is important to note that each article in the sourcebook is designed to stand on its own and can be read and used independently. The publishers and authors of individual papers encourage readers to quote, reproduce, disseminate and translate materials from this sourcebook for their own use. Due acknowledgement, with full reference to the article's authors and the sourcebook publishers, is requested. The publishers would appreciate receiving a copy of these materials.

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Volume 3

DOING
Participatory Research and Development



Volume Overview

Participatory research and development (PR&D) is done within a knowledge system with components, processes and actors that are interlinked. Innovations emerge as a result of participation and interaction among stakeholders. Hence, it is not only associated with perspectives and approaches that are multiple and diverse, but also with processes that are non-linear, iterative and cumulative. Doing PR&D entails keen consideration of a delicate balance between rigor and relevance, expertise and teamwork, specificity and generalization, learning and action. It requires familiarity with approaches and methods that can effectively and efficiently address the diverse and dynamic nature of rural households, communities and institutions.

As the papers in this volume indicate, there is no one-way of doing PR&D. Some researchers conduct on-farm experiments and ask farmers to participate in their research. Others encourage farmer experimentation and seek the help of researchers and other development workers for ensuring relevance and effective use of the results. Some people see PR&D as an opportunity for farmers to experience the benefits or advantages of improved practices. Others see it as a way of generating innovations and practices that are more relevant to and practical for farmers. For some, it is a vehicle for learning and empowerment. For still others, it is an arena for development action and systematic reflection.

Stakeholders' participation in the research and development process usually leads to more interrelated issues with many ramifications that require much attention. These actors may have a more holistic and integrated view of agriculture and natural resource management than researchers do, with many implications for the way research agendas are formulated, implemented and managed. Doing PR&D requires integrated, interdisciplinary, inter-agency and cross-sectoral teams of R&D professionals.

Another dimension of doing PR&D is the cyclical nature of its processes. PR&D involves description of existing systems, diagnosis of constraints and opportunities, design and testing of ideas and their wider dissemination and reinforcement. It also includes facilitating group formation, institutional innovation and developing platforms for collective learning and action, in addition to the usual elements of planning, implementing, monitoring and evaluating project activities.

The way of doing PR&D continues to evolve as practitioners relentlessly explore, innovate and generate new ideas and techniques. The papers in this volume document the experiences of different institutions as they design, adapt and learn from the various approaches, methods, tools and techniques in the course of doing PR&D. The papers are varied and reflect different degrees of stakeholders' participation and research sophistication. The volume is organized into the following sections:

- Technology Development
- Strengthening Local Organizations
- Multi-Stakeholder Based Natural Resource Management

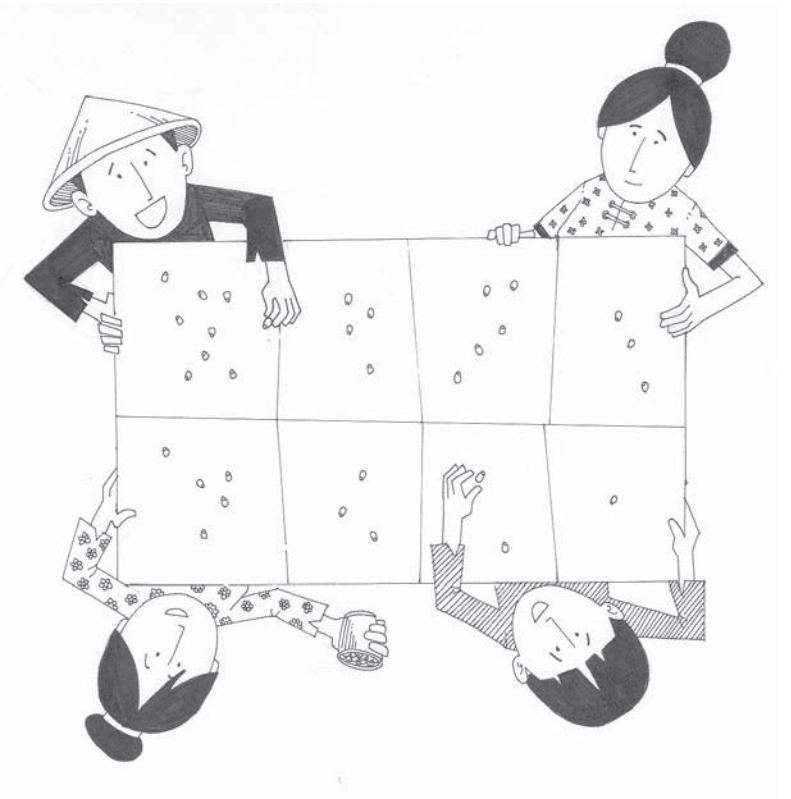
We hope that these papers provide you with a range of ideas and insights to help you start with or strengthen your own initiatives in participatory research and development.

Technology Development



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Identifying Local Stakeholders' Research Priorities: Methodological Challenges

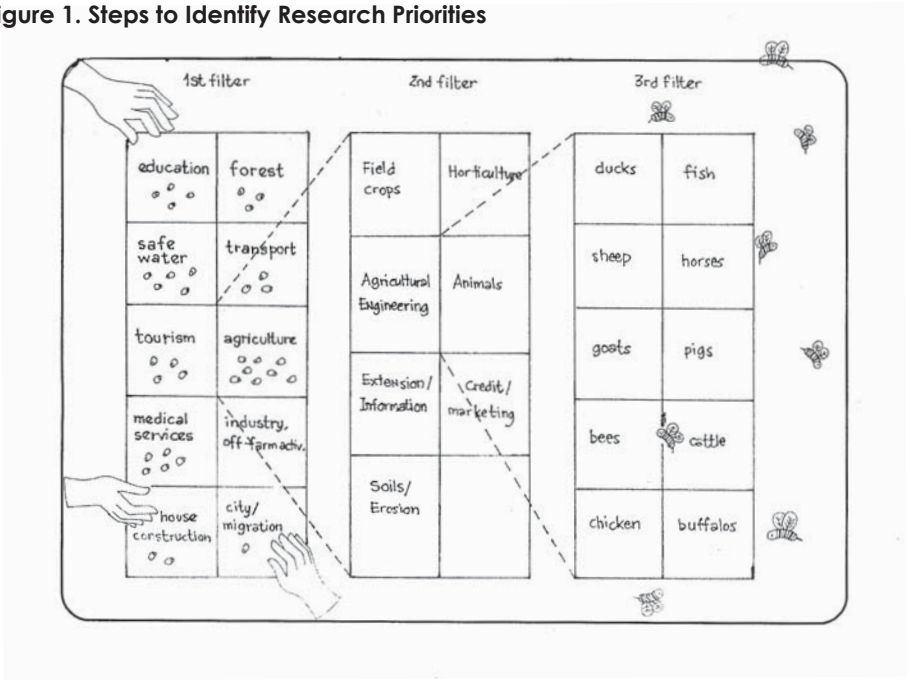


Local stakeholders' priorities for research in agriculture and natural resource management were a primary consideration in a long-term collaborative research program on "Sustainable land use and rural development in mountainous regions of Southeast Asia". The project implemented by the University of Hohenheim, Germany, in cooperation with four Thai and four Vietnamese research and teaching institutions used the concept of ranking to enable male and female farmers in selected villages to set their own priorities for the following five-year period.

Identifying Research Priorities

Various pictures representing a whole range of agricultural and non-agricultural subjects were shown to these farmers. They were then asked to distribute maize seeds on the pictures. The more seeds they placed on a picture, the higher they prioritized the topic. The procedure started with general topics, such as health, education, agriculture and forestry (Figure 1).

Figure 1. Steps to Identify Research Priorities



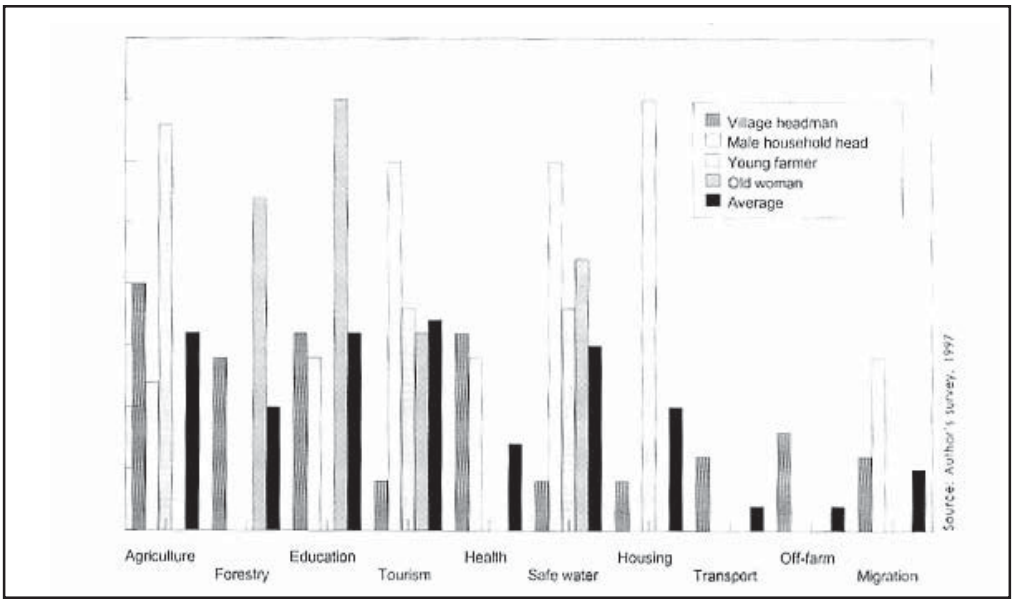
The first filter gave insights into how villagers perceive the future importance of agricultural issues as compared to other topics. Since the research program had a clear focus on agriculture, farmers were asked in the second filter to indicate priorities in the field of agriculture, covering issues such as field crops, horticulture, credit/marketing and animals. A third filter brought information about the relative importance of certain animals and crops, for instance.

Farmers were asked to add other issues (by visualizing them on additional cards) if they felt that the pictures presented did not cover the range of crops grown or types of animals raised in the village. In some cases, the pictures were misunderstood and needed to be adapted to the local context.

After three rounds of priority setting supported by visual tools, further details could be gathered by open questions on specific topics such as crop diseases, animal nutrition problems, or market access. Not surprisingly, the results suggested high variability of priorities depending on the socioeconomic status, ethnic origin, age and gender of the respondents (Figure 2).



Figure 2. Individual Priorities of Four Respondents in an Ethnic Minority Village of Northern Thailand (Relative Importance)

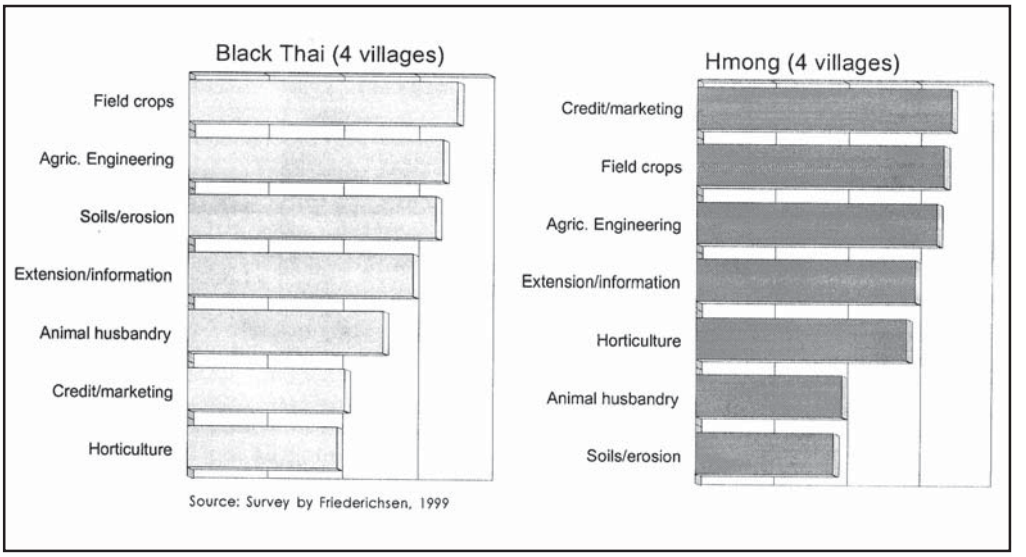


To reduce this heterogeneity, different approaches were tested to obtain an "up-scaled" picture of the main areas of interest and the priority setting of farmers. Working only with village leaders was considered as one possibility to reduce variation, but was later abandoned to avoid social bias towards village elites. Instead of doing the exercise with individuals, groups of farmers were chosen. Usually, groups were determined by gender, as women could express themselves more openly when their male counterparts were not present.

Working with farmers' groups resulted in a more general idea of male and female priorities, which did, however, neglect the considerable differences within the groups (Figure 3). These could only be captured by taking note of the decision-making processes among the participants. Unfortunately, this was sometimes limited by language barriers. The respondents in both Thailand and Vietnam belonged to different ethnic minority groups and an interpreter speaking their language was not always available which would have allowed further discussions.

From the start of the preparation for the research program, it was clear that not all priorities could be considered, given the limitations set by the donor agency. Some priorities could be discarded directly, for example, those that were driven by acute but only temporary concerns, such as the shortage of water in some areas during the El Niño phenomenon. Other priorities were beyond the mandate of scientists, for instance, the lack of citizenship rights raised by ethnic minority farmers in protected areas of Northern Thailand. Health or educational problems also did not match the disciplinary background of the researchers. Some farmer priorities, such as input-intensive vegetable production in highly erosive sloping land, would not be compatible with Thailand's agricultural and environmental policies, which only allowed fruit trees or other perennial crops in certain watershed conservation areas.

Figure 3. Priorities of Black Thai and Hmong Farmers' Groups in Son La Province, Northwest Vietnam



Limitations of the Methodology

In expressing priorities, rural people often face difficulties in distinguishing between research programs and development projects. Some of the problems mentioned by farmers could be solved by extension workers or development projects, if these would introduce technologies and practices that were already tested successfully under similar conditions elsewhere.

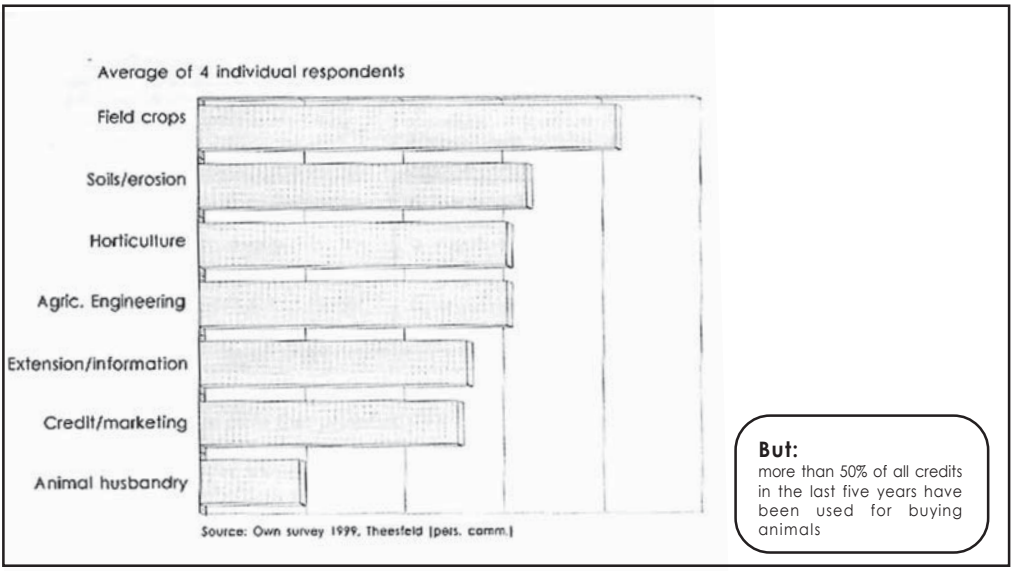
On the other hand, the researchers have their own problems in sorting out research questions from the priorities mentioned by farmers. If Hmong farmers in Northwest Vietnam give access to credit and markets the highest priority because they are disfavored by the formal financial markets and poor infrastructure, is that a problem that deserves more research or is that a pure development problem and a question of political will?

Farmers sometimes also present problems they think the outsider wants to hear (cf. Neubert, 2000). By presenting a whole range of visualized topics simultaneously to the farmers, this bias might be reduced, although not totally excluded. Some farmers' priorities and relevant research questions could not be identified during a short village survey or with the use of participatory appraisal tools. Therefore, the combination of qualitative and participatory methods with longer-term field studies is a necessary prerequisite to gain a more realistic picture of the situation.

In a Dao village of Northern Vietnam, Participatory Rural Appraisal (PRA) exercises with both male and female farmers suggested that livestock does not play an important role in the village. An intensive study on rural credit, however, found that more than 50% of the credits were invested in animals. It turned out that the village headman had recently announced that farmers should not increase

their livestock numbers due to limited feed resources. This indicated that the response of farmers given during the PRA exercise was the "politically correct" view, but did not reflect their real priorities (Figure 4).

Figure 4. Priorities in a Dao Village in Ba Be District, Bac Kan Province, North Vietnam



A major limitation of the ranking of topics by using pictures lies simply in the fact that not all potential priority themes can be visualized. Land tenure conflicts and local power relations, for example, have significant impact on access to resources and technologies and are thus relevant for research, but appeared too abstract to be visualized. Another limitation is that pictures might be interpreted differently, depending on the sociocultural and educational background of the respondents.

Finally, in heterogeneous highland regions, the selection of villages for investigation already predetermines some of the results. The fact that the presence of the researcher, and the expectations that farmers have of him/her, can also influence farmers' stated preferences, cannot be excluded.

Ethical Considerations and Interests of Other Stakeholders

As with many methods from the PRA toolbox, priority ranking can raise high expectations among the participants of the exercise. While priority ranking for development-related problems (e.g., construction of a school or a rice mill) can directly result in material benefits for the villagers, beneficial results of agricultural research cannot be guaranteed. In the particular case of this research program, funding was not assured. It is therefore imperative that farmers participating in the ranking of priorities are informed about the uncertainty of the implications of their participation.

The example below (Table 1) shows that priorities seen by upstream farmers are not necessarily compatible with the views of other stakeholders in the region. While the population in the upper watershed would primarily emphasize their production functions, other stakeholders are usually more concerned about the service functions of the watershed. In following only the interests and priorities of upstream communities, research could miss out on issues that are relevant for a broader range of stakeholders.

Table 1. Conflicting Priorities in Watersheds of Mountainous Regions in Southeast Asia - Production Versus Service Functions

Production functions prioritized by the resident population in mountain watersheds	Service functions prioritized by other stakeholders (lowland populations, national governments and the global community)
sustain agricultural production on a long-term basis	conserve biodiversity and protect natural ecosystems
improve water availability for irrigation	regulate downstream water flows and prevent sedimentation of rivers and dams
retain forest resources for local uses: timber, fuel, grazing, non-timber products	sequester carbon to alleviate the threat of global warming

Adapted from Garrity, 1998

Conclusion

Picture-based ranking of research topics can be an interesting tool in identifying local stakeholders' priorities for agricultural research programs. It is important, however, to avoid typical biases of short-term diagnostic methods, to be aware of ethical concerns and to try to balance farmers' perspectives with the interest of other local stakeholders.

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Participatory Research and Development for Sustainable Agriculture and Natural Resource Management: A Sourcebook

Using Participatory Tools in Setting Gender-Sensitive Criteria for Acceptable Rice Varieties in Eastern India



Sustaining household food (rice security) is the main goal of poor farming households in rainfed lowland rice environments in Eastern India. To these people, this goal is difficult to achieve due to the biophysical and socio-economic factors constraining rice yields. Despite the long-term efforts through rice breeding research, some farmers in Eastern India have resisted their adoption and still continue to grow traditional rice varieties. This may be due to the farmers' lack of accessibility to new seeds or the lack of suitable rice varieties that are better than what are being currently grown. There has been a lack of understanding of the farmers' selection criteria, their environments and gender roles in rice production and processing.

Even with women's active involvement in rice production, postharvest and seed management, scientists who are mostly male often talk with the male farmers only. Ignoring women's knowledge and preference for rice varieties may be an obstacle to adoption of improved varieties, particularly in areas with gender-specific tasks, and in farm activities where women have considerable influence.

A released variety in India such as Pant-4 is high yielding but it is rejected by women farmers because it is difficult to thresh by hand. In contrast, traditional varieties that have low yields are still grown because of their desirable taste and their eating and cooking qualities that make them well-suited for rice products that women prepare.

This paper discusses the methods used in integrating a gender dimension in participatory varietal selection and lessons learned.

The Project

In 1997, the International Rice Research Institute (IRRI) in collaboration with the National Agricultural Research System (NARS) in Eastern India launched the "Farmer Participatory Plant Breeding Program." The program wanted to know two basic things:

- that farmer participation in rainfed rice breeding can help develop suitable varieties more efficiently
- that stages along a breeding program could be identified where farmer interfacing is optimal

The program had two components: a plant breeding component and a social science component that included gender studies. Since 1998, the program has incorporated gender concerns in on-going participatory plant breeding projects conducted by IRRI scientists and NARS. To incorporate both male and female farmers' perspectives, the following strategies were used:

- developing methodologies for assessing male and female criteria of useful traits of rice varieties of male and female farmers
- developing participatory approaches that include male and female farmers in selecting new rice lines
- further enhancing women's knowledge and skills in germplasm conservation
- enhancing NARS' capacities in conducting male and female farmer participatory approaches in rice germplasm enhancement and conservation in rainfed rice environments

The gender study was conducted in two villages of Uttar Pradesh. Basalatpur in Siddathnagar district represents a submergence-prone rainfed area while Mungeshpur in Faizabad district is a drought-prone area. Table 1 summarizes the villages' characteristics.

Table 1. Characteristics of the Project Sites

Characteristics	Research Sites	
	Basalatpur, Siddharthnagar	Mungeshpur, Faizabad
Agroecology	Submergence-prone	Drought-prone
Farming households (total no.)	140	133
Upland (%)	30	20
Between upland and lowland (%)	0	20
Lowland (%)	70	60
Adoption of modern varieties (%)	<20	82
Irrigation (private pump) (no.)	1	10
Average farm size (ha)	1	0.49
Caste composition of households (%)		
Upper caste	6	9
Backward caste	18	49
Scheduled caste	21	42
Minority	55	0
Distance to market (km)	5	28
Degree of market orientation	High	Low

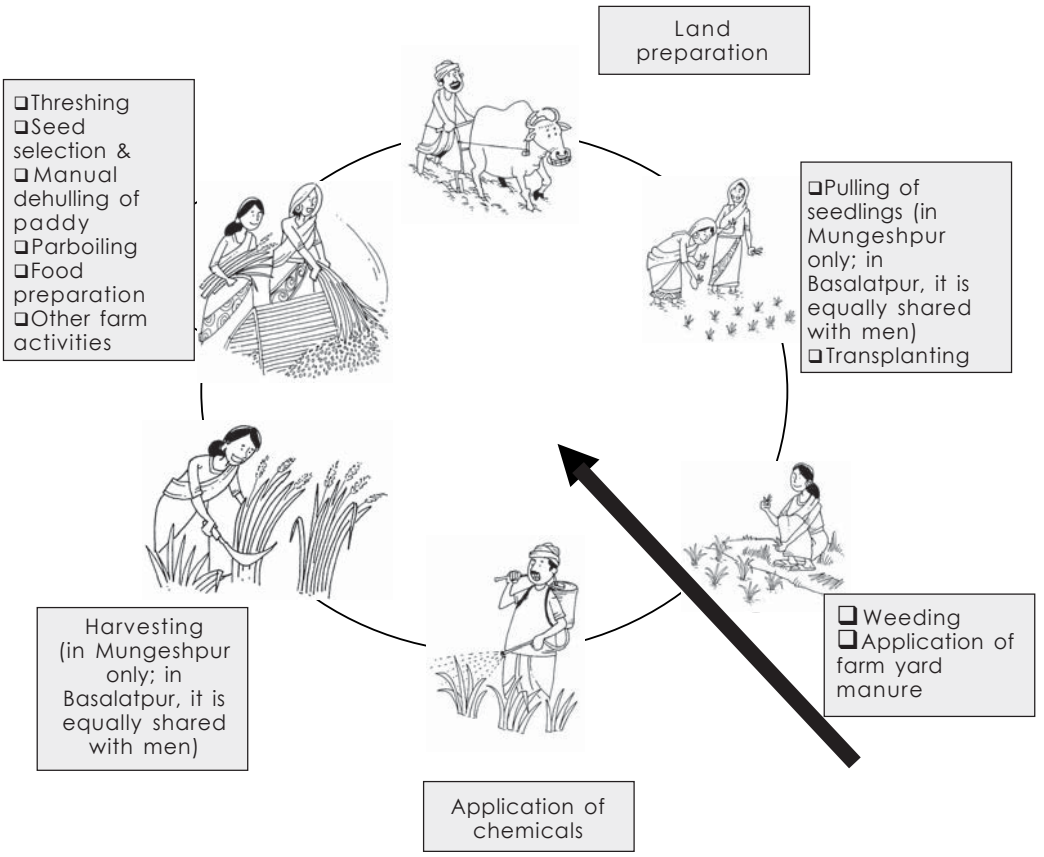
Women respondents were in their 40s and relatively younger than the males. Most of the women had farming experience of 20 years or more. The men, on the other hand, were more literate than the women.

Getting Male and Female Farmers' Criteria of Acceptability

To promote acceptance of modern rice varieties, the program set out to understand better the farmers' selection criteria, paying particular attention to women's opinions. Various participatory approaches were used.

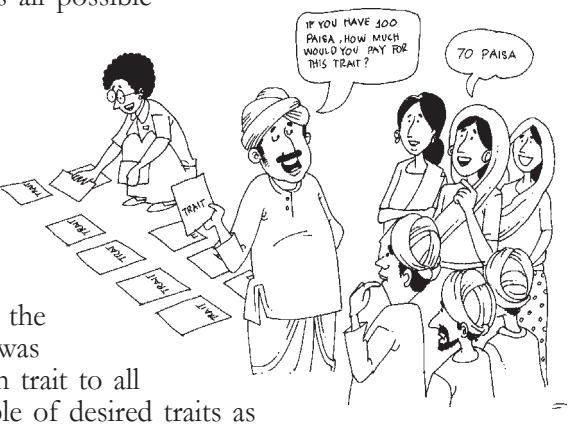
Female participation in rice production in both villages was high. Some tasks were dominated by men while others were generally done by women (Figure 1).

Figure 1. Activities Dominated by Either Male or Female Farmers in Two Villages of Uttar Pradesh, India.



Participatory Ranking Through Graphic Illustration of Traits

Illustrations of land types as well as all possible traits of rice were prepared. Paired combinations of land type and possible trait were then shown to farmers. They were then asked to select only the important traits they would consider in selecting rice varieties for the lowland and upland fields.



After all respondents had answered, the weights per trait for each land type was summed and the proportion of each trait to all traits mentioned was taken. A sample of desired traits as specified by men, women or both are presented in Table 2.

Table 2. Rice Traits Preferred by Male and Female Farmers in Two Villages of Uttar Pradesh, India

Research Sites		
By both male and female farmers	**By male farmers only**	**By female farmers only**
❑ Grain yield ❑ Duration (days from planting to harvest)	❑ Resistance to abiotic stress e.g., drought ❑ Adaptation to specific soil type	❑ Taste ❑ Post-harvest quality ❑ Cooking characteristics ❑ Quality and quantity of straw for animal folder ❑ Competitiveness to weeds

Note: These are just a few of the 15 traits ranked for lowland and upland farming by both villages.

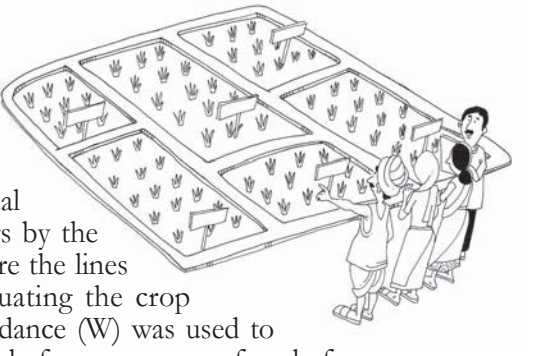
- In Basalatpur, both men and women preferred short duration, medium height varieties. Short duration crops were chosen because of the importance of growing early winter crops like oilseed, linseed, peas and potatoes.

- Women cited adaptation to several food preparations and other rice products as important criteria for selection, especially if traditional methods like hand pounding are still being used.

- High grain price is an important consideration for lowland farmers who sell traditional varieties that command a high price like *Kalamanak*. In contrast, grain price is not that important to the villagers of Mungeshpur because their harvest is mostly used for home consumption.

- Both male and female farmers of Mungeshpur place high priority to grain yield, and eating and cooking qualities. More women prefer traits like short to medium-maturity, grain price, competitiveness against weeds and ease in threshing.

Farmers' Preference Ranking



Five female and five male farmers observed 13 rice genotypes grown on individual plots in farmers' fields. They were then asked to rank the 13 rice lines from 1 (excellent) to 13 (worst) on the basis of visual assessment. The rankings of the new cultivars by the farmers generated a matrix (n x k), where n are the lines being evaluated and k are the farmers evaluating the crop performance. Kendall's coefficient of concordance (W) was used to measure the agreement in rankings among male farmers, among female farmers, and the correlation between male and female farmers' ranking. High and significant correlation values indicate close agreement on the ranking of the 13 rice genotypes by men and women in the sample.

In both villages, both male and female evaluators agreed closely in their ranking of the 13 rice lines. Early maturity and high-yielding lines were very acceptable.

Farmer Participation in Rice Varietal Selection



During the monsoon season, two farmers from each of the villages of Mungeshpur and Sariyawan (rainfed neighboring village) of Faizabad district, and Basalatpur of Siddathnagar district were selected to check the performance of 13 rice genotypes on their fields. The genotypes were 10 advanced lines from a shuttle breeding program from Uttar Pradesh and three released varieties for lowlands.

Of the 13 genotypes in Basalatpur, two are scented varieties (*Kamini*, which flowered in 136 days, and *Sugandha* flowering in 124 days). Scientists distributed the seed through the farmer Participatory Plant Breeding (PPB) project. In this approach, breeders select the most promising lines with farmers. Including female farmers as cooperators gave the women an equal chance to participate in selecting rice genotypes.

The average rice yields obtained by the two female farmers were higher (2 tons per hectare in Mungeshpur and 3.3 t/ha in Sariyawan) than those obtained from the male-managed farms. Average yields were below 2 t/ha because of the infestation of pests and diseases at the time of maturity. This indicates that if women are given equal access to improved seeds and farm management skills, they can be better farmers. Since 1998, participatory varietal selection had been going on farmers' fields by male and female farmers.

Sensory Evaluation of Introduced Rice Cultivars

An evaluation of sensory characteristics was conducted with farmers in a village of Bihar. Twenty-four farmers (12 women and 12 men) evaluated 15 upland rice

varieties as raw rice and parboiled rice for milled and cooked rice appearance, color, odor, texture, stickiness, taste and overall acceptability. The rice samples were milled and cooked by the women farmers following their ordinary practices.

Opinions of women and men farmers were similar, with significant to highly significant correlation between their rankings for milled rice appearance, cooked rice appearance, texture, color and taste. However, they did not agree strongly on stickiness and, to lower extent, odor. In terms of overall acceptability, there was no difference in women and men farmers' opinions on the tested varieties nor in the final choices of the varieties they liked most and least (Singh *et al.,* 2001).

Lessons and Insights from the Case Study

Several lessons were learned in developing and testing the methodologies for farmer participation that included a gender dimension. These lessons are related to the following concerns:

- **Number of cooperators per site.** Due to limited seeds, only two to three trials/farmer were included in each village. Thus, the risks of losing information due to severe drought, poor management of trials, etc. were higher with small number of farmer cooperators per site. Thus, in 2002, the number of cooperators (including women farmers) was increased per site. The "Mother-Baby" trial model may provide an alternative in testing a large number of cultivars under farmer management (Atlin *et al.,* 2002).

- **Number of varieties on demonstration trials to rank.** Farmers had difficulty in visually ranking too many (13-25) rice lines using the scale from 1 (best liked) to n (least liked). Farmers were willing to test a maximum of five varieties only on their field. A simple rating system, for example, 1-3 (bad, average, good) or 1-5 numerical scale, may be more preferable.

- **Constraints in postharvest operations.** Harvesting and threshing small quantities of new rice cultivars impose more hard work on female cooperators. Dehusking paddy manually and hand threshing the small quantities of new rice cultivars for identification and evaluation were too laborious and time consuming. Thus, it is important for field workers to help the women during the harvesting and threshing phase and to ensure that varieties/lines do not get mixed.

- **Selection of women farmer cooperators.** Farmer cooperators may be chosen based on these characteristics: *de jure* and *de facto* female heads of households who have long-term experience in farming; actively involved in rice operations and in decision-making; and no caste preference (whether from the upper caste or low caste).

Proper selection of cooperators will help ensure that the new rice lines are better managed and seeds are properly cleaned and stored.

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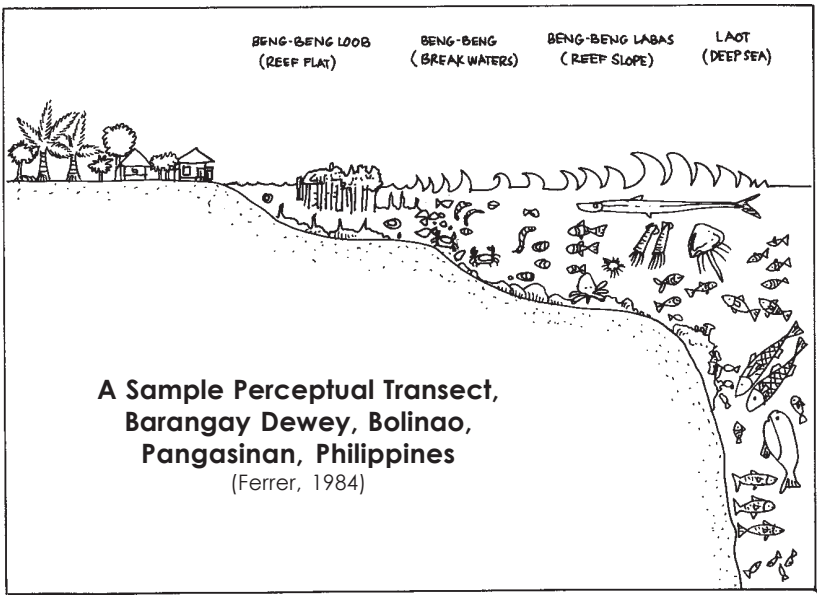
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Use of Perceptual Transects in Coastal Aquaculture and Fishery



A Sample Perceptual Transect, Barangay Dewey, Bolinao, Pangasinan, Philippines
(Ferrer, 1984)

Over the last two decades, considerable attention has been focused on the development and refinement of participatory research and development (PR&D) methodologies. In the Philippines, the bulk of this work has taken place within the context of rural development initiatives focused on small agricultural communities.

There has been a general evolution of tools and techniques beginning with Farming Systems Research (FSR) and moving on to more contemporary tools, including Farmer Participatory Research (FPR), Rapid Rural Appraisal (RRA), Participatory Rural Appraisal (PRA) and Participatory Learning Approach (PLA). The primary focus was on strategies to generate better dialogue and understanding between researchers and farmers.

Traditional approaches to aquaculture and fishery management have been criticized because they tended to focus almost exclusively on the behavior of fish, while ignoring for the most part, the behavior of fisherfolks. It has also been noted that ignoring the

Building upon RRA and PRA, participatory approaches to aquaculture have often been used to increase the researcher's or practitioner's understanding of the role that aquaculture and fisheries management play in rural livelihood as opposed to the more technical activities. Participatory tools have been used primarily to assist in needs assessment and identification of research questions and opportunities for more effective management of the fishery resource base.

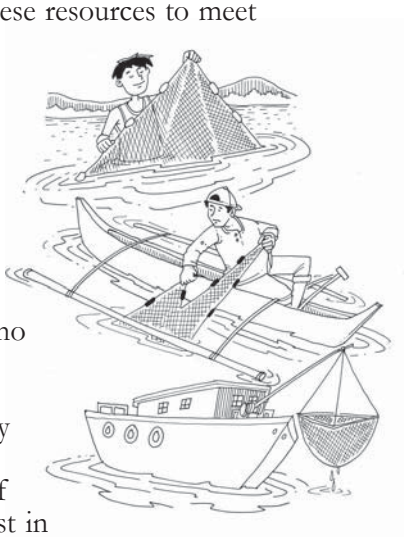


interrelationships between fish, fisherfolks and regulators invariably leads to management strategies that fail to meet long-term objectives.

A key element in the application of RRA to fisheries management has been the use of participatory tools to create more collaborative relationships between planners and those affected by the plans. One of the major lessons learned has been that the major constraints to improved management tend to be related more to conflict resolution than limitations in technology.

Participatory Research and Development Applied to Coastal and Reef Fisheries

The focus in adapting participatory processes to coastal zone aquaculture and fishery resource management is not only on participatory tools but also on conditions and environments in which they were originally developed. One of the basic conditions that provided a base for the applications of participatory approaches in agriculture is the farmer's general control over land and labor. Such farmers are free to decide on how they allocate and use these resources to meet their immediate needs for food and income.



Unlike the majority of small farmers who own or have direct use rights over the land they farm, coastal fishers and operators of certain kinds of aquaculture systems generally compete in a kind of common property environment. Compared to small farming communities where residents tend to share similar resource management strategies and goals, coastal residents often find themselves co-existing with multiple stakeholders who can have a different and often conflicting agenda.

An individual fisherfolk or a particular fishing community does not own a coastal reef. It is basically a common property resource (CPR). Even if a village considers itself to have traditional use rights over the reef, most reefs exist in national waters that are in essence an open access resource available to all citizens. This means that it is very difficult to keep outsiders from coming and exploiting the same fishing grounds for their own interest and profit.

Traditional residents often have little real control over the key resource base on which they depend for livelihood, with increased population density in most coastal areas. This can have a profound impact on the efficacy of participatory approaches designed to increase the ownership and control the villagers have over their own development.

Another difference between inland and upland agricultural environments and coastal zones is the degree to which they are impacted by forces beyond the control of local residents. There are general steps that upland farmers can take to reduce soil erosion in their fields. In fact, empowering farmers to assume greater roles in soil conservation and natural resource management, either individually or collectively, has been a focus of much participatory work.

Coastal residents are often severely impacted by upstream erosion, water pollution and flooding, over which they have no control. For most coastal areas in Southeast Asia, seasonal river flooding, pollution and siltation of mangroves and reefs caused by upstream erosion and run-off is a major constraint to artesinal fishery and aquaculture.

This comparison applies not only to environmental conditions but extends to the economic sector as well. Farmers and coastal fisherfolks both rely on external markets and have little influence over price. Farmers, however, have greater options to withhold food crops from the market hoping to get a better price later in the season.

Fisherfolks, unless willing to dry their catch, have little choice but to sell their fish on the same day they are caught, and hence are at the total mercy of buyers. Practitioners of PR&D in coastal areas need to recognize these conditions and develop appropriate tools and techniques that will help residents to deal more effectively with a complex, multi-stakeholder reality.

Early work in the Philippines includes the development of a manual of rapid appraisal techniques for Philippine coastal fisheries (Fox, 1986) and a set of coastal resource profiles (Ferrer, 1984). In the mid 1990s, researchers at the International Center for Living Aquatic Resources Management (ICLARM) developed a set of methodologies for assessing the contribution of aquaculture in small farming systems (RESTORE) and the management of coastal and reef fisheries (RACE, RAFMS and RAMP).

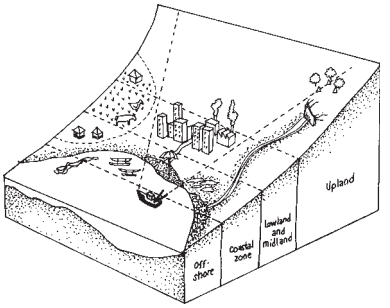
The Research Tool for Natural Resource Management Monitoring & Evaluation (RESTORE) is a long-term transformational process that is closely aligned with PLA and participatory action research. Rapid Appraisal of Coastal Environments (RACE) and Rapid Appraisal of Fisheries Management Systems (RAFMS) are largely research-led adaptations of RRA and PRA methods. RAMP is an ethnographic-based process that involves the collection of secondary and primary, as well as quantitative and qualitative data.

Use of Perceptual Transects in Developing Fishery and Coastal Zone Management

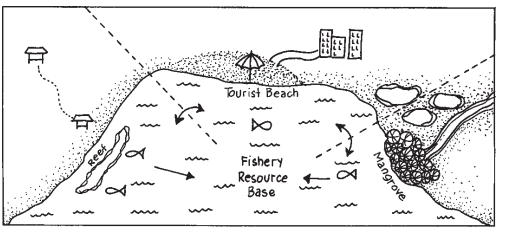
Practitioners need to focus not only on local households and community groups but also on identifying external factors that have impacts on how villagers perceive and manage their coastal resources. The transect analysis is a tool that can help practitioners and villagers recognize the factors and actors affecting a development activity.

A transect is a visual cross-section of a particular environment that highlights the different microenvironments or subsystems within the area under investigation. Transect analysis focuses on the flows or energy and resources from one area to another.

The Geographical Information System (GIS), satellite imagery and RRA complement the transects in generating and displaying a range of information and data. The PRA-type tools capture a higher degree of complexity surrounding fishery and aquaculture activities in coastal areas.



A Sample Vertical Transect



A Sample Horizontal Transect

It is possible to construct generalized transects that reflect a complex array of resource and material flows within and between terrestrial and marine environments. The coastal transect generally covers many miles of considerable physical and ecological differentiation, unlike the small-scale transects of a given upland farm or village that can be trekked by a group of researchers and farmers.

Researchers and practitioners should recognize perceptions of different stakeholders as important predictors of human behavior, especially in environments with a high degree of human and biophysical diversity. Transects and focus group interviews can be used to develop imagery of both the real and perceived environment. Inconsistencies between the perceptions of the environment and the behavior of different stakeholder groups are often indicators of unseen barriers to collective action and effective co-management of the resource base.

Perceptual transects that approximate the world view of different stakeholders can assist in identifying:

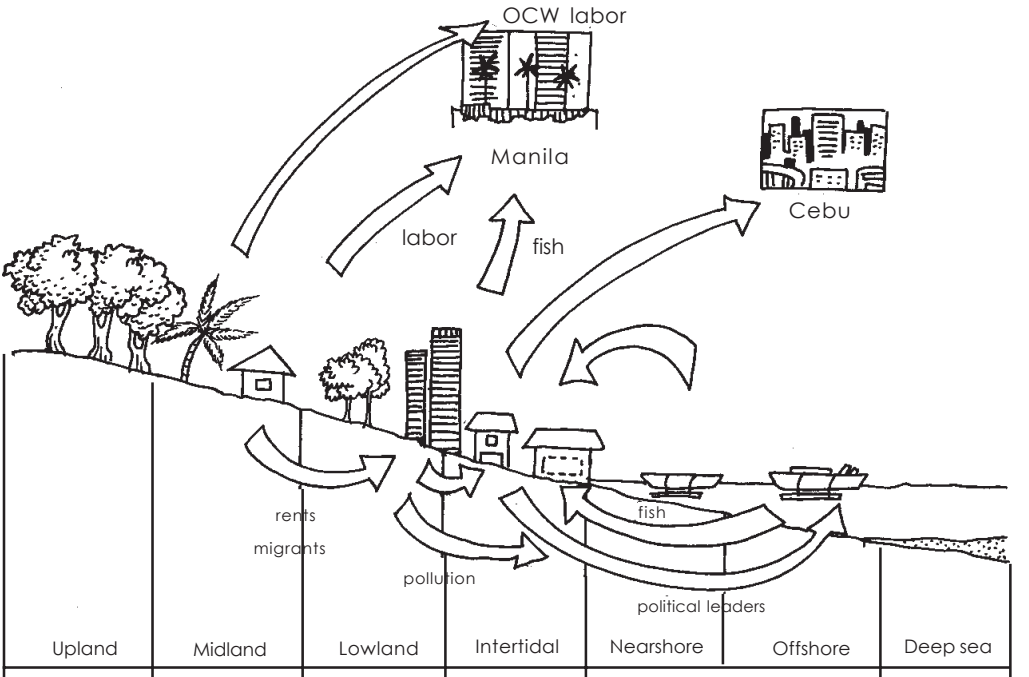
- different views of the resource, and its various uses
- society- and value-based norms that influence distribution and allocation patterns

Steps in Developing Perceptual Transects

A range of tools and techniques associated with RRA, PRA and PALM (informal interviews, resource maps and geographical and historical transects) can be used to help community residents generate their own perceptual transects. Having individual informants and villagers or fisherfolks draw their own transects and resource maps can often result in the identification of many important elements in the environment that may not have emerged in the informal interview.

Each stakeholder or stakeholder group, including both men and women, must be presented with the same opportunity to "paint" as broad, or as narrow, an environmental picture as they wish. It is critical that the image clearly reflects, as much as possible, all aspects of the environment that are important to each stakeholder, or in someway impact upon their quality of life. Such maps and transects can depict perceptions in both space and time.

Figure 1. Sample Coastal Transect
Biophysical, Socioeconomic, Administrative and Political Characteristics
Maqueda Bay, Philippines.



Upland	Midland	Lowland	Intertidal	Nearshore	Offshore	Deep sea
Secondary forest	Coconuts/corn grown by tenant farmers on land owned by municipalities	cassava/corn grown by tenants on land owned by municipal elite	municipal elite control market and dominate fish distribution to regional and national urban center	heavy competition between artisanal and commercial fishers		
	loocal traders supply fish to Inland villages on market days	denuded hillsides	difficult for Local Government Unit (LGU) to enforce fishing regulations	common use of illegal trawling and dynamite		
	out migration of village youth for schooling and domestic labor	high cost of electricity and poor infrastructure make local processing of fish and agricultural products difficult		completely unregulated open access marine resource base		
				over-exploited fishery but with same control of illegal methods fishers feel there would be enough for everyone		

Adapted from: McArthur, 1995

Perceptions are an Enduring and Resilient Force

Perceptions commonly reflect an ideal or desired state that may not necessarily be consistent with actual conditions. In a discussion with a group of fisherfolks in Central Philippines, there was general agreement among respondents that if only illegal trawling and the use of dynamite could be controlled, there would be enough fish for everyone. This view was not borne by an objective assessment of the local fishery by marine biologists and fishery specialists (Pullin *et al*., 1994). Nonetheless, this perception and others like it, are likely to be the driving force behind management behavior and fishing strategies.

People base decisions and behavior on how they perceive a situation and not so much because the perceptions accurately mirror local conditions, but because they reflect what people want to believe. People the world over tend to reject or deny what is unpleasant, or uncontrollable. The more useful a perception is to a particular group, the longer it is likely to be maintained, even in the presence of evidence to the contrary (McArthur, 1995).

Strategies designed to elicit perceptual transects or mental resource maps may provide important information which practitioners and stakeholders can use to deal openly with differing interests in managing a common resource base. A comparison of perceptual transects may help identify groups of people who place a similar value on a specific set of attributes or behavior. Such judgment groups (Hammond *et al.*, 1975) may play key roles in conflict resolution as they make explicit the differences between competing groups.

Perceptual transects, as a tool, can help to identify what different stakeholders feel they have to gain or lose in the resolution of a dispute. Such transects may also be useful in distinguishing between conflicts that arise out of competing interests and those that emerge from different value orientations.

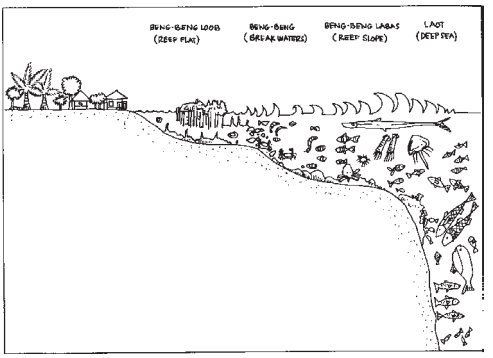
The inclusion of perceptual transects in the management database should produce a closer balance of focus on both prey (fish) and predator (human fisherfolks). The objective is looking both at what fisherfolks are doing and what they think the fish are doing. This multi-objective approach should build upon measured assessments of the fishery base, as well as perceptions and perceived expectations of the fisherfolks and the regulators.

Comparisons between present and past situation historical transects can provide a striking summary of the changing conditions to which coastal residents and fisherfolks have to adjust. Observing the transect making process (be it on paper or drawn on the ground) can often provide valuable information on local environmental knowledge and the degree to which this is shared across a village or between different stakeholders.

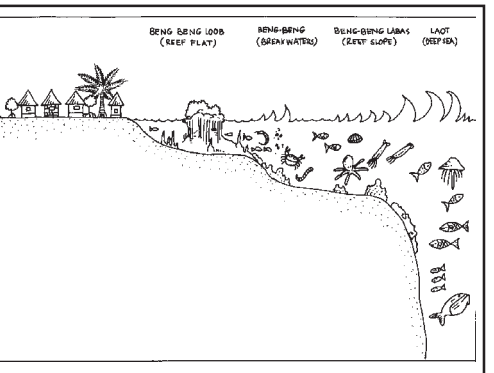
It is assumed that an individual perceptual transect will focus the greatest detail on aspects of the resource base that are most useful or meaningful to the stakeholder. The rest of the surrounding environment will likely be compressed and exhibit less differentiation.

It is possible to construct a composite perceptual transect based on the detailed portions of several individual stakeholder resource maps that represent different stakeholder groups such as men, women, artesinal and commercial fisherfolks. Such images help identify areas of potential complementarity in resource management, as well as nodes of competing or conflicting interests.

Figure 2. Sample Perceptual Transects of PAST and PRESENT Conditions



Sample Perceptual Transect of PAST Conditions (Barangay Dewey, Bolinao, Pangasinan, Philippines)



Sample Perceptual Transect of PRESENT Conditions (Barangay Dewey, Bolinao, Pangasinan, Philippines)

Building upon the physical transect, color-coding or some other technique may be used to indicate different stakeholder ownership or access patterns to a particular resource. Colored arrows may also be used to indicate which group of stakeholders has primary control over particular extraction technologies, market structures, and channels of distribution.

In comparing different perceptual transects, it may be possible to identify distinct judgment or interest groups among the various stakeholders. An important objective in analyzing perceptual transects is determining the nature of the key groupings of stakeholders in the resource base, and the important value orientations, economic interests and political positions they hold. The transect also facilitates identification of monetary and non-monetary resources and their impact on market transactions and property rights.

Future Challenges and Opportunities

It is clear from the various approaches and methods described that applying PR&D processes in aquaculture and fisheries owes a lot to the evolution of participatory methodologies focused on agricultural and community development. Adapting the methods and tools to fit aquaculture and fisheries was necessary. Working in densely-populated coastal areas requires addressing not only the needs of individual families and fisher groups. Increasingly, one also needs to work within the context of a larger arena of competing municipalities, as well as national and foreign stakeholders who all claim varying rights to, or are attempting to exploit legally or otherwise, the open access to coastal fishery.

The challenges are more social and political, rather than technical in nature. Where conflict is an overriding issue, participatory methods may have to embrace aspects of stakeholder analysis and dispute mediation processes. This creates an opportunity in which communities and fisher groups can assume greater roles in designing and implementing management strategies. The issues in an open access

resource environment are very similar to those encountered by development workers who are trying to apply participatory processes to integrated watershed management.

Practitioners need resources to work with multiple villages and groups. They should also motivate communities and stakeholders to participate in processes that will hopefully help them identify common interests. Ultimately, this increases their awareness on how actions and management strategies affect surrounding communities along the coastline or up and down a watershed.

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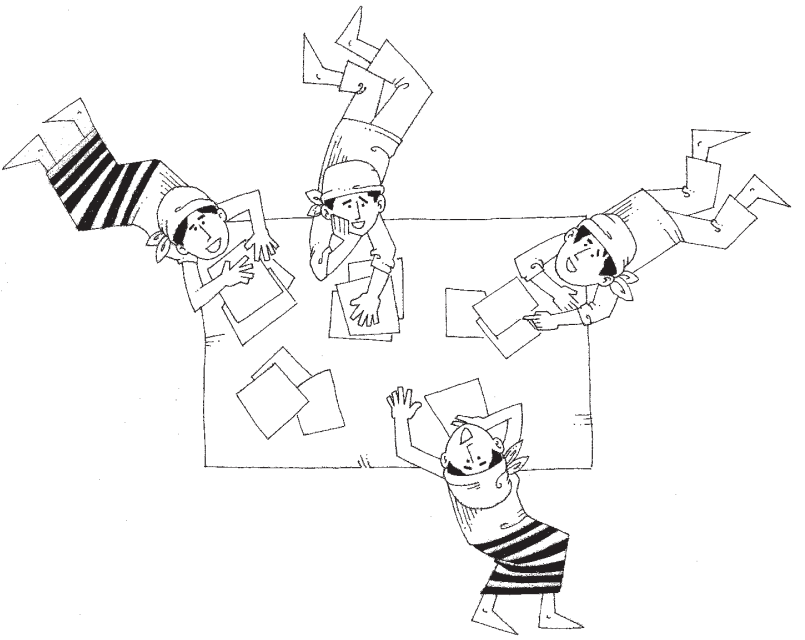
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Development of a Farmer Recording System in Burkina Faso



Collection of quantitative and qualitative data requires regular monitoring of labor and other inputs. Conventional surveys do not produce sufficiently detailed information, and close monitoring by scientists would have been too time-consuming.

In Burkina Faso, the Integrated Soil and Water Conservation in Africa (ISWC) program was facilitating joint research on the sustainability of improved traditional planting pits called zaï. It also looked at the socioeconomic constraints related to zaï, such as the use of materials and the time investment for digging and managing the planting pits at the household level. It was responsible for monitoring the joint experimentation but could not visit the participating farmers on a daily basis to interview them about their activities. The scientists felt that reasonably reliable quantitative information could be generated only if the farmers would record the data themselves. They believe that developing a Participatory Rural Appraisal (PRA) tool would also serve to reduce the role of external actors in participatory research (PR) and to increase the credibility of PR in the eyes of conventional researchers because scientifically-valid data would be generated.

Instead of text that the farmers could not read, drawings were used to visualize the different agricultural activities. Because keeping records was a completely new activity for the farmers, the scientists thought it best not to overload them with data collection and therefore reduced the number of parameters to be recorded to a minimum.

Most farmers involved in the ISWC-Burkina program are illiterate. Setting up and carrying out joint experiments and fully involving the farmers in these experiments required the creation of a system that would allow them to record data about their farming activities.

During a working session in May 1999, the scientists, a PRA specialist from the PRA Network of Burkina Faso, and farmers involved in the program selected the following parameters: labor inputs, the amount of organic matter used (which largely determines the success of zaï) and the yields of cereals (millet and sorghum), and crop residues.

Description of the Recording Tool

The new tool consists of a series of recording sheets that allow farmers to record the selected parameters on a daily and weekly basis. They need not write down numbers; they can simply mark one of the boxes. Three types of sheets were developed to collect the information. In each case, a different sheet is used for each major farming activity, and all sheets for one activity are bound into a booklet.

- The first type sheet is for recording the labor invested in a farming activity on a daily basis over a week (Figure 1). Each activity is represented by a symbol. And under each activity, every actor or source of labor input (man, woman, child...) are also represented by appropriate symbols.

Figure 1. Sheet for Recording the Labor Inputs Into Agricultural Activities

			Farming Activity			
Days in the week	Duration of work	Labor input **Man**	Labor input **Woman**	Labor input **Child**	External labor input	Cash expenses on hired labor
Day 1 (1 symbol)	●					
	◒					
Day 2 (2 symbols)	●					
	◒					
Day 3 (3 symbols)	●					
	◒					
Day 4 (4 symbols)	●					
	◒					
Day 5 (5 symbols)	●					
	◒					
Day 6 (6 symbols)	●					
	◒					
Day 7 (7 symbols)	●					
	◒					

Legend: ● Full workday ◒ Half workday **X** Day of the week **W** Local currency

- The second type of sheet summarizes the use of labor over the entire season for each farming activity (Figure 2). It thus gives the farmer an overview of the total amount of labor invested in each activity being monitored.

Figure 2. Sheet Summarizing Total Labor Input Into a Defined Agricultural Activity Throughout One Season

	Activity Monitored 			
	Man 	Woman 	Child 	Paid Labor 
	9	28	13	W O
	38	76	33	W O

- The third type of sheet is for recording the amount of materials carried to and from the fields (e.g., the amount of compost taken to the fields, the amount of harvested grain and crop residues taken from the field to the compound) (Figure 3).

Figure 3. Sheet for Recording the Amount of Manure Transported to the Fields

	No. of donkey carts 	No. of baskets transported by bicycle 	No. of baskets carried on the head 
Number			

Developing and Using the Tool

The development of this tool required the participation of all the partners in the joint experimentation. The process went through the following steps.

Defining the Content and Approach

During a working session, the scientists, non-government organization (NGO) staff, and the PRA specialist from the PRA Network discussed the general contents of the tool needed, the general approach to be taken to develop it, and a time frame for its development. The contents reflected the data needed by the scientists to analyze the zaï technique.

Designing the Tool

The scientists and the PRA specialist then exchanged ideas on the form in which the different activities to be monitored will be presented. The basic principle was that it should be easy for the farmers to master the tool. For each major farming

activity associated with the zaï, representative symbols were identified. The PRA specialist made drawings and tested these with some of the farmer experimenters to find out whether they understood the symbols. The symbols that passed the tests were integrated into recording sheets.

The scientists participated regularly in the discussions, as they wanted to be sure that their interests were being taken into account. The PRA specialist prepared draft booklets for the eight following activities: compost production (labor for compost pits digging, filling, watering and emptying), compost transportation to field, digging and fertilizing of zaï pits, sowing, weeding, maintenance, harvesting, harvest transportation and storage, crops residue transportation. The major focus was on the labor requirements for each activity, but two booklets were concerned on quantities (the amount of compost and manure used and the total harvest).

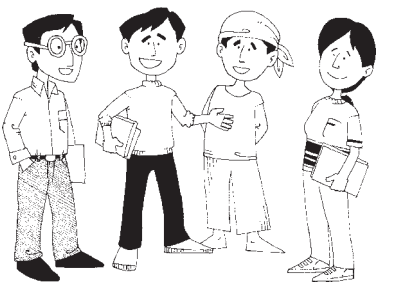
Presenting and Discussing the First Draft of the Tool

The scientists, NGO staff, and PRA specialists met with nine farmer experimenters and explained to them how to use the tool. The nine men quickly understood and had no difficulties in completing some exercises proposed by the scientists and in filling in the different sheets. The farmers proposed small changes in the drawings so that they would be easily recognized.

Finalizing the Tool

Based on the farmers' comments, the PRA specialist finalized the design. The PRA Network then produced 50 sets of each of the 12 booklets.

Training Farmer Innovators to Use the Tool



The 20 farmers who were involved in the experiments and who would start working with the tool, along with 12 other interested farmers, met for a demonstration of the tool and did several practical exercises with it. This session allowed the farmers to familiarize themselves with the tool. Because of the time and costs involved in producing the tool and monitoring its use, the ISWC program initially gave it only to the 20 farmer experimenters. The farmers started using it immediately after the training. It took only one month to move from Step 1 to Step 5. The process started in May 1999, and because of the wet season (it is usually expected in June), the scientists urged all partners to move ahead quickly.

Monitoring and Supporting the Farmers in Using the Tool

Field agents from Organisation Recherche Formation Appui Accompagnement aux Communautes de Base (ORFA), an NGO involved in the program, visited each of the 20 farmers once a week to provide support, and if necessary, to help correct certain mistakes in filling in the sheets. The support visits to the farmers became less frequent after one month because the field agents could see that the

farmers had fully mastered the tool by then. However, during monitoring by ORFA, it became evident that six of the 20 farmers (30%) were recording exaggerated data. The field agents could easily discern this, because they knew the composition of the labor force in each household. They did not discuss this matter openly with the farmers, leaving them to find out for themselves whether it was advantageous to exaggerate. The ORFA staff suspected that these farmers wanted to emphasize to the others how much work they were investing in the different activities.

Analyzing the Results

The scientists analyzed the data and discussed them with the 20 farmer experimenters at a meeting held in April 2000. However, before this, the farmers had started using the data themselves. In 1998, a Farmer Innovator Network had been formed in Yatenga Region with the support of ISWC program and, during a meeting in November 1999, the 20 farmer experimenters described the tool to all 41 members of the Network. During this session, one of the farmer experimenters presented some of his calculations. He had used the total labor inputs that he had recorded for each activity and valued each working day at 750 CFA (about US$ 1.25 per day). He was thus able to present a clear picture of investments into the different farming activities.

Lessons from the Program

During a meeting of all partners in April 2000, a general evaluation was made of the use of the recording tool. The following lessons were drawn:

- The tool was generally applied well. Seventy percent of the farmer experimenters filled in the data correctly and calculated the total number of days for each activity, while making a distinction between the source of labor (men, women and children).

- Two farmers asked support from literate persons (generally their children) to keep the records. This may have led to errors, because these other family members were not trained in the use of the tool.

- The innovators proposed certain changes, such as the need to include the costs of food and drink for traditional group labor; this confirms that they fully understood and mastered the tool.

- During a brainstorming session on what to do with the tool in the future, the farmer experimenters suggested that the tool should be made available to their neighbors. They have concluded recording information in this way would be useful for all farmers, and therefore wanted to see the use of the tool widely spread.

- The interest in the tool is broad and the farmers who have experienced it are thinking about how they could continue to use it even after the ISWC program has ended. They have already copied the contents of each recording sheet into their own notebooks.

- All farmer innovators appeared to use the tool for decision-making. One illiterate farmer, Ali Ouédraogo from Gourcy village, exclaimed enthusiastically that, from this moment on 'even our meals will no longer be unplanned.' The use of this tool has stimulated the farmers to ask additional questions, such as 'Should we reduce the area we cultivate?' and 'Why have certain fields not produced well despite all the labor or manure used?'

- All scientists and field agents who were involved in this experience have agreed to continue to use and refine the tool.

The same 20 farmers continued to use the tool in the year 2000. The first impressions of the ORFA field agents are that the exaggerations observed in 1999 are no longer being made. The farmers felt that they have developed a new skill that helps them to make better decisions. Further monitoring and analysis by all research partners should show the impact of the use of this tool on the farmers' management decisions.



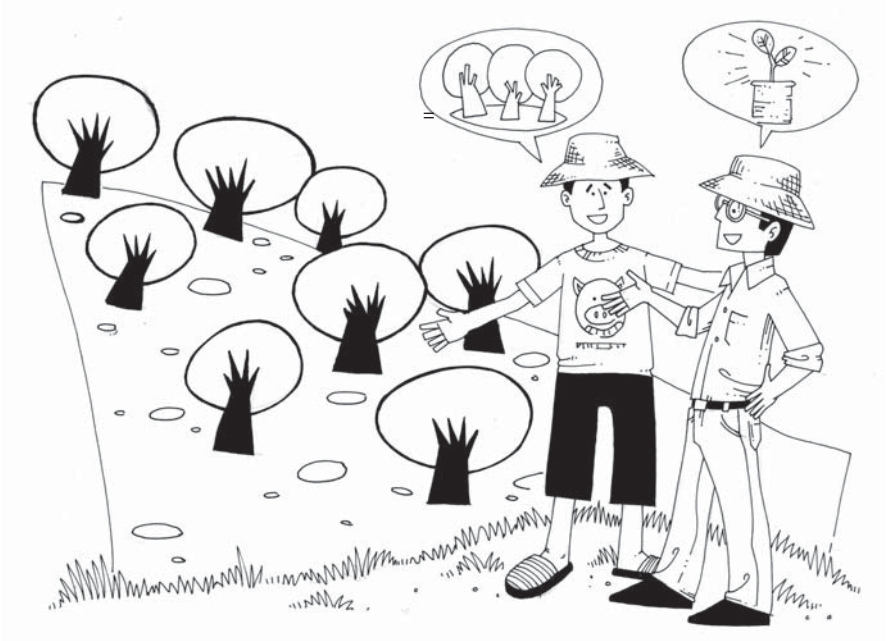
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Farmer Demonstration Trials:
Promoting Tree Planting and Farmer Innovation in Indonesia



In many areas across Southeast Asia, deforestation has created a scarcity of productive forest resources. This shrinking forest base, combined with a growing human population and an expanding middle class with discretionary income, results in an increased demand for forest and tree products – timber, fruit, spices, medicines, etc. This demand creates incentives for smallholder tree farming. In some communities, smallholder farmers have spontaneously planted or protected trees to provide products for home and market. Farmers see tree farming as a way to diversify production and income; reduce risk; make more efficient use of their limited inputs (labor, time, land, capital); and build assets for the future. Smallholder tree farming is often successful because of the farmers' self-interest to profit from their efforts. However, these systems are not universal.

In many communities, farmers are adjusting from a situation of 'open-access forests' to one where trees are scarce. These farmers lack the tree planting skills necessary to develop viable tree farming systems. Well-intended top-down development efforts to help farmers expand tree resources often achieved little, because species selection, plantation design, and location are often imposed without considering farmers' objectives or market opportunities. Active farmer participation is essential to develop successful tree farming systems that address the biophysical and socioeconomic conditions faced by farmers.

This paper describes farmer demonstration trials (FDT) and summarizes the experiences in developing FDT with smallholder farmers and non-government organizations (NGOs) in Indonesia.

Farmer Demonstration Trials

Farmer demonstration trials are evaluation trials designed by researchers/ extension staff with farmers for establishment and management under farmers' biophysical, socioeconomic, and management conditions intended to:

- test and demonstrate the advantages of good germplasm (species, provenances, varieties, clones, or seed sources)
- expand on-farm tree resources
- inspire farmer/NGO innovation
- serve as a future source of on-farm seed production

Implementation Team

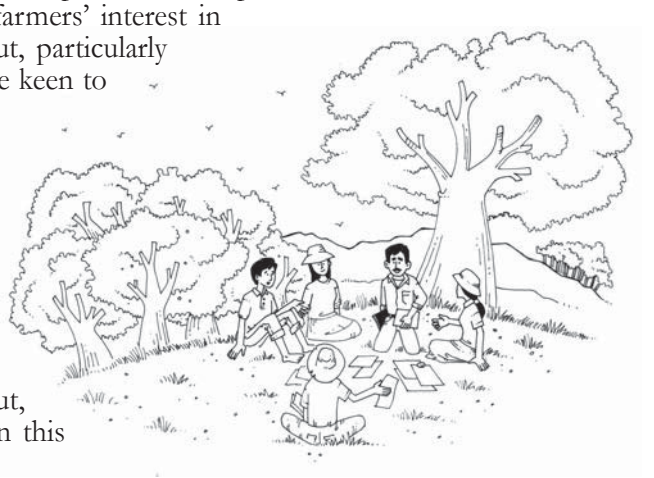
Developing a program on FDT requires an implementation team (IT) of at least two people: a community organizing specialist and a tree specialist. The IT can be larger, or can seek assistance when necessary from social or technical specialists of government agencies, NGOs, or other stakeholders.

Getting Started

Farmer interest should be gauged under informal conditions. Most often, FDTs are conducted where the IT is active. Pre-existing linkages provide easy access to communities. Contact key farmer leaders and ask if they could discuss tree farming with you. Adjust time to fit farmers' schedules. Be ready to discuss the issue during the preliminary contact, but realize farmers are busy and it may be best to return a few days later.

Initial Discussion

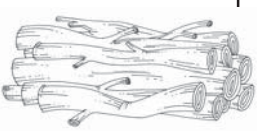
Tell farmers you are interested in learning about their tree farming systems. Avoid mentioning trials or tree-planting support until after you have gauged their interest. Start by asking farmers about their current tree resources, tree management methods, and the tree products collected from forests. The discussion should lead to farmers' tree problems and priorities. If not, steer the conversation to those topics and farmers' interest in tree planting. Record farmers' input, particularly their priority species. If farmers are keen to plant trees, mention FDTs and schedule a follow-up meeting (farmer workshop). Even a little interest is enough to get started. However, if farmers are not interested, do not push the issue. Forcing a community to plant trees is a sure formula for failure. Choose another community. In order to obtain representative input, 10-20 farmers should participate in this initial discussion.



Germplasm and Markets

Germplasm and markets are crucial elements to any successful tree-planting activity. Before the workshop, conduct a rapid reconnaissance of the local area to determine tree germplasm (seed or seedlings) availability and tree product marketability. Farmer priority species for which germplasm is available and strong markets exist for their products, can be considered 'best bet' species on which FDTs should focus. Germplasm availability is evaluated by visiting tree nurseries, tree seed dealers, and seed sources. Whether seedlings should be produced or purchased depends on the existence of village tree nurseries and the time remaining before the planting season.

'Best bet' species are species for which sufficient evidence indicates strong value to both household and market economies, making those species a priority for smallholder tree-domestication activities and FDTs.



In the first year of a FDT program, it may be easier to purchase, rather then produce seedlings. Marketable tree products are identified by visiting local markets and market agents. Farmer leaders can assist in this process. Betser (2000) provides a framework for rapid market surveys. Although the framework is more detailed than what is needed here, it provides insight on ways to identify marketable tree products. More thorough market analysis and germplasm evaluation can be conducted as the FDT program progresses.

Farmer Workshop

The farmer workshop is held in the village. Its purpose is to confirm farmer interest, build partnership, and develop a work plan. Start the workshop by reviewing farmers' and IT's interest in tree farming and the FDT concept. A short review may be sufficient, but be prepared to discuss FDTs in detail. To facilitate this process, invite other specialists (a forester or horticulturist) to complement the skills of the IT during the workshop.

To provide visual examples of possible FDTs, the workshop should include a field visit to timber, fruit tree, or mixed plantations – whichever is appropriate. Contact the landowner or manager prior to the visit and ask them to present a site summary. The IT should point out key aspects of the tree system that are relevant to farmers. Farmers will benefit greatly from the field visit.

Designing Farmer Demonstration Trials

Following the field visit, the farmers are ready to design FDTs, with the assistance of the IT. The key aspects of a FDT design are objectives, species, tree spacing and management. Draft designs should be completed during the workshop.

CAUTION: Field trips: Do not visit sites that are not relevant to farmers or that are beyond the IT's capacity to adapt to farmers' conditions.

Objectives

The objectives should be simple and clear. For example, to introduce x new species and test their survival and growth rates (during the first two years) under local

biophysical conditions or to compare the survival and growth rates (during the first 2 years) of x species under local biophysical conditions. The species included in the FDT should be specified by common and botanical name. Farmer and IT objectives could differ, but should be complementary. The IT should avoid imposing their objectives to farmers!

Best Bet Species

A list of best bet species will result from the rapid reconnaissance. It may include local species (as a control), new provenances or varieties of local species, and new species. With concurrence of farmers, the IT may add species to the best bet list that may fit farmers' priorities. Species may be timber, fruits or multiple-purpose trees. Each of these species groups has a different function. If more then one species group is included in a FDT, the objective is not to directly compare their performance, but to evaluate their compatibility. It is wise to start with species that serve both a household use and meet a market demand.

Tree Seed

Most farmers and NGOs involved with tree planting activities face annual shortages of tree seeds. To meet their needs, they use whatever seed is available regardless of quality. Studies indicate that over 75% of the seed used is collected locally. Establishing quality on-farm seed sources is a viable way to improve the quality of the tree seed used by farmers and NGOs. See Mulawarman *et al.*, 2003 for information on seed source establishment and management.



Trial Design of FDTs

In the beginning, particularly with farmers who have limited tree-planting experience, the design and objectives of FDTs should be made simple. One standard design and set of objectives will suffice for all participating farmers.

Tree Spacing and Management

Tree spacing and management greatly effect FDT success. Farmers with limited tree-planting experience will require strong guidance. FDTs are intended to address farmers' needs. Listen to farmers' concerns and use their input to develop the design. Sometimes farmer input is not technically sound. For example, many farmers want to plant at dense spacing without thinning trees. They initially ignore that trees need additional space as they grow larger. Politely explain the limits of their design and suggest alternatives. Most farmers will appreciate the comments and quickly grasp the reason.

Examples of Trial Design

A simple design could have the objective to compare growth and survival of five timber species, each planted in two blocks of 25 trees at spacing of 2 x 4 m (total area approximately 0.2 ha). Such a design will provide farmers the information they seek and targets success. As farmers gain experience, more complicated, farmer-specific designs will develop.

Examples of more complicated designs are alternate rows of short- and long-rotation timber trees, or testing various intensities of branch pruning. More complicated designs require more management and monitoring from the IT and tree specialists. The IT must be ready to provide this input.

The idea is not to dictate a management regime, but rather provide a range of options, which farmers can adapt to their conditions. Intercropping with annual crops during the first 1-3 years should be

encouraged. Farmers will benefit from crop yields, and trees will benefit from management (fertilization, weed control, etc.) of the annual crops. Mulawarman *et al.,* 2003 provides good guidelines of successful tree establishment and management.



Roles and Support

At the onset, it is important to be clear about roles and levels of support. Generally, farmers and the IT design and establish FDTs together. Farmers are responsible for managing the trials, with advice from the IT. However, if farmers wish to alter the management plan – even remove the trees – they are free to do so. Both farmers and the IT conduct monitoring and evaluation (M&E), as each may have different objectives and criteria. Franzel (2000) describes the *bao* game, an evaluation technique the IT can help farmers implement. The IT should clearly state that the trees are farmers' property. The IT has no claim to the trees and nor is the IT responsible for buying the tree products. Discuss the respective roles and responsibilities of farmers and the IT with all participants and document the outcome.

Appropriate support from the IT include the cost of workshops, field visits and trainings; technical information (manuals, leaflets, etc); germplasm; nursery materials; and agricultural inputs (fertilizer, pesticides in case of infestations, etc). Hats and t-shirts are a good promotional tool that build enthusiasm – but they are not necessary. Avoid giving money. Experience indicates money attracts the wrong type of participants; raises unrealistic expectation; hampers self-motivation; and dilutes the focus of the activity. Asking farmers to provide some type of in-kind matching support strengthens partnership and demonstrates farmers' commitment.

It is wise to start a FDT program with a small number of farmers. At one site, only seven farmers in two villages were involved in first year activities. Following the success of those trials, 20 additional local farmers and a few neighboring villages wanted to establish FTDs. Success breeds demand, the IT must gauge its capacity to meet demand before expanding.

Other Stakeholders

Government technical agencies and NGOs have roles to play in developing FDT. Most technical agencies are mandated to serve the needs of the smallholder farming communities, but are ill-equipped to do so. Through involvement in the FDT process, technical agencies will gain participation skills. Experience shows that the staff of technical agencies quickly perceive the advantage of participatory approaches in their own work. While meeting their agency's mission and goal remains a priority, benefiting smallholder communities becomes an important objective. Most NGOs have close linkages with local communities and understand local conditions. Not all NGOs are proficient with tree-planting activities; but their staff is usually motivated and eager to learn. Operating through NGOs can

greatly expand the impact of a FDT program. The planning workshop is modified for an NGO audience; the level of technical intensity can be increased. Each NGO could develop one or a series of FDTs. Roles, responsibilities and levels of support should be specified in a contract.

Timeframe and Planning

Implementing a FDT program should take 3-12 months. To facilitate planning, initial contact with farmers should be three months before the planting season – at least 4 -5 months if a nursery is to be established and seedlings are to be produced. Ample nursery management guidelines exist and need not be discussed here. Any forestry office and many NGOs can provide advice regarding nurseries. The farmer or NGO workshop may take 1-3 days.

A three-day workshop would have the following agenda:

- Day 1 – Discuss local tree farming systems, farmer tree needs, and FDT concept
- Day 2 – Field Visit
- Day 3 – Design of FDTs

As with any tree planting activity, FDT establishment must be preceded by thorough land preparation and planned to coincide with the beginning of the rainy season. Most FDTs are established on fallow or marginal agricultural land. Control of grass and other herbaceous vegetation is a priority during the first year.

Follow-up meetings every 3-6 months should be held to visit FDTs and identify tree-related problems and opportunities. If the implementing organization is active in the community, FDTs should be one component of a wider development program.

Research or Development?



FDTs are primarily a development tool, working examples intended to develop on-farm tree resources; help farmers gain tree-farming experience; and generate information that is immediately applicable to farmers' conditions. Research applications are of secondary importance. FDTs are generally good to evaluate farmer acceptability and profitability of the species and designs tested, and to identify farmer innovation. Because replication, randomization and treatments are not strictly applied, FDTs have limited potential to evaluate biophysical parameters. If biophysical evaluation is desired, parallel researcher-controlled trials can be established nearby on farms or research stations. Franzel (1999) provides a comparison of researcher and farmer trials, which is illustrative to people interested in developing FDTs.

Limitations and Related Issues

There are a number of technical, policy and socioeconomic issues that may limit the potential of FDTs. Key technical issues include germplasm collection and management, tree propagation and nursery management, tree management, fire management and intercrop management. Farmer training in these areas will enhance FDT success and sustainability. Policy concerns include land tenure, market access, and tree utilization. Inadequate rights in these areas restrict farmers' ability to benefit from tree farming. Parallel activities by interdisciplinary teams to address policy issues can enhance farmers' tree-farming rights and thus the relevance of FDTs.

Jealousy, competition and favoritism within the community can limit the success and impact of any development activity. Participation in a FDT program should be transparent and equitable, including as many community sub-groups as possible. The potential public benefits and impacts of the FDT process should be articulated to the entire community. Jealousy within the community can be reduced by producing (or purchasing) extra seedlings for distribution to interested farmers. At distribution, the IT records the name of the farmer, species/number of seedlings distributed and objective/plan for planting the seedling. Farmers are reassured that the seedlings are their private property and the IT has no claim on the trees or their products.

Tree product marketing, postharvest processing, and enterprise development are often identified as holding great promise for smallholders, as these issues have received little attention to date. Certainly the development of smallholder marketing linkages should be prioritized. Postharvest processing and enterprise development are much more complicated. Undertaking these activities requires a lot of new information, planning, skills, capital and cooperation among farmers; timely delivery of products; and entails significant financial risk. It is not likely that most farmers or farmer groups are prepared to assume such new challenges. Thorough assessment of the individual and institutional capacities within a community is required before promoting these activities.



Postharvest processing and enterprise development can not be considered an easy first step towards expanding local economic capacity. Farmers would be better served to first focus on establishing permanent market linkages, thoroughly understanding market demand, and developing their capacity to produce reliable quantities of high-quality tree products that meet market specifications.

Application Domain

FDTs are relevant to all rural populations, particularly those with a paucity of forest resources and close proximity to market centers. They are flexible and easily integrated into existing farming systems, particularly where landholdings are small (2 ha or less); marginal soils do not support continuous annual crop production; household labor and capital are limited; and need dictates the production of multiple crops (annual and perennial) for multiple purposes (timber, fuel, fruit, shade, soil conservation, etc). Experience shows that FDTs are an effective means of involving farmers in species evaluation and technology innovation. FDTs are very suitable to conditions where off-farm or seasonal employment in urban areas restrict the availability of household labor. FDTs help farmers develop the tree-farming systems and skills that are better suited to such socioeconomic conditions than annual cropping alone.

The technical and leadership capacity built through the FDT process empowers communities and creates conditions where sustainable smallholder tree farming cultures can evolve. Beyond enhancing local livelihood, the creation of tree-farming cultures directly advance the international public environmental goals of land rehabilitation/reforestation, carbon sequestration, watershed protection and biodiversity conservation.

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Participatory On-Farm Technology Testing: The Suitability of Different Types of Trials for Different Objectives



In participatory on-farm evaluation, farmers are partners with researchers in the design, implementation and evaluation of technology. This paper outlines the objectives for conducting on-farm trials and presents a typology for its classification, focusing on how different types of trials may be used to meet different objectives.

Adapted from:
Franzel, S. and R. Coe. 2002. Participatory On-Farm Technology Testing: The Suitability of Different Types of Trials for Different Objectives. *In:* Bellon, M.R. and J. Reeves (eds). Quantitative Analysis of Data from Participatory Methods in Plant Breeding. Mexico, DF: CIMMYT.

Objectives of On-Farm Experimentation

On-farm experimentation has several different objectives.

- First, it permits farmers and researchers to work as partners in the technology development process. The more often and the earlier that farmers are involved in the technology development process, the greater the probability that the practice will be adopted. On-farm trials are important to gather farmers' assessments of a practice, to find out their ideas on how innovations may be modified and to observe and share farmers' innovations.

- Second, on-farm testing is useful for evaluating the biophysical performance of a practice under a wider range of conditions than is available on-station. This is important because soil type, flora and fauna on research stations are often not representative of those found on farms in the surrounding community.

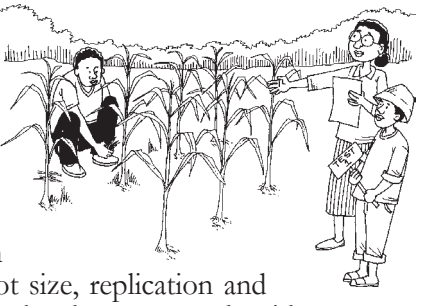
- Third, on-farm trials are important for obtaining realistic input-output data for assessing the profitability of practices.

- Finally, on-farm testing provides important diagnostic information about farmers' problems, preferences and livelihood strategies.

Types of On-Farm Trials

There are different ways of classifying on-farm trials. One common way is to classify them according to the balance of researcher and farmer involvement in their design and implementation. The classification presented here builds on the work of Biggs, 1989 and is explained in greater detail in Franzel *et al.,* 2001.

Type 1: Trials Designed and Managed by Researchers



These are on-station trials transferred to farmers' fields. They are useful for evaluating biophysical performance under farmers' conditions and for obtaining accurate information about the interaction between the biophysical environment and crop management (Franzel *et al.,* 1995).

These trials require the same design rigour as on-station research with regard to treatment and control choice, plot size, replication and statistical design. At the design stage, however, the researcher has to consult with the farmer on the site's homogeneity and history. These are more expensive and more difficult to manage than on-station trials. They often involve renting land from farmers and using laborers from the station to implement the study.

In conducting this type of trial, it is often useful to get farmers' feedback on the different treatments.

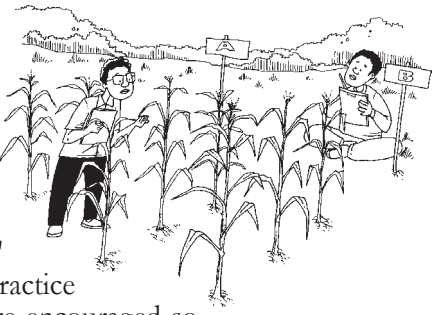
Type 2: Trials Designed by Researchers and Managed by Farmers



Farmers and researchers collaborate in the design and implementation of the trial but the farmers are responsible for conducting all the operations of the trial. These trials follow the conventional scientific approach to conducting an experiment: test treatments are laid out in adjacent plots and compared to control treatments. Researchers consult farmers on the design of the trial and each farmer agrees to follow the same prototype (or chooses one of several possible prototypes) so that results may be compared across farms.

In Type 2 trials, the objective is to get reliable biophysical data over a broad range of farm types and circumstances. Other data that may be reliably gathered are: cost and return analysis; quantity of inputs (e.g., labor) and outputs (e.g., crop yield). Type 2 trials are useful for assessing farmers' assessments of a specific practice and their suitability to their circumstances. Farmers are encouraged to visit each other's trials and to conduct group field days to assess the practice at different growth stages.

Type 3: Trials Designed and Managed by Farmers



Farmers learn about new practices through visits to field stations, on-farm trials, or from other farmers. In Type 3 trials, they plant and experiment with the new practice as they wish. Farmers are not obliged to plant in plots and it is possible that there are no control plots.

Researchers and farmers together monitor the farmers' experiments, focusing on the assessment of the new practice and on any innovation done. Farmer-to-farmer visits are encouraged so that farmers can compare experiences and assessments. Any farmer experimenting with a new practice on his/her own could be said to have a Type 3 trial.

Suitability of Trial Types for Meeting Research Objectives

Suitability involves both appropriateness of the trial for collecting the information and the ease with which it can be collected. Different types of trials are suited to different types of analysis.

If you want to determine...	Then use...
Biophysical response	Types 1 and possibly Type 2
Profitability	Type 2
Acceptability, in terms of	
Feasibility	Types 2 and 3
Farmers' assessment	Type 3 and possibly Type 2
Other information	
Identify farmer innovation	Type 3
Determining boundary conditions	All types



Farmers' assessments are more accurate in Type 3 trials for several reasons. Because farmers control the experimental process, they are likely to have more interest and information on the practice. Furthermore, because farmers in Type 3 trials usually have less contact with researchers than farmers in other types of trials, their views of a technology are less influenced by researchers' views. Finally, whereas it is often necessary to provide inputs to farmers in Type 2 trials to ensure that results are comparable across farmers, no inputs except possibly seed are provided in Type 3 trials. Thus, farmers' views in Type 3 trials are more likely to be

sincere than in Type 2 trials where positive assessments may simply reflect the farmers' interest and satisfaction in obtaining free inputs. Finally, all three types of trials play a potentially important role in defining the boundary conditions for the technology, i.e., the biophysical and socioeconomic conditions under which the practice is likely to be adopted by farmers. Which type of trial is best depends on the objectives and particular circumstances of the participants (both technician/researchers and farmers).

In a hedgerow intercropping trial in western Kenya, 50% of the farmers claimed that hedges increased crop yields, whereas technicians noted yield increases on only 30% of farms. The technicians claimed that the difference was due to farmers trying to please researchers.

Swinkels and Franzel, 1997

Continuum and Sequencing of Trial Types

The different types of trials are not strictly defined, rather they are best seen as points along a continuum. For example, a trial may fit somewhere between Type 2 and Type 3 as in the case where farmers agree to test a specific protocol (Type 2) but over time, individuals modify their management of the trial (Type 3).

The types of trial are not necessarily undertaken sequentially. Researchers and farmers may decide to begin with a Type 3 or to simultaneously conduct two types of trials.

In Zambia, many farmers planted Type 2 and Type 3 improved fallow trials in the same year (Kwesiga *et al.*, 1999). They tested a particular set of practices in their Type 2 trials and used Type 3 trials either to extend their plantings or to test a modification of the practice. Researchers wished to assess biophysical response in the Type 2 trials, and to monitor farmers' innovations in the other trial. Types 2 and 3 trials often generate questions or sharpen hypotheses about biophysical factors, which can then be best evaluated through Type 1 on-farm or on-station trials.

Handling Complexity

Complexity is determined by the number and diversity of components, the length of the cycle of the technology, and the size of the trial. In a trial comparing annual crop varieties, it is often possible to combine biophysical and socioeconomic objectives because according to the above definition, the trial is not complex. However, most agroforestry trials are complex and thus, different trial types are needed to meet the different objectives.

Promoting Farmer Innovation

Promoting farmer innovation is often mentioned as an objective of on-farm trials but little has been written about how to achieve it (Reij and Waters-Bayer, 2003). Among the three types, it is only Type 3 that really shows the extent of farmers' innovation because here, farmers have complete control over the experimental process.

In a farmer training center in Zambia, farmers were given potted seedlings for planting improved fallows in their farms. To reduce the cost of transporting them to the farms, a farmer removed the seedlings from the pots and carried them bare-rooted in basins. When farmers' plantings of these seedlings proved successful, researchers conducted Type 1 trials to compare the performance of bare-rooted seedlings grown in raised seedbeds with potted seedlings. They found no significant difference in performance and, as potted seedlings were much more costly to produce, they were phased out.



Franzel *et al.*, 2002

Conclusions

The Type 1-2-3 classification system is useful for highlighting the different objectives for conducting on-farm trials and for illustrating the suitability of different types of trials for particular types of assessments. Researchers may be tempted to use the same on-farm trial to collect information on both biophysical response and farmer assessment though these objectives are often conflicting. Collecting biophysical data requires a high degree of control, whereas farmer assessment is most valid when individual farmers are allowed to use the practice in the manner they see fit.

Researchers and farmers interested in biophysical and socioeconomic data may be better off conducting separate trials: Type 1 trials for biophysical data and Type 3 trials for socioeconomic assessment. The more complex the trial or technology, the less effective a Type 2 approach is likely to be for both biophysical and socioeconomic assessments.

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Participatory Research and Development for Sustainable Agriculture and Natural Resource Management: A Sourcebook

Comparing and Integrating Farmers' and Breeders' Evaluations of Maize Varieties in East Africa



While Kenyan farmers still grow many traditional maize varieties, they increasingly face soil, pest and environmental constraints to crop productivity. Most of the popular improved varieties were released more than 15 years ago, and an 18-year-old variety still accounts for half of the maize seed sales. The International Maize and Wheat Improvement Centre (CIMMYT), therefore, started a breeding program in East Africa where farmers are engaged much earlier in the selection process, leading to the evaluation of entries by many people in several locations. The approach requires a more systematic and quantitative methodology than the classical participatory approach, where farmers are only asked to evaluate varieties at the very last stages. Farmers and multidisciplinary teams have now collaborated for more than three years, trying different approaches and updating the methods continuously.

Sufficient material is currently available to begin a critical review, pertaining to three key questions:

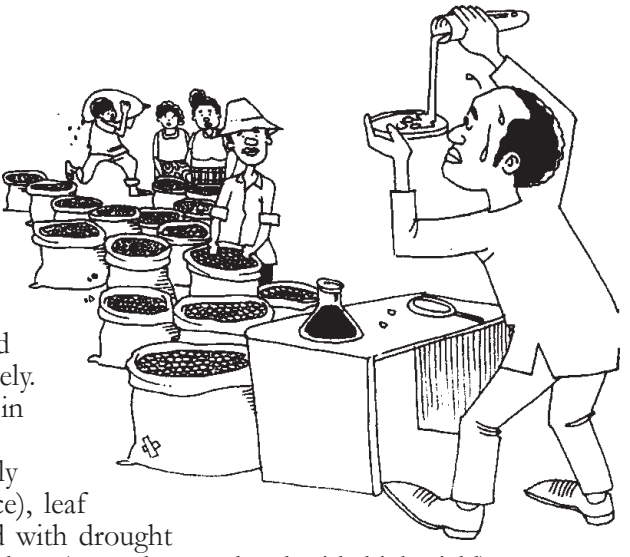
- Are the methods appropriate and appreciated by all partners involved?
- Is the information gathered complementary to classical breeders' selection data?
- Does the method improve the selection and increase the adoption rate?

The Africa Maize Stress Project

The Africa Maize Stress (AMS) project was initiated to develop varieties and crop practices for high stress environments, in particular drought, low nitrogen and pests. The initial project covered the whole of Subsaharan Africa, and special methods were developed to breed for drought resistance. In Zimbabwe, in particular, CIMMYT studied the physiology of drought tolerance in maize, and developed a method for on-farm participatory variety selection. In Kenya, the breeding effort started in 1997.

In 1999, a set of 50 promising varieties was selected for the semi-arid areas. During this year, the first Participatory Rural Appraisals (PRAs) were conducted to understand farmers' selection criteria and perceived constraints in maize production, including pest problems. In 2000, the first on-farm trials were conducted. In the 2002 National Performance Trials (NPT), four of the varieties outperformed the local check. The project provided farmers' and breeders' evaluations, but preliminary analysis reveals large discrepancies between farmers' and breeders' evaluation.

How They Did It



The breeders selected entries that yield well and were early maturing, two negatively correlated traits. In Kenya, more than 1,000 varieties were tested simultaneously under optimal conditions of fertilizer and water and under stress conditions without fertilizer and with irrigation cut off prematurely. Several observations were used, in particular concerning yield, the anthesis-silking interval (strongly correlated with drought tolerance), leaf senescence (negatively correlated with drought tolerance), number of ears per plant (strongly correlated with high yield), resistance to disease, and others. CIMMYT has developed a special software where all observations were entered, and this software calculated a combined breeders' index, which is general score representing breeders' preferences.

The PRAs were organized in communities nearby Kenya Agricultural Research Institute (KARI) research stations where the varieties are being developed. During these PRAs, farmers described the criteria they used for maize variety selection, the major constraints they faced, and the major pests. At the end, they were asked for their interest in participating in variety evaluation and the period when they would like to come and see the varieties.

In 1999, the first evaluations were conducted in four stations of KARI. In 2000 and 2001, a mother and baby approach followed. All entries were compared together in a central plot, and farmers tried out subsets under their own conditions.

Soliciting Farmers' Selection Criteria

Farmers mentioned a wide range of criteria and their ranking differed substantially between sites and groups. Early maturity and yield, however, were the criteria mentioned by all groups in all sites. Mentioned by more than half of the groups, the second group of important criteria included yield-related characteristics such as cob size and grain size, other grain and cob characteristics, and drought tolerance. Other criteria mentioned by at least three out of seven groups were pest and disease resistance, taste and processing characteristics.

After the group discussions, farmers were asked if they were interested in evaluating the varieties being tested. In all the four sites, farmers were enthusiastic to evaluate the varieties in question. They expressed preference in evaluating them twice: once in the vegetative stage (preferably at tasseling), and once at harvest. Visits were organized accordingly.

On-Station Evaluation

The trials were conducted in four KARI research stations in the arid and semiarid areas. In each station, 50 new entries were tested, laid out in small blocks, two rows of five meters for each entry. The statistical design was an alpha lattice design. Special software was used for the randomization and calculation of a breeders' index, a linear function of different variables such as yield, anthesis-silking interval, cob aspects and others, depending on the breeders' strategy. The index has a scale of 0 to 1. The lower the index, the better the variety is considered for the traits included.

Farmers evaluated the new varieties on the station by using an evaluation form with a line for each variety, and a column for the qualities mentioned as selection criteria to check if the variety was considered good for that criteria. The farmers were invited twice: at tasseling, to score for early maturity and drought tolerance; and at harvest, to score for cob size, well-filled cob, and yield. In both instances, farmers were also asked to give an overall evaluation.



The breeding program calculated the selection index for all varieties, resulting in a rank. A number of varieties had to be discarded because of undesirable traits, resulting in a final list of varieties to be continued in the next cycle.

Central or Mother Trials

In the following season, 16 varieties were retained and tested in a central location-the mother trial-and subset on farmers' fields-the baby trials. In the mother trials, farmers ranked 10 varieties higher than the local check, Katumani, while breeders ranked 11 better. However, there was no statistical correlation at the 5% level between the overall score of the farmer and the selection index of the breeders.

To further analyze the relationship between the farmers' and the breeders' order of preference, each evaluated variety was mapped in a two-dimensional diagram, where the horizontal axis represents the farmers' rank and the vertical axis represents the breeders' rank (Table 1). The table shows how variety V31 (or according to the breeders' code: EE-EAC-31) was selected first by farmers, but came only sixth in the breeders' evaluation. Varieties acceptable to both groups could be found at the top left corner. Three varieties were appreciated: V31, V33, and V21. Two more acceptable, but not outstanding varieties, were V16 and V46.

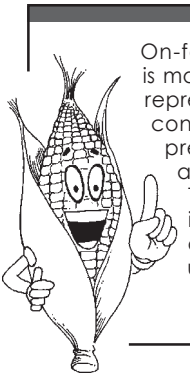
Table 1. Order of Top 12 Varieties (V1-V50) as Ranked by Farmers and Breeders Compared to the Local Check KCB (Katumani Composite B)

Breeders' Ranking	Farmers' Ranking											
	1	2	3	4	5	6	7	8	9	10	11	12
1			V21									
2												
3												
4		V33										
5							V16					
6	V31											
7						V46						
8												V8
9												
10										V9		
11									V13			
12											K C B	

Note: The breeders' name of the lines is EE-EAC-1 to EE-EAC-50, for "Extra Early- East and Central Africa"

Baby Trials

The same varieties were also tested on-farm under farmers' conditions, in blocks of four at a time. At harvesting, 11 varieties were overall evaluated by farmers as better than the best local check, and seven did better in more than one location. It was also remarkable that local varieties scored substantially higher in the overall evaluation. This indicated that factors other than yield play an important role. The overall evaluation could be seen as a farmers' selection index. To decompose this index, the overall score at harvest was regressed on the score of the individual criteria: yield, well-filled cob, cob size and vigor. Yield had the highest coefficient (0.5), followed by vigor (0.2) and well-filled cob (0.2). Cob size was not significantly different from zero.



On-farm evaluation is most likely to represent farmers' conditions and to predict future adoption. Therefore, it is important to analyze and understand this evaluation.

The results show that the model predicts a large amount of the variation (R2=62%) but some elements are not captured by the individual criteria, showing the importance of including an overall evaluation score.

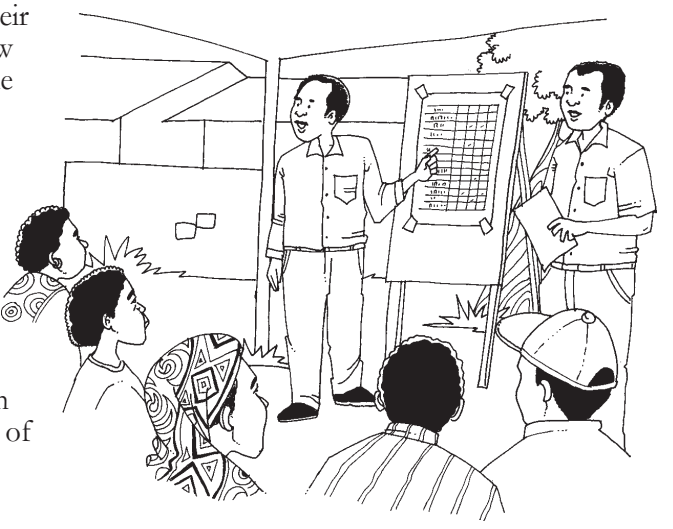
The individual coefficients represent how much the overall evaluation increases with an increase of the score of an individual criterion. When the score for yield of a variety increases by one, its overall score increases by 0.5; when the score for vigor increases by one, the overall score increases by 0.2, all other factors equal. Thus, the coefficients can be considered as the weights of a selection index. The non-significance of the criterion "large cob" comes a bit as a surprise after the group discussions, but it does make sense because larger cobs do not necessarily bring more or better food to the table. The results show how farmers' selection index can be approximated and then compared with the breeders' index to make the breeders' index more responsive to the farmers' needs.

Conclusion

The participatory methods clearly show how classical breeding has difficulties responding to farmers' preferences, but so far the two approaches have not converged in a method suited to both. Scientists like to control many factors and they can state with high accuracy that under these very controlled circumstances a limited number of traits have improved. The problem arises when these highly controlled circumstances might not represent farmers' conditions and the limited number of traits might not represent farmers' preferences. This becomes very clear from the very poor correlation between farmers' and breeders' evaluation. The exercise, however, provides very useful insights to bring the two together by improving the methodology of both breeders' and farmers' evaluation.

The breeders' index could be improved through changing the functional form (linear is not always appropriate) and the variables included and/or the weights attached to different variables (too much weight is placed on yield). Breeders should be more transparent, explain their choices and engage in discussions with farmers to compare their respective preferences.

Asking farmers to define their criteria and then scoring new varieties on a numerical scale turned out to be very convenient in data collection, although cumbersome in the analysis. The criteria could use some harmonization, so farmers' responses at different sites could be classified in the same number of categories, which would simplify the analysis of farmers' evaluation of new



varieties. For farmers' evaluation on-station or in mother trials, high variability needs to be taken into account by inviting farmers in larger numbers (at least 50). To make a speedy analysis possible, sufficient resources should be made available to people with sufficient training. The analysis should then be included in the selection of varieties for the next cycle.

The baby trials need some serious rethinking. In this example, the data is not very useful: the variance is very high, the sample size is small, and a lot of data was lost, both through bad weather and poor organization. The experience indicates that enough resources have to be made available to allow for regular visits to assure the quality and quantity of the data and a swift data entry and analysis. The process could be improved by increasing the data collected by the farmer, through well-structured questionnaires and proper training so farmers can fill them in themselves. A simplified yield measurement by farmers should also be tried out. In the baby trials, farmers could include more evaluation criteria than is possible in the mother trials, and these data would be very useful for improving the selection index.

Finally, the experience has shown that farmers are happy and eager to participate in selecting new varieties. The methodology still needs work, but it is clearly showing some promise to bring breeders' and farmers' selection more together. The collaboration between breeders, farmers and social scientists shows promise in improving the selection procedure by taking into account the farmers' preferences at the early stage of the process.

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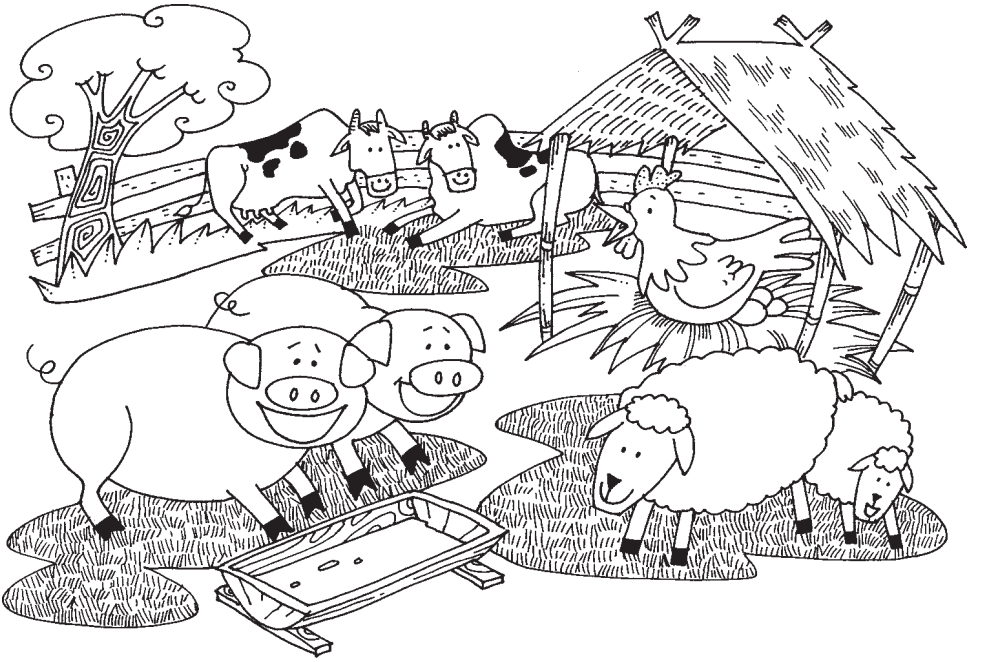
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Participatory Research and Development for Sustainable Agriculture and Natural Resource Management: A Sourcebook

Putting the Economic Analysis of Animal Genetic Resources Into Practice



Approximately 70% of the world's rural poor depend on livestock as a component of their livelihoods. Animals of different characteristics and hence outputs suit differing local community needs. Livestock diversity thus contributes in many ways to human survival and well-being. Despite the importance of this diversity, according to the Food and Agriculture Organization (FAO), 1/3 of livestock breeds worldwide are at risk of becoming extinct and the rate of extinction continues to accelerate.

Economic arguments for the conservation and sustainable use of animal genetic resources (AnGR) can be an effective means of garnering the necessary support for the development of appropriate enabling environments. However, economic valuation of AnGR has received only limited attention, even though a conceptual framework exists for the valuation of biodiversity in general. The main reasons for this include: methodological difficulties inherent in valuing genetic resources (as opposed to biodiversity *per se*); limited knowledge about appropriate analytical techniques; and a lack of data regarding local breeds.

As recent advances in the field of economic valuation have increasingly eased methodological/analytical constraints, data availability has become more of a bottleneck. The latter is particularly complicated by the problems of missing markets and market imperfections commonly encountered in developing country situations where marginal and subsistence food production systems dominate the

peasant economies in which much of the world's surviving AnGR diversity can be found. It is therefore this category of economic agents and non-market functions that one needs to be able to study in order to derive economic values. The question is how can this best be done?

The Need to Use Participatory Rural Appraisal Techniques

In the context of the empirical results of biodiversity valuation studies and the difficulties confronted when applying the methodologies/surveys in rural areas/ sectors remote from the market economy state, Pearce and Moran (1994) note that*: "**One area of further research involves the possible modification of economic techniques for use in conjunction with an established body of participatory and rapid rural appraisal methods".***

Participatory rural appraisal methods have in fact long been advocated as useful planning tools with livestock keepers, as well as in selecting genetic traits in cattle improvement programs. These have also been used to facilitate better understanding of livestock keepers' breed interests and their preference for production and functional traits, in addition to being applied to livestock keeping to accomplish situation analysis and technology development. For facilitating processes of local innovation where the livestock keeper is the key knowledge holder (e.g., forage options in low external input systems), it has been suggested that use of participatory approaches is mandatory.

Using participatory rural appraisal methods in the economic analysis of AnGR is based on the need to account for livestock keepers' purposes, preferences for different genetic resource attributes and the value they place on these across a range of species, breeds and production systems.

Economic techniques can also benefit from being used in conjunction with participatory rural appraisal methods. This involves not only the collection of information but also its eventual use by local people in planning further activities. The emphasis in participatory rural appraisal is often as much on the information as it is on the process and seeking ways to involve the community in planning and decision-making. With regard to AnGR, this is particularly important as *in-situ* community-based management of indigenous breeds is a key element in their conservation and sustainable use.

A Case Study of A Local Breed of Pig in Southeast Mexico

The local (c*reole*) pig breed in Yucatan, Mexico is now used as a case study to illustrate how such methodologies can be combined to complement each other and the type of results that can be attained. In particular, we seek to provide answers to the following topics:

- How important are the local pigs to the livelihoods of backyard farmers in Yucatan?

- What is the population status of the breed?
- What threats to the breed faces?
- What kind of conservation and sustainable use interventions might be successful, considering their costs and benefits?

Valuation Tools and Techniques Used



Series of mixed-mode surveys were applied using a range of rural and participatory appraisal tools including, *inter alia*: semi-structured interviews, direct observation, inventory, timelines, seasonal calendars, wealth ranking, preference ranking and pair-wise rankings. These tools were used to obtain information relevant to backyard local breed pig rearing, past and present. Selections of such tools were applied in focus groups, at household level, commercial farm level, market level, with key informants (e.g., local pig breeders, butchers, consumers, livestock association personnel, etc.) and were also applied longitudinally by monitoring selected households over a 12 month-period.

These are combined with a number of economic valuation techniques with the goal of determining, *inter alia*:

- the relative returns attainable from different breeds
- the current value of the pure/crossbreed pig market
- the magnitude of funds that could justifiably be allocated to a conservation program
- the degree to which market demand for local breed pig meat could be harnessed to support conservation and sustainable use
- the specific villages and households that would be most cost-effective to target for participation in a conservation program

The valuation techniques considered are as follows:

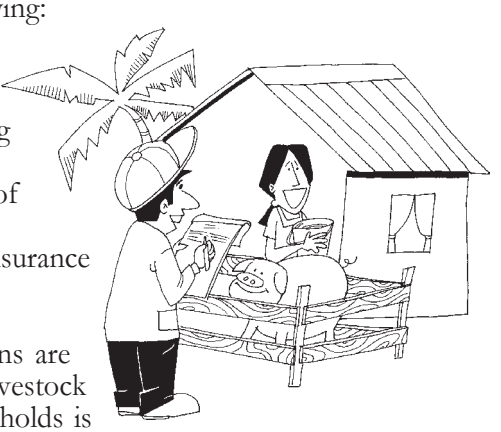
- **Market Share** (uses an estimate of the market value of the local breed to justify conservation program costs)
- **Contingent Valuation** – choice experiment (estimates livestock keeper trait and breed preference values, thereby providing an indication of appropriate breeding program goals and differences in relative returns to rearing different breeds)
- **Production Loss Averted** (uses an estimate of the cost of a potential catastrophic loss – e.g., an outbreak of a new disease - as a measure of what can be justifiably spent on a conservation program, based on the assumption that conservation of AnGR would prevent these losses)

- **Contingent Valuation** - taste test (provides an indication of consumer willingness to pay [WTP] a premium for local breed meat products and WTP for conservation activities)

- **Least Cost Conservation Program** with elements of Opportunity Cost (uses a measure of the opportunity cost differential that would have to be paid to provide sufficient incentive for a number of livestock keepers to continue rearing the local breed. By choosing those households where this opportunity cost is lowest, participants of a least cost conservation program can be identified)

Outcomes of Economic Valuation Techniques Based on Rural Appraisal Data

The results of these surveys clearly showed: the scale of genetic erosion that has taken place in the local pig population; the changes in backyard pig rearing that has taken place in terms of the numbers of families involved and the purposes of pig husbandry; the factors which influence the distribution of pigs in this system; and the animal characteristics and traits that the pig owners consider important. In particular, it is worth highlighting the following:



- Pigs are regarded and managed as convertible assets by the rural households, and backyard pig keeping fulfills several non-income functions including savings, and (in the form of an asset available for emergency expenditures and other purchases) insurance and buffering. Income functions (production as a semi-commercial enterprise) and consumption functions are less important. The importance of livestock as a convertible asset for poor households is also consistent with the findings of Dorward *et al.* (2001).

- The importance of pigs as a convertible asset can also be appreciated from the alternatives that households identified as capable of fulfilling prioritized pig production functions. About 57% of responses suggest that a loan, pawning of a valuable item or increasing home (i.e., non-farm) production would be the major alternatives to pig rearing. A further 11% would obtain pigs on loan (or sell other animals) in order to continue pig production.

- Breed preferences by pig keepers are related to the ability of the different breeds to fulfill the main functions related to pig keeping purposes. Pig keepers differentiate between pig breeds for the different keeping purposes identified (sales, breeding, savings, and consumption). Crossbred pigs (local x imported) are preferred for all functions identified (consumption, breeding, savings, payment and sales). The highest preference expressed for the local breed is for consumption. Reasons for preferring the local breed are related to the adaptive traits (e.g., dietary range and foraging ability)

that enable them to perform these functions in low external input rearing systems. Improved breeds are preferred for productive traits (e.g., growth rate). The local breed component of crossbreds is important for maintaining a balance between productive and adaptive traits.

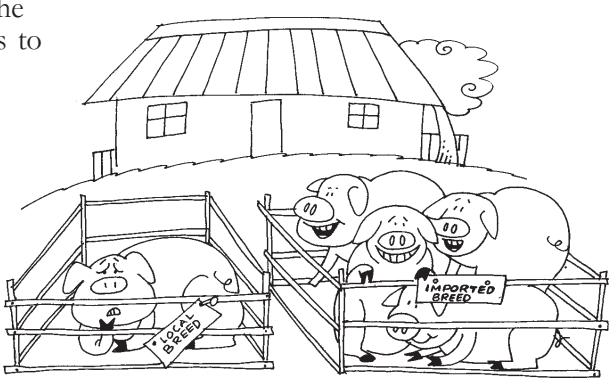
For pig keeping purposes, functions are considered to be the interactions of the animal with its environment as expressed through peformance and behavior. Purposes are the reasons animal keepers have for keeping livestock based on a subset of their functions.

- A more in-depth understanding of the factors affecting breed choice is attained from a preference ranking exercise. Based on 26 characteristics identified as important by interviewees, the local pig ranks first in 14 of them, among which are adaptive traits. The suitability of local pigs to low external input systems can be appreciated, as can the advantage of imported genotypes - largely in terms of growth rate - when a higher level of investment can be applied. The qualities of the local breed carcass, with the exception of meat content, are preferred by a significant proportion of pig keepers.

- Despite the livelihood importance of backyard pig production and the preferences expressed for many of the local pig's traits, the impact of the imported breeds on the local pig population has been to contribute to a severe genetic erosion. The state-wide random sample survey of villages revealed that although nearly half of the pigs reared by families in their backyards have some proportion of local breed pig genes, the purebred local pig is, according to FAO risk status criteria, critically threatened in the state of Yucatan, with less than 100 purebred female animals remaining.

- The population data also indicates the type of breeding program approach that is needed as the local pig population has arrived at such a low level numerically that a viable population would have to be constructed through sampling pure and crossbred populations, backcrossing, and multiplication. This work would have to be done *ex-situ* initially until there existed a population of sufficient size to supply *in-situ* producer groups that could then sustain the population under commercial and family rearing conditions.

Applying the data resulting from the mixed mode rural appraisal surveys to the valuation techniques described above reveals the conservation program costs and benefits summarized in Table 1.



The low estimated annual costs for the local breed pig conservation and sustainable use program suggest that the least cost approach does indeed provide a useful framework within which households/villages

where conservation costs would be minimal can be costed into a conservation program. Compared to the benefits of conservation, the costs are several orders of magnitude smaller. A very strong economic argument for implementing a conservation and sustainable use program can therefore be made and needs to be undertaken urgently if the breed is not to become extinct.

Table 1. Summary of Results of the Selected Economic Valuation Techniques

Economic Valuation Technique	Local Pig Breed Conservation and Sustainable Use Benefits (US$ p.a.)	Local Pig Breed Conservation Costs (US$ p.a.)
Market Share	$490,000	
Production Loss Averted (Yucatan state only)	$1.1 million	
Contingent Valuation (Taste test)	$1.3 million	
Contingent Valuation (Choice Experiment) and Least Cost Approach		$2,500 - $3,500

The size of the net benefits identified also raises the question of whether the local breed is, as predicted by economic theory, in fact being lost because they are, from the farmer's private perspective, less profitable than other breeds.

While certain types of household (e.g., larger better-off ones) expressed trait value preferences that support this theory, many other households did not. Yet, backyard local pig production has declined across all households. It would therefore appear that the purebred population has fallen to such a low level that such factors as the lack of availability of local breeding stock, rather than farmer net returns *per se* are determining breed choice.

Even in larger better-off households, the crossbred is preferred over the exotic. Thus, there still remains the issue of how to maintain a purebred line that can be used in crossbreeding activities.

At the level of society, the large size of the net benefits of a conservation and sustainable use plan suggest that there are also a number of very significant market failures that need to be addressed if the benefit values (e.g., local breed pigs as a reservoir of disease resistance or in terms of their existence value to urban consumers) are to be harnessed for conservation purposes. In addition, the market distortions introduced by subsidizing imported breed production in the commercial sector are considerable and the levels of subsidy (approximately US$38 million p.a.) are of several orders of magnitude greater than the costs of local breed conservation. A genetic resource of importance to the maintenance of subsistence farmer livelihoods is thus being lost for the lack of minimal funds, while vast and AnGR diversity threatening subsidies are provided to large commercial farmers.

Conclusions and Recommendations

The field work and analysis provided insights into the economics of backyard pig production in Yucatan together with an understanding of the economic forces leading to the critically low population levels of the local pig breed.

A central objective of this work was to provide a basis for future research oriented towards the establishment of an appropriate conservation/breeding program for these local breed pigs. In so doing, the use of participatory rural appraisal methods, in conjunction with recently developed/adapted analytical techniques, was shown to be capable of providing the data required for understanding the type and costs of the interventions necessary to promote the conservation and sustainable use of AnGR.

The challenge is now for such multidisciplinary, multi-methodology approaches to be applied more widely to the issue of AnGR conservation and sustainable use, especially by relevant research institutes and policymakers.

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Upland Research in Lao PDR:
Experiences with Participatory Research Approaches



In the Lao PDR uplands, population pressure, convergence of villages to roads, and formulation of new land allocation policies are reducing fallow periods in the traditional slash-and-burn rice-based systems. Short fallow periods render these upland systems unsustainable as soil erosion, weed pressure, and labor inputs have increased. Yield likewise declined, causing increase levels of poverty. This situation has created a demand from both farmers and government agencies for sustainable agricultural technologies to improve upland farmers' livelihood.

A considerable amount of research has been conducted over the years to develop suitable upland technologies. However, adoption by farmers was limited. One of the reasons is the vast upland diversity including biophysical (as seen in differences in climate and soils), socioeconomic (such as ethnic and cultural diversity and large differences in opportunities and constraints between individual households), and market (particularly market opportunities and market access) factors in the uplands. With such diversity, technology recommendations need to be site-specific. Further, these diversities necessitate the use of participatory and adaptive research approaches through which researchers and farmers can develop technologies suited to their conditions.

Lao PDR is landlocked in the heart of Southeast Asia, bordered by Yunnan Province of China, Cambodia, Myanmar, Thailand, and Vietnam. Seventy percent of Lao PDR is covered with mountains and high plateaus. The Annamite mountains run the length of the country as does the Mekong mountains. Lao PDR has a population of about 5.5 million, comprising 68 ethnic groups. Majority of its population live in the uplands.

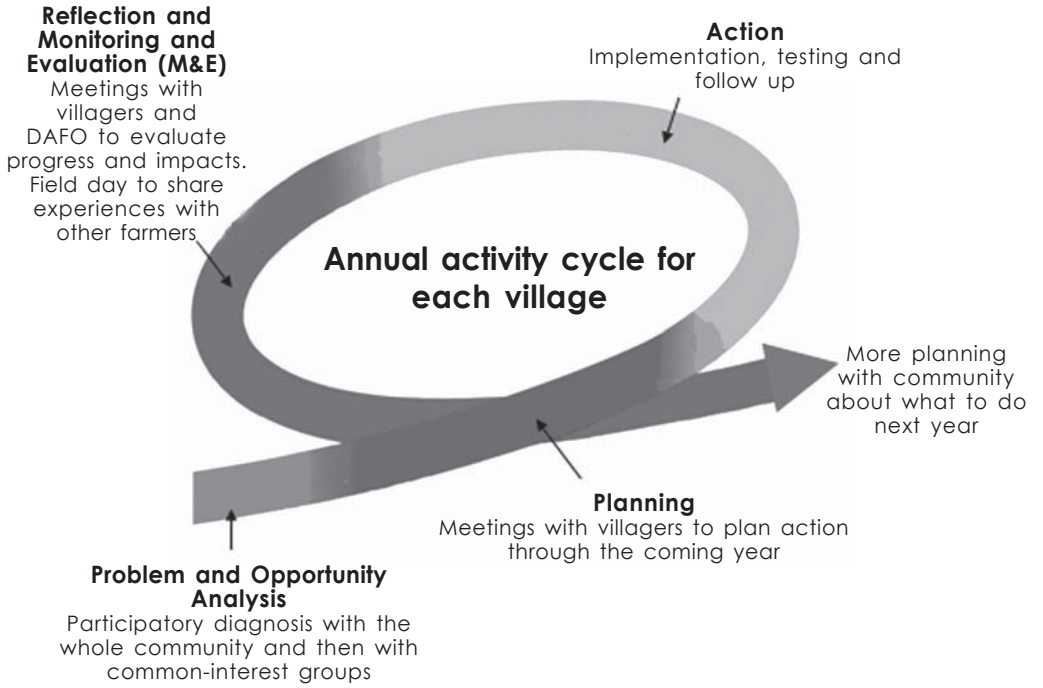
An Integrated Participatory Research Approach for the Uplands

NAFRI Partners

- International Rice Research Institute
- International Center for Research in Agorforestry
- International Center for Tropical Agriculture
- International Water Management Institute
- Australian Centre for International Agriculture Research

In 1999, the Lao PDR National Agriculture and Forestry Research Institute (NAFRI) teamed up with several international agricultural research centers to establish the Integrated Upland Agricultural Research Project (IUARP). The IUARP's objective was to develop sustainable upland livelihood systems through an integrated and participatory research approach. The IUARP worked in seven villages in Luang Prabang Province of Northern Lao, representing a wide ethnic, socioeconomic, and market diversity. The processes in the research cycle used in each village were the same and described in the diagram below.

Figure 1. Village Activity Cycle (based on a concept by Hagmann *et al., 1998*).



Problem and Opportunity Analysis

The research cycle started with a Participatory Diagnosis (PD). The PD had three main goals:

- it built the trust that must exist between researchers and farmers
- farmers identified and prioritized the problems and opportunities they wanted to address
- groups of farmers with common interests were formed to work on these issues

The PD typically involved two steps and required two days (about 3-4 hours each day). First, researchers worked with the community to gain a greater understanding (by using tools such as resource mapping, seasonal calendars, and well being analysis) of their agricultural and livelihood systems. Second, researchers moved on to work with the main common-interest groups (e.g., farmers with livestock, farmers with paddy) to gain a more thorough understanding of:

- the problems that were of most concern within their agricultural and livelihood systems
- the causal links between these problems
- what actions farmers had taken in the past to minimize each problem
- which of the problems were of highest priority for solution
- what actions they would like to take to solve these problems in the future

Planning

With the priority concerns of farmers identified, NAFRI and the other partner organizations were able to suggest a range of technology options, which were likely to contribute to solving the problems within the resource constraints experienced by the farmers.

Since many of the options were new to farmers, focused study tours were organized to expose them to the potential of these options. For example, one of the main problems in all villages was declining upland rice yield. Farmers were able to see some technologies that could help them increase rice yield or that may provide alternative income sources by which rice could be purchased (an indirect solution to the problem).

After the main problems and opportunities had been identified and farmers were familiarized with some of the most promising options, research issues that needed to be investigated for each technology option were discussed. For example, often there were many varieties of a particular crop. While scientists may know those that are best adapted to the biophysical factors in a village, they are less likely to be able to predict farmers' preferences. For this reason, it was important to identify a broad range of varieties (or other treatments, depending on the research issue) at the early stages of testing.

Action

Interested farmers were then identified to test these options, taking care not to coerce farmers into participating. Others preferred to simply observe the technology being tested in someone else's field during the first year. Often in the first year, the better-off farmers were the first to test the technologies.

Since many technologies were completely new to farmers, regular follow-up throughout the first season was essential – not only to monitor, but also to answer farmers' queries and provide encouragement for them to continue.

Reflection and Monitoring and Evaluation (M&E)



At the end of each year, a Field Day was organized to provide an opportunity for farmers to share their experiences and allow other farmers to express their interest in technologies they want to test the following year. Thus, through this process, planning for the following year was already being initiated.

Likewise, at the end of the season, in addition to the data researchers normally collect (e.g., yield data), formal evaluation of technologies with the participation of farmers was conducted. A valuable tool for this is "Farmer Preference Analysis" (Horne and Stur, 2003) due to its flexibility and ease of use. Farmers were asked to score/rank treatments being tested (e.g., varieties) and identify the positive and negative aspects of each treatment, thus, providing key insights on critical follow-up research issues.

Outcomes

During the first year, 50 farmers tested seven different technology options. In the second and third years, between 200 and 300 farmers, representing about 50% of the households, evaluated about 20 technology options. After two or three years, farmers were at various stages of adapting, expanding, and integrating tested technologies into their farming systems. With this expansion, the initial goals of "Participatory Research" (PR) were challenged to include goals normally associated with extension. One reason was to identify and better understand those technologies, which provided significant impacts and were likely to be more widely adapted and adopted. There was also a need to understand what 'enabling' inputs (e.g., training, seeds) may be required to prime wider adoption.

Date. September 21, 2003 Researcher: Kamla
Village: Pakcheck
Farmer number: Women: 10 Men: 9

Variety name		Mak hin Soung	Nok	Mak fay	Met gnay	Labourn	Local
Score	Women	5	8	0	3	0	4
	Men	7	6	0	2	0	3
	Total	12	14	0	5	0	7
Positive aspects		-Big seed - Long panicle - Adapted to many soils - Thick stem	-Looks nice - Big seed - Many Seeds Long Rice grows well in poor soil		-Big seed -Strong stem -Uniform panicles - short duration		-Good tillering -Tall but does not lodge - Long panicle many grains
Negative as		Late duration	-Many Leaves	-Short Plant -small seed -itchy seed - Only grows well in some soil..	- Few grain - Long duration - Poor emergence	-suspectible to pest -Non-uniform panicle emergence - Not pretty	- Does not grow well in poor soils

Technology Development Example: Intensive Fruit Tree-Based Gardens

Many types of technologies are being developed and evaluated (ranging from frog raising to non-timber forest product [NTFP] management and rice production). One such technology is the intensive fruit-based garden.

Farmers identified two main problems during the participatory diagnosis: declining rice yields and limited opportunities for income generation. They saw fruit trees as one option that had the potential to generate income that could then be used to purchase rice, if necessary.

While farmers liked the idea of growing fruits, their major concern was the time required from planting fruit trees to harvesting (five years or more). A sustainable system that ensures a continual source of income was therefore developed. An annual crop such as upland rice was grown along with a medium-duration fruit (e.g., pineapple or banana), hedgerows along the contours, and fruit trees along the hedgerow. Income was derived from the annual crop for the first year, from the medium-duration from the 2nd to the 5th year, and from the fruit tress from the 5th year onwards.

Fourteen farmers tested this option during the first year. Key research issues addressed during the first year were: which medium duration fruit crop to grow (pineapple or banana); and which were the 'best' hedgerow and fruit tree species. It was gathered that farmers preferred pineapple to banana because of its better market opportunities. High consideration was also given to those species perceived to be well adapted to local biophysical conditions. For hedgerow species, *Leucaena* and *Stylosanthes* were the most popular, as besides being used for soil erosion control, both grew well and were an excellent source of livestock feed. Issues identified for further research included pineapple spacing and arrangement and evaluation of other crops that could be integrated into their existing system.

To meet the demand for planting materials, some farmers were trained on how to develop and manage a fruit tree nursery. Since then, three nurseries have been established. Meetings between farmers and nursery owners were also held to decide upon fair prices. Furthermore, to allow for the expansion of the medium-duration fruits, a "sucker bank" was established. In this system, farmers who were initially provided pineapple or banana seedling material (called suckers) by the project were required to provide other interested farmers with the same amount of material they had received after two years.



Within three years, over 60 farmers tested and expanded this technology. In the first year, it was mostly the better-off farmers who were evaluating. However, other farmers also tried the technology, as they have seen its benefits. Interestingly, many farmers have been developing their areas into intensive fruit tree based gardens by adding other plant species into the system (such as NTFPs, vegetables.), raising small livestock due to easily available forages, and where water is available, farmers established fishponds.

Lessons Learned and Challenges

The IUARP experience generated the following lessons and noted down some challenges for future research efforts.

On Learning and Collaboration in the Field

The initial management structure of the IUARP depended heavily on inputs provided by NAFRI centers based in Vientiane, the Lao capital. Realizing the bulk of the work in the field, a local implementation team was organized comprising of key technical staff based in Luang Prabang. This decentralization and devolution of responsibilities to the field was a major factor in empowering the local team to

work directly with farmers. This ensured technical and financial inputs were provided in a timely and responsive manner, and field-based realities and learnings were relayed to supervisors and policymakers in Vientiane.

Placing the locus of implementation responsibilities in the field — with oversight and specific technical inputs from the center — also fostered a positive and concrete environment for effective inter-agency collaboration among a host of national and international partners.

On Training

A shift in research approach (to include participatory approaches) required a heavy investment. Training and follow-up were conducted until the approaches had become mainstreamed. Lao researchers usually have good technical training, however, participatory research methodologies were completely new to them. On-farm research has historically involved approaching the village head to identify a farmer to work with or rent land from to do an experiment or demonstration. The farmers remained an uninvolved bystander with little to no knowledge of what was being tested in their fields. Interestingly, many of the researchers, when first exposed to participatory research methodologies, said they were already using this methodology. However, after having used the approach in the field, they were quick to see the difference between working in farmer's fields and engaging farmers actively in the research process.

An initial sensitization course conducted provided a general overview of the theory, approach, and methods. On-the-job training followed, as new skills and tools were needed. This saved time and made the training immediately practical. For example, the PD training occurred during the dry season and actual PDs were conducted during the training. In a similar way, preference analysis training was conducted at the end of the growing season.

On Meeting Farmer Expectations

Farmer interest and expectations following the PD were high. Meeting these expectations was critical in maintaining the interest and trust developed during this process. In this regard, it was important that the researchers and the community create realistic expectations together, considering the human and financial resources. A temptation of local researchers, when confronted by interested and excited farmers, was to promise much more than could be done. If expectations were not met, farmers would be less interested in future collaborations. The adage "a small success is much better than a big failure" was good to remember at this stage. For this reason, identifying 'entry point' technologies (that could be reliably expected to deliver early benefits) was hugely beneficial to the PR process.

When expectations are met, researchers and farmers have a much easier time working together in the future. After a couple of years using PR approaches, one researcher commented that working with farmers used to be difficult, now it was easy, in fact they were coming to him.

On Respecting Farmers' Opportunities and Constraints

With increased farmer involvement, care needs to be taken to not overburden the farmers with unnecessary meetings. This was a potentially large problem for the IUARP that involves so many research groups. During monthly meetings held by the local research team, they made sure that farmer meetings were combined, if possible. Also, focusing on "on-the job" training, so farmers were not simply used for "practice", reduced the number of meetings.

Trust was strenghthened when the researchers kept their appointments with farmers. The most common complaint from farmers was that researchers seldom keep appointments. This suggested that the farmers were keen for the researchers to visit. Interestingly, another common complaint was that researchers did not provide enough follow-up.

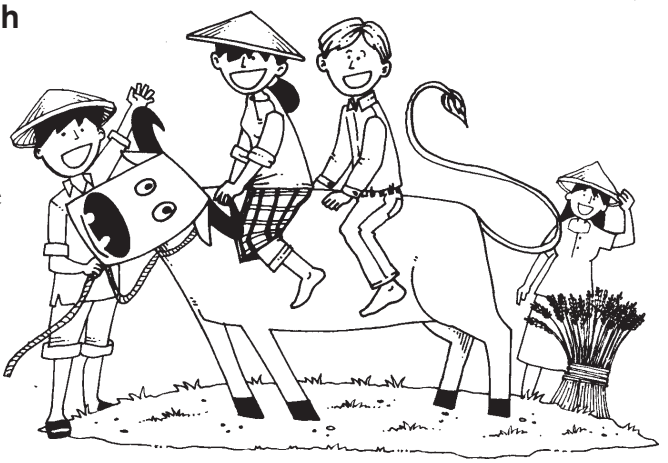
On Accelerating Impacts

There was a lot of pressure on local research institutions to come up with technologies for the uplands that reduce slash-and-burn cultivation. Initially, there was concern that using participatory approaches would slow down progress. Part of the concern was because of the time required for training and in the initial steps in working with farmers to understand their problems (e.g., the PDs). However, the impacts accelerate: new staff learn more quickly from the experienced field staff (given the mentoring opportunity) and new farmers, who generally preferred advise from other farmers to technicians, had many experienced farmers to learn from.

There was also the feeling that farmers would not adopt technologies quickly and they should rather be told what to do. While the participatory research process did tend to start slowly, this pace was necessary, as it took time to do the training and PDs. It also allowed the community to become familiar with the researchers. After a year of working with farmers, the process was anything but slow, as farmers became more interested in testing new options. In the IUARP, farmers were adapting and adopting these technologies and integrating them into their systems after only two or three years.

On Scaling-Out Research

Through participatory approaches, new and exciting technologies are being developed, adapted and adopted. The challenge for the IUARP is how to support scaling-out. Clearly, it is not feasible to invest the same amount of effort in every village, so what is the role of research in this regard?



Firstly, as promising technologies emerge, extension materials are being developed as the primary tools, which extension workers can use to encourage wider adaptation and adoption. At the same time, the IUARP is becoming a key visiting point for development and extension workers who want farmers from other areas to see innovations for themselves. This is a prime opportunity to be developing and documenting locally appropriate methodologies for farmer-to-farmer exchange of experiences.

Secondly, the uplands are incredibly diverse and specific recommendations cannot be broadly applied. Thus, it is essential that researchers work within this diversity and develop broad recommendation domains for promising technology options.

The IUARP continues to work closely with farmers, further refining technologies and testing new ones. Furthermore, mutual trust has been developed enabling us to jointly address more complex issues.

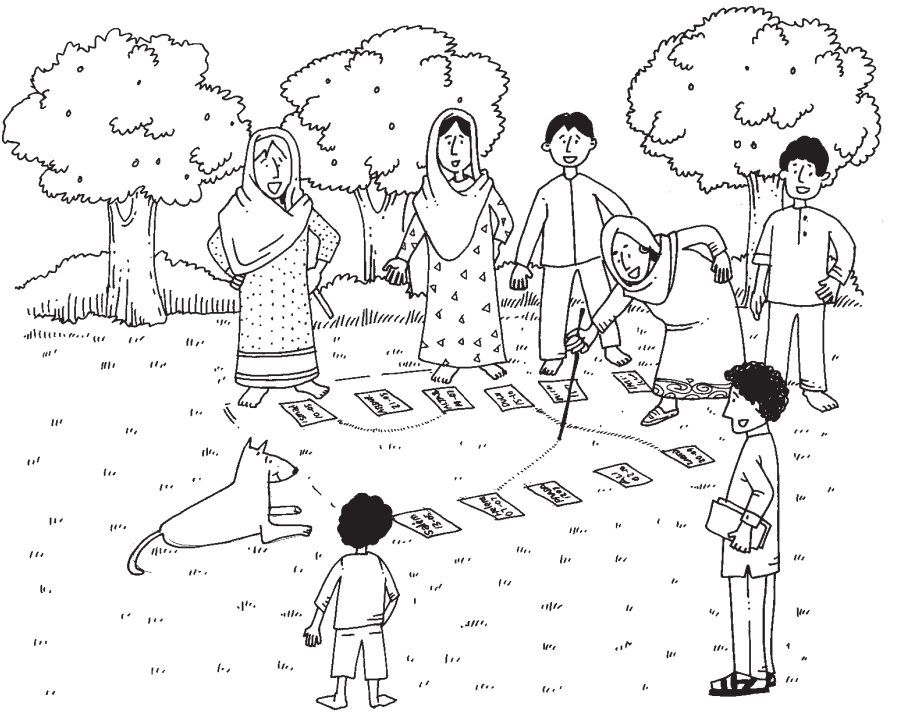
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The Innovation Tree: Visualizing Dynamics in the Community Innovation System



An Innovation Tree is a new tool that helps people to visualize and analyze the way in which an innovation is spread over time among community members. It is a useful tool to distinguish between innovators, early and late adopters, and to help both outsiders and the community to understand some of the social and psychological dimensions that influence the adoption and diffusion of an innovation within that community. The Innovation Tree also allows for investigating how different personalities or types of innovators play a different role in promoting the technology to their colleagues, which is of direct relevance for developing farmer-to-farmer extension activities.

This paper illustrates how the community in Maria village, Bogra, Bangladesh expressed their points of view and expertise, after being triggered by the Innovation Tree to analyze their own innovation adoption and diffusion process. Adoption is considered as the individual dimension of the process: individual households refuse or adopt an innovation for various reasons, while diffusion is the next step explaining how and why (or why not) the adoption spreads between individual households.

This discusses the experience of the Seed Health Improvement Sub-Project (SHIP) under the Poverty Elimination Through Rice Research Assistance (PETRRA) project in Bangladesh, managed by the International Rice Research Institute (IRRI).

SHIP started in 1999 and has mainly focused on improving the quality of farmer-saved seeds. As the project began its fourth year, increased emphasis was put on how to improve scaling-up strategies. Farmer-to-farmer extension and the use of local leaders and institutions were mentioned as important uptake pathways, yet with no clear understanding as to how to proceed, and without information on the point of view of the end-users.

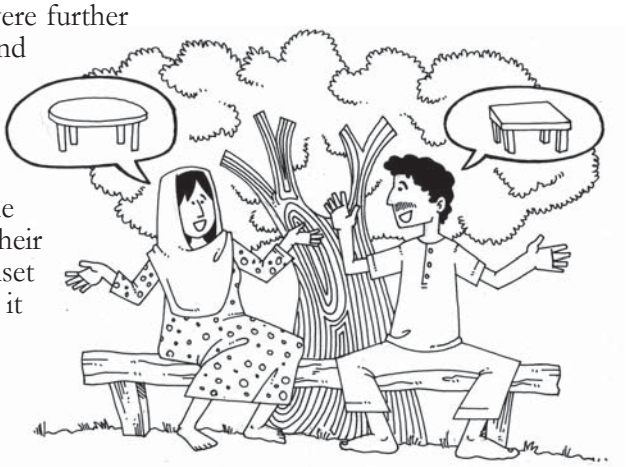
CABI Bioscience trained local partners in innovative extension approaches. The new participatory rural appraisal (PRA) tool presented here is an output of this mutual learning process.

Stimulating Innovation

People in Bangladesh traditionally dry their rice seed on the floor or on a bamboo mat, also called *chatai*. The introduction of irrigation pumps and new rice varieties over the past 10 years or so enabled a lot of farmers to grow a second rice crop during the dry season. However, properly drying *boro* seed has become one of the major bottlenecks, because it is harvested at the onset of the rainy season. In Maria village, multipurpose seed drying tables were developed in a participatory way by stimulating people's creativity.

As postharvest activities are mainly the responsibility of women, a learning session with them (from 30 participating households) was organized. To ensure full ownership, the concept of improved drying was introduced, through a visualization and reflection session on underlying principles such as ventilation and evaporation. A few questions, embedded in real-world situations, were developed to stimulate the thinking process, and by the end of the two-hour session, all agreed upon useful criteria for making seed-drying platforms or tables.

In a next session, these criteria were further discussed with both husbands and wives, and the participants developed a monitoring sheet and transferred this to an A4 sheet. All households received a copy and were asked to record the date at which they would make their table. It was made clear at the onset that if they wished to make one, it would be at their own expense.



Within a period of only five months, all 30 households engaged in the project had adopted the idea of this technology, each bringing in their own innovations. More than 60% of the multipurpose drying tables were designed and made after close consultation between husband and wife. Personal observations and informal talks also revealed an important exchange of ideas between households. How people within the community inspired one another, and what could be actually learned from this were likewise accounted.

Analyzing the Innovation Diffusion Process

Visualizing the innovation diffusion process could help in:

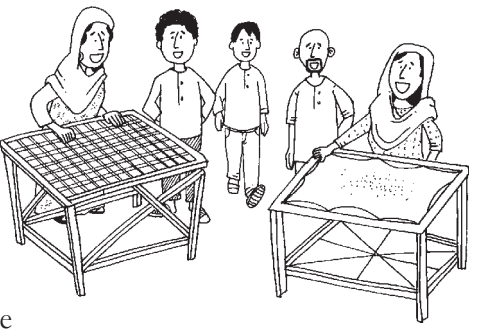
- provoking community reflection and raising awareness about the dynamics of the process
- providing insights in the social and psychological dimensions underlying the innovation adoption and diffusion process
- probing which people, or more specifically personalities, to engage in a particular farmer-to-farmer extension activity

A better understanding of the innovation diffusion process could help outsiders in better targeting their community-innovation activities. In the selection of extension workers, not only the technical, but also the facilitation skills are important criteria. This is equally important when selecting farmer facilitators, and as such, a way to gather insights in the underlying social and psychological dimensions of the dynamics of the community innovation system was looked into. No PRA tool existed to visualize such a process and encompass some of these factors.

The Innovation Tree: How it Works

Each household needs a card about half an A4-size, and there should be enough markers. The session is best held in an open space in the village, but could also be done indoors presuming availability of a large floor or wall. Lines can be drawn with either a stick in the sand, or with crayons on harder surfaces.

The Innovation Tree can be done using the following steps:



1. Invite those households who have adopted or adapted a technology for a meeting. Brief them about the objective of the exercise, and provide cards and markers.

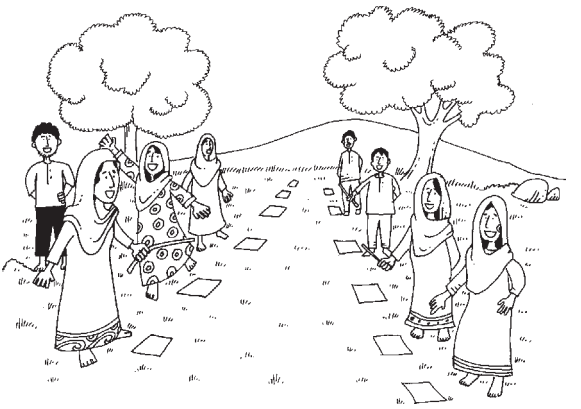
2. Ask them to write their name on the card along with the date on which they adopted the technology. The fact that they themselves have recorded this date on their monitoring sheet may help at this point. In case the illiteracy rate is high, pictures of the participating households can be used instead of written names.

3. Explore with the participants whether the technology could be classified into broad groups. For instance, the participants clearly distinguished two broad classes of drying tables, namely, light ones and heavy ones.

4. Draw one line for each group, leaving ample space between each line. The length of the lines depends on the number of participants, and whether you do it indoors or outdoors. In the open space, allow for at least half a meter per household.

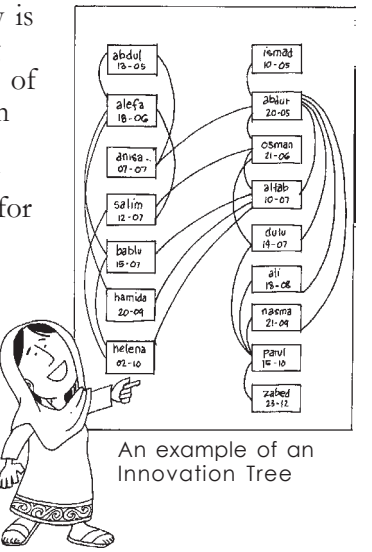
5. Ask the participants to place their cards on the line according to which broad group they belong to.

6. Ask them to re-arrange themselves according to the date at which they have adopted the innovation. At completion, innovators should be at one end, while late adopters at the other. After having laid their card on the line, they can go back to the group.



7. Ask the person or household who first made the innovation to take the floor and explain who or what inspired them to do this. One facilitator guides the process, while another records all the comments.

8. Consequently, in chronological order, ask all the others to draw one or several lines to cards of households who inspired them to also adopt the idea of the innovation, while adapting it to their personal needs and limitations. Lines can be drawn within or between groups. The facilitator tries to find out what exactly convinced them to do it, and what other than personal factors were involved in the decision-making process. Although subtlety is the master of the facilitator, the underlying question is 'Why was household x a source of inspiration and not household y, while both adopted the innovation before you did?' Preferably a third facilitator simultaneously copies the name cards and lines on a sheet for later processing.



An example of an Innovation Tree

9. The last part of the exercise is the most important one, as this is the time to facilitate group discussion and stimulate reflection. The first step in the discussion should deal with the innovation process itself. Depending on the objective, focus more on either the technical, economic, social, or psychological dynamics of the innovation system.

10. During the last part of the discussion, the facilitator tries to draw on the insights gained from the exercise, and explores who could contribute in which way to scaling-up the innovation diffusion process.

Revealing Social and Psychological Factors

Farmer decision-making in adopting a technology is influenced by institutional, economic, cultural, social and psychological characteristics. A whole range of anthropological and social science tools exists to reveal mainly the first three categories. The social and psychological factors enhancing or inhibiting the actual adoption can be analyzed directly with the community through the Innovation Tree. As these factors are often location- and technology-specific, a list of factors is given based on a literature review and personal experience (Table 1).

Table 1. Some Social and Psychological Characteristics Influencing the Innovation Adoption Process

Social Factors		Psychological Factors	
Stimulating Adoption	**Inhibiting Adoption**	**Stimulating Adoption**	**Inhibiting Adoption**
Personal communication network*	Opposition in the farming community	Innovation proneness*	Complexity of technology
Social participation*	Social isolation	Risk-taking ability	Risk avoidance
External pressure* [1]	Poverty	Extravert*	High level of stress
Common need for solving a problem*		Overall knowledge	Lack of knowledge on the technology
		Self fulfillment*	Lack of motivation
		Pride in ownership*	Mistrust of project staff
		Level of aspiration	

[1] The presence of the project and visits of international staff contributed to certain people being eager to make a good impression.

* Factors identified in the project by applying the Innovation Tree.

The above factors partly determine whether a technology is adopted or not, but the Innovation Tree exercise also enables the researcher to investigate how different personalities or types of innovators play a different role in promoting the technology to their colleagues.



The first type of innovator has inspired a wide range of people from different levels within a community and has a modest, mild, and inquiring character. This innovator has enthusiastically engaged in farmer-to-farmer knowledge strengthening of seed health management, both within and outside the community.

The second type has enthused fewer and mainly like-minded people within the community, and has a strongly competitive character. This innovator has been more eager to go outside the community to promote the drying table that shows his own ingenuity, rather than getting engaged in farmer education activities (Table 2).



Table 2. Profile of the Two Types of Innovators

	Type 1 Innovator	Type 2 Innovator
Main interest	Knowledge/Process	Technology/End product
Personality	Modest, mild, and inquiring	Competitive
Social interaction	Intense	Limited to like-minded people
Potential contribution to extension	Action learning	Technology promotion

Conclusions

Although the Innovation Tree has so far only been used on a small-scale in a few villages and with a focus on a technological innovation, it can be applied with any type of innovation, whether triggered by a project, a workshop, or any other communication channel.

As illustrated, the Innovation Tree is a useful tool to distinguish between different types of innovators, but also to better understand the psychological and social dimensions underpinning the decision-making process, which would be difficult to disclose in other ways. This may yield valuable information about which people or personalities (and even institutes) will engage in a particular scaling-up activity.

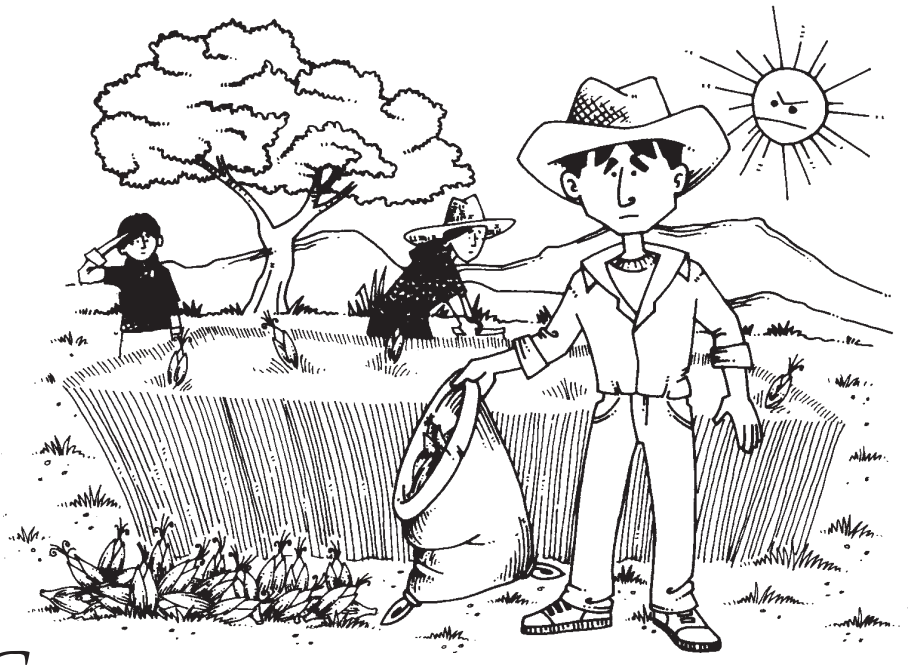
However, as with any PRA tool, none can stand on its own and therefore the need to complement this tool with other tools or techniques such as semi-structured interviews and personal observations. The tool may need to be modified to take account of the different adaptations made to the innovation by the different participants.

It is important to realize that the output from the discussion following this PRA exercise goes much further than the actual innovation adoption and diffusion process. Indeed, as is often the case, discussion topics quickly evolve towards social development issues and how community members see their role in this process.

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Participatory Research and Development for Sustainable Agriculture and Natural Resource Management: A Sourcebook

Supporting *Campesino* Experimentation on Livestock: An Example from South East Mexico



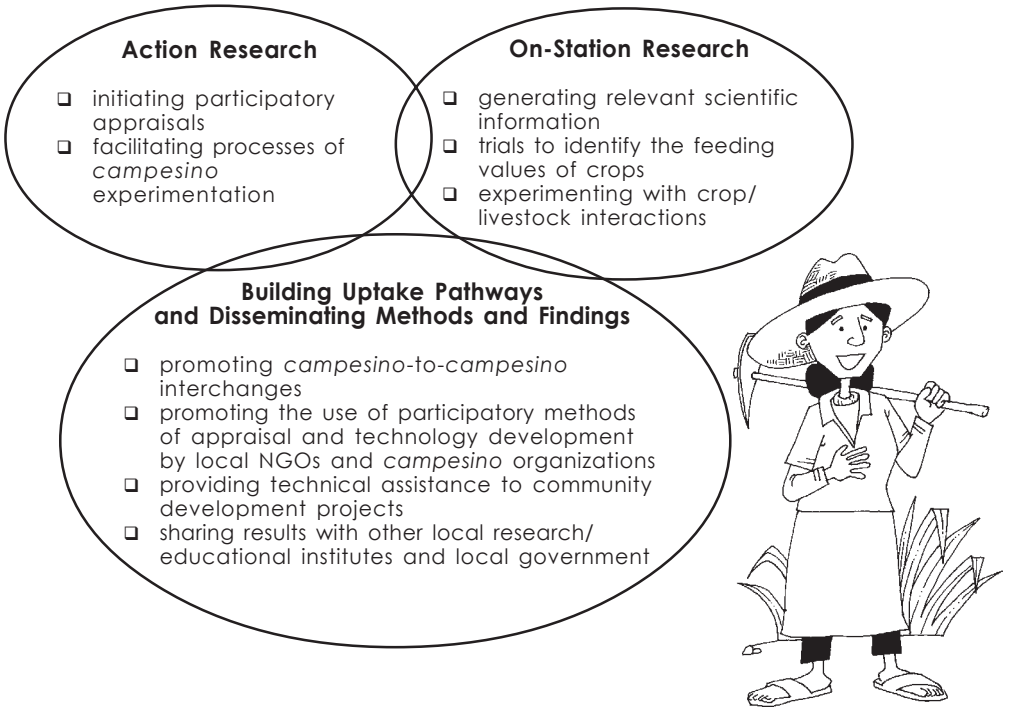
Campesino households in SE Mexico, as elsewhere in Latin America, face situations of declining food security due to the disintegration of traditional agriculture, or poor natural resource management (NRM) in colonized areas. The main livelihood activities of these households include crop and livestock production (mainly poultry and pigs) for subsistence and sale. Such marginalized agriculture depends largely upon processes of innovation to overcome constraints.

Campesinos are people in Latin America who are involved in agriculture for both subsistence and commercial reasons. Crop and livestock husbandry is central to the *campesino* culture and well-being.

The project described here sought to overcome both product (i.e., improved livestock feeding systems) and process (i.e., facilitating and strengthening local capacity in *campesino* experimentation and diffusion) constraints. Actions by *campesino* groups, non-government organizations (NGOs) and researchers have been concerted in this process. The project involved *campesino* households of four villages--Mahas, Xohuayan X'culoc and Sahcabchen--in the states of Yucatan and Campeche. The objective of the project was to optimize *campesino* livestock rearing so that household livelihood and food security were improved. Processes of *campesino* experimentation were facilitated. Animal science research supported *campesino* innovations. The results of these linked activities were disseminated by using *campesino*-to-*campesino* methods.

Livelihoods and gender approaches allowed an understanding of both the potential of, and the limits to, *campesino* experimentation, in the areas of alternative feed sources for small livestock and ethnoveterinary practices. Better ways of partitioning maize and other food/feed resources between family and livestock needs were explored to improve food security.

Following the inception phase, during which contacts were established with the local NGOs and through them with *campesino* communities, the project operated on three main activities:



Action Research

The action research activities followed an iterative sequence of four phases designed to establish and consolidate dynamic *campesino*/researcher linkage (Figure 1). In each phase, a number of tools were used as described below (Table 1).

Phase 1: Appraisal

Contact was made with a cross-section of families in each community through existing *campesino* groups working with local NGOs and/or grassroots organizations. Participatory appraisal tools were used to gather the needed information to form a characterization of household livelihood strategies and of crop and livestock husbandry. Information gathered was also used to delineate priority issues from the *campesino*'s perspective. Several *campesino* families were already familiar with the participatory research methods, which not only facilitated application, but also validated or qualified the method's usefulness. Secondary information about the communities and the zones was also collected where available.

Figure 1. The Phases and the Sequence of Activities Within Each of the Communities Where the Project was Conducted

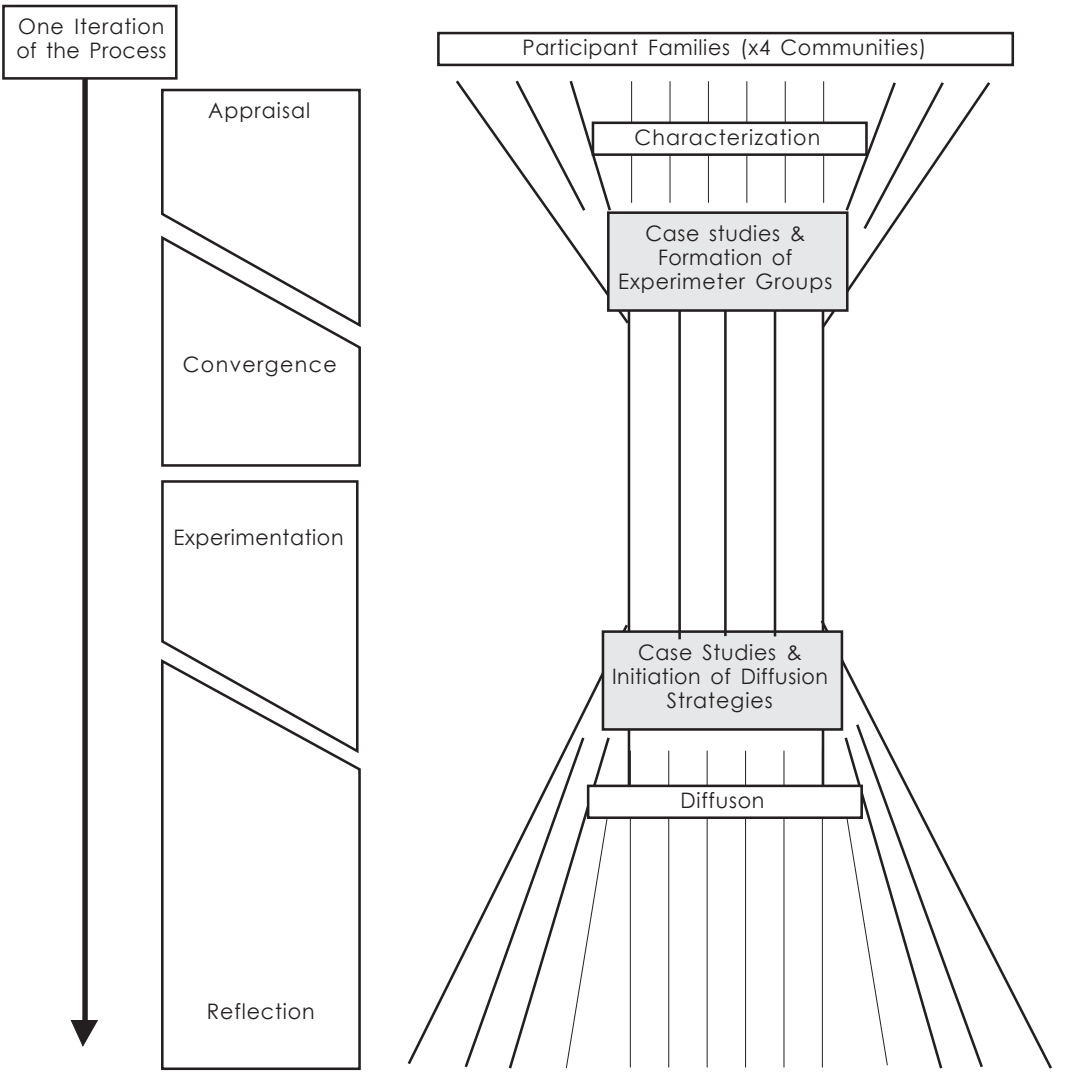


Table 1. Tools Used in Action Research

Phase	Tools
Appraisal	semi-structured interviews, mapping (villages and resource flows), institutional diagrams, well-being calendars, profiling for activities, production, and responsibilities, gender-disaggregated activity calendars
Convergence	group meetings, dialogue, brainstorming, key question identification, well-being ranking, animal inventories
Campesino experimentation	maize-scarcity assessment, participatory budgeting, livelihood budgets
Reflection	consultative evaluation, timelines, *campesino* experimentation books, *campesino*-to-*campesino* exchanges, participatory evaluation of on-station research

Phase 2: Convergence

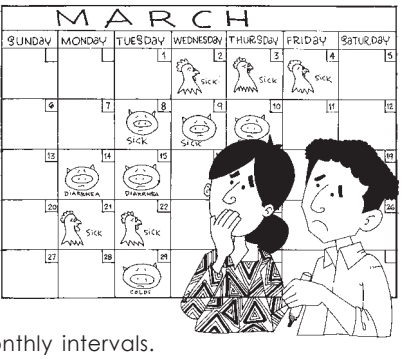
Households interested in the theme of crop/livestock integration and willing to provide case study material were identified and *campesino* experimentation groups were formed. Each group then identified themes for experimentation. In this phase, the researchers attempted a more in-depth approach to understanding the socioeconomic context, and case studies were also initiated.

In each village, the *campesinos* who had participated in the appraisal stage were invited to a meeting where researchers determined their interest in forming a *campesino* experimentation group that would specifically try out innovative animal husbandry techniques. The research team presented this idea to them. Brainstorming was used to focus on why they would want to form their own group and how it would operate.

In all four villages, animal health was a priority issue for the *campesinos*. While health issues did not fall explicitly within the research team's remit, for collaboration it was felt that an attempt could be made to respond to their questions about poultry health. The opportunity could then be used to link the issues of animal health to problems with diet.

Animal Inventory...

Animal inventory was an offshoot of the researcher's interest in studying the animal population levels and the quantity of maize dedicated to animal feed and human consumption. The tool began as a list of each household – number of chickens, turkeys, and pigs; and quantity of maize given. However, it became apparent that the *campesinos* have different conceptions regarding types of animals (e.g., chicks, small chickens, chickens, hens, etc.) and a more detailed inventory was developed according to their own categorizaton. Hand-drawn pictures of the different animals were used. The inventory was conducted every month, and the differences between one month and another (consumption, deaths, purchases) were listed and identified. This took about 10-15 minutes for a group of 8-10.



The purpose of the technique was to provide more detailed information on maize consumption and the time of purchase. The intention was to use that information as a discussion theme with *campesinos*, to facilitate the identification of feed shortage periods, and how trade-offs are made between the allocating maize to family or 'investing' it as animal feed. Due to quantity of the data generated, it was not initially analyzed directly with participants. Instead, this was carried out by the researchers who processed the information by using spreadsheets, and developed easy-to-understand tables. The tables were then presented to the groups at six monthly intervals.

Livestock population levels and animal feed quantities were graphed for each household, and explained. Questions were asked as to what was understood from the graph, what had been learned, and what this implied for the management of livestock. The graphs proved to be difficult to interpret for some households in the first village visited. The graphs were later adapted in order to be more visually apparent, which had better, though still mixed results. *Campesinos* saw the analyses a second time when they were presented at the village level. They also saw them at the end of the *campesino* experimentation process, when results were relayed to the *campesino* experimentation groups.

Phase 3: Experimentation

Once *campesino* experimentation groups were formed, the next question was how to facilitate and monitor the experiments and maintain momentum when experiments "failed" or became "uninteresting". This proved to be a methodological challenge. An iterative response, as prescribed by a participatory approach, is essential to maintaining an appropriate response for the researchers unused to "uncontrolled" experiments. The *campesino* experimentation groups in the four villages were formed using an interactive participatory approach. However, the process differed in each village. The development of trust relations between researchers and *campesinos* was crucial to intitiating and continuing a shared learning process. A flexible use of participatory methodology is crucial in facilitating the development of experimentation groups and enabling participatory monitoring and evaluation (PM&E).

Phase 4: Reflection



An example of the reflection and monitoring process followed can be observed in the case of the *campesino* experimentation group in Xohuayan. The benefits anticipated were represented in drawn images and presented in a matrix format done by the researchers at the monthly meetings, following the construction of the hen houses, and were analyzed with the *campesinos*. Two months after the construction of the houses, the women were very concerned about the absence of egg production. Many blamed the enclosure of their birds. This type of straightforward monitoring process gave the *campesinos* an early opportunity to discuss problems in group and to seek out possible solutions with other *campesinos* and the research team. However, it proved difficult to revise the benefits on a monthly basis due to the quantity of topics to be dealt during meetings. Eventually, they were checked every 3-4 months.

Using lists written in bright primary colors proved to be an important technique. But given the potential problems surrounding testing new husbandry techniques, the researchers also spent much time during monthly meetings discussing problems related to their experiments. This led to new actions being taken.

Example

In Xohuayan, despite the restoration of egg production, many women disproved of the hen house and abandoned its full-time use. The researchers urged a revision of the group's objectives in an attempt to "evaluate" their experience to date. The women expressed a need to meet alone without the researchers to discuss their future. The researchers readily agreed.

One month later, the women returned to share the results of their meeting without the researchers. They had met as agreed, but instead of evaluating themselves or analyzing their future, they had decided to use their meeting to prepare and try out deworming with a herbal treatment the researchers had shown them. A discussion arose, about the types of problems they were currently having with their poultry. From this, the researchers drew out a subject list that served as the basis for their future experiments, and were to be monitored along with the hen-house innovation.



These activities were discussed, debated, and some tested out during the eight months. The vaccination option was discarded after a lengthy debate between the *campesino* experimentation group and researchers about the risks of applying the vaccination to weak/ill poultry. However, the women pursued other activities.

Action Research Tools and Methodologies

From all the phases of action research described earlier, these tools and methodologies were used, with the corresponding results across all phases.

Visiting Sites of Experiments

In all four villages, this simple process of visiting the experiments of other *campesinos* in their own village and others was key to *campesino* experimentation group meetings.

- In Sahcabchen, this involved all the *campesinos* helping out to catch and weigh the pigs.
- In X'culoc, visits were made to the home gardens where experiments had been planned.
- In Xohuayan, the women went to visit their colleagues' hen houses on a regular basis. This offered good opportunities to discuss husbandry techniques. In all villages, it assisted in allowing *campesinos* to share ideas and experiments.
- In Mahas, a woman commented that she had fed her chicks whole maize grains since three days old and they were growing fine. This diet had saved her time and money that would have been spent on milling maize. However, other women said feeding whole maize grains to chicks had not worked for them and their chicks had died. A rich and enthusiastic discussion ensued among the women about variations in diets.

Researchers and NGOs organized several exchange visits to experiments in other villages. It was considered important for the researchers as one village in particular, Xohuayan, had been cultivating Mucuna for several years and had a successful pig-rearing experience based on alternative feeding strategies.

These types of visits facilitated reflection on the constraints and opportunities available to *campesinos* in the different villages. Market access, soil types, local vegetation for forages, and seed varieties were key themes compared by the *campesinos*. However, these topics were sometimes considered negative, as many *campesinos* reflected upon the lack of resources in their village when compared to others. However, they served to stimulate experiments in their own villages as the *campesinos* expressed desire to carry out innovations in animal husbandry techniques.

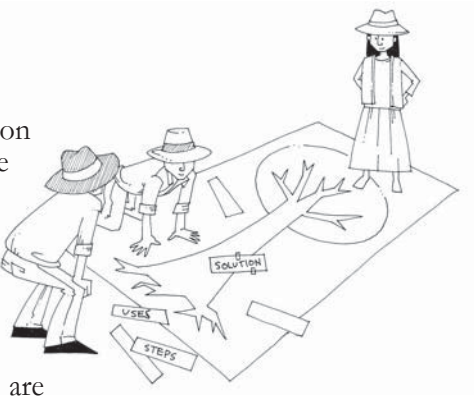
Village Maps and Illness Calendars

In all villages, the workshops on poultry and pig health utilized participatory methods to assist in the shared learning experience. An example of this can be observed in the following case. In Mahas, in one workshop session, the causes, effects, and treatments of fowl-pox were discussed by using visual aids. To consolidate the learning process, women (24 in total) were divided into two groups. One group constructed a seasonal illness calendar, while the other drew a village map on which households with ill poultry were identified, as were locations where dead and infected animals were thrown. Each group then presented their findings to the whole group. Discussions followed as to why seasons influence their poultry's health. The map allowed the researchers to re-emphasize how diseases are transmitted by other animals, a novel concept for these women. Furthermore, the application of these methods gave the research team valuable information on seasonal variations in Mahas and a detailed map of the village, which continues to serve as a reference point in meetings between researchers and the women's group. In addition, these resources proved useful to PM&E.

Drawing Illness

In the animal health workshops with the *campesinos* from Sahcabchen and Xculoc, the farmers drew pigs and identified where cysticercosis could be found. This was part of an important discussion on the causes of this illness and led to important local beliefs being expressed to the researchers. Several *campesinos* believed that cysticercosis was caused by eating a local plant and/or fruit. This type of belief could prove to be a severe limitation in testing out alternative locally-available forages and plants. Hence, the health workshops also helped establish a common ground, based on trust and sharing, knowledge that would enable testing of alternative animal husbandry strategies.

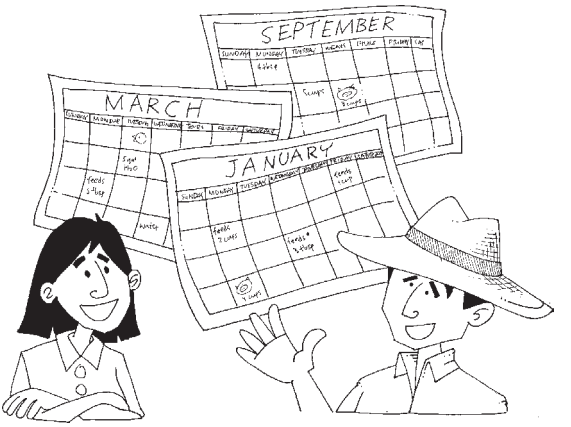
Problem-Opportunity Tree Analysis



Problem trees enabled collaborative identification of problems, their causes and effects. They were carried out within group meetings to enable reflection about cause and effect, and opportunities available to *campesinos* to resolve animal health problems. A tree is drawn on a large sheet of paper, or sticks are used to create a tree. The trunk is the problem (e.g., high poultry mortality), the roots are

the causes, and the branches are the effects of the problem. The opportunity tree turns the situation around and the trunk becomes the desired situation (e.g., healthy chicken). The participants then think about ways in which this can be achieved by converting the causes of the problem into means to avoid illness. From this technique, experiments were also defined.

Seasonal Feed Calendars



The animal health workshops were also used to reflect on seasonal influences on poultry and pig diet and the preparation of Mucuna and its use as a feed supplement. This was done using calendars, depicting monthly variations in feed availability. Thus, the animal health workshops facilitated the identification of links between health and crop/livestock interactions. Furthermore, a wider context was presented within which experiments could be considered and evaluated.

Regional Workshops

The results for the four villages are extensive. Hence, the results from one village, X'culoc, will be used as a specific example of the process but generalized conclusions for all four villages will also be presented.

The objective of the first one-day regional workshop (June 1999) was to enable a participatory analysis of the initial analysis, developed from well-being rankings and animal inventory. The all-women groups were invited to participate in this workshop to scrutinize and criticize the analysis of the techniques undertaken by researchers. To facilitate this, the researchers divided the workshop participants into their *campesino* experimentation groups and first discussed the technique of ranking and its objectives.

The results of well-being rankings in their villages were depicted with a hand-drawn pie chart, showing percentiles and numbers of families belonging to each well-being stratum, with symbols of the assets that characterize each stratum. The pie chart was entitled "How we live". The responses ranged from a despondent 'yes, we really are that poor' to 'no, there is one person who's poorer than all the rest'. In one village, the diagram was rearranged. Each group then presented their ranking results, with their own comments and changes back to the entire group. Their insights and changes were incorporated into the ranking results for two of the villages.

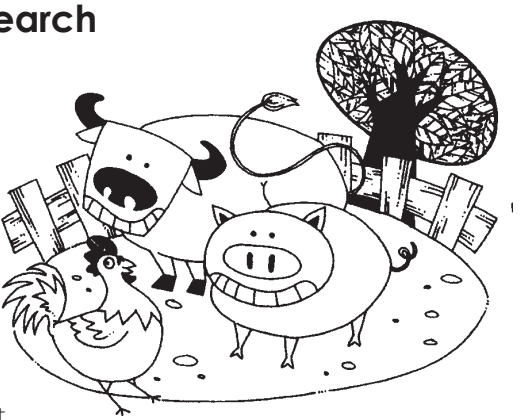
Later that same day, the analysis of the animal inventories was presented to each *campesino* experimentation group by facilitators using a fictional character and discussing animal husbandry according to season. The villagers then discussed whether this was a true case from their village, the nature of her difficulties, and how she could improve her animal husbandry practices.

The purpose of this workshop to the *campesino* experimentation process was crucial for researchers. The joint analysis facilitated a reflection on the results and hence changes could be incorporated before the conclusions were drawn and presented to all *campesino* experimentation groups nine months later in March 2000. The June workshop was particularly important for the animal inventory results, as many of the limitations of the technique were nullified, in particular, the confusion over animal age-types.

The objective of the final one-day workshop in March 2000 was to facilitate a sharing of the experiences of each of the *campesino* experimentation groups. It was also used to provide a forum whereby the *campesino* groups could think about how they wish to continue in the future. Approximately 70 *campesinos* and several local NGOs participated so that the future could be considered with potential NGO involvement. Each experimenter group informed the participants of the types of experiments they had tried, methods used, and the benefits and problems experienced. They used mostly large sheets of paper with key words and images to explain their stories, told in Spanish and Maya. In addition, each group shared their books with the other groups.

Outcomes of the Action Research

Accessibility of Experiments



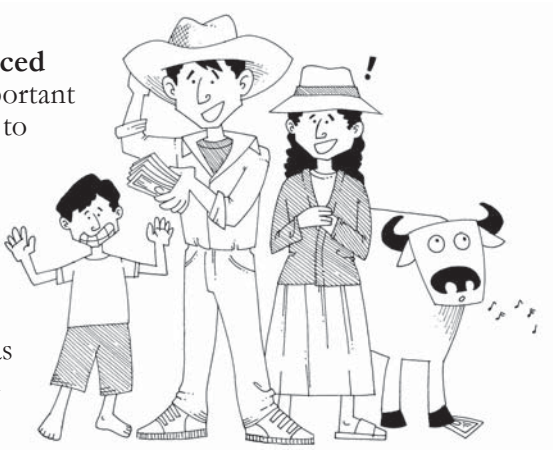
The results of the animal inventory, when processed by researchers in Excel, demonstrated that the experiments were not 'exclusive' to any particular socioeconomic group. They were equally accessible to the poorest and the poor.

Collection of forage, poultry pens and cold remedies appeared to be the most accessible innovation, showing the highest experimentation rates. It is interesting to note that both forage and cold remedies were suggested by the *campesinos* rather than the researchers. There was 80-100% experimentation rate on these two experiments, and 30-40% for the other experiments. Poultry pens, which were initiated within the villages, should be treated separately given that an NGO donated the fencing.

The three innovations which involved Mucuna were problematic, given the scarcity of the seeds and the high prices, which *campesinos* could sell them for in 1999. This meant that many households sold them rather than feeding them to their pigs. In addition, there was little time to be able to produce enough.

Other analyses conducted revealed that there was no significant difference between other characteristics of the innovations in terms of accessibility and experimentation levels. Thus, it appears that the main characteristic, which affected the level of experimentation, was whether the experiment was locally suggested and 'demand-led'.

Utility of Experiments



For the poorest households, the **reduced use of maize** was considered an important benefit of feeding forage and Mucuna to livestock. It was recognized that the reduction of maize used for livestock increased maize availability for family consumption. This was particularly true for the poorest households who experienced severe maize shortages. The **speed** at which animals fatten was an important benefit raised for all feed alternatives. The **income** generated from sales was highlighted as being beneficial to the family for different purposes.

The increase in the **number of animals** was highlighted as an important benefit. In the case of the poultry pens, numbers of poultry reared increased. Both poultry pens and vermiculture appeared to increase the number of eggs laid. Changes in the **aesthetics** of the animal appeared to be important. 'Pretty animals' was the term used to describe healthy animals. This was mentioned for the entire alternative feed innovations, for both pigs and poultry. The **workload** did not seem to be a constraint to experimentation for the majority of experiments.

The speed of the impact of the benefits is important to the experimentation level. Those innovations for which tangible benefits were seen quickly such as cold remedies were experimented widely – results were discussed within workshops and, participants, hearing positive results from other group members, attempted the experiments. The visual, quick, tangible benefits thus tended to be adopted and diffused more quickly. Those experiments for which benefits were delayed for over a long period (Mucuna experiments) had a lower experimentation level. It has been seen that the experiments were accessible to all of the participants, and were appropriate to the different resource endowments of households.



Recommendations for Livestock Participatory Technology Development (PTD) Processes

- Support techniques/experiments that are cheap, easy to apply and based on local traditions: here these have spread widely and persist despite no assistance (e.g., lemon with water).

- The researchers have to be committed to continually adapt their role in the multi-dimensional situations that arise in PTD.

- A lengthy period (five years minimum) is required for considerable adoption and adaptation of techniques/experiments that require significant labor input, and a new and alien management (e.g., mucuna as a crop and feed).



- Poverty definition and distribution in villages must be identified as this influences the ability and willingness of people to try out new crops that can substitute maize, which is crucial to well-being.

- Gender needs to be included. For instance, Yucatan women, in general, do not make crucial decisions for crop husbandry. In Mahas, the women are interested in cultivating mucuna but their husbands were not incorporated within the *campesino* experimentation group. Thus, mucuna was not planted. In this situation, the project needs to work with both sexes, separately.

- Working with an NGO that can follow-up the work after the project ends is crucial. This increases adoption and spread of techniques.

- Ensure the speedy diffusion of PTD results to a wide variety of government institutions.

References

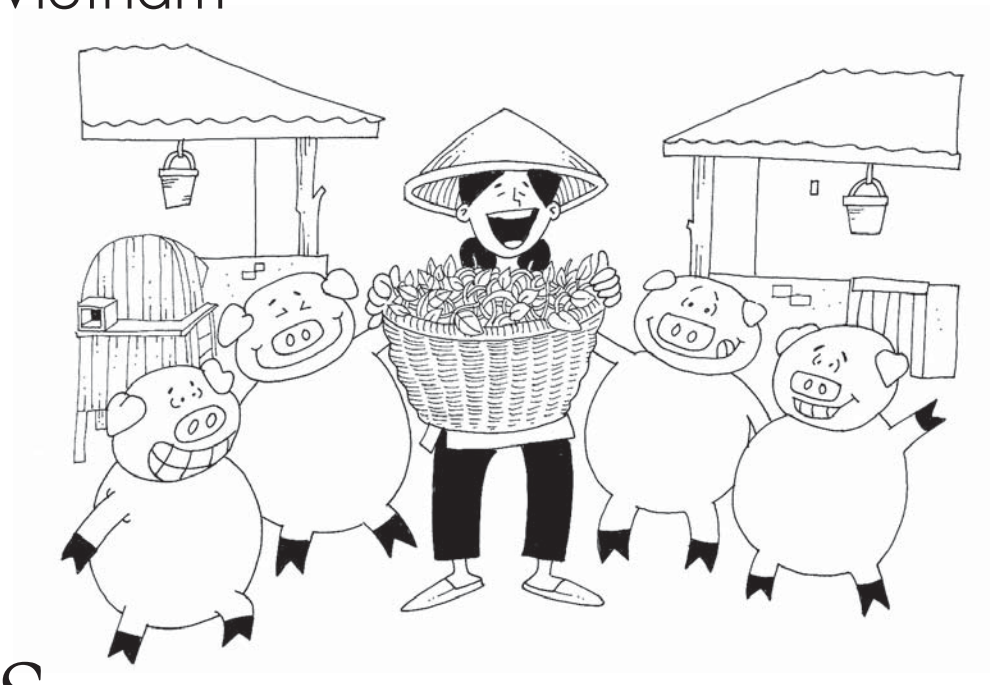
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Participatory Technology Development and Dissemination: Improving Pig Feed Systems in Vietnam



Sweetpotato-pig production is an important system that generates income, utilizes the unmarketable and undesirable crops, and provides manure for soil fertility maintenance. This system is practiced by many households in sweetpotato-producing region in the developing world. Considering the importance of this system to rural household economy, improvements in this system could have widespread impact.

Partner Institutions in Vietnam

- National Institute of Animal Husbandry
- Vietnam Agricultural Research Institute
- Hanoi Agricultural University
- Food Crops Research Institute

With the aim of generating income through improved sweetpotato-pig feed system in Vietnam, the International Potato Center's (CIP) Sweetpotato Postharvest Project and the Users' Perspectives with Agricultural Research and Development (UPWARD), collaborated with Vietnamese research institutes in a diagnosis-intervention-dissemination process of situation analysis, participatory technology development (PTD), scaling up and monitoring and evaluation (M&E) over a six year period (1997-2002).

The situation analysis involved a series of production surveys conducted between 1997 and 1999 and a large pig supply-market chain identification survey. PTD, on the other hand, included on-farm technical interventions such as sweetpotato

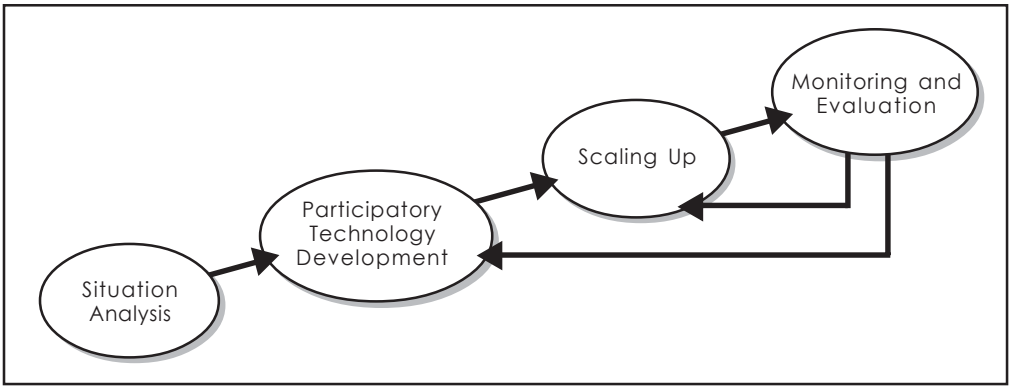
varietal selection specifically targeted for pig feed, sweetpotato processing to increase the economic efficiency of using sweetpotato as pig feed, and pig-feeding trials to examine the methods of increasing pig growth efficiency. As the project evolved, other important feed sources such as cassava and peanut stems were all incorporated into the intervention activities.

Table 1. Project Activities Conducted Between 1997 and 2002

Process	Activities	1997	1998	1999	2000	2001	2002
Situation Analysis	Pig production assessment	■	■	■			
	Supply-market chain identification			■			
Participatory Technology Development	Sweetpotato varietal selection	■	■	■	■	■	■
	Sweetpotato root and vine processing		■	■	■	■	■
	Pig feeding trials with silage		■	■	■	■	■
	Sweetpotato and cassava combination feeding				■	■	■
	Sweetpotato and peanuts fermentation						■
Scaling Up	Farmer-to-farmer training						■
M&E	Impact study						■

After five years of PTD in farmers' fields with limited number of farmers, data from a preliminary survey confirmed that there were enough appropriate results to disseminate widely to crop feed-based pig producers. Scaling-up activities involved a farmer-to-farmer training approach with follow-up monitoring and evaluation. The results of the M&E have subsequently been used as inputs to PTD in a wide range of subjects and consequently used to update the farmer-to-farmer training curriculum.

Figure 1. The Diagnosis-Intervention-Dissemination Strategy



Situation Analysis

Pig Production Assessment

The production assessment was conducted in a few waves of studies:

- first wave of exploratory studies with observations in a few towns in Thanh Hoa and Quang Nam provinces
- formal studies in seven provinces in northern, central, and southern Vietnam, with a survey instrument based on the results from the first wave of preliminary studies
- continuous reconfirmation and verification of the survey results in the field with informal discussions with farmers

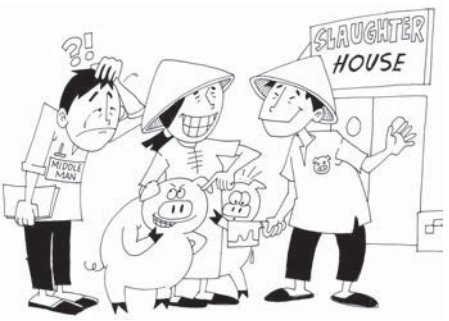
The pig production assessment showed that pigs were important household economic activities all over Vietnam, but the scale of the production and feeding method was larger in the south than in the north. While the northern small farmers fed fresh sweetpotato root and vine, dry cassava chips, rice, rice bran, maize, and various forms of vegetables/grasses as the main feed sources, such crop feed was not nearly as common in southern Vietnam, particularly in a province like Dong Nai where pigs were mainly produced on a large-scale and fed on commercial feed. In a province like Vinh Phu, where there was substantial sweetpotato production, pigs were still fed very little sweetpotato because of the high price of sweetpotato in the market.

This data indicated to the project team to focus efforts on the sweetpotato-pig system improvements for the small pig producers of the northern and north-central provinces. Moreover, the fact that crop feeds were harvested in different seasons meant seasonal availability of crop feeds must be taken into account to improve the system. This led to the later trials of experimenting with cassava and peanut stems along with sweetpotato roots and vines. Experimenting with peanut stems was a response to farmers' requests of seeking alternative feed source between August and November when little feed is available while the abundance of peanut stems served no other purpose than green fertilizer.



Supply-Market Chain Identification

Marketing and price fluctuations emerged as major constraints to profitability. Results of the marketing study that included 1,758 samples in 13 provinces and nine different survey instruments (i.e., nine categories of respondents) revealed that the supply-market chain most commonly shared by the provinces consisted of pig raisers, pig middlemen/collector, pig wholesaler, slaughterhouse, pork middlemen, pork retailer, and consumers. The results also showed that the most expedient chain was from pig-raisers directly to slaughterhouse, which directly sold to consumers, but this was unusual. Due to such complex supply-market chains, the profits were low for pig raisers while pork prices were high for consumers, particularly urban consumers.



Participatory Technology Development

Sweetpotato Varietal Selection for Pig Feed

On-farm sweetpotato selection trials have been conducted in multiple seasons because sweetpotato was planted two or more seasons a year, often as a short stopgap in between rice crops and in multiple locations as sweetpotato was grown in many different agroecological zones in Vietnam. Peanuts and other high-value crops have often replaced sweetpotato in spring and summer. The project also reduced the number of trial sites in these seasons.

After three years of selection (1999), a couple of varieties (KB1 and K51) emerged as high-yielding clones with wide adaptability and were released through the formal government channels as sweetpotato varieties. More clones are being developed but in the meantime, many farmers have adopted and are satisfied with KB1 and K51.

The selection trials aimed at selecting sweetpotato varieties that would provide more starch in the roots and protein in the vines per hectare than the local varieties. Unlike any other country, it is common in Vietnam to grow sweetpotato specifically for vine production to complement the cassava root- or maize-based diet. Therefore, both dual purpose varieties, of which the total dry matter from both root and vine, and forage varieties, of which the total protein yield from the vine, were selected.



Forage selections also showed potential in improving the total protein production in vines. However, despite the fact that many farmers grow sweetpotato for forage purposes only for spring or summer, selection for such purpose did not interest the farmers.

Sweetpotato Root and Vine Silage

Sweetpotato root and vine processing trials mainly experimented with a wide range of fermentation methods to increase the nutritional value, extend the storage life, and reduce the labor requirement for daily processing of pig feed. Twelve different ways of ensiling sweetpotato vine with various proportions of different additives were tested. The vine trial was later replicated for root silage, with six treatments with grated roots and six with shredded roots. The results of vine silage trials showed no significant difference in nutritional value between 14, 30, 60, and 90 days after silage. The data showed that root and vine ensiled with sun-dried chicken manure contained the highest crude protein, dry matter, ash and pH, all of which indicate a better feed source.



Ensiling is a simple process that requires little investment or equipment. The only equipment needed is a set of scales for weighing the ingredients and bags for storing the ferment. Thus, farmers can easily adopt this silage method to improve pig growth and increase profit.

Participating farmers stated that the heavy labor requirement for cooking was one of the major obstacles to increasing production. Indeed, when freed from this chore, farmers were able to increase their production.

Feeding Trials with Silage

Feeding trials were conducted following the vine and root silage trials to examine the effects of feeding root or vine silage to pigs.



All feeding trials were conducted on farm in Pho Yen District of Thai Nguyen Province, with five to seven households, each with six pigs (two pigs per treatment). All trial pigs were F1 pigs, a crossbreed between the local *Mong Cai* sow and the introduced Largewhite boar. Efforts were always made to ensure that there was no significant difference in the weight of the piglets, or the sex ratio, in each treatment of the feeding trial to avoid bias with the results. The piglets were always given an adjustment period of five days before the trial. During this period, the piglets were fed increasing amounts of fermented feed each day to help them adjust to the new diet.

The most important finding was that uncooked sweetpotato root silage could achieve pig growth comparable to that of cooked sweetpotato roots and with much lower cost in labor time and fuel. Instead of elimination through cooking, more than 30% of trypsin inhibitor was reduced through ensiling, which appeared to be enough to remove the need for cooking. Moreover, silage can be stored for at least five months, so ensiling also effectively resolves the storage problem.

A follow-up feeding trial was conducted in the same village to examine the growth efficiency when including 10%, 20%, or 30% (on dry matter basis) of sweetpotato root silage in the total diet. The results suggest that adding as little as 10% of sweetpotato root silage to the feed is an effective option. These results suggest that a variable feeding regime would require the lowest input to achieve the same growth as feeding the same amount of silage during the three-month period. So variable the amount of sweetpotato root silage in the feed, from 30% (dry matter basis) in the first month to 20% in the second month and to only 10% in the third month, may achieve better growth and economic efficiency than feeding 10% silage through the three-month period.

Trials with Other Crops as Feed

Various crops are available in different months of the year as feed. Farmers would like to learn how to combine these crops, not simply use sweetpotato roots and vines, for each season, as farmers prefer to utilize as much of the root crops as possible to reduce the feed cost. A trial was conducted to examine the different ways of combining processed and unprocessed sweetpotato vine and cassava roots to satisfy the feeding needs at the end of the year. The trial results showed no significant difference between the different ways of combining ensiled and dried roots and vines. This indicated that farmers had the option of drying or ensiling roots or vines depending on weather and labor availability, and the growth efficiency would not be reduced as long as they combined the two.

Farmers expressed interest in investigating ways of processing peanut stems into a viable pig feed. Thus, a trial was designed to investigate the feeding value of peanut stems fermented with rice bran, corn meal, or cassava meal as additive, and the potential of replacing rice bran with peanut stems as an additive for sweetpotato root fermentation in order to reduce costs.



Fermenting peanut stems with rice bran, corn meal, or cassava meal did not enhance nutritional value of the stems. On the other hand, sweetpotato roots, when fermented with 15%, 30%, or 45% peanut stems, have higher pH (i.e., not as acidic) and crude protein levels than the roots fermented with an equal amount of sweetpotato vines. Moreover, it is more economically efficient because while peanut stems have little cash value, sweetpotato vines are commonly sold as pig feed and the values can be very high during the off season.

Scaling Up and M&E

Farmer-to-Farmer Training

After five years of work, farmers began adapting some or all of the technology to improve their pig production system. From the PTD stage in which a limited number of farmers were involved, the scaling-up strategy used a farmer-to-farmer training model. Three farmers (one from a local women's union, one from a veterans' association, and one from farmers' association) of each of the seven communes in seven provinces were invited for four days of farmer-trainer training. The project's long-term collaborators—two sweetpotato breeders, one veterinarian, and one pig nutritionist from various national research institutions and agricultural universities—provided the training.

These 21 farmer-trainers have since conducted training on various subjects, depending on the relevant season (e.g., training on sweetpotato cultivation at planting season and training on silage at harvest season), with limited assistance from the national collaborators. A second farmer-trainer training session has been planned for other districts to disseminate these technologies to additional farmers. These trainings provide farmers with a venue to present the results of their training activities and share their experience with the new trainers, and an opportunity to provide comments and feedback on the curriculum and training methods.

During these four days, the farmer-trainers received training in the following areas:

Content

- Sweetpotato varieties for pig feed and overall cultivation techniques, from planting material preparation to harvesting.
- Sweetpotato root and vine silage preparation.
- Balanced pig feeding and general nutrition management.
- Pig health and disease prevention, identification and treatment.

Method



- The national collaborators were asked to prepare a training guide for use by farmer-trainers in training other farmers.
- Each national collaborator followed his/her own training guide so that the farmer-trainers may learn how to use this guide in the future.

Monitoring and Evaluation Through Impact Study

An impact study has been designed, pretested and administered to monitor the process of the farmer-to-farmer training and to document the impact of these training activities based on six years of PTD. A total of 210 households were interviewed on the past and current patterns of crop production and utilization in relation to pig production to analyze the adoption behavior of the farmers.

Impact of Pig Feeding Trial

The pig feeding trial appeared very useful to the participant farmers. Their experiences in the feeding trial helped them to improve their pig raising practices and increase their income. Moreover, the trial became the means by which farmers gained access to technical support. Almost all of them (93%) adopted lessons from the trial.

Since pig raising is a major activity of nearly every household in Vietnam, the income derived from it is very important according to 93% of the participant farmers; this income was primarily spent for feeds. The income also allowed the households to buy furniture (80%), spend for housing (77%), finance production (63%), and provide for their children's needs (53%).

Most of the non-participant farmers heard about the trial from the participant farmers, whom they asked to train them in pig raising.

Both groups of farmer-respondents agreed that pigpens must be clean and only medium-sized. Moreover, they suggested that the results of the trials be disseminated through meetings, or directly to farmers.

Impact of Extension Meetings

The participant farmers found the extension meetings effective and very important to them. Expectations in these meetings included gaining knowledge and skills in pig raising to improve decision-making and participating in other activities. They felt the need for more information on fermentation, feed formulation and daily feed rationing, pig diseases management, and sweetpotato cultivation methods. On the other hand, non-participating farmers expressed willingness to attend extension meetings if invited. Most (73%) preferred morning meetings because of longer free time and better chances of good weather. Animal husbandry techniques and common disease management were considered as the most important aspects of pig raising; and hence, are the major topics of interest.

Technicians are perceived to be more knowledgeable, so that they are the preferred resource persons in these extension meetings. They felt that participant farmers can only provide very practical skills as resource persons. However, an extension worker-participating farmer training team is believed to be better because both good theory and practice will be available.

Overall Impact

The pig feeding trial has had a strong impact on animal husbandry, bringing about changes in the practices of both the participant farmers and the non-participant farmers. Such changes may be seen in the kind of feeds they use, ways of feeding, and in balancing of pig diet. Increased appreciation for other feed crops like corn, soybean, cassava and especially sweetpotato was also noted. Sweetpotato is particularly important because both its leaves and roots can be used as pigfeed.

The respondents claimed that the implementation of the pig feeding trial saved an average of 2.7-3.2 hours/day of their time. This savings in time became time made available for relaxation such as watching TV, as well as time to do other work. Thus, farmers' application of learning from the trial improved the efficiency of household pig raising. Correct feed rations resulted in higher monthly weight gain of pigs, leading to increase in income of both participant and non-participant farmers.

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Participatory Research and Development for Sustainable Agriculture and Natural Resource Management: A Sourcebook

From Concept to Impact:
Developing and Communicating Multipurpose Seed Drying Tables in Bangladesh



Bangladesh has recently become self-sufficient in rice, with a production of 39 million tons in 2001, an increase of about 40% over the past ten years (FAO, 2002). This has mainly been the result of the introduction of a new, irrigated cropping cycle during the dry season, and improvement of the existing rainfed one. The intensified cropping cycle has created a particular new problem: ***'how to properly dry seed during the rainy season?'***.

In Bangladesh, agriculture has been mechanized to some extent over the past years, however, engineers have paid little or no attention to issues like seed drying and storing. This is surprising because 95% of the rice seed is currently farmer-saved, hence, improved post-harvest technologies could directly benefit both household and national economies.

However, resource-poor farmers in developing countries are often bypassed in the technology generation process. This may, in part, be because an organized group which may communicate their needs to technology designers is lacking. It may also be that researches are not open-minded and willing enough to accommodate their suggestions. This is particularly problematic for the poorest people and when there exists no functioning platform for governmental institutes to regularly interact with non-government organizations (NGOs), communities or their institutions (Ashby, 1990).

This paper describes the experiences of the Seed Health Improvement Sub-Project (SHIP) in working with the Rural Development Academy (RDA) in Maria village, Bogra, Bangladesh. We discuss how learning-based approaches can improve the development and dissemination process of mechanical technologies, and ensure full ownership by its end-users. In this case, we illustrate the importance of building on local knowledge, experiences and experimentation, and the role of outsiders in facilitating the innovation adoption and adaptation process.

SHIP was initiated in 1999, under the Poverty Elimination Through Rice Research Assistance (PETRRA) project in Bangladesh. It is a collaborative effort between the Bangladesh Rice Research Institute (BRRI), the International Rice Research Institute (IRRI), CABI Bioscience (UK Center) and several government and non-government institutions. Since 2001, CABI Bioscience has provided training in participatory research and innovative extension methods.

Qualitative information on the technology (e.g., the origin of local innovative ideas, its use-flexibility, impact and expected durability) and quantitative measurements (e.g., size and cost of the drying tables) was obtained through informal household interviews and participatory community meetings.

Developing the Participatory Process

Participatory methods ought to be used in a creative and flexible way, and, if needed, in combination with other approaches, depending on the local circumstances. Otherwise, these methods risk of becoming yet another imposed, top-down approach to fulfil and satisfy one's agenda. Rather than giving a blueprint of how to develop a mechanical technology in a participatory way, we will pinpoint a few issues that need to be given due consideration.

An overview of the different steps involved in the development and dissemination of the technology is given in Table 1.

Table 1. The Seed Drying Technology Development and Dissemination Process

	Steps in the Process	Objectives
Diagnosis and Planning	Background information evaluation	Review existing information related to seed health. Define key sites for project intervention based on agro-ecological and/or socio-economic characteristics.
	Community meeting and mobilization	Introduce project staff, present project objectives and build rapport with target communities.
	Community information gathering	Assess farmers' knowledge, attitudes and practices in rice seed management.
	Participatory needs assessment	Assess needs and constraints of community with regard to improving seed health in function of social groups. Assess training needs of project staff with regard to facilitation and participatory methodologies. Plan staff training and community interventions.

Table 1. The Seed Drying Technology Development and Dissemination Process...
continued

	Steps in the Process	Objectives
Implementation	Participatory technology development workshop	Train project staff in facilitation and participatory technology development approaches.
	Meeting of village women	Introduce the concepts of ventilation and evaporation. Stimulate creative thinking in solving problems. Enhance project responsibility and ownership by women.
	Village households meeting	Develop criteria for good multipurpose drying tables. Stimulate discussion within and between households.
	Developing drying tables	Develop tables based on general criteria developed by the community and responding to specific household needs and limitations.
Feedback and Scaling-Up	Village picture exhibition	Create awareness among non-project staff. Get community feedback on strengths and weaknesses of tables. Develop pride and ownership among participants.
	Uptake pathways workshop	Evaluate performance of project staff and members. Expose and train project staff in developing innovative dissemination strategies. Develop scaling-up strategy for the technology.
	Going public	Expose innovator farmers to a new platform for marketing their skills. Get feedback from people from outside the village. Enthuse local officials to support farmer-to-farmer extension.
Scaling-Up	Video production	Assess most relevant knowledge gaps and adoption barriers. Understand key motivational factors of early adopters. Involve trained women in script research and video development.
	Communication fair	Distribute videos to a wide range of organizations. Enthuse government officials and national TV stations.
	Village video sessions	Reach a large number of resource-poor women.

Preparing the Ground

Before entering a community, a good understanding of the key issues and key players involved in seed health was required. The SHIP project has achieved this through a combination of activities such as literature review, expert interviews and multi-stakeholder workshops. Although RDA had hardly any contact with Maria village before the onset of the project, their close proximity has probably made both parties aware of the potential for future collaboration on other topics related to rural development. It has also helped create a relationship of mutual respect and understanding. Anticipated mutual benefits are one of the driving forces of the participatory process.

Research Relevance and Community Enthusiasm

A needs assessment through village group meetings and farmer workshops resulted in recommendations for participatory training, on-farm research, and participatory technology development. Seed drying in the rainy season was perceived as a major problem in all sites as drying has been traditionally done on the earthen floor, bamboo mats (*chatai*), dried cow dung or jute bags. The functional solution to this problem is the demand for improved seed drying. How to respond to this demand and to what extent men and women farmers are involved is both technology- and location-specific, but will by and large determine the adoption level of the technology.

Learning from past experiences, the project staff decided to focus activities on those topics identified by the communities as most relevant and for which a high potential for success and enthusiasm could be anticipated. Technologies should be accessible to resource-poor farmers, environment-friendly and gender-sensitive. The development of seed drying tables was obviously one of the options that could be explored, although at this stage the project was a bit reluctant to go in with a pre-designed model. It was decided to introduce the concept of drying through a learner-centred approach rather than a technology.

Back&Forth is a method developed in Bolivia in the 1990s through which mechanical tools are developed and redesigned in the laboratory and on-station after several Back and Forth visits to the community for comments (Bentley & Baker, 2002). Although intended to build on feedback from farmer communities, mechanical engineers working in the SHIP project developed a combustion dryer on-station, which uses rice bran as fuel and electricity to power the fan. Upon a first demonstration on-farm, farmers considered it too expensive and too difficult to keep track of the right temperature, and rejected this innovation. As many villages in Bangladesh do not have electricity yet, the project decided to introduce a different approach.

Designing, Developing and Validating the Technology

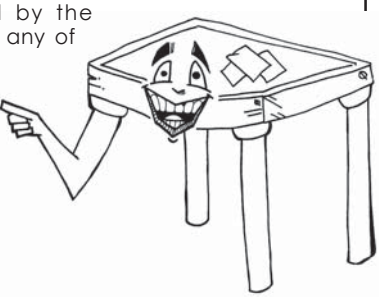
Because women in Bangladesh have the main responsibility for seed drying, a two-hour session with 30 women of Maria village was organized immediately after the needs assessment. The meeting was facilitated in the local language Bengali. A limited number of questions, embedded in real-world situations, were developed to stimulate the creative thinking process related to evaporation and ventilation. By the end of the session, women raised the idea themselves to develop drying tables. Both staff from RDA and the participating women felt empowered by this approach.

In the next session, both the women and their husbands were involved to stimulate household interaction. A matrix was established consisting of the major criteria for a good drying table (Table 2). This matrix with drawings made by the women, was transferred to an A4-sheet, photocopied and delivered to the households. It served as a guiding sheet for the design of drying tables, as such bringing back at the household level, the criteria developed and filtered by the community.

No incentives were offered in terms of materials or financial contributions. Each household was left free to decide whether the technology would be useful for them or not, and hence whether to make a table or not. In the next village meeting, nearly all 30 households had made a table of some sort, with some people already having some experience about the performance of their own design.

Table 2. Criteria for Drying Tables Developed by Maria Community Members

Criteria	Description
Seed drying	Drying should be possible in any season.
Portability	The table should be easy to move so that the women can always move the table to a place in their home yard where there is no shade.
Cost	The overall production cost should be kept to a minimum.
Material	Materials used should be locally available.
Height	The table should be high enough so that the seed is protected from chickens, toddlers and playing children, who often mix seed from different varieties. Proper height should also relieve (or prevent) back pain.
Size	It should be small enough to be moved easily by one or two people. The width is important; tables should be easily taken through the door of the house to be used for indoor purposes.
Strength	Opinions were divided for this criterion. Some people wanted strong and enduring tables, while others said that if it broke down after a year, that would be no problem, because they can always make a new and better one as long as it is cheap.
Multipurpose use	People also came up with clearly different ideas about what other functions the table should accommodate. Manual seed cleaning, threshing (which in Bogra has so far been done by beating the panicles on the earthen floor), drying other materials, household purposes, dining table and baby cot were all possibilities mentioned at this stage.
Slanting	This idea was actually introduced by the project staff, but was not retained in any of the designs.
Folding type	One household had very limited space and suggested a foldable table, which they could put on their roof whenever not in use.



Innovative Feedback Loops

Going Public...

"Going Public" is a method by which a two-way information flow is generated at an arena where people gather naturally, such as bus stops, crossroads or markets. In Bangladesh, people often gather briefly at crossroads for an informal chat; this setting was used by the project to get some extra feedback from other people living in or near the project village.

The weekly market, on the other hand, created opportunities to discuss with people from a wide range of villages within the district. Farmers trained during the project discussed the importance of proper seed drying as one of the components to improve seed health.

To share experiences with other people in the community, and because of the difficulty of bringing all these designs in one place, a village picture exhibition was organized to further spread the idea and raise local awareness. All tables were photographed with their respective owners and pictures displayed in a public space with a few live models. In this evaluation session, Participatory Rural Appraisal (PRA) tools were used, including matrix ranking and gender analysis to evaluate the strengths and weaknesses of the different designs. The picture exhibition provided a forum for the people to take a closer look at their own innovations, get community feedback and increase their pride.

Following the picture exhibition, "Going Public" exhibitions with different models of community-made drying tables were held at an important crossroads between two villages, and at a weekly open-air market or *hat*.

Capacity Building: A Continuous Process

The project adopted a process- and results-oriented approach rather than a technology-oriented one, necessitating the organization of a workshop on farmer participatory methods. The global concepts and methods had to be understood first, before each team could act locally in their own site.

Emphasis of Participatory Approaches

- generation of technologies through participatory variety selection, participatory technology development, etc.
- generation of knowledge through discovery-based learning approaches
- validation of on-station developed technologies through adaptive research
- validation of traditional knowledge and technologies either on-farm or on-station

The communication and facilitation skills of scientists, engineers and extension people involved in the SHIP project have been continuously upgraded. Capacity building was achieved through an iterative process of: communicative learning through community group discussions and experience sharing workshops with other project teams; and individual learning through frequent household interactions and constructive self-evaluation sessions following community activities.

The role of the master trainer or facilitator was to develop a judicious learning environment, provide appropriate learning tools and empower the project team to trigger both communicative and individual learning at the community level. Besides learning and facilitation, the institutional setting plays an important role in triggering change. The fact that the institutional setting was supportive of a participatory approach in the SHIP project further contributed to its success. To achieve this, the national project coordinator and high ranking officials of the

different partner institutions were involved in activities as much as possible, and stimulated to interact with the rural households throughout the project.

Adopting and Adapting the Innovation

From Concept to Innovation

As the project did not introduce a technology, but the concepts of evaporation and ventilation, the idea behind the technological innovation first entered people's minds. Several households quickly put the ideas into practice, and these innovators served as examples for the rest of the community. Within about two months, 2/3 of the participants had adopted the innovation (Figure 1).

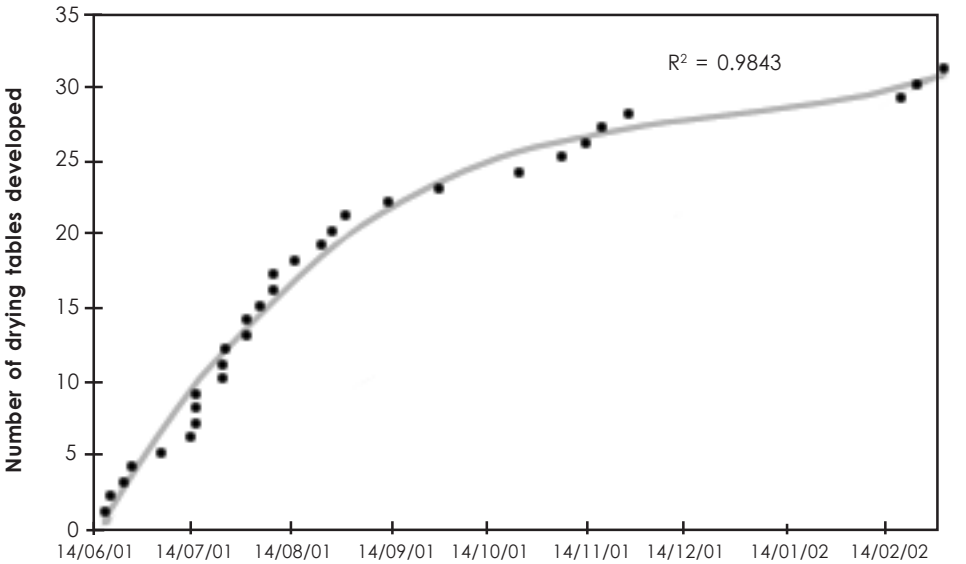


Figure 1. Trend Showing the Adoption Over Time of Multipurpose Drying Tables at Maria Village, Bangladesh (30 households)

The households adopted the idea first and only then did they apply a technology that fitted their financial limitations and personal household needs. Two clearly distinct ranges of designs evolved out of this process: light and heavy tables. The light tables can easily be used indoors and outdoors for keeping kitchen utensils and drying other food stuff such as rice flour, herbs and fish. On the other hand, the heavy tables are mainly used for drying and threshing the rice seed, and for relaxing on it. Due to the process-oriented approach, the project's initial focus on seed drying empowered households to tackle other constraints such as threshing. Creativity and necessity have turned these tables into multipurpose drying tables.

Gender Issues in the Design Process

Women, being generally smaller than men, raise the issue of gender compatibility in tool design (Jafry, 2001). In the SHIP project, even after we stressed the need for women involvement, still in 1/3 of the cases, they had not been involved in the designing process (Table 3).

Table 3. Contributors in Designing and Making Drying Tables, % of households (n=30)



	Designer			Maker		
	Farmer	Farmer + Wife	Farmer + Carpenter	Farmer	Farmer + Wife	Farmer + Carpenter
Heavy tables	35.7	64.3	-	-	42.9	57.1
Light tables	37.5	62.5	-	18.8	81.2	-
Total	36.6	63.4	-	10.0	63.3	26.7

Interestingly, most of those models were regarded by the women as either too high or too costly. Having discussed these issues during public meeting, men realized their mistake and contributed to better joint within-household decision-making about other issues from this moment onwards.

Farm Economics

For the development of the drying tables, every household calculated the total cost based on the actual cash costs such as materials bought or payment to carpenter, and an estimation of the costs of the materials they had at hand. When comparing the cost of the tables with other farm tools, the average price of a heavy table is about US$5, which is slightly higher than a knapsack sprayer or a plow, which not all farmers can afford to buy. The average cost for a light table, on the other hand, is only US$1, which equals the price of two to three jute bags, and is less expensive than a bucket, a water jar or a *motka* (clay pot), which most resource-poor farmers can afford.

Mothers and Fathers of Invention

If necessity is the mother of invention, its father is a new idea or a new piece of information (Bentley, 2000). Necessity was addressed from the early onset of the participatory technology development approach and partly contributed to the approach being taken up so smoothly and enthusiastically. It also explains how the introduction of a concept rather than a technology simultaneously triggered the community to address other constraints or necessities such as threshing.

This project also illustrates that Bentley's (2000) interesting idea can be expanded. Innovative ideas have been incorporated in the design of the drying tables, not only based on new information, but also on insights from previous exposures or experiences that suddenly became relevant in solving a problem (Table 4).

Table 4. Ingenious Ideas in Making Drying Tables Acquired Through Learning Activities

Innovation	Description
Binding structure	The way to bind different bamboo sticks together was borrowed from traditional roof binding technique.
Folding type	The household that made a folding table reported to have acquired this idea from a folding camp bed, which they had once seen being used by a 'rich man'.
Polythene socks	Table legs were given polythene socks to prevent the wood from rotting. This idea developed after associating table legs with human legs.
Food safety box cum table	One household integrated the innovation of a drying table with the existing idea of a box to keep food out of reach of animals such as rats.
Carum board	Carum is a traditional game played by two people who are standing around a square table. A separate surface can easily be placed on top of this game and as such be used to dry seed.
Polythene surface	A fertilizer bag is cut open and used as surface as this is easy to handle. When it suddenly starts raining, the polythene sheet can be easily taken inside.
Jute cloth surface	The project learning session on ventilation triggered the idea that if the wind could reach the seed at both sides, drying would be faster. A woman mentioned that a window screen would give good aeration, but as it was quite expensive, she used a jute cloth instead. To facilitate handling, she knitted two handles to the cloth.
Jute cloth on corrugated sheet	People know that roof tops made from corrugated steel become very hot. This triggered the idea that by using an old piece of corrugated sheet covered by a jute cloth, the seeds will dry faster, as the heat comes both from above and below.
Multi-layered drying surface	Triggered by the learning session and combined with the necessity due to a lack of sufficient drying space in their home yard, this farmer used multiple layers of drying sheets at intervals of about 0.2 m.
Clay pillars	People in Barisal use clay pillars to support a parboiling container, during which process the clay is baked. As bamboo is hardly available in this part of the country, people developed the idea to use these columns as support for a drying surface.

Measuring Impact

Although this paper mainly describes activities undertaken in Bogra, the project approach has resulted in more than 50 designs, all suited to local conditions.

- About 80% of women participants find it easier to manually clean their seed on the table, and all have fewer backaches. However, many found it straining for their eyes and back, as it was done on the floor. Ergonomic considerations should not only be limited to the technologies developed, but also to the project training activities undertaken.

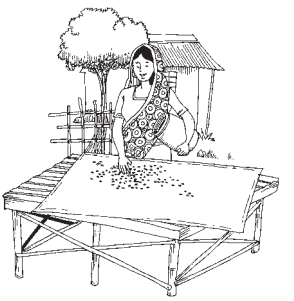
- Participating male farmers have increasingly appreciated the family approach. Rather than inhibiting women from participating, they now encourage their wives and daughters to attend project activities. Women also reported having gained more access to the household decision-making.

- All participants reported a significant improvement in seed purity as it is no longer mixed with inert material, or varieties. Many mentioned that seed actually dries faster on the table and agreed that their seed is more healthy, looks brighter and that seedlings are more vigorous.

- Drying seed on a table allows women to quickly bring their seed in the house when it suddenly starts to rain. People also feel they can now dry seed even if the floor is wet and there is no direct sunlight.

- Some farmers complained that the seed drying capacity of the light tables was limited to 10-20 kg, about the amount resource-poor farmers keep for storage. Some households who first made a light table have started to make heavy tables, whereas some who started off with heavy tables have seen the complementary benefits of the light table and now have both.

- All participants who had made a heavy table said it reduced labor requirements for threshing.



Scaling-Up Potential

One of the challenges of any participatory method lies in reaching a large number of people with the same quality approach. Feder *et al.* (1999) described scaling-up as one of the generic problems in extension which can be partly overcome through mobilizing other players in the extension process, empowering farmers and farmer organizations, decentralization and use of appropriate media.

Allen *et al.* (2001) stated that the use of linear approaches to extension are especially suitable for innovations developed primarily to increase productivity and/or reduce costs. Whereas a more collaborative approach between scientists, extension and end-user is needed if we wish to change people's behavior. To improve their thinking and decision-making skills in a dynamic environment, the learning has to be embedded in real-world situations.

Following this line of thinking, it should not pose any problems to promote multipurpose seed drying tables fairly easy and straightforward through linear extension. However, in the case of participatory technology development, with a strong focus on farmer empowerment and a decentralized approach, we believed that a hybrid between the linear transfer of technology and the learning tools and messages that triggered the innovation process would improve uptake.

Participatory principles were further incorporated in the scaling-up process. A new small-scale and low-budget project was developed to produce training videos with women from Maria village. Early results of our research indicate that learner-centered videos that incorporate specific elements of the participatory innovation development process trigger behavioral changes more cost-effectively than farmer-to-farmer extension.

So far, more than 700 copies of videos have been requested by and distributed to NGOs for use within their projects. The communication fair organized by

PETRRA in September 2003 was indispensable in bringing the video programs to the attention of extension service providers. In March 2004, the video team received an award for effective communication from the prestigious International Visual Communication Association in London (Van Mele *et al.,* 2005).

Conclusions

To improve rural people's problem-solving and decision-making skills in a dynamic environment, learning approaches have to be embedded in real-world situations. Our approach has merged participatory, learner-centered approaches with communication media to speed up the scaling-up process. Initial results look very promising. Especially for technologies that are not too knowledge-intensive, such as seed drying and storage, innovations can be disseminated in a cost-effective way when gender-sensitive, participatory approaches are used in both the production and dissemination process.

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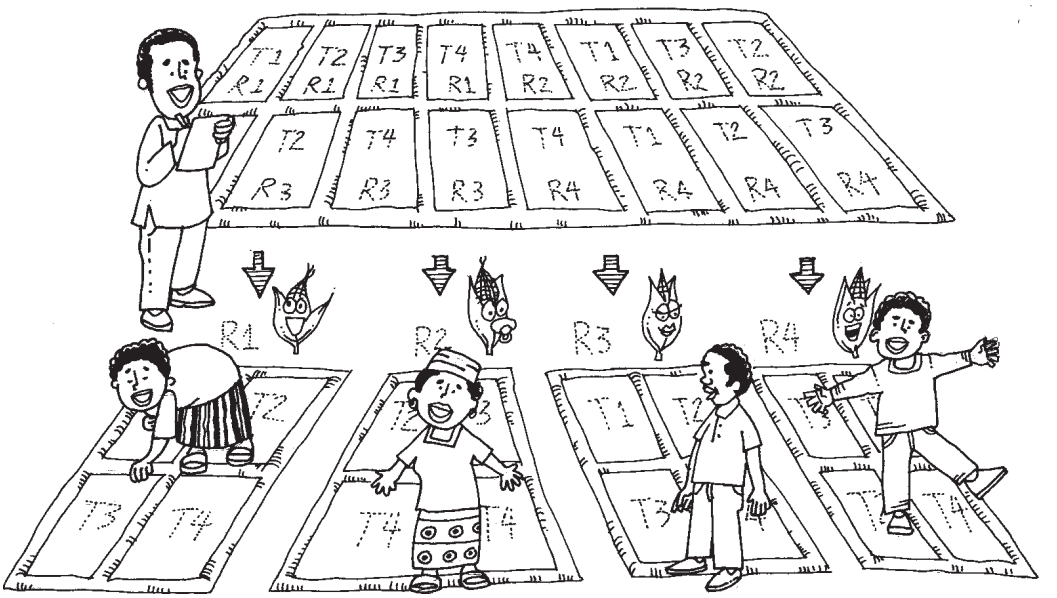
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Mother-Baby Trial Approach for Developing Soil, Water and Fertility Management Technologies



Smallholder farmers in sub-Saharan Africa face a severe soil fertility crisis. Surveys in Kenya, Malawi, Zambia and Zimbabwe consistently show high amount of soil nutrient deficiencies, caused by continuous cereal cultivation with limited use of fertility inputs. Fertilizer use is very low, particularly in semi-arid areas. Researchers have hypothesized that currently-available technologies are a poor fit with farmers' resource endowments, investment priorities and risk preferences. In such case, it is believed that Farmer Participatory Research (FPR) is needed to develop technologies that are better suited to smallholder conditions, and hence more easily adopted.

Many researchers now argue that virtually all research should involve farmer participation (Ashby *et al.*, 1987; Chambers *et al.*, 1989; Hagman *et al.*, 1998). But despite the proliferation of FPR research and methodological tools, **there has been little analysis on what kind of participatory research leads to what outcomes and why some methods are more successful than others.** Alternatively, if certain outcomes are desirable in a given situation, what kind of participatory research should be encouraged?

The mother-baby approach is an on-farm participatory mechanism to introduce and test a range of technology options suited to a heterogeneous community (Snapp, 2002). It involves three "levels" – mother trials, baby trials, and farmer experimentation (Figure 1). This trial design serves multiple functions: generating data on performance of alternative technologies; creating the basis for researcher-farmer dialogue to refine the options being tested; and encouraging farmer experimentation even in the absence of researchers. The approach is used to help characterize farmers' risk management strategies, target technology to specific groups (e.g., women farmers), and to provide lessons on how to broaden adoption.

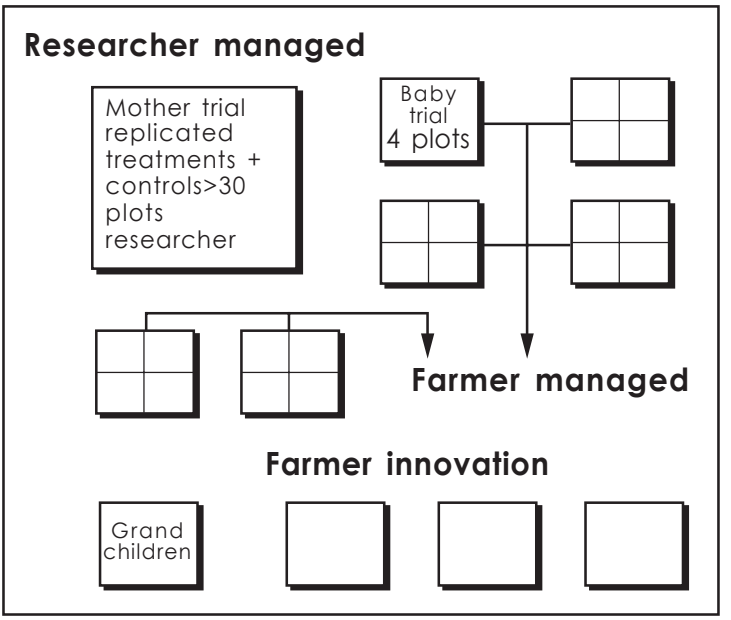


Figure 1. Typical Mother-Baby Trial Layout used in Malawi

Table 1. Levels of the Mother-Baby Trial Approach

Mother trials	Baby trials	Farmer experimentation
❑ researcher designedq ❑ researcher managed ❑ completely randomized with 2–4 replications/site ❑ designed to compare "best bet" technologies	❑ located around mother trials ❑ consist of a few treatments chosen from the mother trial ❑ unreplicated ❑ maybe managed by farmers or researchers ❑ allow farmers to see for themselves the performance of treatment at different trial sites ❑ allow for faster larger-scale testing at different locations under different management conditions	❑ farmers select and test technologies of their own choice ❑ they develop their own methods to experiment ❑ modify treatments when needed, share results with other farmers, and identify technologies that offer significant benefits

Mother-Baby Trials

The field project was implemented in collaboration with the national research and extension services, Bunda Agricultural College, Concern Universal, and the International Center for Maize and Wheat Improvement (CIMMYT). The trials were extended to Zimbabwe in collaboration with the national program, CIMMYT, TSBF, and the Intermediate Technology Development Group.

The International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) field tested the mother-baby participatory on-farm approach for developing low-cost soil, water and fertility management technologies suited to smallholder farmers in marginal areas. Rather than a single "ideal" technology, the mother-baby approach was used to test and promote a "basket" of options, to account for diversity in farming objectives, resource endowments, and tolerances for risk.

Using this approach, researcher-derived "best bet" technologies were evaluated in Malawi for four seasons.

The fieldwork was conducted in six case study areas: three each in Malawi and Zimbabwe, representing a diversity of conditions – in terms of agro-ecology (e.g., rainfall ranging from 400 to 1500 mm), population density, and marketing infrastructure. The soils are mostly sandy or sandy clay, easy to cultivate but inherently infertile, with low organic matter content, and deficient in nitrogen, phosphorus and sulfur.

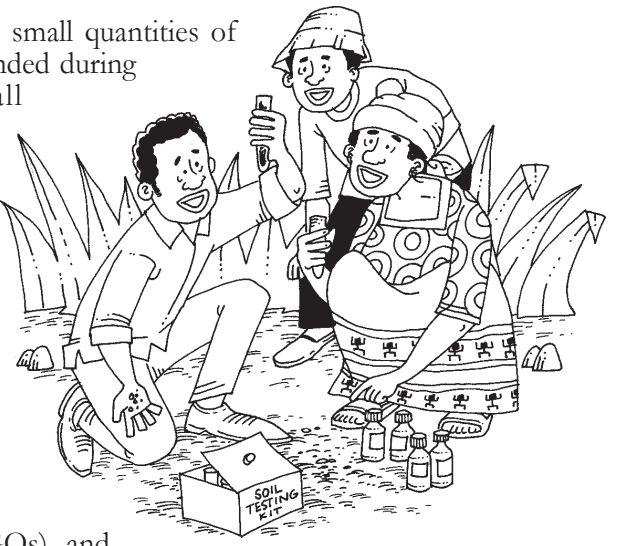
The average farmholdings in Malawi and Zimbabwe are 2 ha and 3.2 ha, respectively. Maize is the dominant crop. Maize is often intercropped with a variety of legumes and other crops. Some farmers also grow cash crops – tobacco and cotton in Malawi, sunflower and cotton in Zimbabwe. In the wetter areas, farmers produce marketable surpluses of maize and cash crops. In the drier areas, most households fail to produce grain surplus to their requirements, and earn the bulk of their cash income from livestock production and labor migration.

To achieve faster and greater impact, the mother-baby trial approach was combined with crop simulation modeling using the Agricultural Production Systems Simulator (APSIM) model. APSIM was used to formulate "best bet" options for on-farm testing. In turn, on-farm testing generated data for validating APSIM and for developing "what if" scenarios. Outcomes and risks were estimated for several important scenarios, and risk-return tradeoffs calculated for alternative soil, water and fertility management options. This allowed temporal comparisons of risks and returns from these technologies. The results were then used as a basis for discussion among stakeholders – farmers, extensionists, and private sector input suppliers – about scaling up.

Application of Mother-Baby Trials in the Field

Baseline crop management surveys were implemented to set research priorities and benchmark adoption rates for technologies targeted by the project. Researchers designed "best bet" soil fertility technology options, taking into account the different needs and resources of different farmers. This was based on findings of the baseline surveys and participatory rural appraisals.

Originally, the best-bets focused on small quantities of chemical fertilizer. These were expanded during experimentation to include small quantities of cattle and goat manure, manure-nitrogen fertilizer combinations, and maize-legume intercrops and rotations. Also tested were other technologies that complement fertility inputs, such as weeding, water harvesting techniques (modified-tied ridges, dead level contours, infiltration pits), and seed priming.



At the start of the project, researchers, extension and staff of non-government organizations (NGOs), and farmers were trained in FPR methods, as well as in simulation modeling. Over 600 trials were planted: 10 mother trials and 455 baby trials in Malawi (over four seasons), and 27 mother and 117 baby trials in Zimbabwe over two seasons. Trials were monitored by field enumerators, who visited host farmers periodically over the season, and recorded detailed observations on a standardized format. Soil samples were also collected and tested to monitor changes in soil fertility.

Field days were held at all six study areas. Host and non-host farmers visited trials as a group and compared them with their own experiences (baby trials and farmer experiments). Comparisons were made using farmer-derived criteria as well as standard ranking methods (matrix, pairwise and absolute rankings), and provided a better understanding of farmers' preferences and priorities.

Farmers were surveyed at the end of the season to collect data on farmers' individual rankings of the technologies, resource endowments, knowledge and understanding of trials and trial results, changes (if any) in farmer practice, and farm production. These data were used for assessing the risk-return tradeoffs of investments in the best-bet technologies relative to other investment options available to farmers. Researchers and extension agents were surveyed to assess changes in their practices, and record their perceptions of the mother-baby approach.



Outcomes of Applying Mother-Baby Trials

Based on the FPR conducted on mother-baby trials the following results were ascertained.

- **Mother-baby trial is a good communication and learning tool and generates swift results**.
  Farmer participation results in the generation of a broader range of technologies that are scientifically sound, practical, and adoptable, with significant potential for improving farming methods, yields, and household food security. The approach helps researchers establish a good understanding and mutual trust with farmers. Farmers give feedback on technologies that they find most useful (with very honest assessments), and even advise researchers how to improve their methods. Extension agents benefit from a better understanding of the criteria farmers use when making adoption decisions.

- **Spontaneous adoption begin during experimentation**.
  Farmers are encouraged to experiment, and gain the confidence to apply the new technologies not only on trial plots but on their main fields. Group experimentation, evaluation and decision-making result in faster learning compared to individual experimentation and assessment. Although households farm as individual families, technology adoption is often a group decision.

- **There is differential uptake of technologies, and gender is an important factor**.
  Male-headed households tend to adopt technologies that are labor intensive and land extensive (e.g., cereal-legume rotations and green manures). *De facto* female-headed households favor technologies that are cash-intensive and labor saving (e.g., hybrid seed and inorganic fertilizers). *De jure* female-headed households adopt technologies that are cash and labor saving (e.g., cereal-legume intercrops, and dead level contours that are constructed during the off-season).

- **The process by which farmers participate is important in identifying the most suitable technologies and disseminating them quickly.**
  If participation in trials (choice of host farmers) is based purely on who volunteers, this results in sampling bias and factor biasing of the technology options. The trials mostly benefit farmers who can afford to buy hybrid seeds and fertilizers; and have livestock, implements and carts to transport manure. In contrast, specifically targeting resource-poor households during selection of host farmers results in a broader set of technologies.

Lessons from Field Application of the Mother-Baby Approach

Field application of the mother-baby approach points out valuable lessons:

- Communication is the foundation of any successful participatory research endeavors.
- A through review of the literature and stakeholder analysis should be conducted initially as it will broaden the range of partners, technology options and participatory approaches considered.
- Facilitated discussions or role-playing and brainstorming are useful exercises in thinking through and defining the goals of the participatory research. This investment in partnership building will improve the design of the trials, and levels of engagement with different stakeholders.
- Choosing the most appropriate trial design will depend on the goals of the participatory research project. If generation of knowledge about biological processes is a primary goal, then researcher-led trials may be most appropriate. Frequently, this involves replicated 'mother trials'. Replicated across the landscape researcher-led 'baby trials' may be an overlooked opportunity for research on biological processes across different scales.



- Leadership of trials by farmers should be considered if empowerment of farmers to conduct experimentation and understanding of farmer decision making are major goals of the project.
- For either mother or baby trials, it is important to use trial designs and statistical analysis that document variability across sites. Variability is an opportunity to understand processes involved and to identify technologies that perform well across different environments.
- Across all trial designs, it is important to 'build in' a voice for farmers and other stakeholders in the research process. This can be through joint discussions of outputs, investing time and resources in forging farmer-researcher partnerships and through conducting surveys. Farmers provide unique insights into analysis and results. Identification of trade-offs and reasons for variation in performance can be the basis for new hypotheses.
- Documenting farmer assessment is critical to identifying promising new technologies and varieties.

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Conclusions and Recommendations

Five conclusions have emerged from these trials.

- A substantial amount of high quality data can be collected on-farm using mother-baby approach. The quality of data is often comparable to that from an on-station trial.

- The suitability of technologies to different households is empirically observable and can be used to predict adoption potential and target these technologies accurately in new areas.

- The approach encourages farmers to experiment, and they rapidly gain the experience and confidence to use the technologies in their main fields.

- Farmers conduct adaptive research that can be used for moving from process research at the plot level to analysis at the whole-farm, landscape and watershed levels in order to define adoption boundaries and scale out technologies.

- Mother-baby approach leads to joint researcher-extension learning, feedback, and changes in practice by both groups. This helps improve the efficiency of research and extension, improves accountability, and produces greater impact.

Mother-baby trial approach, initially tested for fertility management technologies, has now been adapted for variety evaluation as well. CIMMYT's Southern African Drought and Low Soil Fertility Project uses the approach to test maize varieties under researcher-managed (mother) and farmer-managed (baby) conditions. Mother-baby design is particularly useful for technologies that are easily copied and can be spread through spontaneous farmer-to-farmer exchange but are currently limited by sociological and cultural factors such as witchcraft and grant systems of exchange.

Three recommendations are made for further adaptation.

- Adapt mother-baby trial approach for better targeting of best bet technologies. There is a need to move from plot level to whole-farm, landscape, and watershed scales of analyses; and link crop simulation, household survey data, mathematical optimization methods, and geographic information system (GIS) to define adoption domains. Mother-baby methodology needs to be adapted to analyze the average treatment effects of technologies when there is self-selection among host farmers and plots and substantial heterogeneity.



- Adapt the mother-baby trial design for group-based adaptive work for making the transition from research to dissemination through Farmer Field Schools (FFS). The FFS experiment plots can be designed as the mother trial and farmers' individual trial plots as babies.

- Adapt the mother-baby trial approach for shifting the focus of extension from moving individual components (e.g., soil conservation, tillage, soil fertility management) to integration of several components. Mother-baby trial approach needs to be adapted to develop ways of presenting to farmers the interaction between different technology components in order to accelerate adoption.

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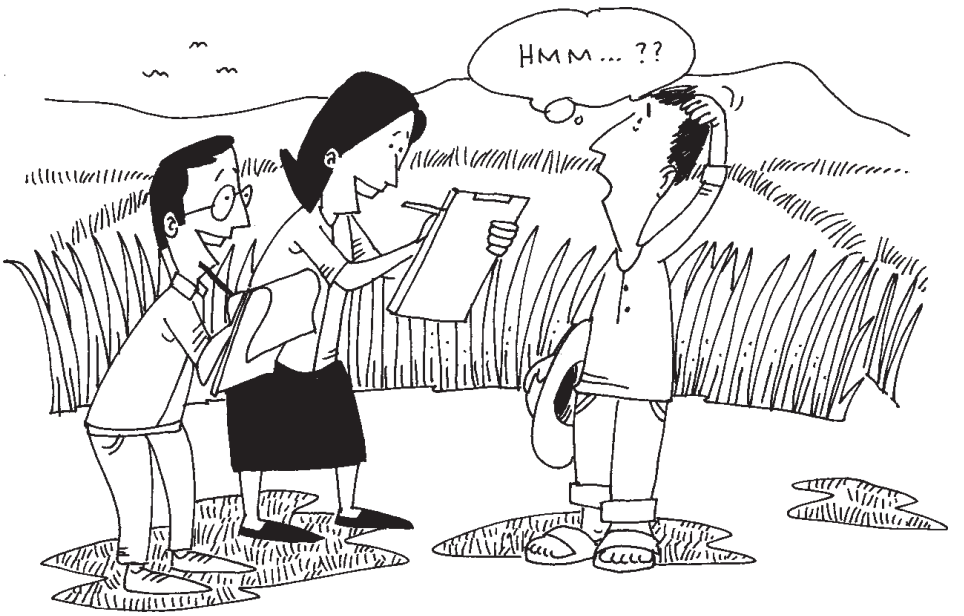
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Analyzing Data from Participatory On-Farm Trials: Research and Participation



Participation and the systematic collection, analysis, and interpretation of data are not contradictory activities. Among some practitioners there is a belief that adoption of a participatory paradigm removes the need, or even makes it impossible, for researchers to collect and analyze data. The purpose of participation is seen as empowerment of local people, which is inconsistent with researchers conducting activities that meet their own objectives. However, many researchers recognize that broad conclusions of relevance beyond the immediate participants are still necessary, and that a part of this research must be the collection and interpretation of data.

A participatory approach, however, has implications for the collection, analysis and presentation of data. Data from on-farm trials take many forms, from crop yields measured on individual plots to the reported consensus of participants at a group meeting. Data collection is done using qualitative and quantitative methods and by different individual and groups of people. Data analysis can also be for, and to some extent by, different participants, each of whom have their own interests and objectives.

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Data for Whom

In the case of participatory crop breeding trials, participants include farmers, researchers, extension staff, consumers, traders and regional planners. While a farmer is interested in making decisions about varieties to select for his/her farm, a regional planner might be interested in average performances, and a researcher's interest is to get heterogeneous responses. Each requires a different type of analysis. As researchers are often also the facilitators of the whole process, it is their responsibility to ensure that each participant has the data they need in a useful format.

Why should researchers make data and results available to farmers?

- ❑ Farmers are supposed to be beneficiaries of the activities and can only benefit if information is given back to them.
- ❑ Giving farmers results is an act of courtesy as they have made the research possible through their involvement.
- ❑ Farmers can provide considerable insight into the analysis and results. It is very common to hear the complaint that data from on-farm trials are very variable. This variation is a reality, and understanding its causes should be an objective of the research. Such an understanding eventually leads to improved farmer decision making. Farmers understand some of the reasons for the variation, and their insights often provide a framework or hypotheses for analysis.

Approaches to Data Analysis

When researchers conduct classical, on-station experiments, the analysis often follow a standard pattern (e.g., analysis of variance followed by tabulation of means and application of "means separation procedures"). Often, little attention is paid to exploratory analysis, designed to detect the main patterns and surprising observations. Very minimal effort is made at creative presentation of results.

When participatory approaches gained popularity, analysts made attempts to find interesting and informative ways to present data, but they tended to forget formal analysis, and, at times reached invalid conclusions.

The two approaches to data analysis are both needed in on-farm research as they reinforce each other. Graphical and exploratory methods show the important results and reveal odd observations and unexpected patterns. Formal methods, on the other hand, allow measures of precision to be attached to results and allow extraction of estimates from complex data structures. Neither the exploratory nor the formal approach is better—both are needed to satisfy different roles.

Presentation and analysis, however, are not the same. The method of presenting results depends on the nature of the results, the story they tell, and the audience. The general steps in data analysis are shown on the next page. Iteration between the steps is necessary. Training materials by Coe *et al.* (2001) provide more information about analysis of experiments.

Formal Statistical Analysis

A formal approach, similar to that commonly conducted, for example, on crop yields measured in a classical trial using analysis of variance and reporting variety

means, has a role in the analysis of some participatory trials. Any set of data comprising multiple observations that are not identical require statistical analysis to summarize the common patterns. Without formal analysis, it is difficult to see how the research activity can generate information relevant to anyone other than the small number of farmers directly involved.

Formal statistical analysis aims to improve the estimates and to provide measures of precision, i.e., standard errors and confidence intervals. This is the role of analysis of variance and associated procedures in "regular" designs. The choice of appropriate methods depends on: the objectives of the analysis; the design (who compared what treatments or varieties under which conditions); and the type of measurements taken.

Steps In Analyzing Data Set

- ❑ **Define clear analysis objectives.** Often, key graphs and tables can be defined at this stage, even without the results with which to fill them in.
- ❑ **Prepare the data.** Data sets have to be entered and checked, suitable transformations made (e.g., to dryweight per unit area), relevant information from different sources (e.g., farm household data and plot level yields) extracted to the same file, and so on.
- ❑ **Exploratory and descriptive analysis.** The aim is to summarize the main patterns and notice further patterns that may be relevant.
- ❑ **Formal statistical analysis.** The aim is to add measures of precision and provide estimates from complex situations.
- ❑ **Interpretation and presentation.** This includes merging qualitative information from farmers with the numerical results.

Data and Analysis Types

The nature of the response variable is one factor which determines the type of analysis to be conducted, whether formal or informal. It is therefore important to understand exactly the data collection and what the numbers represent.

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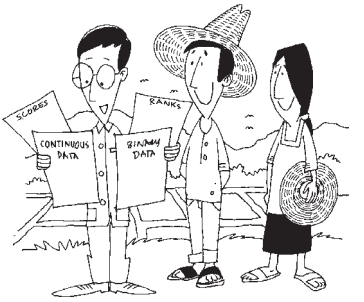
Quantities such as crop yield can be measured on a continuous scale, e.g., in kg/m^2. The numbers have the property that "2 really is the average of 1 and 3", making many common statistical procedures appropriate. Such quantities may be on a "ratio" or "interval" scale, the difference depending on whether the scale has a real zero. For example, a yield of 1 t/ha is 50% of a 2 t/ha yield, but a temperature of 10°C is not 50% of 20°C, as the zero for temperature is arbitrary.

Scores or Rating

Scores or rating refer to data recorded on a scale from "poor" to "excellent", or "less than enough" to "more than enough". The categories used are often given numerical labels, such as 1, 2, 3, 4, 5. These are called scores or ratings and such a scale is also described as ordered categorical. The labels are arbitrary. An observation of 3 is higher than an observation of 2, but we cannot say that it is better by the same amount that an observation of 5 is better than 4. An analysis would ideally use the ordering in the data without using the actual numerical label to ensure that the results are the same regardless of which labels are used.

Binary

Data recorded with just two categories are common, e.g., "yes" or "no", "dead" or "alive", "acceptable" or "not acceptable". Analysis is based on the frequency with which the categories occur.



Ranks

In many investigations of preference, data are collected by asking respondents to rank alternatives. The options available are placed in order without any attempt to describe how much one differs from another or whether any of the alternatives are, for example, good or acceptable. We might have variety A ranked above B, which is ranked above C, yet none of the three are considered good. The data would look the same in the case where a respondent placed them in the same order, but one, two, or all three were acceptable.

Analysis of Data in Participatory Research and Development

Researchers conducting participatory on-farm trials, particularly variety selection trials, often have difficulty analyzing the results. The difficulties include:

- The experimental designs used are often irregular in layout due to farmer participation (e.g., in choosing which varieties to test on their farms) or constraints arising from trials being located in farmers' fields.

- The focus of analysis often shifts from overall varietal selection or technology assessment to understanding the variation across farms. This is genotype x environment interaction (GEI), where the E may include social or economic variables in addition to biophysical environments.

- Much of the quantitative data collected may be ratings and rankings, for which the more usual methods of analysis may not be appropriate.

Many researchers report that participatory on-farm trials give highly variable results, making interpretation difficult. Certainly, if a standard analysis aimed at identifying differences in variety means is conducted, the result may well be a very high residual variation with correspondingly large standard error of variety differences, implying only vague knowledge about the relative performance of the entries. However, the variation can often be understood as GEI.

The environment in which a participatory trial takes place is heterogeneous. There are many sources of hidden variation, including social or economic factors, as well as the more usual biophysical definitions of environment. For example, male and female farmers may assess varieties differently, or ratings may depend on the level of market integration of a farmer. The analysis must therefore be able to identify and describe these GEIs. When this occurs, the results are often the most useful output of the trial because they allow recommendations to be adjusted to particular local conditions.

Alternative Analytical Methods

The problems associated with participatory research data suggest that some of the standard tools based on analysis of variance or regression are not appropriate. However, some simple extensions that use the same underlying principles can be used to facilitate insightful analysis of data from these studies.

Linear models allow to disentangle the effects of treatments and covariates, including understanding some GEI. Mixed effects models and the REML (residual maximum likelihood) method allow for multiple levels of variation, such as within farms, between farms and between villages. Generalized linear models can be used to describe variables on scales other than continuous. Together, these provide a powerful set of tools.

The most useful analysis is often one that concentrates on finding explanation for variation in treatment effects across farms. One approach is to analyze these data by calculating treatment contrasts or differences on each farm. Regression methods can then be used to identify factors associated with variation in the differences. This can simplify many complex problems and lead to new insights into the data; however, it can be inefficient or too repetitive if there are many treatments. Another approach is to use regression models or their equivalent with multiple error terms. This allows many designs to be analyzed within a common framework; however, the analysis can be opaque and estimates non-intuitive. These methods are not new. Descriptions can be found in numerous publications including Kempton and Fox (1997) and Hildebrand and Russell (1998).

Farmer Involvement in Data Analysis

Farmer involvement in the interpretation and analysis of trials helps in two ways: it puts the information in context and provides useful explanations of the results. Farmer focus groups can be used as venue to present and discuss results. An important question is how to present the results, particularly when the trials are very extensive and located over a large area. This may require the involvement of local extension workers and simple representation of results for analysis.

It is also very important that farmers understand the purpose of the trial and what is being assessed - some sort of training may be required. Lack of understanding may lead to the generation of inaccurate or unimportant information. Worse, it may lead to inappropriate actions by farmers which may invalidate the experiment, for example, by spraying one plant to protect it, when the purpose of the experiment is to assess the resistance of two varieties to a pest or pathogen.

Farmers can also provide insight into reasons for the variations in results, which may help to direct formal analysis. For example, if farmers identify that some of the low yields come from plots known to be infertile, some measures of fertility should be built into the formal analysis. Farmers may also be able to tell you something about the trade-offs between different assessment criteria, for example, expressing satisfaction with a variety that is not the highest yielding, but has some other desirable property. The data may need converting to units that farmers can use and understand.

Computer Softwares

A spreadsheet package such as Excel is good for much of the descriptive analysis. Its flexible facilities for data selection and transformation, tabulation, and graphics are useful. However, dedicated statistical software is needed for the analyses described above - they cannot be done in Excel. There are several packages with almost equivalent facilities. Genstat (2000) is one of the most convenient and easiest to understand, particularly as methods for different problems can be addressed with a similar set of commands. The key commands used for each analysis are included in the text with their output. SPSS is widely used by social scientists but is not particularly useful for the analyses described above.

Unfortunately, many of the available statistical analysis programs are expensive, although countrywide licensing may be possible. It is important to assist the national programs in accessing affordable softwares. Further training on the use of the software may also be required. A version of Genstat has been made available free for users in Africa – see details in the references section.

Finally

It is true that analysis of data from participatory trials may be more complex than from trials designed completely by researchers. But that is not a reason for not doing it! Many simple methods, based on tabulating and graphing summaries, can be very insightful. When you need something more, which is beyond your own experience, get some help. Statisticians or biometricians with skills in this area are attached to many instutions.

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Participatory Research and Development for Sustainable Agriculture and Natural Resource Management: A Sourcebook

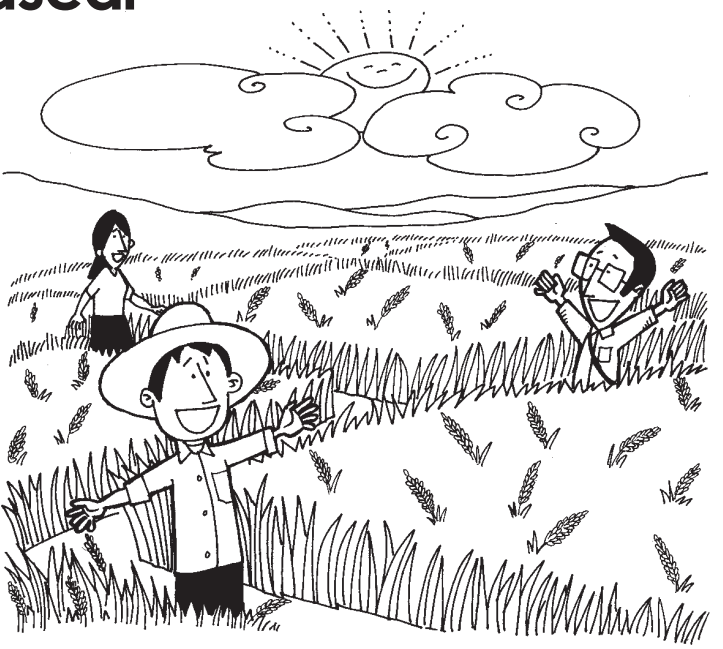
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Strengthening Local Organizations



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Development of the System of Rice Intensification in Madagascar



The development of the System of Rice Intensification (SRI) 20 years ago in Madagascar by Fr. Henri de Laulanié, S.J. -- based on 20 years of working with farmers to improve their rice production without dependence on external inputs -- is a most unusual case. It is unusual partly because SRI is one of the most remarkable agricultural innovations of the last century. It is also unusual because of the resistance, sometimes vehement, that it has encountered from the scientific community despite the evident benefits that it offered particularly for poor farmers and for the environment: doubling yields or even more without requiring the use of fertilizer or other chemical inputs, and using less water.

This case demonstrates a lesson for scientists, extension personnel and farmers -- for all to be open to new ideas, no matter what their source. Not every proposed change in agricultural practices warrants much attention; but if a possible innovation would have many benefits, it should be subjected to empirical rather than logical tests, because our scientific knowledge is not (and never will be) perfect or complete. In the SRI case, a paradigm shift was involved, one that is not yet fully understood and certainly not universally accepted. Typical positivist approaches for testing and validating new knowledge were not applicable because larger issues were at stake, issues that are not amenable to either proof or disproof just by hypothesis testing.

The case is instructive as it goes against the now popular view that farmer knowledge, being based on generations of trial-and-error and subsequent validation, is a superior source of information and provides insights about how

to practice agriculture. SRI changes dramatically the practices that farmers growing irrigated rice have used for centuries. Part of the resistance came from the innovation's being so counter-intuitive: where smaller would become bigger, and less could produce more. This sounds like nonsense; but it is possible and true.

The Challenge

When Henri de Laulanié was assigned by the Jesuit order to move from France to Madagascar in 1961, the first thing he saw around him was the great poverty and hunger of most of the people, one of the poorest populations in the world. He also saw their deteriorating natural resource base, with drastic soil erosion and accelerating deforestation, these two processes being connected.

Laulanié concluded that raising the yields of rice, the staple food providing more than half of the daily calories of Malagasy households, was the greatest contribution he could make to the well-being of the people around him. It was also essential if continuing destruction of the precious tropical rainforest ecosystems was to be halted.

Laulanié had a degree in agriculture from the best university in France (now known as Paris-Grignon) before entering the seminary in 1941, so he knew basic agricultural science if not much about tropical rice. There were few scientific resources to draw on in post-colonial Madagascar, in libraries or in research institutes, so he started working directly with farmers, carefully observing their practices, asking questions, trying things out on his own paddy plot.

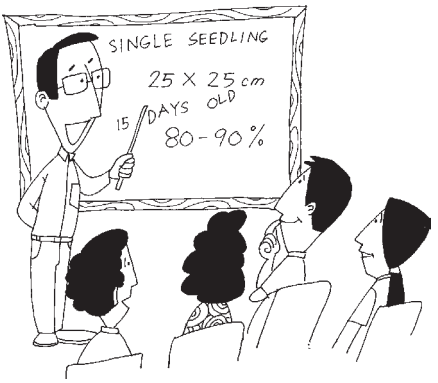
Assembling the Innovation

Laulanié found a few farmers not transplanting rice seedlings in clumps of three, four, five or more, as farmers all around the world choose to do. Instead, these farmers planted individual seedlings having found that single seedlings produced as well or better than clumps of plants. Also, this way they could reduce their seed costs, a consideration for very poor farmers. So he tried this himself, and found it was a good practice.

Then, in another area he observed some farmers not keeping their paddy fields continuously flooded throughout the season, as is done around the world wherever farmers have access to enough water. It is widely believed that rice plants fare best in saturated soil. But Laulanié found that they could grow even better if raised in soil that is kept moist but never continuously flooded. While rice plants could survive under flooded conditions, they did not thrive.

Having started to grow single seedlings in unflooded soil during their period of vegetative growth (after panicle initiation, he kept a thin layer of water, 1-2 cm, on the field), Laulanié next introduced a practice of his own. The government was promoting use of a simple mechanical hand weeder known as the 'rotating hoe' (*houe rotative*). This churned up the soil with small toothed wheels, burying weeds in the soil to decompose. It also aerated the soil in the process, though nobody considered this a benefit at the time.

Laulanié decided to try planting seedlings in a square pattern, rather than in the rows being promoted by rice specialists. This way he could use the weeder in two directions, i.e., perpendicularly. He tried this with 25x25 cm spacing just to see what would happen. To his pleasant surprise, widely-spaced rice plants, growing singly in moist but not flooded soil, did better than others grown with the common practices.



At this point, the priest established a small school in Antsirabe to teach young farmers these new methods and to give them a basic education that prepared them for life rather than for further studies and white-collar employment. In 1983-84, a fortuitous accident occurred. Two weeks after planting the rice nursery, Laulanié had second thoughts and decided that they might need more seedlings for the field, so more were planted for what looked likely to be a water-short season.

A good rain fell when the first set of seedlings was 30 days old. Because they were not sure whether any more good rain would follow, the teacher and his students decided to transplant all of the seedlings into their rice field, the tiny ones only 15 days old as well. They had few hopes or expectations for the spindly younger seedlings. Yet after a month, these began to surpass the older ones, and by the end of the season, their yield was much higher (Laulanié, 1993).

Rather than pass this off as a fluke, the next year younger seedlings were planted again, and then even younger seedlings. By the end of the decade, it was clear to everyone at the school and to the farmers who visited them that using younger seedlings gave much better results, provided that they were planted singly and far apart, in a square pattern (even up to 50x50 cm when the soil quality had been built up by these practices) in soil that was both well aerated and moist during the plants' growth period. They did not know about research showing that when rice plants are kept continuously flooded, up to 78% of their roots degenerate under conditions where the soil lacks oxygen (Kar *et al.*, 1974). The negative effect of continuous soil saturation on roots' growth and functioning was being overlooked by both scientists and farmers alike.

SRI was developed initially with the use of chemical fertilizers, because everyone believed that this was necessary to increase yields, especially on Madagascar soils where most of which were very 'poor' as evaluated by standard chemical tests. When the government removed its subsidies for fertilizer in the late 1980s, and poor farmers could no longer afford to use it, Laulanié and his students began working with compost. In most instances, this gave even better rice yields when used with the other practices.

Proceeding with the Innovation

In 1990, Laulanié and several of his close Malagasy friends established a non-government organization (NGO), Association Tefy Saina, to promote SRI and rural development. The NGO name means "to improve the mind in Malagasy",

(as they saw SRI as not just a means to improve rice production and meet food and income needs). It was thought that SRI's spectacular results could open farmers' minds to further innovation beyond rice cultivation because improvements came from changing practices that had been used for generations by farmers' ancestors, venerated in traditional culture and beliefs. For the priest and his friends, human development and spiritual growth were considered more important than agricultural improvement alone.

In part, because SRI was not seen and treated in narrowly technical terms, it was scoffed at and rejected by Malagasy and international scientists who learned about it, though a few European NGOs gave Tefy Saina some small grants for training in the early 1990s. In 1994, the Cornell International Institute for Food, Agriculture and Development (CIIFAD) began working with Tefy Saina to introduce SRI to farmers in the peripheral zone around Ranomafana National Park under a project funded by the United States Agency for International Development (USAID). This was one of the last remaining large blocks of rainforest, under serious threat from the slash-and-burn cultivation of upland rice.

Farmers around Ranomafana were getting lowland rice yields of only 2 t/ha from their small irrigated areas. To feed their families, they needed to practice upland cultivation. Raising lowland yields was thus seen as a requirement for saving the rainforest, as well as for reducing poverty. In 1994-95, only 38 farmers would try the new methods, which changed four things that had been done from time immemorial in Madagascar, and in most other rice-growing countries:

- Instead of planting seedlings 30-60 days old, tiny seedlings less than 15 days old were planted.

- Instead of planting 3-5 or more seedlings in clumps, single seedlings were planted.

- Instead of close, dense planting, with seed rates of 50-100 kg/ha, plants were set out (carefully and gently) in a square pattern, 25x25cm or even wider if the soil was very good; the seed rate was reduced by 80-90%, netting farmers as much as 100 kg/ha of rice.

- Instead of keeping rice paddies continuously flooded, only a minimum of water was applied daily to keep the soil moist, not always saturated; fields were allowed to dry out several times to the cracking point during the growing period, with much less total use of water.

Why hadn't farmers tried these new practices before? All looked very risky, and even a little crazy. Why should tiny young plants perform better than larger ones? Why should fewer plants give more yield than more plants? Why should plants not be kept flooded if water was available? Water was thought to be like fertilizer, and rice was regarded as a water-loving plant. The chance that a farmer would ever try *all four of these practices together*, and risk the scorn of his neighbors as well as the wrath of his ancestors, was unthinkable.

The farmers around Ranomafana who used SRI in 1994-95 averaged over 8 t/ha, more than four times their previous yield, and some farmers reached 12 t/ha and

one even got 14 t/ha. The next year and the following year, the average remained over 8 t/ha, and a few farmers even reached 16 t/ha, beyond what scientists considered to be 'the biological maximum' for rice. But this has been calculated based on rice plants that had degenerated and truncated root systems.

Understanding the Innovation

How could such remarkable results be obtained? There is demonstrable *synergy* among these practices, when used together, especially when the rotating hoe is used to control weeds — and aerate the soil frequently during the growth period. This has been documented by replicated multi-factorial trials (N=288 and N=240) in contrasting agroecological situations: tropical climate, poor sandy soils at sea level vs. temperate climate, better clay and loam soils at high elevation. These trials showed that when compost is added to the soil, increasing soil organic matter and nourishing soil microorganisms beyond what the plants' own root exudates, large increases, even a tripling in yield, can result. On poorer loam soil, SRI practices gave 6.39 t/ha compared to 2.04 t/ha with standard practice (mature seedlings, close spacing, continuous flooding, NPK fertilizer). On better clay soils, yields went from 3.0 with standard methods to 10.35 t/ha with SRI (Randriamiharisoa and Uphoff, 2002).

With SRI methods, one could see after the first month a much greater number of tillers, 30-50 per plant, with some plants producing even 80-100 tillers. If one pulled up SRI plants, one could see that they had much larger and deeper root systems. A pull test to measure the resistance that plant root systems give to uprooting found that it took 5-6 times more force (kg/plant) to do this for SRI plants. Having more roots can support more tiller growth and more grain filling, while plants having a larger canopy with more photosynthesis can support more root growth and root exudation benefiting soil microbes.

Scientifically, the most interesting phenotypic change was in the relationship between number of tillers/plant and number of grains/tiller (panicle). For SRI plants, this correlation was *positive* rather than *negative*, as is widely reported in the literature. With a larger root system, SRI plants can access both more soil nutrients, right through the ripening stage with less plant senescence (aging), and a wider variety of nutrients, including micronutrients not provided by NPK fertilizer. SRI methods contribute to more grain production and also to a lower percentage of unfilled grains and to higher grain weight.

SRI achieves higher yields, sometime over 20 t/ha when soil conditions are optimal. It does not follow the two strategies that produced the gains of the Green Revolution: (a) **changed and increased genetic potential**, and (b) **use of external inputs** — more fertilizer, more water, more agrochemicals. SRI was hard at first to understand because it took such a different path.

Instead, SRI changes prevalent practices for plant, soil, water and nutrient management so as to: (a) **increase plant root growth and functioning**, and (b) **enhance the abundance and diversity of soil biota**, ranging from microorganisms (bacteria and fungi) through micro and meso-fauna (nematodes and protozoa) to macro fauna (particularly earthworms).

Spread of the Innovation

This case study cannot go more into the mechanisms and processes, which are still only partially documented and understood, but they are increasingly validated by SRI use in a growing number of countries around the world (see Stoop *et al.*, 2002, and Uphoff, 2003). Good SRI results have now been reported from countries ranging from China, through Indonesia, Philippines, Cambodia, Laos, Thailand, Vietnam and Myanmar, to Bangladesh, Sri Lanka, Nepal and India, to Madagascar, Benin, Gambia, Guinea, Senegal and Sierra Leone, and now to Cuba and Peru.

The methods raise, concurrently, the productivity of land, labor, capital and water, without tradeoffs, something never seen before. SRI practices achieve different and more productive *phenotypes* from any genotype of rice by providing a better growing environment in which the plant could express its genetic potential. SRI is best understood as part of a growing movement in the agricultural sector toward what could be characterized as *agroecological innovation* (Uphoff, 2002).

This strategy seeks to capitalize on *synergies* among species and organisms when these are provided with optimum growing conditions. Conventional agricultural practices, favoring monoculture, seek to maximize production of single species, one at a time, taking them out of the context of their natural environments, changing that environment by plowing, fertilization, irrigation, etc.

Lessons and Insights

What can be learned from this experience about participatory research and development (PR&D)?

- We cannot assume that current farmer practices are always ideal or the best. They have been developed under certain conditions, constrained by knowledge and imagination as well as biophysical factors. Farmer knowledge is a good place to start, and should always be respected. But it should not be idealized. It was just a few 'deviant' farmers who contributed some of the novel ideas that made SRI possible.

- We should work closely with farmers in the development of any agricultural innovation. Fr. de Laulanié had a great and self-evident love for rural people, demonstrated throughout his 34 years living among them in Madagascar. He was devoted to helping them improve their productivity and welfare. He avidly learned from them. But he also formed his own opinions, always subjecting practices and ideas to empirical tests.

- Scientists should avoid becoming prisoners of their present knowledge and captives of prevailing paradigms. Paradigms are needed to make sense of the world and to be able to act upon it. But they are constructs made by human beings, not true in themselves. Theory is necessary to organize knowledge and to test it, but the ultimate tests are always empirical, not logical. While quantum physics is the most powerful body of scientific theory in the world today, its strength lies not in its logic--it is quite illogical in many ways--but in its repeated verification by empirical results.

- There has been a lot of effort going into systematizing the processes of participatory research and development, e.g., through participatory action research and participatory rural appraisal (PRA). As recent reflections on PRA show, it is important not to let techniques and processes become rigidified and routinized because then means become ends in themselves (Cornwall and Pratt, 2003). Fr. de Laulanié worked with great originality and dedication. He had respect for science, having been trained in it, but particularly for farmers and for empirical truth. He improvized the whole process by which SRI was developed.

If Father de Laulanié had been guided (and constrained) by a lot of preconceptions, it is unlikely that he could have discovered anything as unique and powerful as SRI, breaking with ages-old practices to 'liberate' genetic potentials that have existed in rice plants for millennia. We must never let form triumph over substance or let methodology foreshorten our vision and imagination.

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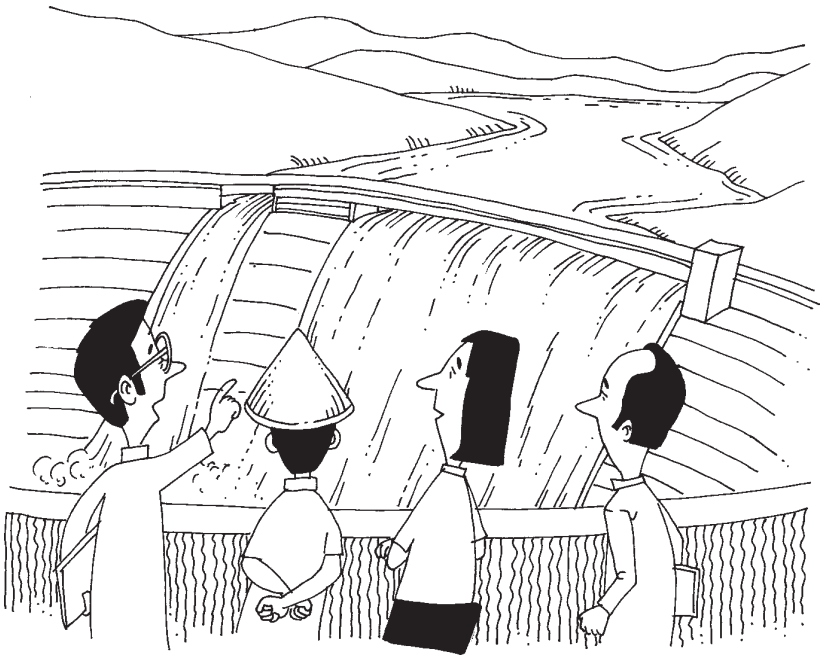
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Community-Based Sustainable Environment Management Planning: Kudnamsai Water Quality Monitoring

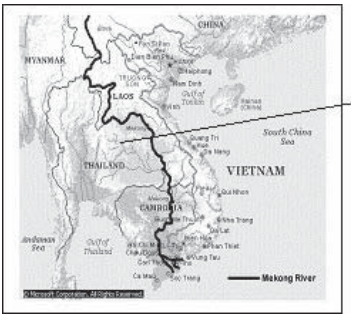


Kudnamsai is one of several hundred thousand small communities in the lower Mekong Basin, located in the Nam Pong district of Khon Kaen Province, Northeast Thailand. The community lies on the Pong River, a tributary of the Mekong. Originating from the pristine mountain streams of Phukradueng National Park in Loei Province, the Pong flows across the upper northeast provinces of Thailand and combines with the Chi and the Mun Rivers to join the Mekong at Ubolratchatani.

The Pong channel in Khon Kaen Province is closely interconnected and regulated by Ubolratana, Nong Wai and Mahasarakham Dams. As such, the Pong does not flow naturally and the dilution capacity, water quality and volume of water available for use are dependent on the regulated dam flows.

Large industries, irrigated farmlands and cities compete for water abstraction to meet their daily and seasonal consumption. Located downstream of Ubolratana Dam, the largest northeast reservoir, Kudnamsai is one of the most highly competitive reaches of the Pong. The Kudnamsai villagers with traditional rice farm and fishery livelihoods lie within a large industrial precinct.

(Source: http://www.thewaterpage.com/images/MekongMap.jpg)



Water Profile

- Water Reserve: three dams and mixed sectors
- Water Abstraction and Waste Discharge: industries/community/ agriculture: pulp and paper, power plant, sugar and tropioca mills, whisky and bottling, city and small town daily consumption, rice farm irrigation, fish-tilapia caged fisheries

Kudnamsai has so far been recognized to be a critical pollution stretch of the Pong River (Koocoosamut *et al*., 1987; Hangwa and Fugon, 1998; Inmuong and Sangpradub, 2001). Many villagers have complained of skin rashes on contact with the water, salinity of irrigated land and decline of aquatic biota. There are intermittently of widespread fish kills of fish reared along the Pong riverbank in caged pens and more occasionally, of fish within the river channel (DOH, 1998; also available on the web: http://www.anamai.moph.go.th/factsheet/health1-9en.htm).

Since 1992, local representatives have tried to raise awareness of the above issues and seek support from local, provincial and central governments. Government officials responded to the complaints by establishing a program to monitor the Pong River water quality two or three times a year.

The results were analyzed in comparison to Thailand's Surface Water Quality Standards (MoSTE, 1992), largely defining the Pong in measures of "good", "fair" and "poor" categories, most suitable to making recommendations for water resource use (DPC, 1997). At best, the governments were informing the public of water quality variation against the standards. To this end, the government program was not providing an answer to the community concerns.

Government investigations of point source water pollution were confronted with difficulties in identifying where pollutants came from (Hangwa and Fugon, 1998). Ironically, although large industries were an obvious source, the effluents from these sources were usually found to meet the end-of-pipe water quality standards (despite the massive volumes of water discharged into the river). Total maximum daily load (TMDL) limits are not yet widely adopted or enforced across Thailand.

Key Issues of the Pong River Raised by the Community

- Poor water quality
- River channel tightly regulated by three closely interconnected dams
- Accumulated sediments in the Pong riverbed
- No integrated watershed conservation/management plan
- Local community has a limited legitimate role in local water resources management and conservation

Governments recognized that they had responded to community concerns to a limited end. However, enforcing the dilution of effluents was notably not considered a feasible option.

The provincial government maintained that pollutants in the Pong come from many sources. Suggested solutions to alleviate the problems, therefore, would

come from the actions of several parties following a statute provincial plan comprising, for example, awareness raising, public campaign and waste minimization activities (KKU, 1994; KKU, 1995). Managers of the dams regulating the Pong reasoned that flows were released according to an agreement regime set forth by a multi-party community, government and industry regime. The Pong pollution problems remained largely unresolved (Ouiyanon *et al.*, 1996; Sangpradub *et al.*, 1998).

From 1993 to 1997, the villagers sought to apply pressure on the government by holding several rallies at the city hall in Khon Kaen and at the central government in Bangkok. In 1997, the new Thai Constitution Act was mandated, stipulating public participation and emphasizing the role of communities in local environmental management and planning, marking the first key change to Thailand's countrywide environmental management approach.

A second prime change occurred within the same year when council authorities at sub-district levels were legally established nationwide. The aim of the council is to promote local welfare and a community participatory decision-making role in local management affairs (BJC, 2000).

The Start of a Community-Based Water Quality Monitoring Initiative

Although the Thai Constitution Act (1997) permitted local public involvement in environmental management planning, the new policy was problematic. Provincial and local governments predominantly lacked the skills, resources and experience to initiate community participatory research or monitoring projects. Likewise, communities were entering a period of empowerment unprecedented in Thailand. The Kudnamsai subdistrict council and community did not know how to implement a community-based water quality monitoring initiative (Inmuong *et al.*, 2001).

The Community Development for Sustainable Environment Association (CDSEA) research team was among the first groups in Thailand to explore how communities can undertake and manage a water quality monitoring project under the New Constitution. The team consisted of local academics (Mahasarakham and Khon Kaen Universities) and resource officers (Khon Kaen Regional Environmental Health Center) whose CDSEA membership was founded with the expectation that the Association could attract wide interest groups--villagers, farmers, school principals, students, non-government organizations (NGOs) and other community leaders--to join the project. The team received operational financial support from the World Health Organization (WHO) and Health Systems Research Institute for an action research project over the three-year period (1999-2001). No budget was forthcoming from the Thai government.

The key questions initially raised by the team were whether:

- the local community could implement and manage a water quality monitoring program (unprecedented in Thailand)
- what the key supporting role of the subdistrict council would incorporate

The team extensively reviewed international practices (e.g., the United States Volunteer Water Quality Monitoring Program and Water Watch Australia) from the project outset. Three acknowledgeable international volunteers who have assisted the development of the project to date are Amanda Hunt from New Zealand (1999) and Australian Youth Ambassadors for Development (AYADs), Jessemy Long (2000) and Stephanie Cobb (2002-2003).

International Contributions

- Developing a protocol (manual/ handbooks/equipment) on community-based water quality monitoring
- Allocating budget to the community projects via a National Community-Based Water Quality Monitoring Program
- Building an information network between community projects and governments
- Establishing regional coordinators in a supervisory and support role for community projects/programs

Many university students, community leaders and NGOs recognized the project to be a new initiative in Thailand and volunteered to assist the team develop water quality training guidelines for the Kudnamsai community. In mid-1999, the team and colleagues completed a set of practical monitoring manual handbooks to be used to train the community volunteers using field- based equipment.

Participatory Action Research (PAR)

The followed a PAR approach. The team invited key local representatives (community leaders and subdistrict council personnel) to be co-researchers in the project. Project objectives, goals and tasks were set-up accordingly.

A training workshop series was organized throughout 2000 with the assistance of graduate students who volunteered to be community-group advisors. Fifty participants age 18-74 years attended the first workshop for chemical and biological testing. Two subsequent workshops addressed monitoring aims, objectives, site and data analysis and handling of key group of volunteers. A meeting was held to discuss establishing the Local Environmental Information Center (LEIC) as well as the election of Committee monitoring volunteers.

The community volunteers collected samples from nine monitoring sites in the Pong River on a monthly basis. Samples were analyzed for basic chemical and physical parameters: dissolved oxygen, electrical conductivity, nitrate-nitrogen, phosphate, pH, temperature and turbidity. Macroinvertebrates (bio-indicators) were intensively collected and identified from sites, with the assistance of Khon Kaen researchers and graduate students.

Information is the Key to Change

In late 2001, a local website (www.thai.net/kudnamsai) was created by the CDSEA team, and has developed to become the prime tool of the LEIC. The homepage aimed to raise awareness of community-based actions at Kudnamsai. Information on the website is now accessed locally, nationally and internationally.

Several local industries, farmer groups, community leaders and government officials regularly visit the webpage to monitor fluctuations in the regularly uploaded water quality data. Moreover, monitoring data and key information available on the website have been used as key evidence to resolve local water conflicts and pollution abatement.

Project Outcomes

Community volunteers at Kudnamsai are capable of monitoring water quality and handling and analyzing data, given the timely provision of technical and financial support. The key role of the Kudnamsai subdistrict council to financially support community participatory actions was to establish the LEIC as a centerpoint for a community-based water quality monitoring program. Incorporating community-based action and information toward a sound sustainable watershed management and planning approach is the long-term project goal.

- Many student and river groups continue to visit Kudnamsai to learn more about the local community-based monitoring project activities. Over 25,000 people have visited the Kudnamsai website to date. The online web board provides a discussion forum for the exchange of ideas, critical discussion and suggestions.

- The CDSEA aims to continue providing capacity-building support for any community-based sustainable environmental management projects. However, it still needs financial contribution from international organizations. As such, this exercise in the region is largely viewed to be at the early development stage.

- Local communities in Southeast Asia still need capacity-building support from both the national and international organizations. The future development plan by the community set forth leaves the questions for all interconnected local, national and international organizations to assist in what the local organizations need. More pilot studies, which fitting to local tropical ecosystems as well as diverse sociocultural differences, should be advocated across the region.

Future Development Needed

- Kudnamsai is only one of the nine subdistricts in the Pong watershed. Expansion of the project to quantify a water quality profile across the Pong watershed is necessary.
- Integrated watershed management concept should be initiated, promoting all stakeholders to be involved and play a role.
- More research on bio-indicators is needed. Aquatic biota can make much more sense in a community monitoring context, particularly in a pollution impact response to chemical hazards.
- Studies on policy development and implementation of local community-based actions for sustainable water management should be advocated.
- The community vision on a sustainable watershed management approach should be established by organizing a series of workshops.
- Pilot studies on the youth's role in school-based actions on water quality monitoring should be initiated.

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Forest Management Learning Group: Building Forest Users' Capacities



The Forest Management Learning Group (FMLG) is a learning and capacity-building process, which uses non-formal adult education methods, based on experiential learning techniques and participatory training methods. The learning process aims at building forest users' capacity for developing community silvicultural practices and creating an opportunity for shared learning between rangers and communities to generate new silvicultural knowledge that answer local needs. In situations where planning systems allow, silvicultural practices can be incorporated into the community forest management plan.

The approach gives much less emphasis on targeting forest users with preset extension messages, and gives more emphasis on improving users' capacity to analyze their forest management systems and practices, and developing and testing possible solutions that address forest production needs.

The FMLG process is based on the successful experience of the farmer field school (FFS) approach developed by the Food and Agriculture Organization-Integrated Pest Management Program (FAO-IPMP) in rice production in the region. The FFS approach on rice cultivation showed that farmers can become experts in ecosystem analysis and can make informed decisions about the necessary interventions from both ecological and economic points of view.

FMLG and Community Forestry

Community Forestry is an umbrella term denoting a wide range of activities, which link rural people with forests, trees, and the products and benefits to be derived from them. Community forestry may therefore be considered as one dimension of forestry, agriculture, rural energy and other components of rural development rather than as a separate discipline.

The sustainable management of forest resources plays an important role in sustainable land use, poverty reduction and food security. Opportunities to participate in decentralized resource management, a willingness to respect and incorporate traditional knowledge into resource management plans, and ensuring community access to technological innovations and/or opportunities to develop forest management practices and technologies based on felt needs are important factors that contribute to sustainable livelihoods in communities.

Current forest management planning systems rarely allow for the range of goods and service that local users seek to manage the forest for, and remain highly cumbersome and geared primarily to large-scale reforestation schemes. To maximize the benefits from local forest management activities, there is a need to develop appropriate forest management practices, which support local forest management efforts, and protect biodiversity and other cultural values.

Community forestry programs are based on recognition of the dependence of local people on their resources and of their interest in managing them. Moreover, shifts in national economic structure associated with economic development tend to promote greater decentralization of forest (and other resources) management thus creating conditions, which allow local communities and the private sector to increase their influence on forest management decision-making (Nair, 2001). In response, governments are shifting toward more participatory forest management strategies. This has implications on how forestry extension programs and research are planned and implemented.

During the past 15 years, attention has been focused on the social and institutional aspects of the community forestry development process. More effective community forestry is believed to depend much on appropriate silvicultural systems and practices designed to improve forest productivity to meet local needs. In general, little progress has been made in developing new silvicultural technologies and practices to enable the natural forest to better meet the many needs of villagers for different forest products, food security and services. Limited research, however, has been carried out to develop simple, readily-available, and cost-effective silvicultural techniques to assist forest users in managing their forests. Villagers themselves are now asking for assistance in developing more productive forests, but foresters have had difficulties in supplying the technical information they need (Donovan, 1998).

The FMLG is being developed by the Regional Community Forestry Training Center (RECOFTC) to respond to forest users' needs and interest to learn more about forest management practices. The process has been developed and tested in close collaboration with several community/social forestry projects in Vietnam and Nepal.

Participatory research in forestry is essential in achieving sustainable food productivity increases upon which the short- and long-term food security of a growing world population will depend, and clear management agreements and an effective local institution to manage commonly owned forest resources are seen as prerequisites.

Implementing the process requires a shift in forestry planning and extension strategies and facilitation skills. Over the long term, some of the benefits include the following.

- Identifying, generating and testing locally appropriate forest management practices to ensure that the needs of local users are being met.
- Improving the capacities, knowledge and confidence of users to actively manage local forest area to satisfy local needs.

- Strengthening the capacities, knowledge, analytical skills and confidence of facilitators in working with local forest users.
- Improving the relations between users and forest department staff.
- Improving existing management plans to ensure that they address the changing needs of local people.
- Generating locally developed information and creating opportunities for networking and the spreading of locally appropriate information.

Roles of Various Actors in the FMLG Process

The process is based on interaction between users and facilitators. The emphasis is on involving users and facilitators in a learning process, which focuses on local needs and builds upon the users' knowledge and experiences. To do this, forest rangers and field facilitators should be co-learners, while helping users meet their needs from the forest.

Role of the Forest Users

'Users' are local people who depend upon the forest for their livelihoods and are members of a user or forest management group. The Learning Group is composed of forest users who have an interest or need to actively use the forest. The "community forestry management group" refers to the formal (or informal) body responsible for local forest management.



Role of the Facilitator and Facilitation

Facilitation is the conscious process of assisting a group to function as a group to successfully achieve its defined task. It is a critical element of the FMLG process, which was developed to deal with groups of users involved in a range of diverse forest management issues. A field officer or group leader trained in adult learning and/or group decision-making principles facilitates the FMLG process.

The evidence for learning is change - changes in behavior, knowledge, understanding, skills, interests, values, awareness or attitudes. Therefore, the facilitator's job is to encourage learning rather than deliver information, offer explanations, or provide answers. Facilitators initiate discussion and encourage users to participate. They highlight some comments and summarize others; they compare and connect remarks and point out opposing views. They guide the process, but not the outcome.

Role of Scientists and Other Technical Resource Persons



It is recognized that a facilitator may not have all the technical knowledge and skills required to cover the full range of forest management issues, which may arise. In such cases, the facilitator should identify and bring in the appropriate human resources, such as forestry staff, knowledgeable farmers, and specialists; or organize visits to nearby villages to address the issues.

Foresters are no longer seen as just expert technicians, and capacity-building efforts will need to support and encourage the shifting role of the forester from a "manager" to a "facilitator". Existing forest knowledge will need to be complemented with a whole new set of skills, which focus on mobilizing community knowledge and practice, opening up channels of communication, and building mutual understanding between users in participatory decision-making processes.

When and How to Initiate a Learning Group

The FMLG process has been developed in a range of contexts, but under specific circumstances. When selecting a community forestry group to work with, it is important to keep in mind that they have:

- ❑ expressed interest in improving forest management operations
- ❑ the recognized authority (formal or informal) to carry out experiments and forestry operations on the particular patch of forestland
- ❑ developed a management plan, and appropriate local forest management institutions have been established and are functioning
- ❑ an appropriate diagnosis of local livelihood systems and the interaction between local use and forest conditions

FMLG usually consists of 20-25 participants selected from and by the members of a community/user group. The FMLG process lasts for at least 1-2 years, depending on the silvicultural practices under experimentation. In planning the meetings, consider the following:

Initial meetings. The FMLG meets at least four or five times to undertake initial assessment before the season, when forestry operations begin. During this period, participants have time to get to know each other better and form a strong team.

During the season. The frequency of meetings may vary from once a month to every 3-6 months, depending on the experiment. In general, there are about 5-7 meetings in the first season.

Scheduling and duration of group meetings. There are no fixed rules, but the facilitator should involve learning group members in setting the time and schedule of meetings. It is suggested that group meetings take no more than half a day (3-4 hours).

Venue. The learning group meets at a convenient meeting place, close to the forest area, where forest management practices are tested.

Steps in the FMLG Process

Step 1. Starting FMLG in your Area



Community Selection/Site Selection

Due to the complexity of factors that influence the management of a community forest, some prerequisites need to be considered when planning FMLG program in your area. Selecting the community should be based on expressed interest by the community itself. As some forest management practices take at least one year to identify and test, it is very important to ensure full commitment from the group for the full test period. The best times to propose FMLG to the community are when a community-based forest management plan has been prepared and implemented, appropriate village institutions responsible have been established, and laws and regulations allow the community to actively manage their forest.

Objective: To identify communities or forest user groups ready and interested to learn more about forest management practices. If the FMLG process is not responding to users' interests or the prerequisites are not in place, other approaches that serve users' needs better should be sought.

Selecting the FMLG Members

Once the community has indicated its interest in forest management practices, you may need to assist it in selecting a smaller group of members (20-25 persons) that will form the FMLG and actively participate in the group meetings. The selection of a smaller group is important as many communities have more than 100 members and are too large for everyone to be involved. In a community, different forest interest groups (stakeholders) with different ideas and needs on how the forest should be used exist. The FMLG members should represent these different interest groups and genders (all stakeholders in the community).

Objectives: To assist the community in selecting a smaller group of members (20- 25) that will form the FMLG; to clarify the flow of information between the learning group and the whole community; and to finalize the venue and dates for the meetings.

Step 2. Getting the Group Members Settled In

Group members have many questions and concerns when they first meet, and might not even voice these directly. This step is specifically designed to clarify concerns, roles and responsibilities; and develop a set of group norms to guide the learning group. This will foster self-confidence, and promote exchange of information.

Objectives: To help the group feel welcome, and to create an atmosphere of cooperation and sharing.

Step 3. Identifying Forest Production Needs and Selecting the Forest Area

The forest users' learning is motivated by the need to find solutions to real-life problems. Consequently, users will be interested in learning more about forest management practices only if they address these identified needs. During this step, group members examine how the forest is used and how this relates to their present livelihood systems. Using this information, they can then look at the implications for the future in terms of their needs and the forest management practices, which will best meet these needs.

Objective: To identify production need(s) that will be addressed and also the forest area where experimental plots will be established and alternative management practices tested.

Step 4. Selecting Forest Management Practices and Topics of Special Interest



Once the group members have identified the forest production needs they want to address, they can decide on the most suitable management practices/silvicultural techniques that best address these. Ideas may be generated by pooling group knowledge or by exchanging information with other communities, users and specialists. These forest management practices determine which field experiments the group selects. In addition, the group identifies special forest management topics that members would like to learn more about that are not part of the experimentation. Demonstrations of appropriate technologies and skills related to these special topics will be carried out in the group's own forest area.

Objectives: To undertake a needs-based resource assessment; to generate ideas on and select alternative silvicultural practices for testing; and to increase the users' self-confidence in experimentation.

Step 5. Planning and Establishing Field Experimentation

During the season, the FMLG conducts field experiments to study alternative forest management practices or technologies. These need to be planned carefully. As changes may occur anytime during the season in the forest experimental plots, regular observations of selected indicators are necessary. This would allow users to

monitor the forest management practices under experimentation and enable them to make informed decisions and introduce any corrective measures that might be necessary.

Objectives: To strengthen forest users' confidence so that they will feel free to experiment, and to assist the group in planning field experiments. This includes identifying what, when, and how to observe changes in their field experiments, and how data will be recorded and made available to all group participants and shared with the whole community.

Step 6. Conducting Regular Group Meetings During the Season

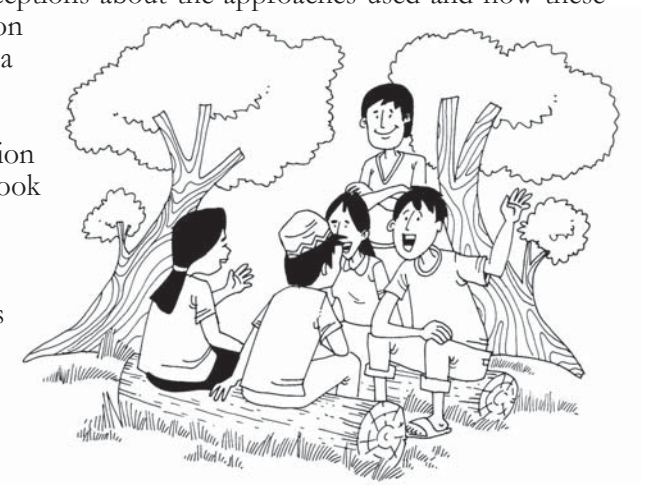
At this stage, forest users have established several season-long experiments, and a program has been prepared. During this season, the group can regularly organize two-three half-day meetings. Field experimentation, reflection and analysis by individuals with group feedback, provide participants with opportunities to acquire new skills.

Objectives: To provide group members with the opportunity to observe changes taking place in their experimental plots, and to reflect on their field observations for one or more seasons.

Step 7. Sharing Lessons, Self-Evaluation and Re-Planning

Experimentation results and lessons learned by the FMLG are shared with the whole community at different times during the season by using different methods. This allows the learning group to build the confidence of the community so that possible changes in the existing forest management plan can be made to better address forest production needs.

At the end of the season, the group undertakes a self-evaluation exercise. Participants are asked to reflect on what they have done and learned. Learning group members can share perceptions about the approaches used and how these can be improved. Depending on group interests and priorities, a re-planning exercise can be conducted to either continue with the present experimentation or to explore new issues and look for answers to new questions.



Objective: To share experiment results and lessons learned within the learning group and with the whole community, assess their usefulness and explore new learning opportunities.

Cases from the Field

From Makwanpur District, Nepal

Two leasehold groups within the Nepal-FAO Hills Leasehold Forestry and Forage Development Project initiated a farmers' forest management school, an FMLG process, in mid-2000. Under the FAO-Nepal project, blocks of degraded forest are leased to poor households for 25 to 50 years with the aim of reducing poverty and environmental degradation. The two leasehold groups in Makwanpur district which started the FMLG have seven and five members, respectively. Each member has about 1ha of land with a 25-year lease and an operational plan. The group had already successfully established the production of fodder grasses - used to feed livestock and to produce seeds for market - on their forestland. The group did not have previous experience in forest management and their knowledge of forest management practices was limited. The FMLG identified income generation from fuelwood production (mainly for the market but also for their own consumption) as the need to be addressed.

The learning group drew up a list of about 25 familiar fuelwood species and found that seven of these species were available in their own forest. They ranked the seven species according to perceived fuelwood and coppicing potential (quantity and quality) and identified four species worthy of experimentation. The aim was to identify the fastest-growing species which would produce the largest amount of fuelwood in the shortest time, the species with the strongest coppicing capacity, and the most effective spacing between trees.

The FMLG established five experimental plots plus one control, which would be observed for at least two years. Farmers regularly observed changes taking place in the experimental plots, mainly through visual observation and the use of local measurements. The use of measuring tape for record-keeping was more difficult, owing to the high illiteracy level of the group. The following measurements were recorded: diameter and height of each tree left standing (by hand size and measuring tape); number, size and length (by finger, arm) of new sprouts/coppice at six months; amount/weight of biomass produced by coppicing at six months (by backload); and fuelwood harvested (by backload).



From Yen Chau District, Vietnam

Na Nga is a Thai ethnic minority village in Yen Chau district of Son La Province in northern Vietnam. The FMLG process in Na Nga was developed in collaboration with the Social Forestry Development Program, a technical cooperation program between the Vietnam Government and the German Agency for Technical Cooperation (GTZ), which was already assisting the district. Na Nga has 115 households and a total population of 527 people. Its 575ha include 124ha of natural forest and 64ha of forest plantations. The villagers' livelihoods are mainly based on the production of maize, cassava, mangoes and fish. Land-use planning and land allocation were carried out in 1998. Since 1999, 112 land right certificates have been issued to households. Community forestry development activities carried out so far have included the preparation of village-level forest protection and development regulations and a plan to protect the community forest.

During the FMLG process, the Na Nga villagers decided that their priority area for study was techniques for bamboo pole production and associated protection needs. The farmers recognized that the bamboo forest was not managed well; it was too dense and was cut haphazardly.

They selected an area of about 1,000m2 for the experimental plots, which they demarcated using a rope representing a common local land measurement unit. They agreed to place nearby a clearly visible signboard indicating the experimental techniques to discourage community members from cutting the bamboo in the experimental plots.

Cases from the Field

From Yen Chau District, Vietnam... *continued*
They agreed to avoid cutting the first shoot of the season, because it would inhibit the growth, number and strength of other shoots; cut the old bamboo poles (perhaps leaving one or two to help the new shoot grow straight); remove any bamboo growing bent or showing evidence of disease; prune poles up to 1m from the ground; cut old bamboo at 50cm from the ground; and ban the collection of bamboo shoots from the plot.

Six main indicators were selected for regular observations: number of bamboo shoots; number of poles; soil moisture (by observation, i.e.,- by removing leaf litter and then physically inspecting the soil); shape of poles (straight or bent); size of poles (by string measurement); and length of poles (by string measurement).

Conclusion

The refinement of community-based rural management depends on developing simple and cost-effective silvicultural techniques. The participatory development of such silvicultural practices assist forest users to become active managers of their forest resources according to their perceived needs.

Building local users' capacity to identify forest management objectives and priorities based on their needs, promoting low-cost and readily available sustainable silvicultural techniques, and strengthening users' confidence in their own capacity to experiment are investments that will generate long-term benefits.

The need for a production-oriented regime has been realized among professionals and community members, and there is a consensus that the current focus of forest protection has to be converted into the active management of forest.

At the conceptual level, the FMLG could be an appropriate approach to transform the forest resources from a protection-oriented regime to a production regime if the concept is internalized among professionals, the government, non-government sectors, and users group. An understanding of the concept that farmers' indigenous and formal knowledge are complementary and both sets of actors need to learn from each other will create ground for joint learning.

Thousands of forest user groups/communities have been established throughout Asia. Many of these are functioning well and are willing to adopt active forest management. At the same time, there is an increasing number of countries with an enabling policy environment, where community forestry (joint forest management) legislation is in place. In these countries, many users have their own operational plan that provides them the right to carry out harvesting operations and marketing of forest products on their own. The FMLG process should be conducted on an optional base, where prerequisites are in place, including institutional arrangements supporting local forest management.

A FMLG Facilitator's Field Manual and a Trainer's Manual have been developed with support and coordination provided by the Regional Community Forestry Training Center for Asia and the Pacific (RECOFTC) Bangkok. For more information, visit, http://www.recoftc.org

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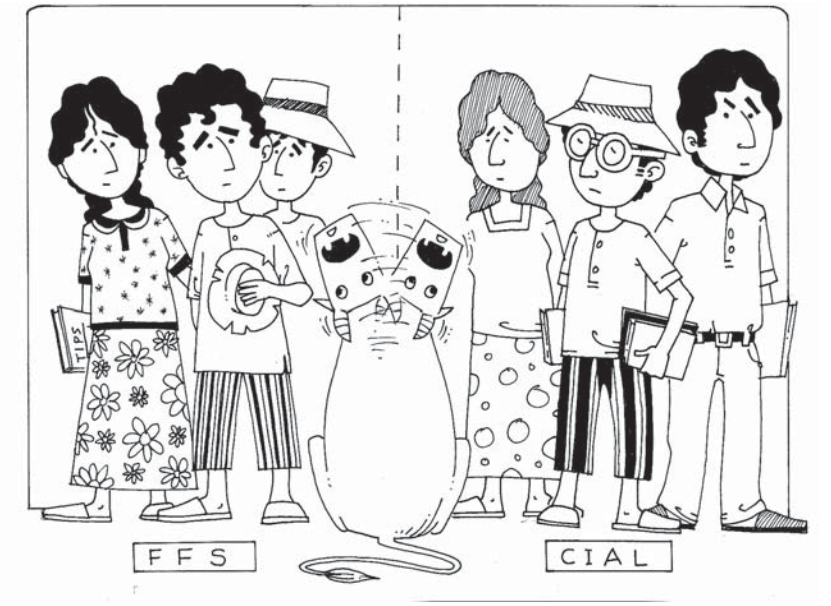
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Farmer Field Schools and Local Agricultural Research Committees as Complementary Platforms: New Challenges and Opportunities



Farmer field schools (FFS) and local agricultural research committees (CIALs) are platforms supporting integrated decision-making and innovation for sustainable agriculture. They share several basic principles and processes but their main objectives differ. The first is oriented towards providing agroecological education through participatory learning, whereas the second is a permanent local research service that links farmer experimentation with formal research.

This paper compares their objectives, principles and processes as a basis for exploring their application and looks at the new challenges and opportunities.

Farmer Field Schools

FFS were initially developed by the Food and Agriculture Organization (FAO) to address problems of pesticide dependency and to develop location-specific management expertise that did not depend on the formal research system. Initial "classical" FFS for integrated pest management (IPM) of rice have been adapted for other crops and topics.

Developing agroecosystem management expertise means building understanding of ecological principles and processes and the impact of farmer management decisions. FFS provide an opportunity for learning-by-doing based on principles of non-formal education. Extension workers or trained farmers facilitate the learning process, stimulating farmers to discover key agroecological concepts and develop management skills through self-discovery activities practiced in the field.

FFS are designed for 20-25 participants from one community, a critical mass around which collective action and follow-up activities can be consolidated after the school ends. FFS hold regular meetings throughout the crop cycle. Improved decision making emerges from an iterative process of agroecosystem analysis (AEA), making and implementing decisions accordingly, observing outcomes and evaluating overall impact.

To discover key agroecological principles, each FFS plants a field where local crop management practices are compared with those based on the participants' AEA. Small groups of 4-5 persons make detailed observations of crop, soil, water, pests and beneficial organisms, and represent these in drawings depicting the development stage of the plants. Each group presents its analysis and proposed actions in a plenary session, followed by questions and discussion. Finally, participants reach a consensus on management practices to be carried out during the week. Drawings from previous sessions are available as reference material to enrich the discussion. Yields and profitability are compared at harvest.

FFS also include "special topics" designed to help farmers uncover unknown ecological relationships. Once internalized, these concepts help farmers make better management decisions. AEA and special topics also develop farmer research capacity by stimulating comparison of the outcomes of different management decisions and by providing regular opportunities for data gathering and analysis.



Each FFS meeting includes a group dynamics exercise to strengthen teamwork and problem-solving skills, promote creativity and create awareness of the importance and role of collective action. The facilitator suggests a problem or a challenge for the group to solve.

A good facilitator is vital: catalyzing, encouraging analysis, setting standards, posing questions and concerns, paying attention to group dynamics, serving as mediator and encouraging participants to come to their own conclusions. A facilitator who raises new questions rather than offers answers is more likely to flourish in an FFS environment. For example, if someone asks, "What's this insect? Is it a pest?" a good facilitator would answer with a question like: "What can we do to find out?"

Facilitators complete a session-long training program to get hands-on experience of managing the crop, while developing facilitation, leadership and administrative skills. Each facilitator is expected to guide at least three FFS per year. Increasingly, farmers are becoming facilitators. Farmers are often effective than professional facilitators because other farmers appreciate learning from peers with similar experience who speak their own language.

A FFS ends at harvest, but follow-up activities support the learning process and collective action. In some areas, Action Research Facilities (ARFs) are developed. Like field schools, ARFs are ephemeral, but generally operate over several crop cycles. They are designed to increase farmers' understanding of basic ecological principles within the larger agroecosystem, investigate serious problems and develop community-level action plans. Studies are conceived and carried out by FFS alumni with support from a scientist-facilitator. Farmers list ideas, both exogenous and endogenous, on how to manage the targeted problem, and study each option systematically. After the facilitator leaves, farmers are expected to continue studying to broaden their understanding of the ecological basis of agriculture and to maintain a community IPM program.

Where gaps in ecological understanding present barriers to developing effective field schools, more permanent ties have been established between formal research services and communities participating in FFS. One example involves World Education (WE), an international non-government organization (NGO) that developed FFS for vegetables. WE sought the support of universities and agricultural research centers, proposing the formation of an "integrated college" between researchers and farmers trained in the FFS approach or investigating on their own. Formal and local researchers worked together to understand and research production problems.

Local Agricultural Research Committees (CIAL)

The CIAL, originally developed by Centro Internacional de Agricultura Tropical (CIAT), is a research service belonging to and managed by a rural community. The research team is made up of volunteer farmers, chosen by their communities because of their aptitude for experimentation. The CIAL links farmer-researchers with formal research systems, increasing local capacity to exert demand on the formal system and to access potentially useful skills, information and research products.

Each CIAL has four elected members and a facilitator and may have additional volunteers. The facilitator may be a trained agronomist from a supportive formal research center or university, an extension service or an NGO. Alternatively, he or she may be a trained farmer who has served on a CIAL. The facilitator plays a key role in developing the CIAL's competence in the research process, and provides feedback on farmers' priorities and research results to formal research and extension services.

Training, through regular visits by the facilitator, continues until the CIAL is able to manage the entire process independently. It equips the team of farmer-researchers to conduct experiments that compare alternatives with a control treatment, and that employ replication in time and space. Training familiarizes farmer-researchers with terminology that gives results credibility with formal researchers. It also builds skills in planning, management, running of meetings, monitoring and evaluation, record keeping and basic accounting.

Facilitation of a CIAL requires profound changes in attitudes and relationships among farmers, rural communities and agricultural professionals. Training of facilitators includes a sensitization process and learning to ask open questions that permit true two-way communication. After a two-week course, facilitators continue in-service training where they form a CIAL, supported by an experienced trainer who visits at key moments and provides feedback on strengths and weaknesses.

The Steps



The facilitator begins by inviting the community to a meeting where the purpose of a CIAL is discussed. Farmers are invited to analyze what it means to experiment with agricultural technology. Local experiences and experimental results are discussed. The possibility of accessing new technologies from outside the community is also mentioned. If the community decides to form a CIAL, it elects the committee.

A CIAL fund, owned by the community, helps absorb research risks. The seed money is usually a one-off donation, but may originate from a rotating fund managed by an association of CIALs. The committee uses the fund to procure inputs for experiments and to compensate members for losses. When an innovation proves successful, the CIAL may add to the fund by selling the harvest or the products of research (e.g., seed). As the fund grows, the CIAL can expand its research, share earnings with participants, invest in new equipment or services, or launch a small enterprise.

A key criterion for elected members is that they are experimenting on their own and are able and willing to serve the community. Elected members agree to take part in a regular capacity-building process over at least one year. They each have a specific role as leader, treasurer, secretary or communicator, and are often assisted by several additional volunteers.

The research topic is determined through a group diagnosis in an open meeting. The opening question is: "What do we want to investigate?" The community prioritizes topics based on the likelihood of success, who benefits, and the estimated cost of the research.

The CIAL experiments generate information on technology options of local or external origin. Offering technology while it is under development and making adjustments based on the feedback obtained form the CIAL is a powerful mechanism for research organizations to respond to farmer priorities.

The facilitator helps the committee obtain the information required to plan its experiments. Other farmers and staff of formal research and extension services are often consulted. The facilitator also helps the CIAL formulate a clear objective for each experiment. Based on the objective, the CIAL decides what to compare, how and when to evaluate, experimental variables, criteria for evaluating results, data needs, and measurement units.

After completing an experiment, the CIAL draws conclusions and presents results to the community. The analysis includes the question: "What have we learned?" Analysis of the process is especially important when an innovation is not successful, or when unexpected results are obtained.

Successive Experiments

The facilitator guides the CIAL through three successive experiments. In the first, "exploratory" trial, the CIAL tests innovations on small plots. These may have several treatments, such as different crop varieties, fertilizer amounts or types, sowing dates or densities. The exploratory trial is a mechanism for eliminating options that are unlikely to succeed under local conditions. The most promising treatments are tested on larger plots in a second experiment. Finally, two or three top-performing choices are planted over a still larger area in the third experiment, often called the production plot. Afterwards, the CIAL may continue with commercial production, or define a new research topic.

Beginning on a small-scale is fundamental. Small plots provide experience of applying new concepts, such as replication and control, and allow the CIAL to gain confidence before moving to larger and riskier scales.

As the CIAL becomes proficient, the facilitator reduces the frequency of visits, from two visits per month initially to one every three or four months. Facilitators visit mature CIALs for feedback on research priorities and results, and to provide access to technology under development by formal research services.

A decade ago, most CIALs were experimenting with crop varieties. More recently new research areas have emerged including small livestock, and pest, disease, soil, water and nutrient management. Case studies suggest that committees studying complex agroecosystem health topics face new challenges, including:

- conceptualizing research questions and designing management options with limited agroecosystem knowledge
- scaling up for collective action issues when designing research on agroecosystem health
- integrating different technological alternatives within overall farm management

The farmers and their communities gain a lot of momentum from the research process, which goes beyond learning how to resolve a production problem to generate income from the innovation. In Colombia and Brazil, many CIALs have formed small companies that produced improved seed (of varieties that they selected), which they sell in neighboring communities. This promotes uptake of the technology, at reasonable prices for their neighbors and can be the seed for building social and financial capital at the community level, which makes CIALs more sustainable.

FFS and CIALs Compared

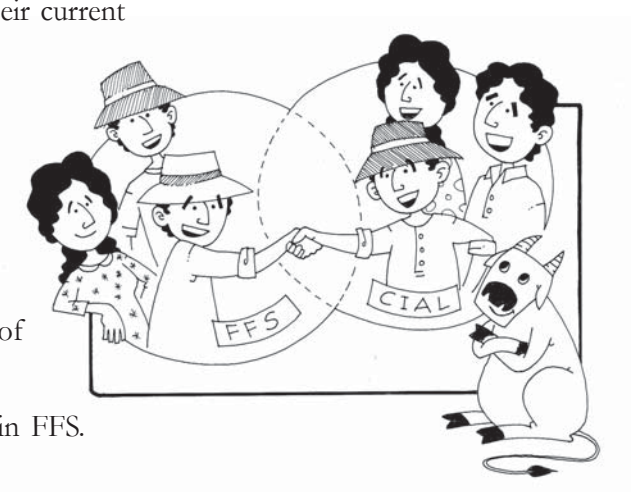
FFS and CIALs share underlying principles. Both consider farmers as experts, stress respect for local values and knowledge and build capacity based on hands-on experience. Both recognize and attempt to reduce the risk associated with learning and research, and perceive outputs as public goods.

CIALs and FFS are organized differently but share several processes. Facilitation styles and the role of motivation are similar. CIALs form second-order associations for increasing the dissemination of research results. Similarly, FFS follow-up activities spread knowledge horizontally through fora and networking.

Both aim to strengthen farmer experimentation and innovation, but in different ways. CIAL experiments are relatively formal; most are controlled comparisons involving a range of technological options. This increases local capacity for research and develops a common vocabulary that makes it easier for farmers to exert pressure on formal research and extension systems. In keeping with the emphasis on the systematic evaluation of technological options, the CIALs are made up of a small group of specialized farmer-researchers, chosen for their reputation as experimenters, and trained to further develop their research skills. In addition, CIALs stimulate local experimentation by raising its visibility and status.

Evaluation methods have been adapted to local levels of literacy by using symbols and simple classification and tabulation procedures. Farmers establish their own evaluation criteria, without influence from professional researchers. Because of this emphasis on respecting farmers' criteria, CIAL members prioritize, design and evaluate experiments based on their current knowledge.

The FFS approach emphasizes experimentation aimed at understanding agroecosystem patterns, interrelationships and structure, as the basis for problem-solving and decision-making, thus observation, evaluation of and identification of interactions among different elements in the system are fundamental to experimentation in FFS.



FFS farmers use drawings and other visual methods to represent what they see as a means of understanding key self-regulating feedback mechanisms. The FFS approach assumes farmer innovation is limited by the lack of this knowledge and by erroneous information - produced by poorly focused extension programs or agro-chemical distributors. The central focus of the FFS is on activities that allow farmers themselves to make discoveries. The responsibility of formal research is envisioned as the development of general theories of the structure and dynamics of specific agroecosystems that underpin effective FFS curricula.

The FFS do not focus on identifying a solution within a range of technological options as the CIALs do. They develop the capacity to manage ecological interrelationships better in the community. Consequently, the FFS are not directed towards a specialized group of farmer-researchers, but towards a relatively large and heterogeneous group within the community to sustain a learning process.

The FFS have been effective in addressing problems in agroecological systems that are well understood (e.g., irrigated rice in Asia). Where understanding of system components and interrelationships is less developed (e.g., in the case of non-crops which lack systemic self-regulation mechanisms), local capacity to evaluate different management options (technologies) is important, and controlled experimentation is required. The demand for technological options implies the need for a strong link with formal research, a comparative advantage of the CIALs.

The second generation of FFS in farming systems that include vegetables and crops rotated with rice, and the ARFs, have incorporated controlled experimentation and the evaluation of technological options, and have established ties with formal research.

CIALs may face knowledge gaps that limit experimentation. For example, a community in Bolivia prioritized an important potato pest, but farmers did not know that the larvae are a stage in the life cycle of a weevil. Thus, they were unable to plan and evaluate different control options. Aware of this difficulty, the facilitator helps farmers discover the insect's life cycle. Although facilitators may offer training when research proposals are limited by knowledge gaps, whether this occurs depends on their skills, knowledge and motivation. Guiding discovery-based learning is not an explicit part of CIAL facilitator training.

Complementarity and Synergy

The trend towards geographical and evolutionary converges has raised the question as to whether FFS and CIAL differ sufficiently to justify the application of both within the same area. We argue that they are complementary and synergistic.

FFS center on agroecological education; the CIAL on establishing a community-based research service linked to the formal research system. FFS are limited in time to one or two cropping seasons; CIALs are established as relatively permanent community-based organizations. Experimentation in FFS is geared towards discovering how the agroecosystem functions and how this is influenced by farmer's management decisions. CIALs concentrate on experimentation through controlled comparisons. FFS build agroecological knowledge to make CIAL research more meaningful. CIALs can generate locally-adapted technological options to strengthen the FFS. Both can be established in the same area or even the same community, although sequence of establishment and linkages needs to be carefully thought through (see Braun *et al.,* 2000b). Development organizations themselves have increasingly come to see FFS and CIALs as complementary (Almanza *et al.,* 2003).

New Challenges and Opportunities

Recently, new challenges and opportunities have emerged for farmer innovation. We look at three of these and identify the ways in which CIALs and ECAs have begun to respond.

Linking with Markets

The rise of globally-linked markets, increasing urbanization and falling product prices mean that farmers increasingly ask for help in entering new markets and adding value to local production. In order to respond to these demands, CIALs are beginning to make links with other actors in market chains. This is especially important in the case of varietal selection, which is still the dominant research theme of most CIALs. In this case, linking with other actors can help them to include end-user preferences in the selection criteria they apply. Some CIALs have gone further and established local businesses to supply these actors with varieties that they have selected that meet their criteria. Because research generates an income for CIAL members, it should enhance the sustainability of the CIAL. At the same time, because it generates private benefits for members, it may also challenge the CIAL's role as generating technology for all the community (public goods).

FFS have also been adapted to this new market context (Rueda *et al.,* 2003). FFS originally were planned around one cropping cycle, they are now being modified to cover one marketing cycle from planning through sale. Farmers are being trained in marketing issues and discovery-based approaches that can be applied by participatory assessments (*sondeos*) of local markets. Many market opportunities demand that products are constantly available throughout the year. This is often beyond the capability of a single community and requires coordination across several communities in implementing FFS and between CIALs. This kind of coordination can play a major role in territorial approaches to rural business development (Lundy *et al.,* 2002) and can also build on the participatory approach for innovation in market chains (Bernet *et al.,* 2004).

Municipalities

In several countries in Latin America, decentralization has led to an enhanced role for municipal governments with a concomitant transfer of responsibilities for service provision and a much greater role for local populations in solving their own problems. Some municipal governments have created units or departments responsible for agricultural development. CIAL groups, perhaps organized through a second level organization, can provide means for farmers to express genuine demands to municipalities, to assess the relevance of municipal agricultural development in a range of ways. FFS, because they build knowledge and empower farmers, can also form a part of municipal activities (Esprella and Aguilera, 2003; Cerna and Porras, 2003).

Local Funding

Both FFS and CIALs have been criticized because they rarely go beyond pilot experiences. Scaling-up of both will depend upon their ability to generate local funding and appropriation by local government and organizations at different levels.

In Bolivia, following the Popular Participation Law, municipalities have substantially increased budgets. They are beginning to demand actions, which support productive activities, but not with the conventional, "top down" approach. Pilot work by the Foundation for Research and Promotion of Andean Products (PROINPA) where the FFS and CIAL platforms were adapted at the community level, provided an example for the municipalities to see and understand the strengths of both, and so request them. As a result, several municipalities in different regions of Bolivia have planned, invested in, and evaluated the implementation of both platforms.

Funding of FFS and CIAL depends not only on outside agencies but also on the community itself. Farmers invest time and capital which may exceed the investment of outsiders. Okoth *et al.* (2003), writing of Kenya, describe a "revolving educational fund" used for funding FFS and maintained from the profits of commercial fields, which FFS participants manage close to their study fields. This example shows that innovations can be made in the FFS methodology to make it locally-funded. CIAT's IPRA project is carrying out research to bring together the experiences with self funding of different organizations working with CIALs. This showed that in Bolivia, CIAL members used a range of mechanisms to help fund research activities, including raffles, commercial fields (similar to the Kenya experience with FFS), sale of agricultural inputs in the community at lower prices and football competitions to support CIAL activities. Investments made by CIAL members included loan of land for research, family labor on trials and donations of seed.

In Honduras, each chapter of the federation of CIALs, is supporting mini-development projects through small loans of the CIALs. These include chicken improvement programs for the women's CIALs, and artisanal seed production for the launching of micro-enterprises. The money is repaid with interest at the end of the project period. Such opportunities for collective action through the CIALs serve as powerful cohesive agents, permitting longer-term research to be undertaken and ensuring economic sustainability of the CIALs as local research organizations (Humphries *et al.*, 2000).

In Armenia LERGs (Local Extension and Research Group, the English translation of the Armenian name for CIALs) are establishing sales points in the local markets where they generate funds from the sale of produce offered in LERG-packaging. These funds will be used to purchase seed of the best vegetable varieties identified via LERG research for provision to the community and other interested farmers (Gyulkhasyan, 2002).

It is important to emphasize the role of institutions (understood as the rules of the game which govern interactions between actors) in facilitating the aforementioned processes and facilitating scaling up. The Popular Participation Law in Bolivia was critical in facilitating funding by municipalities. Additionally, development organizations, building on their field experience, have played an important role in creatively supporting community-based organizations in developing local funding opportunities and in the appropriation of these participatory platforms.

Next Steps

In many countries, the value and relevance of agricultural research and development (R&D) are being questioned. FFS and CIAL promote closer engagement with rural society, building local institutional structures and processes for agricultural development. They make R&D more relevant by putting farmers at the center of development processes and open the possibility of a more fundamental transformation of agricultural R&D systems. Growing interest among a wide range of financing and implementing organizations in both platforms reflects an underlying perception that they are viable new alternatives. FFS and CIALs fit the new emphasis on linking farmers with markets that pervade much recent development thinking, they have attracted the interest of local governments, which are increasingly important development actors. Further, there are opportunities for scaling-up by moving to self-funding mechanisms. Under these circumstances, there is good potential for applying these platforms even more widely. As this occurs, both will evolve further, and their future development should be managed to draw on their underlying synergy.

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Participatory Research and Development for Sustainable Agriculture and Natural Resource Management: A Sourcebook

The *Kamayoq* in Peru: Combining Farmer-to-Farmer Extension and Farmer Experimentation



In the past, governments were largely responsible for both research and extension services. During the 1990s, however, structural adjustments and cuts in fiscal deficits led to a dismemberment of classical agricultural research and extension services. These services are now unable to address the needs of farmers living in complex, diverse and risk-prone environments.

In Peru, for example, the government-funded agricultural extension program run by the *Instituto de Investigación y Promoción Agropecuaria* (INIPA) employed 1400 extension officers in 1986. By the year 1992, there were fewer than 100 officers. Similarly, during the last decade, the Peruvian national research organization, *Instituto Nacional de Investigación Agropecuaria* (INIA) also reduced its size and coverage. Several agricultural research stations have been privatized and primarily address the needs of middle and large-scale farmers.

Faced with a decline in government-funded research and extension, there are examples throughout the world where private research and extension provision has grown. The problem to date has been that few resource-poor farmers are able to pay for this private service. As a result it has generally been directed at larger commercial farmers (Chapman and Tripp, 2003). Less known are a number of initiatives that better complement smallholder farmers' needs and ability to pay. The defining characteristic of these initiatives is the training of farmer-to-farmer extension agents. In the case of the most successful of these initiatives, the extension service is largely unsubsidized.

The *Kamayoq* and Provision of Extension Services

Since the late-1990s, the Intermediate Technology Development Group (ITDG), a non-government development organization, has been working in farming communities in the Peruvian Andes. These communities are poorly served by government research and extension services. In addition, much of the government extension material is written in Spanish. This is a problem for communities in which there are high levels of illiteracy and where the local language is *Quechua*.

ITDG is working in 38 communities, located up to 4000m. The most common crops are maize, potatoes and beans. Many families also have one or two head of cattle each, some sheep and a number of guinea pigs (a food staple in the Andes). ITDG's work includes the training of *Kamayoq*.



In 1996, ITDG established the *Kamayoq* School, where *Kamayoq* receive training for eight months. By the time the training is finished, the *Kamayoq* is guaranteed to have the knowledge and skills to start working. Over 140 *Kamayoq* have been trained, 20% of whom were women.

Kamayoq are farmer-to-farmer extension agents. The name is associated with the Inca empire and reflects local people's affinity with the reciprocal relationship between humans, animals and the *Pachamama* (Mother Earth).

The local government supports the training while instructors include ITDG staff, long-serving *Kamayoq* and experts from regional universities in the cities of Puno and Cusco. Training takes place periodically in a classroom but mainly at different field locations. The course covers a number of subjects.

- identification and treatment of pest and diseases of the main agricultural crops
- identification and treatment of diseases of animals, sheep and pigs
- improved irrigation via the use of a network of drainage channels
- improved pasture
- breeding and rearing of guinea pigs

Combining Participatory Research and Development (PR&D) and Farmer-to-Farmer Extension

Farmer experimentation is vital because bio-physical, social and economic conditions change and farmers need to be able to adapt to these changing circumstances (Bunch, 1982). This is particularly so in the Peruvian Andes where farming conditions are so complex and diverse that it would be difficult to find a ready-to-use technology that needs no further adaptation.

A successful extension program is, therefore, more likely to involve active farmer participation and to be characterized by joint problem-solving rather than standardized solutions. In this context, the role of the *Kamayoq* is not only to provide technical advice and assistance, but also to work with local farmers to find solutions to agricultural and veterinary problems. Examples of PR&D include: the treatment of a fungus disease of maize; the control of mildew on onions; and treatment of animal diseases.



The *Kamayoq* are subsequently able to address the veterinary and agricultural needs of local smallholder farmers. The most sought-after service is the diagnosis and treatment of various animal diseases. Villagers can call on the *Kamayoq* 24 hours a day. More often than not, the farmer extension agents can immediately treat sick animals. In each of the communities where *Kamayoq* live and work, mortality rates among cattle have fallen dramatically.

The *Kamayoq* and the Search for a Natural Medicine

One of the biggest problems in sheep and cattle raising is the parasitic disease *Fasciola hepatica*. The common name of this parasite is "sheep liver fluke." This is somewhat a misleading name because the parasite is commonly found in sheep along with cattle and guinea pigs. In the Peruvian Andes, it is the principal parasitic disease that affects these animals. The vector responsible for the spread of the parasite is the common snail. The snails are found in pastures where cattle and other animals feed.

Although *F. hepatica* rarely kills animals, it does incapacitate them (sick animals often weigh a third less than healthy ones). Infected bulls sell for under US$70 per animal while healthy bulls sell for US$115 each. In the case of cows, there is a reduction of over 50% in milk production from infected animals. Weakened animals are also susceptible to a number of secondary diseases. Few farm families can afford conventional medicines to control the disease and infected animals are seldom treated. *F. hepatica*, therefore, represents a real threat to local people's livelihoods.

The discovery of a natural medicine to treat and control *F. hepatica* depended on a process of PR&D. The positive impact on local farmers' livelihoods is due not only to the PR&D process but also the activities of the *Kamayoq*. These farmer-to farmer extension agents not only played a vital role in working with local farmers during the experimental phase, they have also been largely responsible for growing livelihood diversification along with the growing uptake of the natural medicine.



Challenges in the Implementation of Farmer-to-Farmer Approaches

There have been very few problems encountered in the training. However, the major problem could be the fact that about 40% of the *Kamayoq* have tended to focus on improving their own farms. Thus, they are not able to provide extension advice and assistance to neighboring farmers. This clearly undermines the objective of the farmer-to-farmer approach of sharing skills and knowledge.

Strengthening the Process

ITDG's experience in the Peruvian highlands reveals that it is possible to establish a largely unsubsidized farmer-to-farmer extension service. The extension agents are able to provide suitable technical advice and are able to work with farmers to develop new practices and technologies. While much has been achieved, there is still room for improvement. It is important to encourage future *Kamayoq* to be more committed in community work. ITDG is now seeking to scale up the *Kamayoq* model in partnership with state-based research and extension institutions.

Measuring Impact and Scaling-Up the *Kamayoq* Approach

Due to the lack of a participatory impact monitoring system, ITDG did not measure systematically some of the benefits perceived by farmers who had received advice from the *Kamayoq*. These benefits include fewer animal mortalities and higher incomes from the sale of surplus milk and cheese, but also changes in local farmers' self-esteem and confidence.

Guided by the sustainable livelihoods framework, ITDG and local farmers are now developing a three-stepped and easily replicable approach to measuring the impact of the farmer-to-farmer extension process on local people's livelihoods. The approach involves comparing achievements to the work plan and logical framework, identifying the likely impact of the project in terms of the five livelihood assets, and using a combination of qualitative and quantitative research tools to measure changes in these assets.

Plans on Scaling-Up

There are many aspects considered for scaling-up. ITDG is planning to train additional *Kamayoq* in the highest reaches of the Andes (above 4000m). *Kamayoq* are also organized in a group called the Association *Kamayoq* Toribio Quisipe. The work of the *Kamayoq* has also been recognized within Peru by both the government and some development organizations. The *Kamayoq* are increasingly being contracted by these public and private bodies to extend the farmer-to-farmer training well beyond the communities and region where the *Kamayoq* have operated to date. The *Kamayoq* Association facilitates this process.

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Participatory Research and Development for Sustainable Agriculture and Natural Resource Management: A Sourcebook

Multi-Stakeholder Based Natural Resource Management



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Consensus Building for Community-Based Natural Resource Management



Community-based management of natural resources or common pool resources has become a common strategy for improving resource management and empowering local communities in the past two decades. This is based on such concepts as co-management, use of local knowledge, recognition of local institutions and establishment of common property regimes. Although there has been a focus on design principles for community management institutions and on identifying factors linked with sustainable common property regimes and institutions, there is also a question of how best to initiate such regimes and what participatory planning methods to use.

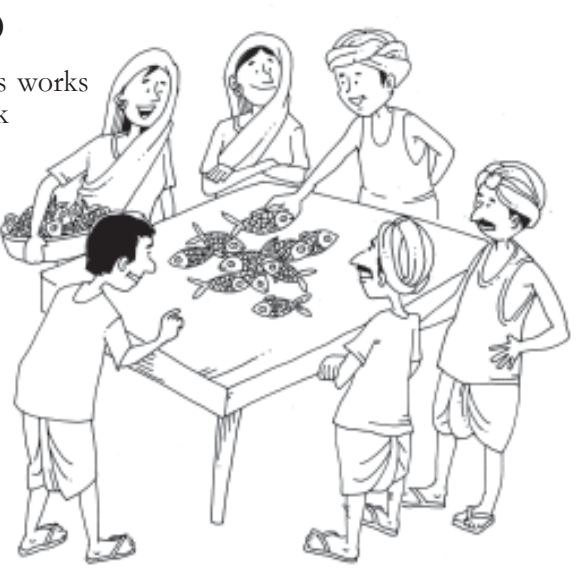
This paper presents a methodology for building consensus among diverse stakeholders for sustainable management of common resources. Consensus building is expected to identify win-win options, that take into account the interests of different stakeholders, and if implemented, would improve the condition of the resource base and lives of users.

Adapted from:
Sultana, P. and P. Thomson. 2003. Methods of Consensus Building for Community Based Fisheries Management in Bangladesh and the Mekong Delta. CAPRi Working Paper No. 30. CGIAR Systemwide Program on Collective Action and Property Rights, International Food Policy Research Institute, Washington. http://www.capri.cgiar.org

A methodology was developed for consensus building called Participatory Action Plan Development (PAPD). This method involves holding a series of linked local workshops where different stakeholders and users of a floodplain participate separately and in plenary to develop a management plan for the common resources they use. The original method was developed by a Bangladesh non-government organization (NGO), the Center for Natural Resource Studies, and a team from Newcastle and Durham Universities (Barr and Dixon, 2001). The method has been used in Bangladesh and has also been adapted and tested in Vietnam.

PAPD is designed to enable the voices of the disadvantaged and less powerful to also be heard.

The Key Features of PAPD



- Each category of stakeholders works separately to identify and rank their problems regarding natural resource management (NRM). Later, all stakeholder groups come together to jointly agree on the priority problems.
- The stakeholder groups separately analyze possible solutions and their impacts, before meeting in plenary to share their analysis and form a consensus on win-win solutions and actions.
- The participants prepare in more detail an action plan for natural resource management.

PAPD is designed to encourage participants to express their views, while avoiding a process that is dominated by locally-powerful and vocal people, and to develop a shared framework of understanding about resource management. It is based on certain principles such as the desirability of consensus, the need for all stakeholders to be involved in the process, neutrality and the sharing of information. However, it does not focus on negotiation or resolving existing direct conflicts between two parties over resources. PAPD focuses on problems, needs and potential solutions that are shared, and the differences and similarities in views of stakeholder groups over them.

Many methods like Participatory Rural Appraisal (PRA) aim to raise individual awareness of resource management problems; PAPD as a process raises collective awareness of the problems and leads towards collective action that can tackle them effectively.

Methodology for PAPD

As originally conceived, PAPD was seen as a two-stage process comprising a problem census (listing of problems and ranking of their importance by different stakeholder groups) followed by stakeholder and plenary planning workshops. However, through the process of applying and testing the PAPD process, it has evolved into three phases that lead into continual or long-term participatory resource management (Sultana and Thompson, 2003). Each phase has a number of different stages and activities (Figure 1).

Scoping Phase

1. Situational analysis (through summarizing local knowledge)

2. Stakeholder analysis (with help of key informants)

3. Household census and invitations to a random sample of households to PAPD (stratified by stakeholder categories)

Participatory Planning Phase

4. Problem census (with each individual stakeholder group)

5. Compilation of problem rankings by facilitators (separating natural resource problems, combining stakeholder group rankings)

6. Plenary with stakeholder representatives and local leaders (to review problems, vote on the top three or four for solution analysis)



7. Solution and impact analysis (with each individual stakeholder group)

8. Plenary with stakeholder representatives and secondary stakeholders (to present the whole process, identify feasible solutions, discuss institutional arrangements proposed by separate groups and next step)

Implementation Phase

9. Develop and adapt community organizations and institutions for fishery/ common pool resource management

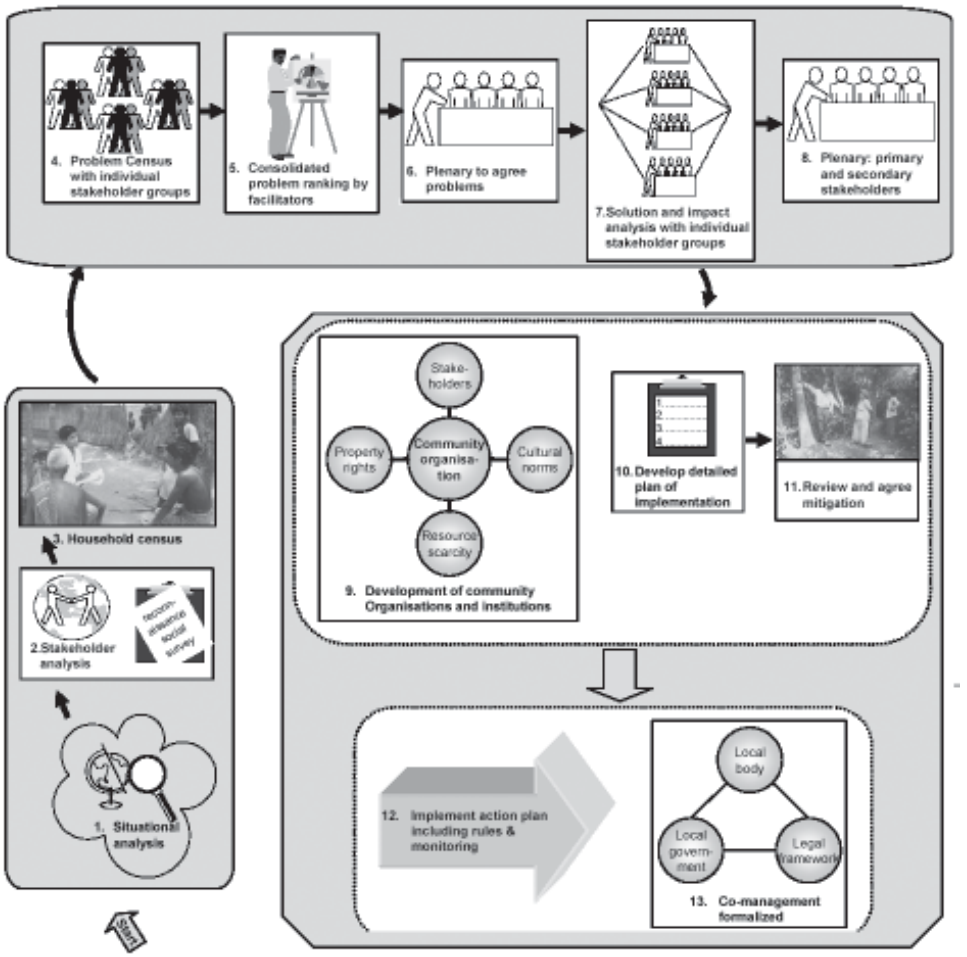
10. Community organization develops detailed plan to implement solutions agreed in stage eight

11. Review of plans by wider community and adjustments to plan (to mitigate or avoid any adverse impacts, for example)

12. Implementation of action plan (for example, physical works, application of rules, monitoring)

13. Institutionalization of management arrangements including local policy support

Figure 1. Thirteen Stages and Three Phases of the PAPD Process



At the heart of the process are stages four to eight that involve participatory workshops with separate stakeholder groups and combined plenary sessions. These stages may be termed the PAPD proper and have been the main focus of the action-research on the method as it is here that the substantive consensus is built. However, this should be seen as one important phase in a larger process. In the more general sense, action research addressing problems of the community has its focus on steps 9 through 13 where both institutional arrangements and fishery management actions are tested and evolve through the efforts of the community with advice and facilitation from non-government organizations (NGOs), government agents and researchers.

PAPD Application in the Field: Vietnam and Bangladesh

The PAPD process and its evolution can be demonstrated by the following cases with Can Tho University in Vietnam and Banchte Sheka (a Bangladeshi NGO which focuses on empowering poor women). Both worked with the WorldFish Center, in Vietnam in the Mekong Learning Initiative, and in Bangladesh adjacent to the site in the first phase of the Community-Based Fisheries Management (CBFM) Project.

In the Bangladesh site, it was not possible to go beyond stage eight during the PAPD held in October 2000, although a separate project involving the same partners has, since 2001, been building on the earlier consensus and has now developed community institutions that have started to implement their plan. Consensus building among all stakeholder groups in the communities that use and benefit from wetland resources is an essential element of collective action and development of co-management institutions. Surveys of participants before and after the core phase of the PAPD process assessed that opinions and some indicators of social capital showed significant changes.

In Vietnam, the local government (the people's organization for the concerned village) became directly involved in the PAPD process in November 2001, after capacity building and PRAs in the previous two to three years. It also provided funding, so the stakeholders followed through to prepare a detailed implementation design where they modified institutions to define each stakeholders' roles and responsibilities for improving resource management and participatory monitoring and research. They started to implement the plan in December 2001 (for example, setting rules for fish conservation and environmental management including sanctions for violators). Stages ten and eleven in the process arose here to bridge between institutional development and implementation. The individual interest groups reviewed the plans and households living next to the resources where physical interventions were planned raised issues of anticipated negative impacts from the interventions or of specific rules. They started to disagree with the plan, and in response the research team facilitated meetings between each individual interest group and the hamlet leaders (government and non-government). Though one-to-one problem identification and alternate solution analysis on an individual basis, it was possible to allay fears in some cases, and in other cases the people's organization agreed to alternative means of implementation to avoid conflicts or potential negative impacts. In this way, the common consensus on benefits was retained and an ownership process even among people who were skeptical of the plan was built. Local consensus building outcomes were validated with the local, district and provincial government authorities in the plenary workshop, and several actions in the plan have been successfully implemented by the community and the local government.

The PAPD approach is an effective way of achieving participatory planning and developing collective action for natural resource management at the local level. The structure of the process ensures that all stakeholder groups are involved, their voices are heard and that it does not rely on self-selected spokespersons. It also enables people from each stakeholder group to understand each other's problems and aspirations, to find common interests, and to identify win-win solutions. This appears to be a good starting point for community-led resource management interventions and for developing local institutions.

The PAPD approach appears to be transferrable from Bangladesh to other social settings, based on experience in Vietnam. However, it is not a way to resolve fundamental conflicts, e.g., regarding access to resources. Application in Vietnam showed the need to add to the process a stage where individual stakeholders (including those who were not directly involved in the PAPD) can reflect on the outcomes and proposed action plan, and where they can investigate and negotiate, with the local community leaders, adjustments to the implementation plans that minimize any short-term adverse individual impact. These experiences confirm that ultimately all parties recognized that there were wider social benefits and that the whole community would gain from working together.

The PAPD method has now been adopted in several projects working in wetland and fishery management in Bangladesh, and there is interest among the NGO community to apply it more widely. In addition, adjacent communities have shown interest in taking up similar practices and processes.

Insights on the PAPD Methodology

Situational Analysis

- PAPD may be carried out in locations where the facilitating organization has already been working because there will be a good understanding of the biophysical, economic, social and cultural environment of the area. This provides the facilitators with insights that they can use during the PAPD workshops.

- Situational analysis does not need to be a formal exercise but may use PRA tools like participatory resource mapping, key informant interviews and site visits.

Stakeholder Analysis and Census

- Key informant discussions identify the locally-relevant stakeholder groups. Stakeholder analysis can be combined with the situational analysis as stakeholder groups tend to be linked with the main resource use activities. However, socio-economic status and gender (e.g., poor and landless women) also need to be considered in the categorization.

- The census is designed to identify the stakeholder categories by incorporating locally-relevant indicators of resource use and socio-economic status like type of fishing gear owned, as well as nationally relevant indicators like land ownership.

- The scoping phase builds rapport with communities in the area and makes them aware of the process even at an early stage.

- In a heterogeneous community where there is differentiation in livelihood assets, wealth, resource dependence and power, it is important that all different stakeholders are represented and participate.

Participatory Planning Phase

- This involves five stages that form a framework for stakeholders to develop a common understanding of their problems and potential solutions. Participants identify the constraints they experience particularly those related to livelihood and natural resources, and share their views on how to overcome these, especially through better resource management.

- There is an inverse relationship between people's willingness to express their views frankly, and the number and diversity of people participating. Individuals tend to discuss issues more freely on an individual basis than in public. Some reasons why people may not contribute ideas to a public discussion are: they do not consider their ideas valuable; they do not want to upset the status quo; they want to avoid offending others; and it is not traditionally or culturally acceptable for them to speak in a public meeting (e.g., women and young people) when it is for others (e.g., male elders).

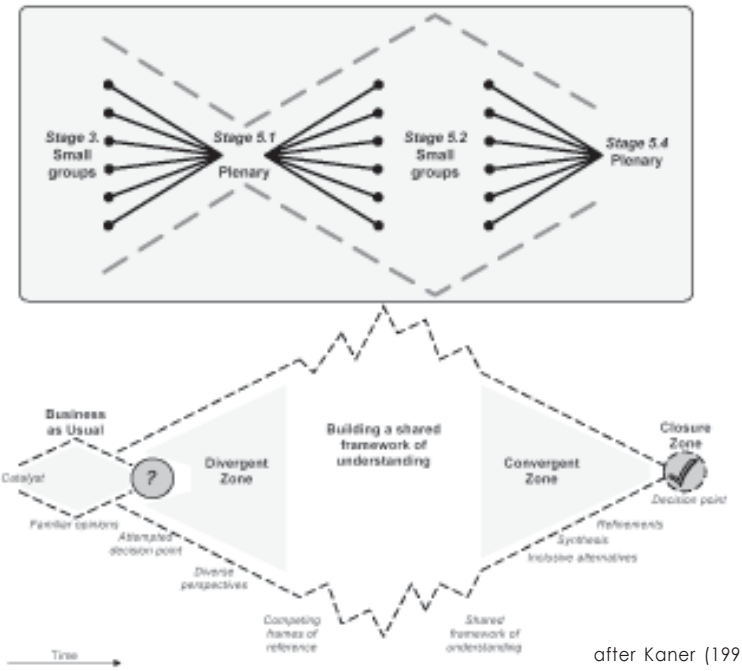
- Building relations with a few key individuals can help obtain information of the real workings of society. This can be validated by triangulation with what other individuals say. However, it is a slow process and involves no explicit public consultation or planning objective.

- An alternative is for people to express their ideas in a less judgmental forum where they feel comfortable, like with friends or with people of similar background. The drawback, however, is that these views are not aired in public and do not contribute to shared understanding and mutual learning, and so there is no change in the status quo.

- The PAPD method takes into account all of these issues through a series of linked separation and aggregation steps that together can result in a balanced view. The separation steps are exercises undertaken by each stakeholder group. The aggregation steps are facilitated plenary sessions where all groups are represented (Figure 2).

The PAPD proper is a short intensive phase of about 7-8 days of workshops, whereas the implementation phase will likely last for several years.

Figure 2. Achieving Balance Through Linked Small Group and Plenary Sessions



after Kaner (1996)

Implementation Phase

- The core phase of the PAPD (participatory planning) is envisaged as an empowering process that builds social capital and leads to establishing or adjusting local institutions and organizations for better management of common pool resources.

- Organizational development is needed and there are more detailed decisions to be taken relating to implementation of the action plan.

- There is also a need to resolve local conflicts within the context of an overall consensus or shared view of problems and solutions, and local government agencies play a key role in this.

- The stages identified are overlapping and mutually reinforcing, and are not necessarily a logical process. It involves iterations and feedback as arrangements are expected to be improved and adapted over time.

Assessing the Impact of Consensus Building Process

Possible indicators and approaches to assess impact of the consensus building are:

- changes the level of cognitive social capital
- enhances trust and reciprocity
- is an empowering process
- is inclusive or representational
- focuses on common issues and goals
- follows principle of civil discourse
- adapts and incorporates high quality information
- encourages challenging assumptions
- maintains the interest of participants
- ensures that consensus is sought only after full exploration of the issues
- results in a decline in reported conflict though this makes the assumption that conflict is the antithesis of consensus, which is not clearly established
- makes use of methods from Alternative Dispute Resolution (more conflict focused, and more focused on outcomes)

One approach for assessing impacts of the PAPD process is to use the sustainable livelihoods framework (Carney, 1998) and to focus on measuring changes in social capital - in broad terms, the networks, relationships, values and attitudes that make and position a community.

Another way is a conceptual framework that separates micro- and macro-levels of social capital (Krishna and Shrader, 1999). The macro-level relates to the institutional context in which organizations operate. Two types of micro-level social capital that may be the basis for understanding consensus building are:

- Structural social capital - includes the composition and practices of formal and informal local institutions that serve as instruments of community development. It also includes things that are visible or tangible and can be devised through group deliberation. It is relatively objective and is external as it can be directly modified.

- Cognitive social capital - refers to values, beliefs, attitudes and social norms that predispose people and communities towards collective action. It is how people think and feel, is essentially subjective and is internal, residing in people's heads and not easily changed by external intervention.

Assessing changes in structural social capital is close to monitoring physical and organizational outcomes of consensus building efforts. These cannot be done on the short term but over a longer period of time. For the short term, changes in levels of cognitive social capital that might be associated with PAPD may, however, be assessed as consensus building aims to change attitudes and values, and to increase the likelihood of collective action.

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Limits of the "Negotiation Platform": Two Cases on Participatory Municipal Planning on NRM in the Brazilian Amazon



Natural resource management (NRM) is intimately linked to the dynamics of land occupation and resource appropriation by different stakeholder with diverse interests. This is especially true in the "agriculture frontier" zones that are characteristic of much of humid tropical forests. This paper analyzes two action research experiments on participatory municipal planning of natural resource management in the Brazilian Amazon.

A group of researchers who teamed up with local and regional farmers' organizations found out that when different approaches to participatory planning on NRM at the municipal level were done, different reactions were elicited from the townspeople, consequently affecting the way that natural resources were preserved and managed.

The "participatory approach" seemed appropriate and favorable because municipal planning was promoted by local stakeholders, particularly the farmers' organizations.

Participatory planning experiments focused on natural resource management were established successively in two different Transamazonian municipalities: in Uruara (1993-1996) and in Porto de Moz (1996-ongoing). The results are discussed in the following cases.

A local action-research team, the Transamazonian Agro-Ecological Laboratory (LAET), in partnership with local and regional farmers' organizations grouped together in the Movimento Pela Sobrevivencia da Transamazonica (MPST, movement for the survival of the Transamazonian), supported two participatory municipal planning experiments.

LAET chose an intervention method based on seeking consensus among the various parties (stakeholders) involved, called the "multi-user negotiation platform." This is also called the "patrimonial approach" with the underlying hypothesis that participatory planning for municipal development would include issues of land occupation (who are the types of people in the area?) and sustainable NRM.

Case 1. The Use of Multi-Stakeholder Platforms: Municipal Planning of Forest Resource Use in Uruara

Uruara is a municipality along the Transamazonian Road, some 180 km west of Altamira. The area was developed when the Brazilian government opened a road through the Amazon forest, formerly Indian area, in the 1970s. Forest enterprises including sawmill operation are major sources of income in Uruara.



Problem/Situation

Initial interviews among the local farmers and researches conducted by LAET showed that among the problems that the local folk were facing, farmers feared the most the massive arrival of sawmills exploiting both public and private forests in an anarchical and uncontrolled manner. LAET also discovered that figures on the volume of wood extracted and the profits made by the *madeireiros* or foresters were twice the official figures.

Approach Used

LAET's research results were presented in municipal conferences organized by various local organizations of the municipality, including the farmers' union. Its initial report on problems was presented in a "municipal conference for alternative economic projects". Its more in-depth study on the forest sector was presented at the March 1995 Municipal Conference on "the forest and wood". These conferences were attended by foresters, representatives of farmers' associations and communities, local and national authorities, and some political figures of the state of Para.

Results

Research results created varied reactions from the diverse stakeholders. For the local people, the results guided them in coming up with innovative proposals for better resource management. Some proposals truly benefited all parties (including the sawmill owners) while others were acceptable to all groups but only under certain conditions. This proved that it was possible to find an acceptable common ground despite strong opposition among different social groups.

The *madeireiros*, however, strongly criticized LAET's report on the considerable margins earned by forest enterprises.



Public officials and political figures used the conferences to push for their own political agenda. Representatives from various public offices took this opportunity to draw public attention to Uruara and justify its preferential treatment by government authorities. Uruara was the first in the area to be given a new line of credit for farming; a new settlement project for landless farmers was also launched. In reality, however, the decision to give Uruara priority had been made even before the first conference. It was part of an agreement between the governor of the state, the Catholic priest, and other local political figures, to win a new city hall in the Transamazonian region through a regional alliance between two political parties. Uruara was to be the center of this alliance. In the end, however, the governor's candidates were not elected despite the considerable economic support of sawmill owners.

Little by little, LAET was pushed out of the Uruara planning process as it was regarded as "bothersome", especially after the forestry seminar. The innovative proposals presented by the local people were also forgotten by the local government and the State. In fact, for the conference initiators, the conference's purpose was not really to apply these proposals but to draw public funding of any sort. The local technicians working for the government agencies (particularly the extension services and regional development agencies) and the outside researchers invited for their expertise --far from bringing neutral knowledge that could be made available to local stakeholders --also participated in function of their own interests and strategies, including politics. This is why the local elite pushed aside LAET at the crucial point when proposals were to be transformed into projects or training for farmers.

Lessons

It is not enough to simply analyze the strategies of various stakeholders vis-à-vis their interests in the resources; one must also take into account their larger strategies, in this case, the field of national politics. The "strategic stakeholders" may give greater importance to hoped-for political benefits than they do to possible economic benefits (from, for example, a new wood optimization technology).

The participatory municipal planning process in Uruara bogged down because of:

- Failure of LAET to recognize and analyze the political context and forces working in the area, as well as the hidden strategies of the different stakeholders.

- Unrealistic belief that discussions among the different participants could be held in an equal footing and that they could produce proposals for the good of the majority.

- Failure of government to act as referee and to guarantee that the agreed proposals would be respected by all parties.

The Platform Method of Multiple Stakeholder Negotiation

The platform method of multiple stakeholder negotiation was tested in the context of municipal participatory planning. The research confirmed the potential of participatory action research (PAR) as a tool to facilitate discussion by a community on its future. PAR also helps in making the local stakeholders more conscious of the probable long-term consequences of present activities and practices. Through PAR, innovative proposals were formulated such as establishing local control of fishing, creating community forest reserves and encouraging local wood processing with low-impact technologies. The cooperation between researchers and farmers' representatives was particularly efficient when the farmers' representatives assumed the facilitation role.

The process was not successful when the government represented only the interests of a small but powerful minority. In Uruará, the local elite manipulated the planning process to their own advantage and against the interests of the majority of the small farmers. Therefore, the multiple stakeholder platform method was not applicable. The existence of "state of law" (passing of democratically-enacted state and local laws and their reliable enforcement) and democratic ethics are necessary for its efficiency.

In the absence of state of law, the participatory research should concentrate first on reinforcing the weaker categories of the population and on analyzing political power relationships in the local communities and regions. This tactic may prove especially desirable where both the national government and the local poor majorities have common interests in better natural resource management and land use. By establishing such a coalition, the capacity of the local elite to block action would be diminished.

Development of Sustainable Farming Systems

Classical methods of research-development and the farming system approach were also used to encourage the development of sustainable farming systems. One of the outputs was a demonstration of the potential of traditional commercial perennial crops of the region (cocoa, coffee, pepper) as the most efficient way to intensify agriculture sustainably. On the other hand, complex agroforestry systems promoted by research and non-government organization (NGOs) were not economically-sustainable.

Based on existing technologies and farmers' conditions, LAET can now formulate models of sustainable farming systems (including livestock and forestry components) in the region. These models can be important tools to orient future agricultural research and extension and policy development especially on land reform and credit for the region.

Partnership with Farmers' Organizations

The farmers' organizations were interested in sustainable development and better management of natural resources at the regional level, in as much as it fitted with their broader political objective. They effectively disseminated information in the cases in which both the farmers' organization and the farmers had common interests in the proposed innovation. Such organizations played an important role in representing the farmers in other instances such as negotiation with the State. Organizations were also important in collective discussion at the municipal and regional levels.

However, the farmers' organizations also had many other priorities and objectives. They wanted to maintain a high control on the research team. The farmers' organization facilitated the research in most cases, but also made research difficult or blocked it when it was contrary to its strategy (for example when the research indicated that mass credit for all farmers was not giving sustainable results, whereas this was one of the popular demands driven by the unions).

The establishment of a common strategy was not achieved. It was impossible to conclude that the choice of the farmers' organizations is the most appropriate for PAR on natural resource management in the frontier context. Researchers cannot expect that representatives of farmers' organizations will necessarily state clearly their own priorities and expose their strategies at the beginning of the cooperation. The researchers, too, can be blamed for lack of transparency. They never explained their professional objectives to the farmers nor their need for scientific recognition.

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Case 2. A Strategy that Empowers the Dominated Majority: Zoning and Participatory Municipal Planning in Porto de Moz

The area around Porto de Moz is more characteristic of the occupation of the Amazon since the 16th century. Most of the Porto de Moz population – *caboclos*– have been on the riverbanks for several generations. Until the 1960s, hunting and gathering were the principal economic activity; since then, wood extraction has grown important.

Caboclos refers to the mixed-race population (Native Indians, Africans "imported" to the region during the slave era, and Europeans) who generally live along the riverbanks.

Problem/Situation

Since the forest and the river were important sources of livelihood, the farmers' organizations of Porto de Moz municipality requested help from LAET to organize a conference on "the future of wood and fishing". The people already had three seminars prior to this and they decided they needed technical and financial support for a more ambitious event.

A rapid participatory research was organized by LAET with the representatives of the local communities. It showed the following problems:

- Rampant logging such that the forest could be depleted in 10-15 years.
- Large boats coming (from the other regions) for commercial fishing were depleting the fish populations.
- No alternative source of income for traditional people.
- Forest companies, unscrupulous people and speculators were claiming large tracts of land in the forests leaving little land left for the traditional inhabitants. There was pressure on the local people to sell their lands to the forest companies at a very low price.

Approach Used

Because of the Uruara experience (Case 1), LAET decided to use a different participatory planning strategy. Working closely with MPST, they decided to dialogue first with local farmers and fisherfolk organizations. Once these groups had finalized and consolidated their objectives and strategies, they would negotiate with other local stakeholders and government. It is important to note that the elected mayor of Porto de Moz was a representative of traditional large landlords, and also the owner of the largest sawmill in the *municipio*. He therefore combined economic, traditional and political power.

LAET first organized a seminar to discuss the results of the participatory research. This was attended by grassroots communities, representatives from other municipalities, local technicians and a representative of the Secretary of State and the Environment. After the results were presented, participants were split into small groups to discuss issues and come up with proposals. The technicians and

researchers were grouped separately to avoid monopolizing speechtime from farmers. The local organizations and the communities prepared a list of proposals that the communities would do or support.

Results

After the conference, a committee for NRM planning was formed that was made up of representatives of local organizations. This committee set priorities, prepared a program of action and monitored the local implementation of the action plans. They called on LAET and MPST only when needed. Among the important results of the committee were:

- rapid multiplication of many community-established rules limiting fishing in the rivers and real control of professional fishing in their areas
- support of the federal environment agency
- decision to establish "community forest reserves" in four communities
- organization of an "environmental awareness-raising" program by local organizations which included presenting environmental laws and the proper authorities to contact in case of conflicts
- creation of a protected area in the flood area around a seasonal lake named "Lago du Urubu"
- support gained in giving the Porto de Moz farmers' union access to its records and supporting their claims on community lands

Lessons

This experience tested a new method of participatory action research for NRM. Unlike the "multi-user negotiation approach", priority was given to the majority of small rural producers and their organizations. Establishing a "negotiation platform" can only be done after these groups have been strengthened and have acquired a clearer idea of their own interests and their NRM strategies.

Conclusions

To efficiently support participatory planning of natural resource use, it is important to analyze and understand the strategies and interests of stakeholders. Awareness of the dissimulation tactics, systematic distortion of information and local power or political relationships is critical. Traditional inhabitants of the Amazon (*ribeirinhos*) and the small migrant farmers (*colonos*) can have real interest in preserving and managing natural resources especially fishing areas and forests, if they can earn regular additional income from them and if the government is ready to delegate land or NRM to what was considered as "free and not owned".

In the context of the Brazilian "frontier", direct use of "platform" negotiation methods and discussion among all parties is not realistic. These methods presuppose government support and an efficient legal system to guarantee that any consensual agreements reached are respected. The Uruara experience underscores the need to empower the dominated majority before entering negotiations with other stakeholders.

Participatory action research can effectively contribute to empowerment and provide new solutions for better local NRM. This new approach may be particularly useful in situations where the national government and the majority of the local populations share an interest in improving NRM and the local elite has opposing interests.

The "multi-stakeholder platform" method was used with limited success in the first case. In the second, priority was given to the empowerment of the weaker and more numerous stakeholders (the small farmers and traditional populations) with more encouraging results. Analysis of the two cases leads to the conclusion that the platform approach is not adapted to situations where the state and justice system are absent or weak.

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Participatory Research and Development for Sustainable Agriculture and Natural Resource Management: A Sourcebook

Participatory Land Use Planning and Governance in Ratanakiri, Cambodia

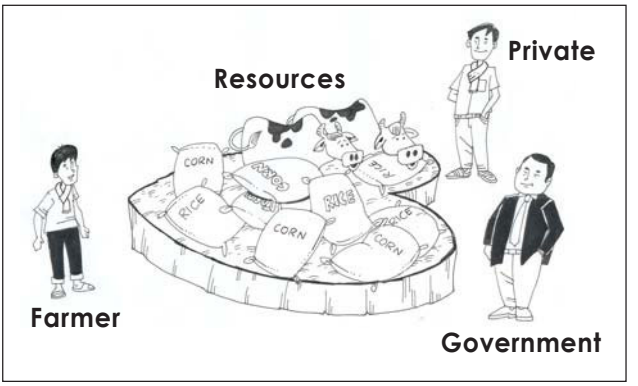


Natural resources are part of the ecosystem that provide goods and services to humans. They support people's sustenance and improve living conditions. Since these resources play such an important role, countries, groups and individuals use various means to control access to these resources. Control over access normally denotes a kind of ownership for use and management of the resource. In fact, many conflicts, battles and wars have been fought to retain or obtain control over resources.

Adapted from a chapter forthcoming in:
Tyler, S. (ed). Community-Based Natural Resource Management: Action Research and Policy Change in Asia. Ottawa: IDRC Books, forthcoming 2005.

The procedures for claiming that a resource is state or private property are usually clearly defined and well established with clear measures to protect these rights. In many countries though, there is growing evidence that when resources are classified as state or private property, this classification normally excludes the very poor and marginally poor, and in fact tends to marginalize them further. Developed countries usually have a system of providing the poor with social security programs and projects that provide them with their basic needs and help them survive without exploiting natural resources. This is different in developing countries, especially those that have poor governments, rich private sectors (a small percentage of the population) and large poor populations that depend totally or primarily on natural resources for their livelihood. In fact, many of these communities manage these resources and consider that the resources belong to them.

In many developing countries, allocating resources only to the government or private owners affects the basic needs of people dependent on these resources. As a result, conflicts arise between these entities in addition to the existing conflicts within the communities. It is also common that the government and private owners normally get better patronage because they are more powerful. But, there is another important consideration, especially with regards to state property. The government staffs in developing countries are normally paid low wages and reap benefits from illegal sale of natural resources, which is more lucrative. This results in different levels of corruption and misuse of natural resources.

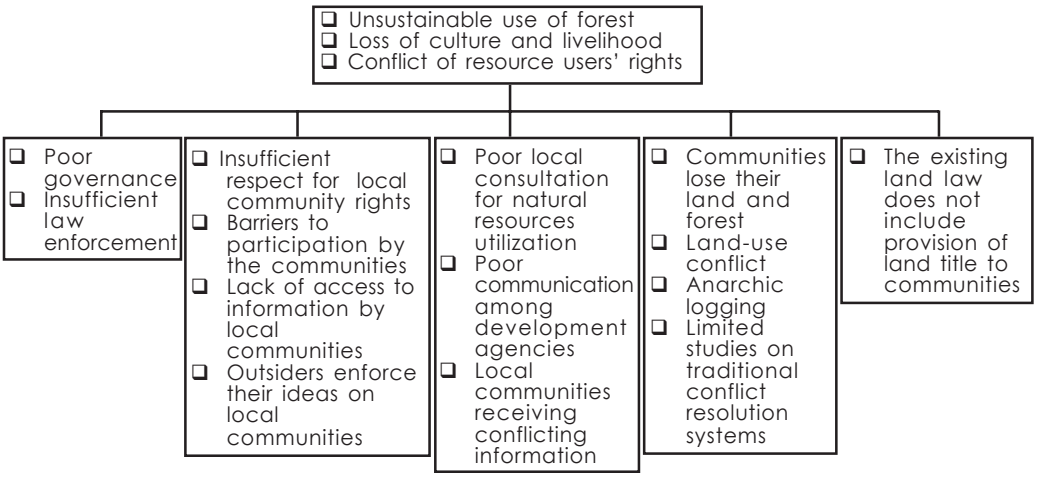


Many projects are using Participatory Land Use Planning (PLUP) as a means for these different entities to come together to consider each other's needs and negotiate, discuss and agree on the use and management of resources in a sustainable manner. This is the case in Ratanikiri, Cambodia.

Natural Resource Management in Ratanakiri

In Ratanakiri, government granted concessions and private owners who are non-indigenous have displaced indigenous communities, whose lives depend almost entirely on natural resources. Government officials are balancing between personal gains and community needs, and national development needs, policies and laws, which are usually for more government control over resources. Some of core problems in Ratanakiri, identified in a workshop in 1997 by stakeholders at local, provincial and non-government organization/international organization (NGO/IO) levels, are illustrated in Figure 1.

Figure 1. Core Problems in Ratanakiri

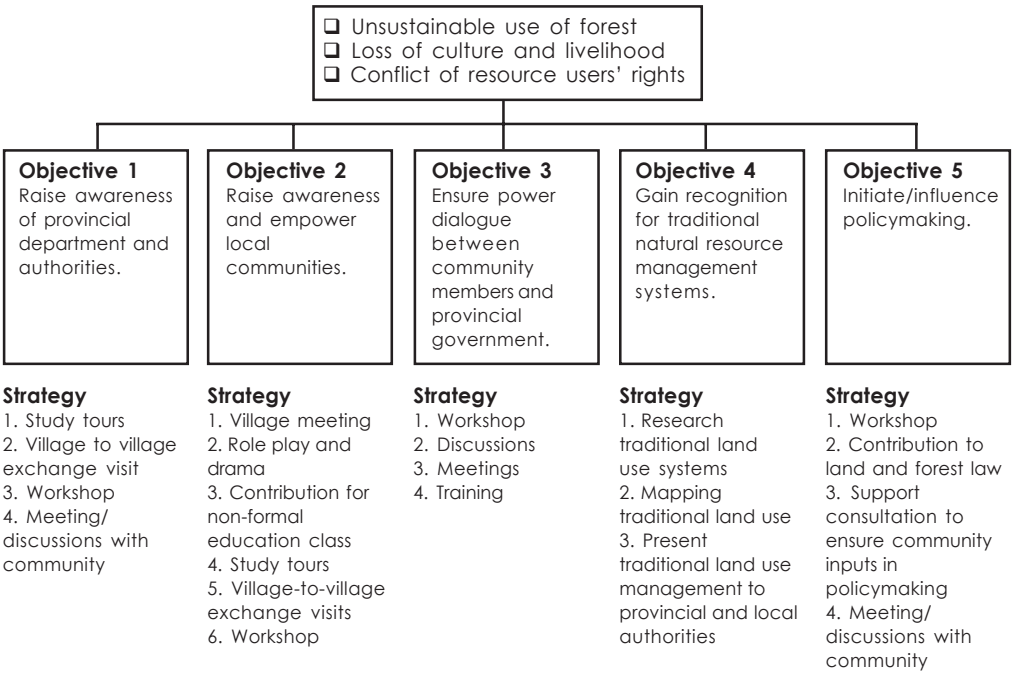


Based on existing natural resource problems in the province, the CARERE support project facilitated the Seila program of Ratanakiri, in cooperation of other stakeholders, to formulate a project with the specific objectives (Figure 2). The project, called Community Based Natural Resource Management (CBNRM), was implemented by the Department of Environment as the lead agency. CBNRM was the backbone of this initiative. The International Development Research Center (IDRC) funded the project through the Seila program.

The Seila Program in Ratanakiri

In 1996, the Cambodian Area Regeneration and Rehabilitation, a United Nations Development Program (UNDP) support project to the Seila Program of the Royal Government of Cambodia (CARERE) project, introduced the Seila decentralized, de-concentrated management, financing and planning of local development program to Ratanakiri. This was a 'bottom up' development process that assisted communities to prepare their Commune Development Plan (CDP) based on the visions of what they want their villages to be in the future. The Commune Development Committees (since Feb. 2002, these have been changed to Commune Councils) with villagers developed these plans, and provincial and district facilitation teams, who were government staffs, facilitated the process. Based on these plans, government sectors and NGOs supported activities in the communes.

Figure 2. Overview of the Community Based Natural Resource Management Project, Ratanakiri (1997)



Core teams were comprised of members from different provincial departments (Provincial Core Team) and representatives from target communes (Commune Core Team). These core teams and the PRDC, relevant departments, community members, and NGOs/IOs in the province were brought together to identify common problems indigenous people were facing. This meeting was also used to discuss and arrive at a common strategy for implementing a CBNRM project in Ratanakiri. To develop a model, it was agreed by all stakeholders that working with and for communities was important.

At the village level, commune representatives acted as facilitators during the introduction of the project to villagers. CBNRM and community forestry activities were initiated. Once the rules and regulations were formulated, these were presented to commune, district and provincial levels for endorsement.

The Ratanaki Team prefers to use CBNRM instead of PLUP because they feel that they assist communities in planning for the use and management of natural resources in a sustainable manner meeting both livelihood and economic needs.

Decentralization of Natural Resource Management

In order that communities manage resources, it was important that communities had a sense of ownership over the resources, which implied that:

CBNRM enabled communities to present their customary land use and illustrate traditional natural resource management systems. CBNRM was used to map the community 'user' areas.

- ownership was communal and not individual
- there was a common understanding of how to use and manage resources
- there was a common understanding how to use and distribute benefits from resources
- secure feeling that this ownership right was long term
- secure feeling that provincial and local authorities supported the enforcement of rules and regulations

In order for this to happen, the project had to influence decision making at different levels



At the Village Level

The key players at this level were the community people, project team (CARERE/IDRC staff) and government staff.

Awareness and Empowerment

Awareness raising on natural resource issues was more concerned with enabling communities to better express their traditional management systems. The other main aspect was to build confidence among villagers in themselves, their capabilities and their systems. Only in situations in which issues were unable to be resolved through traditional problem solving mechanisms, did government/CARERE staff intervene. Usually, all discussions with neighboring villages and problem solving were done by villagers themselves.

- Project team emphasizes that the community people are the **owners** of the projects, hence, it entails full support on their part.
- Existing natural resources and related problems are identified.
- Key players and their responsibilities are determined.
- Stakeholders group to discuss issues at hand. The activity aimed at raising awareness and allowing community members to deliberate on issues regarding resource management and ways on how to development ownership of the activity.

Formation of Natural Resource Management Committee
NRM Committees were established in each target village. These committees ensured natural resource issues were raised in village meetings and were included in the village development plan. These committees were sub-committees under the commune councils. The NRM committees implemented CBNRM activities in their villagers in cooperation with the other villagers and commune councils.

Training
Training incorporated formal participatory training and on-the-job training - the latter being the most effective. Formal training consisted of brainstorming sessions with villagers on various topics to flesh out ideas and thoughts on the best approach to managing their natural resources. Technical training was done on-the-job and included mapping skills, basic aerial photography interpretation, facilitation skills, data collection and use of PRA tools.

In applying the knowledge and skills learned in this training, villagers were asked what they considered community forestry to be, how their village/commune would benefit, and how they planned to manage it. Once mapping started, they were shown how to record observations and collect data in the field. These steps were then verified and corrected by core team members.

Facilitation
CARERE staff assisted department staff not only in setting meetings, but also in making arrangements so that villagers from different locations could meet and discuss issues. Government staff's involvement consisted primarily of recording the results of these discussions.

The CBNRM team, on the other hand, explained to villagers and the government the importance and dynamics of negotiation and in agreeing to a common decision, satisfactory for both parties. When the difficult issues arose, they sometimes needed discussions between villagers and government counterparts.

Building on Existing System
Building upon traditional NRM systems meant that when change was needed, villagers were consulted on how such a situation was addressed previously. This element of the project was critical to ensuring a strong sense of community ownership, while also educating government and department staff of the validity of traditional knowledge.

The project used traditional land classifications as a base to make land use maps of the villages. The villagers prepared sketch maps of the customary village boundaries, and identified the various issues of the land (e.g., agricultural land, spirit forests). Later, computer generated maps were made using these information.

Village exchange visits were key learning exercises. During these visits, villagers were able to discuss traditional NRM issues with other villages, and compared similarities and differences in management methods. These exchange visits also went a long way in strengthening community networks. It was hoped that the various indigenous groups gained a degree of solidarity from such visits.

Respect and Pride

The increasing influx of people and change in Ratanakiri has resulted in indigenous people having increased exposure to new socio-cultural factors. This includes ideas regarding farming techniques and income-generating activities. These socio-cultural changes are having an affect on the level of cohesiveness among indigenous communities. As a consequence, pride among villagers in their cultural heritage, in the face of these soio-cultural changes was and still is suffering, particularly among the younger generation.

Provincial Level

The PRDC, chaired by the provincial governor, is the highest coordinating body in the province, and it assesses and endorses all the plans in the province. The interdepartmental body acts as a forum where departments meet and discuss issues and make joint decisions. Such effort ensures a shared responsibility among the government and departments. It also ensures a unified approach to development.

The funds provided to the PRDC to implement contracts with an emphasis on CBNRM also played an important role in assisting PRDC to negotiate with line departments and ministries. Their advocacy of community participation in planning and implementing development activities increased the confidence of the PRDC with regards to decentralized governance and the acknowledgement of community involvement in the management of natural resources.

Before implementation, a consensus is reached between the departments and community as to how project would be implemented. This was a way of introducing the provincial department staff to the idea of community participation in development activities. But, more critically, their participation represented a commitment to participatory NRM. Department staff were encouraged to conduct activities in a participatory manner and were rewarded with increased responsibility. Trust was very important, as was transparency.

Multidisciplinary studies and workshops were conducted where the different stakeholders could negotiate and come to an understanding as to the proper NRM. This move proved helpful in avoiding conflicts between individuals, large companies, communities and the state.

National Level

During this project, laws were being formulated for the country. In terms of affecting change at the national level, the CARERE project adopted two approaches:

- formal, direct approach that involved mediators and lawyers
- less formal, indirect approach participated in by NGOs/IOs working group



In the **direct approach** the UNDP was requested to seek a lawyer to coordinate with the provincial project and assist in the drafting of the new land law, focusing specifically on issues affecting indigenous people. In the **indirect approach**, NGOs/IOs working group in the province met to discuss and propose comments to the newly drafted laws and sub-decrees.

The project also assisted/funded workshops at national level to discuss land and forest tenure of indigenous communities with other NGOs/IOs. Many times, direct interaction between policymakers and indigenous community representatives produced better results, as when community members presented their issues themselves. Of course, community members had to be groomed not to demand, but to be ready to negotiate and argue their cause.

Achievements

At Project Level (Community and Provincial)

The integrated planning approach endorsed by he project has assisted provincial line departments in Environment, Agriculture, Education, Women and Veteran Affairs and Rural Development to adopt a working approach that is more community-oriented.

At the village level, concrete results include the following:

- SEILA target communes were able to request for land use planning initiatives.
- A 20,000 ha concession was reduced to 5,000 ha in Oyadao district.
- Provincial authorities were convinced of the importance of community-based activities and plans for replication in other communities are done almost immediately.
- Provincial authorities have endorsed six land use plans allowing management rights to indigenous communities.
- Community representatives in many communes with land use plans were able to negotiate and prevent land grabbing and encroachment by non-community members and government officials.
- Villagers and representatives became more confident in expressing their views, although they still need support.
- The increasing influx of people and socio-cultural changes in Ratanakiri have resulted in an increase in the level of cohesiveness among indigenous people and have made the villagers proud of their cultural heritage.
- Communities, with the help of the provincial authorities and NGOs, were able to present their petitions up to the national level.

With the support of IDRC, action-research on CBNRM was added to the CARERE/SEILA Ratanakiri Program in its decentralized planning process. CBNRM planning tools were incorporated into the process which not only addresses a target community's immediate needs, but also their long-term plans to secure the environment and traditional livelihood systems.

At the provincial level, the concrete results inlude:

- The CARERE/SEILA Local Planning Process (LPP) has been modified to include natural resources.



- The provincial government signed the Yeak Loam Lake's 25 year lease agreement with local communities.
- The community and province formulated the Community Natural Resource Management project (CNRM) based on CBNRM concepts. CNRM tries to solve the core problem of communities losing control over the management of resources they traditionally used.
- The national government, based on requests from the provincial authorities, reduced the size of the oil palm concession from 20,000 ha to 5,000 ha in Oyadao district.
- A project target community has been selected to pilot communal land titling by the MLMUPC.
- The province with NGOs and IOs conducted the "Cultural Resource Study" and the Hero Logging concession agreed to avoid logging in culturally/spiritually significant areas.

National and Higher Levels

Ratanakiri has been used by on many occasions to provide input to other projects attempting similar changes to laws and policies in Cambodia. In short, the success of IDRC and CBNRM in the province is a showcase for other projects.

The land law recognized the rights of indigenous communities to possess and use public land to support their traditional livelihood practice systems.

Ratanakiri based NGOs/IOs have also been instrumental in the development of the Draft Policy for Highland Peoples Development of the Inter-Ministerial Committee which, though not formally approved, has been a basis for discussions on every development project concerning highland peoples. A recently adopted 'Sub-decree on Forest Concession Management', signed by the prime minister and minister of agriculture, forestry and fisheries after consultation with NGOs/IOs, was in favor of a local consultative process. As a result of these discussions, agriculture, forestry, fisheries, land planning and environment ministries have become more aware of the local situation and subsequently include community participation, biodiversity and protected areas program in their plans.

Some of the concrete results include:

- The 'Council of Ministers' adopted a land law that included a chapter on indigenous people's communal rights.
- The Logging Concession Sub-degree was adopted by the national government.
- Through UNDP/CARERE, SIDA supported (US$3.5 million) the PRDC in Ratanakiri to continue CBNRM activities from 2001-2005.
- The UNDP/government included Ratanakiri in the interim poverty reduction strategy paper consultation. UNDP is involved in discussions regarding indigenous people at the national level.
- Donor agencies are discussing indigenous peoples' rights with national policymakers.

Lessons Learned

The decentralization of the natural resource management, as experienced in Ratanakiri, Cambodia, generated the following lessons.

- Working with the government may be slow but it produces more sustainable support in the long term. However, the government needs to benefit from the CBNRM approach for the partnership to work.
- A project of this nature requires high quality and committed staff as the work often goes beyond what is required.
- Provinces could adapt procedures to suit local situations, but could not change the structured procedures outlined in other programs.
- A system of check and balance is important to avoid corruption in both the government and community structure. Transparency is also necessary.
- Decentralization and participatory approaches cannot be implemented mechanically. A fundamental change in attitude is necessary and can be achieved by allowing people to experiment with approaches and facilitating the learning from these experiences.
- Land use maps are the most effective, legitimate and convincing means available to villagers to demonstrate natural resource management. They also help illustrate traditional land use management systems. However, participatory land use planning needs more than just making maps and formulating rules. It requires advocacy, negotiation, awareness raising, conflict resolution, capacity building to work together.
- An effective facilitator with knowledge on problem-solving is necessary in a country where war separated people and the government for a long time.

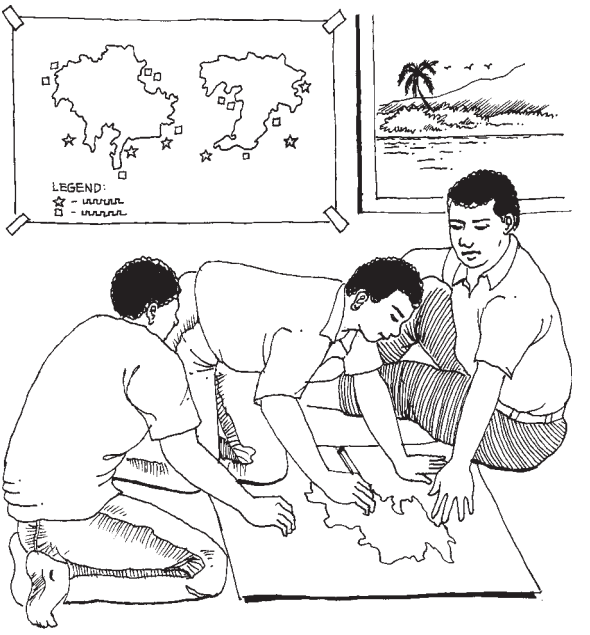
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Development and Implementation of a Resource Management Plan: Lessons from Caribbean Nicaragua



This paper explores the experiences of the Coastal Areas Monitoring Project and Laboratory (CAMP-Lab) in Pearl Lagoon, Nicaragua. This focuses on the efforts of the project to develop, codify and implement a participatory natural resource management plan for the Pearl Lagoon basin. The efforts of the project were tied to the broader political and institutional environment in which the project operated. Progress towards success in all of these areas has been intermittent and dependent on a combination of persistence, recognizing and seizing opportunities, creative efforts at collaboration with a variety of partners, and a staff of local people who are well respected in their communities.

The CAMP-Lab project was initiated in Pearl Lagoon in 1993 through the efforts of a M.Sc. student, from the University of Michigan and a local marine biologist working with the Norwegian Peoples Aid (APN)-funded marine laboratory located in Haulover. These researchers used traditional participatory action research (PAR) methods, such as mapping and ranking exercises, in the village of Haulover to identify issues of importance to the community. This process ultimately led to the identification of the need for a management plan for the natural resources of the area. Based on this pilot activity, these researchers developed the CAMP project proposal, funded by the Canada's International Development Research Center (IDRC), to continue their work in the broader Pearl Lagoon area. Eventually, at the urging of community members, the APN-funded marine laboratory in Haulover was merged with the CAMP to create CAMP-Lab.

The CAMP-Lab Project Context

CAMP-Lab is centered in the village of Haulover just south of Pearl Lagoon town. The project works regularly with eight communities surrounding Pearl Lagoon through CAMP-Lab Committees (community groups) and occasionally coordinates with individuals and groups in another five Pearl Lagoon communities based on individual or group interest in specific activities and the availability of financial resources to facilitate their participation. The project staff has included up to four communal investigators (currently two), selected by the communities, from four different villages in the lagoon and a project leader from the regional capital Bluefields. This team of local staff contributes to a good rapport between the project and the communities and differentiates CAMP-Lab from most other projects in the area that rely largely on staff from other parts of the country.

The geographic setting of the CAMP-Lab project, Pearl Lagoon, is located about 55 km north of Bluefields in the South Atlantic Autonomous Region (RAAS) Nicaragua. The watershed of Pearl Lagoon measures 5,200 sq. km, and contains a rich and diverse endowment of natural resources. Approximately 6,500 people live in 13 communities surrounding the lagoon with populations ranging from 200 to 2,000 per community. The population of the lagoon is culturally diverse with four ethnic groups --the Miskitu, Creole, Garifuna and Mestizo -- who speak three languages -- Creole English, Miskitu and Spanish. Economically, the inhabitants are largely dependent on natural resource extraction including a mixture of fisheries, agriculture and forestry with some additional income from remittances and an opportunistic drug trade. The ecosystems of the region are diverse and include lowland rainforest, swamp forest, pine savanna and mangrove, as well as rivers and the lagoon.

CAMP-Lab's core efforts have focused on working with the people of the Pearl Lagoon communities to implement their management plan for the basin. As part of this effort, CAMP-Lab worked to increase the local capacity to:

1) conduct, research and gather information relevant to resource management in the area
2) analyze and disseminate this information
3) engage with various levels of government and business in meaningful dialogue about the future of their communities and natural resource base

Creation of a Management Plan

In its early phases (from 1995), CAMP-Lab's efforts to develop the participatory management plan paralleled an effort by a Dutch sponsored bilateral non-government organization (NGO) working in the area, Integrated Development of Artisanal Fishery in Pearl Lagoon (DIPAL), to develop a fisheries management plan. DIPAL's work focused specifically on the fishery, and its plan was based on mainstream ecological research with little emphasis on the social and cultural circumstances of the area or space for community influence over the form or content of its plan (Christie *et al.,* 2000). DIPAL's status as a bilateral project gave it ready access to the central government in Managua and its plan was eventually codified in a ministerial decree at the national level.



In contrast to DIPAL's plan, the communities' management plan developed by CAMP-Lab includes both terrestrial and aquatic ecosystems and was developed based on four sources of information:

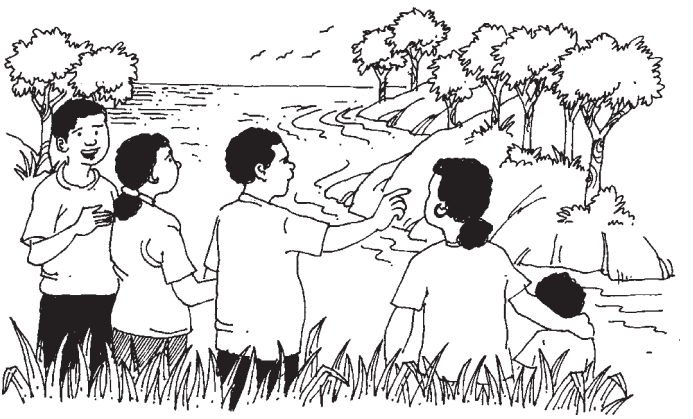
1) the data collected in CAMP-Lab's participatory natural resource monitoring activities
2) research conducted with Central American and Caribbean Research Council (CACRC) related to land use and tenure in Pearl Lagoon
3) the communities' critique of DIPAL's fisheries plan
4) a review of other Latin American management plans

The communities' management plan makes brief references to the land tenure and history of the diverse communities of the Pearl Lagoon basin and the geography of the area. The plan also includes a brief analysis of the socioeconomic condition of the communities of the basin (i.e., education, health, economic activities, transportation and communication) and an agro-ecological characterization of the different production systems used by the people of the area. Finally, the plan outlines different uses, for the local ecosystems and the corresponding norms to be established for their protection (Bradford *et al.,* 2000).

The initial draft of the communities' plan was presented to each community in the basin for review, and it was then revised based on their feedback. The final version of the management plan was officially presented a large group of representatives from all the communities and all levels of government by three community members who were chosen by the project participants based on their ability to present, explain and defend the document (Christie *et al.,* 2000).

Codification of a Management Plan

The initial efforts towards management plan codification were based on the idea that some form of compromise plan would be needed that combined the DIPAL and CAMP-Lab plans. This compromise was seen as necessary by both projects because the regional and municipal levels of government were unwilling to codify one of the plans while a second overlapping plan was being put forward by another group. While DIPAL had a ministerial decree from the national level government codifying its plan, the Autonomy Law #28 governing the Caribbean region and the national law governing municipalities give these levels of government substantial responsibilities and rights related to natural resource management. As a result of this legal setting, DIPAL was concerned with obtaining approval for its plan from these levels of government in addition to their national level approval.



Efforts towards the creation of a compromise management plan were made in a series of meetings with various responsible agencies. DIPAL was generally opposed to having any direct community representation in these discussions and was largely unwilling to compromise on the content of its fisheries resource management plan. For its part, CAMP-Lab was unwilling to make substantial compromises without significant community involvement. Negotiations were even made more difficult by instability in CIDCA's Bluefield leadership at the time. While a number of meetings took place between the two institutions in an effort to reach a compromise, in the end, no compromise plan was possible before DIPAL's departure from the region in January 2002 (Hostetler *et al.,* 2002).

After DIPAL's departure, CAMP-Lab pursued alternative means for codifying the communities' management plan. Ultimately, CAMP-Lab partnered with a relatively new project working in the region, the Swedish International Development Agency (ASDI)-funded North Atlantic Autonomous Region (RAAN) RAAS, whose efforts in the region are focused on supporting regional and municipal levels of government through capacity development. After a series of informal and formal meetings, they agreed to help CAMP-Lab develop a municipal ordinance based on the communities' management plan.

Through massive lobbying, the management plan ordinance was ultimately passed in April 2003. This process also developed a strong working relationship between CAMP-Lab and the municipal council as well as the municipality's environmental department.

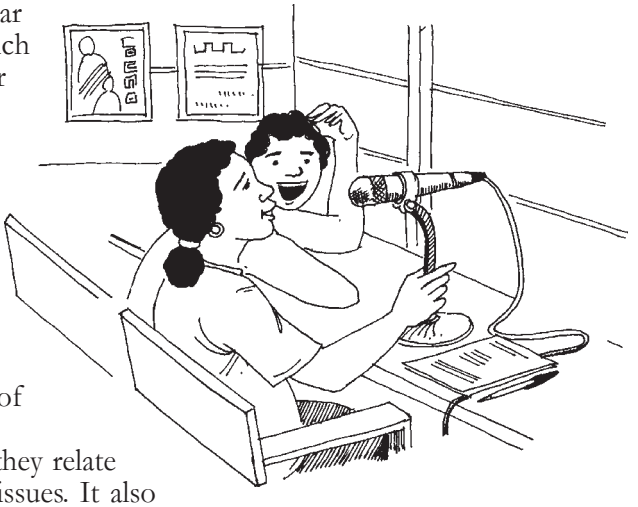
Implementation of a Management Plan

Implementation of the management plan ordinance in Pearl Lagoon is technically the responsibility of the Mayor's office as a component of their environmental program. While codification of the management plan and support from the local government is important for plan implementation in Pearl Lagoon, ultimately, the resources the municipality or any other level of government have to dedicate to this effort are extremely limited. As a result, effective implementation of the management plan can only come through broad local understanding, agreement and effective self regulation. A large part of CAMP-Lab's activity, both before and after the management plan was officially codified, was focused on a variety of efforts to improve local knowledge, dialogue and consensus around environmental issues that would lead ultimately to more sustainable behavior consistent with the management plan. The project maximized the use of popular communications and environmental education.



Popular Communication

The general idea of using radio was raised because of its broad availability in the Pearl Lagoon communities, the lack of stable sources of electricity and relatively low propensity of the people to read. These factors made radio the most accessible source of information and entertainment for many people in the area.



The project made use of popular communication techniques which placed local people at the center of the radio programs' weekly planning and execution (from concept to hosting), especially by young people from the village of Haulover (Tinkam-Moody and McKenzie, 2002).

The radio programs' thematic focus was on key components of the communities' resource management plan especially as they relate to current local environmental issues. It also provided a platform for local people to voice their concerns and opinions about broader environmental issues. Included in the radio programs were locally-developed contributions such as interviews, poems, songs, oral histories and socio-dramas.

The program has managed to broadcast on a weekly basis (provided the radio station was functioning) since early 2002 continuing past the formal end of the project in June 2003 with voluntary support from former CAMP-Lab staff and free access to radio time provided by the station. In early 2004, the Danish International Development Agency (DANIDA) re-established funding to popular communication and environmental education activities.

CAMP-Lab's radio program has been one of the station's most well-produced, popular and reliable shows. Some of the benefits that have come from the use of radio include:

- identifying and developing local communication skills and talent
- increased local discussion and knowledge about environmental issues
- increased local confidence in addressing environmental issues with outsiders
- increased participation in the CAMP-Lab project

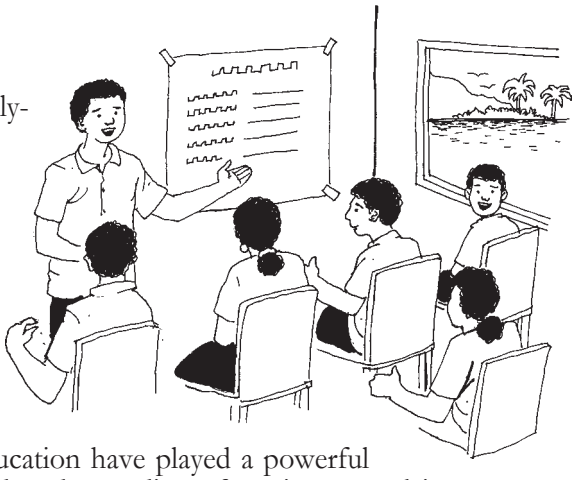
Overall, the use of popular radio provided a useful tool for stimulating broader discussion and understanding of the communities' management plan which would hopefully lead to more effective implementation by the communities themselves.

Environmental Education

Environmental education was started in Pearl Lagoon schools as a response to request for assistance from a number of teachers. Environmental education had not been offered in the schools so curriculum was developed by the CAMP-Lab staff, based largely on its activities and management plan. The project presence in the schools was formalized through agreements with the regional delegate for education and the classes included participatory classroom work like community mapping, field visits and hands-on activities like water testing.

In 2004, as part of the DANIDA-funded initiative, the project has coordinated with the Ministry of Education in Pearl Lagoon to develop an environmental education curriculum for the area. This curriculum, which may be adapted throughout the region, was developed through a consultative process involving teachers, other environmental NGOs and the Mayor's office. It was reviewed and approved in a one day workshop, involving 70 people from throughout the Pearl Lagoon municipality.

In addition to direct involvement in the schools, CAMP-Lab also provided locally-relevant environmental education resources like its tri-annual newsletter *Awake*. This publication is written in the local language Creole English and includes contributions from staff, students and other community members in a variety of formats including articles, artwork, stories and poems.



Overall, the efforts in environmental education have played a powerful role in increasing people's awareness and understanding of environmental issues. There have been an increase in the number of students wanting to pursue university study in the fields related to the environment. Hopefully, the environmental education efforts in Pearl Lagoon will contribute to the medium- and long-term potential for successful implementation of the management plan.

Conclusion

The experiences of CAMP-Lab in creating, codifying and implementing the participatory management plan for Pearl Lagoon provides a number of lessons for others contemplating engaging in similar efforts. Experience has shown the importance of persistence in this type of effort. The ultimate success of this initiative came after a number of fruitless efforts.

- Creative collaboration with a variety of actors in the region including other NGOs, the Ministry of Education and the Municipal government has strengthened activities and provided useful avenues to encourage a move towards management plan implementation in spite of a lack of resources for the task.

- It is also notable that it was possible to engage in activities in support of management plan implementation, like the radio program and the environmental education efforts, before the plan was codified.



- Having local people as project staff play a significant role in ensuring a good understanding of local political dynamics, securing access to local decision-makers (official and unofficial) and maintaining a strong connection with people in the communities based on mutual understanding and respect.

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Participatory Research and Development for Sustainable Agriculture and Natural Resource Management: A Sourcebook

Learning in Action: A Case from Small Waterbody Fisheries in Lao PDR



In southern Lao PDR, stocking of small waterbodies (typically 1-20 ha) by releasing small, hatchery-produced fish, has been actively promoted by the government to increase benefits from the local fishery. Many of these waterbodies are collectively managed by local communities to obtain benefits for the whole village. These so-called "community fisheries" are often seen as one of the principal, if not only, ways that villages can generate communal income to improve livelihoods and pursue village development priorities. It is for this reason that an effort has been undertaken to learn about community management systems and how they can be further developed.



Benefits Derived from Community Fisheries Management System	
Material	**Non-Material**
❑ household level: provision of cash income, availability of fish for poorer households ❑ village level: improvement of the village school, contribution in the cost of bringing electricity to the village	❑ increasing village managerial capacity ❑ creating awareness on the importance of aquatic resource management

Experiences have shown that while stocking is potentially beneficial, the actual outcomes (in terms of production, distribution of benefits, institutional sustainability, etc.) are often different from those initially expected. Many villages involved in stocking and managing lack experience and technical knowledge and, being isolated from each other, their learning is slow. In collaboration with local government staff, the project addressed these needs by actively engaging 38 villages managing community fisheries, in locally-relevant experimental research. This process enabled them to share their skills and knowledge with each other and with researchers and government extension staff, at the same time as generating new information and understanding.



Principles of Adaptive Learning

Building on experiences with community fisheries, a form of participatory research and development termed by the project as "adaptive learning" was devised to generate new information and, at the same time, manage the resources. This adaptive learning approach was based on a number of key principles that, in turn, had implications on the execution of the approach.

- Outcomes are not only about stocking, but also about how people use and interact with the resource. There is therefore a need to find out about the social, technical and human aspects of the system.

- Learning is a three-step process involving the generation, sharing and utilization of information. Understanding how people can best share information is as important as the information itself. Hence, there is a need to focus on preparing for learning early on in the process.

- Learning must be both demand-led and appropriate. Learning activities have to be acceptable in terms of risk and hence require a good understanding of stakeholder issues and concerns.

- The process should be asset-based, building on strengths rather than identifying gaps and weaknesses. There is a need to recognize the different skills, knowledge and understanding of participating stakeholders and build upon these.

- People will only work together if they can see the benefits of doing so. The approach, therefore, requires collaboration, time and a commitment to 'training and explaining'. Commitment to transparency, developing skills, empowerment and explanation are of utmost importance. Developing trust and mutual respect, including of different knowledge types, is crucial.

- Information needs to be generated and shared in an appropriate and timely fashion. Facilitating learning in locally appropriate ways and developing mechanisms for people to develop their own understanding and knowledge need to be incorporated.

The Adaptive Learning Cycle

The adaptive learning approach was viewed as a three-stage process consisting of: preparing for learning, learning and evaluating learning (Figure 1).

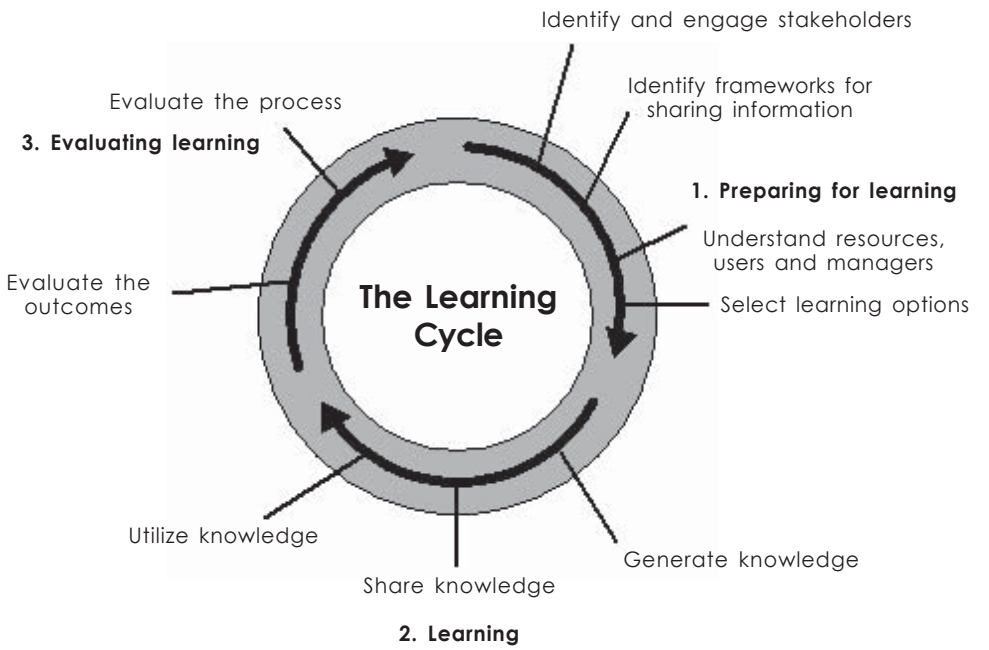


Figure 1. The Adaptive Learning Cycle

Preparing for Learning

The approach sought to bring villages together in a structured way with the assistance of the Lao government, at both the provincial and district level, and external researchers.

The first step was to identify and engage the various stakeholders and determine their various skills and strengths. Doing this early on in the process enabled the proper identification of possible roles and methodologies for each group in generating and sharing information that would complement each other and in increase the learning potential of all (Table 1). It became clear that the government staff, particularly at the district level, were a crucial link between villages and the provincial staff and they subsequently played a central role in the process.

Table 1. Relative Strengths that Stakeholders Bring to the Process

Strengths in Small Waterbody Management, Lao PDR	Local Communities	Government	External Researchers
Capacity to make management regulations	☑☑☑	☑☑	
Capacity to monitor and enforce regulations	☑☑		
Knowledge of local resources and needs	☑☑☑	☑☑	☑
Technical knowledge	☑	☑☑	☑☑☑
Formal research skills		☑	☑☑☑
Access to experience of others' financial resources	☑	☑☑	☑☑☑
Financial resources	☑	☑	☑☑
Capacity to bring stakeholders together to share experiences		☑☑	

A survey, including interviews and a sampling program, was conducted together with the government staff to identify appropriate waterbodies and interested villages. This was also an opportunity to consolidate information relating to the waterbodies and their management, current practices and future directions. Levels of stocking differed between villages and three management systems were identified:

- group fishing by a team selected by the village administration
- leasehold of the waterbody on an annual basis
- an annual fishing day

In over 50% of the villages, raising community income was the primary objective of management. Other objectives included increasing village solidarity and providing fish for those engaged in community work.

There was a diverse range of uncertainties associated with community fisheries management but knowing which was the 'best' management system or what fish to stock were common questions. By analyzing the information that had been collected it was possible to identify what information was needed; whether this information existed and simply needed to be shared effectively; or whether experimentation based on scientific principles could provide the required information and lead to significant gains in understanding.

These concerns were all discussed with those villages that had expressed interest in being involved in the learning process in order to agree a learning strategy. It was decided that, given the interest in species mixes, a stocking experiment with tilapia and carp species mixes as treatments would be tried to find out which species grow best in more and less productive waterbodies. Management systems would also be monitored to find out more about the benefits from each and which were best suited to which circumstance.

Experiments involving different treatments in different places mean some treatments are likely to be, or at least perceived to be, better than others. Allocating treatments therefore requires great care. In this case, differences were only acceptable if they were perceived by the whole group to be fair, and/or were allocated in a fair manner. Collaboration was crucial and providing a forum for discussion and negotiation of affected stakeholders was vital in the planning process. Apart from anything else, successful implementation required this cooperation and coordination.

The learning strategy and experiment involved 38 villages and over 40 waterbodies, hence, it was both necessary and desirable to share the responsibility for the stocking, monitoring and data collection among them.

Learning

The preparation for learning created interest in the process and this provided ideal conditions for a participatory monitoring system. To make the whole process transparent, individual contracts, in the form of 'village action plans', were agreed upon. These contracts outlined and clarified the roles of government, villages and researchers in terms of what each would do and provide. Through planning and training workshops, a monitoring system was established that was designed to use, or build on, existing recording methods. Where this was not possible, those who would be collecting the data were involved in the design of the methods. This helped them understand why information was being collected and made the methods more practical and



understandable. The monitoring system included village interviews and fish sampling to be conducted by the district staff and individual record books to record fishing activity, catches and sales that were completed by each village.

Data analysis was done scientifically and the results from the stocking experiment were consistent overall with the hypothesis that there are advantages in stocking low productivity waterbodies with carp and more productive waterbodies with tilapia. In addition, comparing benefits from management indicated that the total benefit, distribution of benefits, level of community income, and effort required to manage the fishery varied between systems. These results could be used to formulate management advice to bring more benefits both to the villages managing community fisheries as well as to the government that is keen in promoting community fisheries.

An aim of the learning part was that the information should be generated and shared evenly and simultaneously by the stakeholders so that they all had an equal standing and involvement in the process.

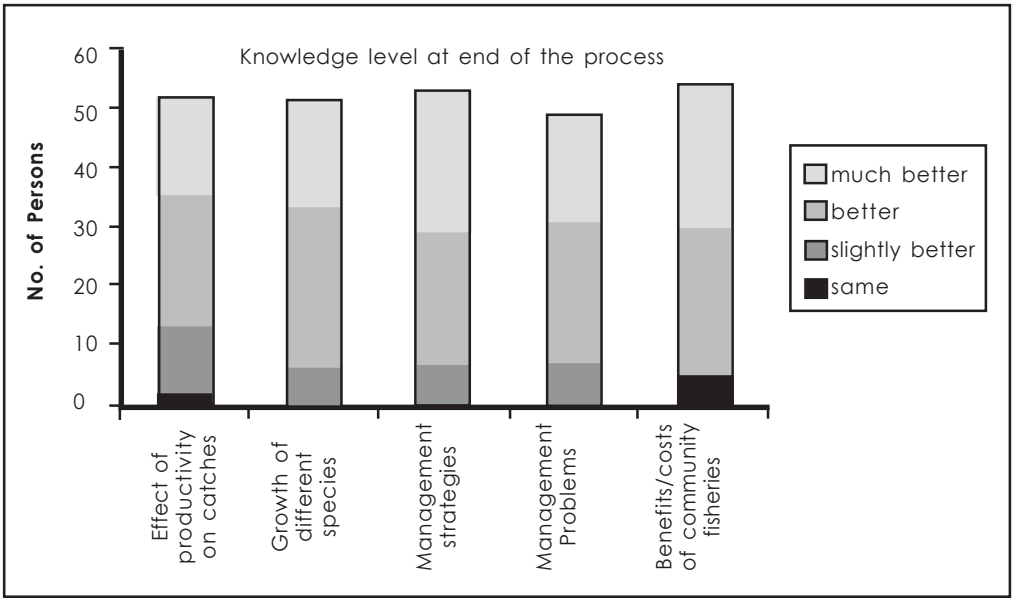


Instead of telling district staff and villagers the conclusions and recommendations from analysis or presenting the results, we ensured that they were involved in analyzing the data that they had helped collect and assisted them in reaching some of their own conclusions. Sharing the results in this way was done at a series of workshops that also provided a valuable opportunity for government staff and villages to discuss experiences with their peers and with each other. These workshops were well received and appreciated and increased both ownership and understanding of the results, crucial if they were to be effectively utilized.

Evaluating the Learning

The immediate result of the project has been increased material benefits, such as fish yields and community income, and an increase in non-material benefits, such as the skills and technical and socio-economic understanding of all involved. The percentage of villages generating community income rose from 59% to 82%. The villagers also felt an improvement in their skills and knowledge as a result of being involved in the process (Figure 2). The information generated and shared was synthesized by government staff into a set of extension recommendations that have since been written into a set of community fisheries guidelines.

Figure 2. Villagers' Perception of Change in Knowledge



The learning process had provided locally-appropriate solutions that met user needs. Adjusting stocking strategies could provide increased benefits at existing levels of inputs, crucial in these systems where maximizing production (often requiring increased inputs) was not always desired. Initial analysis revealed that if the villages involved in the project utilized the results, leading to changes in their stocking policy at existing levels of inputs, yields with a value equivalent to the local project costs could potentially be produced within five years.

All activities were evaluated and the results of the evaluations were used to improve the process. Workshops for sharing information became more effective, improved monitoring and increased people's capacity. The lessons learned from implementing the approach have been synthesized into a set of adaptive learning guidelines (for more information, see Garaway and Arthur, 2002b).

Over the period that the approach was implemented, news spread and more villages were identified that wished to start a community fishery and join the process. It became apparent that the approach was useful not only in bringing real benefits to participating villages and increasing knowledge that would enable increased future benefits, it could also be a means of extending knowledge to other villages and getting them involved.



While the project was very successful, a potential constraint of an approach that involves large-scale experimentation in a development context is the allocation of treatments. Given frequently high discount rates and levels of vulnerability, local communities may not be in a position to incur even small short-term costs and this can drastically reduce learning options. Evaluations of strategies should consider not only total costs against benefits but also who bears the costs and whether they can afford it. The capacity to stock in this case allowed us to develop experimental strategies where no-one was likely to be worse off as a result of involvement and certainly helped in the planning phases, enabling us to reach consensus more easily than might otherwise have been the case (and even then this was a non-trivial matter).

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Participatory Research and Development for Sustainable Agriculture and Natural Resource Management: A Sourcebook

Annex



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Glossary

Adaptive management - is an approach for coping with the complexity of resource management, based on establishing indicators, systematically trying interventions, monitoring their effects and learning from feedback. It depends on the ability of resource managers to receive, understand and respond to positive or negative signals in the physical and social environment and to change management responses accordingly. Adaptive management begins with participatory analysis of the situation at the project site, development of a specific set of hypotheses about what is occurring and identification of actions that could lead to a desired outcome and negotiation of the actions to be tested. Consequently, adaptive management must be a social as well as scientific process, focused on the development of institutions as well as on hypotheses and experimental frameworks. Adaptation also refers to the ability changing assumptions and interventions to respond to the new information obtained through monitoring efforts.

Capacity development/building - is an ongoing learning process by which individuals, groups or organizations increase their abilities to perform core functions, identify opportunities, solve problems, define and achieve objectives, in an effective, efficient and sustainable manner.

Community-based natural resource management (CBNRM) - is a participatory action-oriented research and development approach research which emphasizes the importance of multiple stakeholder analysis and involvement. Increasing concerns about the (mis)management of the natural resource base stimulated the development of such an approach in which both ecological and sociological aspects of resource dynamics are often addressed more at an aggregated level, such as, for example, a micro watershed, a watershed, or a (community) forest. This allows dealing more systematically with the dynamic and often complex interactions among components of a natural resources system or a production system (e.g., farming, fishing, forestry, herding, collecting edibles). Stakeholder involvement refers to the active and meaningful participation of small farmers, large farmers, entrepreneurs, local authorities, local groups, NGO staff and policy makers at different levels who *together* analyze problems and define research and development initiatives and work towards reconciling conflicting or diverging points of views and interests. In particular, the active involvement of NGOs, local governments, grassroots groups and farmer associations is now a feature in many, participatory, natural resource management research projects.

Community of practice - when people work together, they invariably form informal networks of relationships that go beyond formal organisational structures and individual organisations. These networks are often based on personal relationships and common interests or backgrounds. Much important work is done through such informal connections, enabling the accomplishment of tasks faster or better than would be the case if communication and action took place along formal organisational lines alone. Providing conditions that encourage informal networks can help organisations harness their real human capacities and potentials. Although such informal networks are ancient, contemporary organisational development theorists refer to them as Communities of Practice. They emerge from a desire to work more effectively or to understand more deeply. At the simplest level, they are groups of people who've worked together over a period of time and through extensive communication have developed a common sense of purpose and a desire to share knowledge and experience. They employ common practices, work with the same tools, express themselves in a common language and come to hold similar beliefs and values.

Constructivism - a philosophy of learning founded on the premise that by reflecting on our experiences, we construct our own understanding of the world we live in. Each of us generates our own "rules" and "mental models," which we use to make sense of our experiences. Learning is therefore the process of adjusting our mental models to accommodate new experiences.

Empowerment - choices, freedoms, participation in decisions, dignity, respect, cooperation, and the sense of belonging to a wider community.

Epistemology - is the study of the nature, origin and scope of knowledge.

Equity - equal opportunities in access to natural and social and economic resources.

Facilitation - the art of leading people through processes towards agreed-upon objectives in a manner that encourages participation, ownership and creativity by all those involved.

Gender - the different and interrelated roles, responsibilities of women and men. These are culturally specific, socially constructed, and can change from generation to generation, from place to place, and from time to time.

Gender Analysis - is the study of the differences in women's and men's roles and access to and control over resources. It is a tool for improving understanding of how differences between men and women influence their opportunities and problems, and can include the identification of challenges to participation in development. It is a subset of social analysis, the study of human differences and their social impacts. These may, in addition to gender, include age, life stage (e.g. childhood, adulthood, old age), class or social group, ethnicity, religion, and wealth, well-being or resource endowment level.

Innovation, Innovation System - the conception of innovation has changed drastically over the last forty years. During the 1950s, innovation was considered as a discrete event resulting from knowledge developed by isolated inventors and isolated researchers. Today, successful innovation is considered as the result of a process of interaction and exchange of knowledge involving a large diversity of actors in situations of interdependence. Recent social network theories of innovation lay emphasis on the strategic importance of relationships rather than technical tools, and on knowledge rather than technological networks. Knowledge-based innovation requires not one but many kinds of knowledge. Furthermore, it requires the convergence of many kinds of knowledge detained by different categories of actors. These new criteria require a new organizational and functional paradigm where the performance of innovators depends on the relations and cooperation between actors in the system.

Institutional Analysis - the study of how rules shape human behavior. These rules or institutions can be formal and codified as law, or informal and exist as rules-in-use and norms. Researchers using an institutional approach focus on how individuals and groups construct institutions, how institutions operate, and the results generated by institutions. They study the effects of different property rights systems -private, communal, and public and the formal and informal rules at the local, national and sub-national levels.

Participation - participation in society, and in social process, has many shades of meaning. Participation as a consumer can be as trivial as choosing which brand of toothpaste to pick up in a supermarket. Political participation may be interpreted as casting a vote in a general election every four years. Using terms in this way, participation in research could mean as little as filling out a questionnaire, or answering a survey.

This is not what participation means in participatory research or participatory action research. In this context, the word means participation in decision making. A co-researcher is someone who engages in dialogue, so that their contribution can make a difference to the questions asked, the action taken, the research design, the action plan and/or the dissemination of results. This does not mean that every participant must have the same input, or the same interests. Participants have different knowledge and skills, different needs and opportunities, and different amounts of time resources to contribute.

Participatory action research (PAR) - participatory action research combines the action research aims of improving some aspect of society through the research process, with concerns about the politics of research. Participatory action researchers claim that improving society must involve questions of social justice and participation, and that these cannot be separated from issues of control and power. The politics of research involves attention to relationships among researchers, those "being researched", other stakeholders, and the wider society. Not all action research is participatory and not all participatory research is action oriented.

Action research and participatory research are combined in participatory action research. In participatory action research a collaborative group of co-researchers combine inquiry, learning and action. Ideally, the collaboration extends to include all those who are likely to be affected by the outcomes of the research and action as participants in decision-making about all stages of the research process. In reality, almost all participatory action research falls short of this ideal. However, it is becoming increasingly common for groups of people investigate social problems of mutual concern, and take action for improvement together.

Participatory action research raises issues in the relationship between the researcher and those researched. These can challenge the identity and status of academic researchers, and call into question assumptions about the ownership of knowledge, the nature of knowledge, and forms of publication. It is important that relationships among co-researchers are based on mutual respect, negotiation, and reciprocity.

Participatory learning - is an approach aimed at socializing knowledge based on the principles of discovery-based learning popular in Adult Education (adults learn better when they uncover principles and facts for themselves). Farmer field schools are a good example of the use of participatory learning to share knowledge. Participatory learning often evolves into participatory research because questions arise that none of the stakeholders can answer satisfactorily alone. Participatory learning that changes people's fundamental understanding of resource management processes, including their own behaviour, may be a means of empowering stakeholders, in particularly the underpriveleged, to take more control over resources important to them. Participatory learning processes need to be designed with awareness of how they may affect and be affected by power relations since it cannot be assumed that they will definitely provide benefits to the less powerful.

Participatory monitoring and evaluation (PM&E) - is a joint effort or a partnership between researchers and other stakeholders (such as farmers, government officials, or extension workers) to monitor and evaluate, *systematically*, one or more research or development activities. PM&E helps to make research, learning and management processes more accountable to stakeholders and to give participants greater confidence in the results. Easily understood criteria and indicators are developed by local communities, researchers and other stakeholders together. These provide a framework for monitoring and assessing key factors and their direction of change. This continuous monitoring process creates the opportunity to feed back information and learning into the management process.

Participatory natural resource management - involves the management of resources by the relevant stakeholders. It requires the negotiation of goals and acceptable tradeoffs among multiple stakeholders, who may include researchers and other communities. It also involves participatory problem definition, visioning and building a shared agenda for action. Agreeing upon rules of resource management (including ways to enforce compliance) and encouraging knowledge sharing among stakeholders to build a common analysis of a problem or opportunity are both characteristic of participatory resource management. Some of this knowledge may need to be generated through research, but this is often not the case. In many cases, the knowledge exists in a stakeholder group, but it may need to be shared.

Participatory research- arises with the researcher's concern about the politics of research. Questions about control and power, especially in the relationship between the researcher and those being researched, has led to notion of collaboration. The researcher's role often becomes that of a facilitator who works collaboratively with research participants. The forms and extent of collaboration vary. In some cases, participants are involved in every aspect, including establishing research priorities, collecting data, interpreting data, and disseminating results. Participatory research is not a single approach, but rather cuts accross a broad collection of approaches intended to enable participants to develop their own understanding of and control of the process and phenomena being investigated. Key principles of participatory research include:

- *The research reflects a clear and coherent common agenda (or set of priorities) among stakeholders and contributes to partnership building.*
- *The research builds a capacity for innovation by including stakeholders in joint enquiry and co-development of new resource management regimes.*
- *The research addresses and integrates the complexities and dynamics of change in human and natural resource systems and processes, including local understanding of these.*
- *The research combines multiple sources of information and methods, and links together various knowledge worlds through participatory learning and joint enquiry.*
- *Monitoring and evaluation of participation and the research process occur according to agreed codes of conduct and standards of research practice.*
- *Power and risk sharing are conscious research strategies.*
- *The research process is based on iterative learning, feedback loops and mutual sharing of information.*
- *Relationships among partners are founded on mutual respect, accountability and joint decision-making.*

Positivism - in sociology the term is used for to indicate the idea of a science without theology or metaphysics, based only on facts about the physical (material) world. Those who espouse positivism value the scientific method and empiricism.

Stakeholders - are those who affect and/or are affected by development policies, programs and activities. They can be men or women, communities, socio-economic groups or institutions of any size and from any level of society. Each of these groups has particular needs and resources. Each must be represented in the process of deciding upon development activities. This ensures that decision –making is not effectively taken over by one particular group.

Sustainability - meeting present needs without compromising those of the future generations.

Transformative learning - see Participatory learning

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Other Resources

Websites

Action Research International Online Journal

Action research international is a refereed online journal of action research. It has a distinguished international editorial panel, and is sponsored by the Institute of Workplace Research Learning and Development (WoRLD) within the Graduate College of Management at Southern Cross University, and by Southern Cross University Press. The journal consists of an electronic discussion list to which papers can be submitted for comment, and a further list which carries the papers on acceptance. You may submit papers, or you may join the journal as a subscriber.

http://www.scu.edu.au/schools/gcm/ar/ari/arihome.html

Center for Research and Information on Low-External-Input and Sustainable Agriculture (ILEIA)

ILEIA is one of the early protagonists of farmer-researcher exchange, farmer participatory research and participatory technology development. Apart from their very useful books they also offer all ILEIA newsletter articles online since 1995.

http://www.ileia.org/

CHOIKE
Choike is a portal dedicated to improving the visibility of the work done by NGOs and social movements from the South. It serves as a platform where citizen groups can disseminate their work and at the same time enrich it with information from diverse sources, which is presented from the perspective of Southern civil society.

http://www.choike.org/nuevo_eng/about/index.html

Community Development Library
This library has 1,785 publications (160,000 pages) in various areas of community development. The objective of this cooperative project is to provide those involved in the areas of development and basic needs with access to free/low-cost CD-ROM library of approximately 3000 books containing mostly multidisciplinary insights and solutions they need.

www.sadl.uleth.ca/gsdl/cgi-bin/library?a=p&p=about&c=cdl

Consultative Group on International Agricultural Research (CGIAR) Systemwide Program on Participatory Research & Gender Analysis (PRGA)
The site includes top ten resources of the PRGA.

http://www.prgaprogram.org modules.php?op=modload&name=DownloadsPlus&file=index&req=MostPopular&ratenum=10&ratetype=num

Department for International Development (DFID) Plant Sciences Program (PSP)
The website provides an overview of PSP-funded research and many of its outputs (e.g., publications, discussion papers, presentations, etc.) are available in downloadable form. Participatory technology development forms a major component of PSP research with emphasis on the use of participatory- or client-oriented approaches to crop improvement involving interventions, either in the form of improved seeds or improved agronomic methods.

http://www.dfid-psp.org

Eldis Participation Resource Guide
This website includes participation research areas: methodologies, tools and toolkits, indigenous knowledge, conservation planning, farmer participation in research and agricultural knowledge, and participatory monitoring and evaluation.

http://www.eldis.org/participation/index.htm

Food and Agriculture Organization (FAO) People's Participation Homepage
The People's Participation section at FAO's Sustainable Development Program offers a wide range of resources, including texts of the participatory research: Participatory Action Research and People's Participation: Introduction and Case Studies.

http://www.fao.org/sd/PPdirect/default.htm
http://www.fao.org/sd/PPdirect/PPre0030.htm

Foundations of Success (FOS) Improving the Practice of Conservation
This is a network of individuals and institutions that seek to improve the practice of conservation.

http://fosonline.org/Resources.cfm

Global Participation Network (GP-NET)
This has an archive that holds all of United States Agency for International Development (USAID)'s Participation Initiative documents. Thus, the Participatory Practices case study series and Participation Forum summaries are available to all subscribers. The USAID web page also provides access to the Participation Initiative documents.

www.info.usaid.gov/about/part_devel
http://www.info.usaid.gov/about/part_devel/docs.html

GRAIN
GRAIN is an international non-government organization (NGO) which promotes the sustainable management and use of agricultural biodiversity based on people's control over genetic resources and local knowledge.

http://www.grain.org/

GTZ Mainsteaming Participation
This site provides an overview of the current debate and experiences of participatory development in German and international cooperation.

http://www.gtz.de/participation/english/index.html

International Development Research Centre (IDRC)
IDRC is a public corporation created by the Parliament of Canada to help researchers and communities in the developing world find solutions to their social, economic, and environmental problems. IDRC connects people, institutions, and ideas to ensure that the results of the research it supports and the knowledge that research generates, are shared equitably among all its partners, North and South.

http://www.idrc.ca/library/
http://www.idrc.ca/library/world/index_e.html
http://www.idrc.ca/plaw/ik.html
http://WWW.IDRC.CA/CONFLICT
http://WWW.IDRC.CA/MINGA
http://web.idrc.ca/en/ev-50579-201-1-DO_TOPIC.html
http://www.cbnrmasia.org

International Development Service (IDS) Participation Resource Center
Over 6000 documents and videos are held in the Participation Resource Center at IDS including the collection of the Participation Group at IDS and the International Institute for Environment and Development (IIED). The collection consists mainly of unpublished practical information and includes research reports, training manuals, workshop reports, critical reflections and newsletters from practitioners and networks. Abstracts of the documents can be searched online.

http://www.ids.ac.uk/ids/particip/information/index.html
http://www.ids.ac.uk/blds/index.html

Keysheets for Sustainable Livelihoods
These keysheets provide decision-makers with a short, easy and up-to-date reference on issues relating to sustainable livelihoods and infrastructure development for the poor.

http://www.keysheets.org/

Landcare Research (Australia)
Collaborative learning for environmental management (CL-research). The focus of social research in this area is to improve the quality of environmental management decision making. Particular attention is paid to advancing the uptake of research information.

http://www.landcareresearch.co.nz/research/social/

LogoLink
This is a global network of practitioners from civil society organizations, research institutions and governments working to deepen democracy through greater citizen participation in local governance. LogoLink encourages learning from field-based innovations and expressions of democracy which contribute to social justice.

http://www.ids.ac.uk/logolink/index.htm

NRM-Changelinks.net
This is an online resource guide for those seeking to improve the use of collaborative and learning-based approaches.

http://nrm.massey.ac.nz/changelinks/

Overseas Development Institute (ODI)
ODI offers a wealth of resources that are available online, quite a number of them having to do with participatory research. Apart from the series listed below, they also offer the following document and paper series: Seeds Publication List, Key Sheets, Publications on Biodiversity, Briefing Papers and Poverty Briefings.

http://www.odi.org.uk/publications/index.htm
http://www.odi.org.uk/publications/working_papers/index.html
http://www.odi.org.uk/agren/

Participatory Learning and Action (PLA) Notes
PLA Notes is the world's leading journal on participatory learning and action approaches and methods. Since 1988 it has provided a forum for those engaged in participatory work - community workers, activists, and researchers - to share their experiences and learning with others, providing a genuine 'voice from the field'. The PLA Notes CD-ROM brings together all the articles in a fully searchable pdf format.

http://www.iied.org/sarl/pla_notes/whatispla.html

Promoting Local Innovation (Prolinnova)
This website attempts to develop an e-platform for exchanging information and experiences about how to promote local innovation. The focus is on ways to promote local people's innovation in ecologically-oriented agriculture and natural resource management.

http://www.prolinnova.net/

Resource Center for Participatory Learning and Action Network (RCPLA)
The RCPLA initiative brings together 15 organizations (5 in Africa, 5 in Asia, 3 in South America, 2 in Europe) committed to information sharing and networking within the framework of participatory methodologies and approaches. The 15 partners operate at a regional and national level through their own networks. Together with information related to practical participatory activities taking place in their respective countries, partner organizations also share information about trainings, workshops and events concerning participation.

http://www.rcpla.org/partic_themes.html
http://www.rcpla.org/pubs.html

Statistics and Participation by Statistical Service Center, University of Reading
These pages contain materials aimed at helping with the integration of statistical and participatory principles for research. The intention is to contribute to the development of methods that take advantage of the strengths of statistics and participatory methods when gathering information for decision making in a development context.

http://www.rdg.ac.uk/ssc/partiandstats/intro.html

Sustainable Africa Internet Channel
The site is a digital-commons project of the AllAfrica Foundation Carnegie to promote "the advancement and diffusion of knowledge and understanding."

http://allafrica.com/sustainable/

The World Bank Participation and Civic Engagement Group
This site promotes methods and approaches that encourage stakeholders, especially the poor, to influence and share control over priority setting, policy making, resource allocations and access to public goods and services.

http://www.worldbank.org/participation/

University of Hohenheim
These pages contain several website links, discussion list and other resources dealing with action and participatory research.

http://www.uni-hohenheim.de/i430a/links/ar-links.htm
http://www.uni-hohenheim.de/i430a/links/pr-links.htm

World Café
This site is an intentional way to create a living network of conversation around questions that matter. A Café Conversation is a creative process for leading collaborative dialogue, sharing knowledge and creating possibilities for action in groups of all sizes.

http://www.theworldcafe.com/worldcafe.html

CD-ROMS

East Timor PRA
This has 1098 slide powerpoint presentation based on a field exercise and training program in East Timor. Presentation contains slides illustrating the different Participatory Rural Appraisal (PRA) tools and concludes with a discussion of some of the key strengths and limitations of PRA. Prepared by Harold McArthur (hmcarthu@hawaii.edu) and J. B. Friday. University of Hawaii. 2004.

FAO Resources CD-ROM on Participatory Approaches, Methods and Tools
A field tools database of 135 participatory approaches, methods and field tools, developed or applied by the Food and Agriculture Organization (FAO) and other organizations. This database includes 215 FAO documents in English, French and/or Spanish. FAO of the United Nations (IWG-PA-Webbox@fao.org)

Learning Approach to Project Review
Prepared by Clive Lightfoot (clive.lightfoot@agropolis.fr) for CARE-DTC Project, Uganda. September 1999. International Support Group (ISG).

PLA Notes CD-ROM
Edited by Paul Mincher and Cristina Zorat, PLA Notes is the world's leading journal on participatory learning and action approaches and methods. The PLA Notes CD-ROM brings together all the articles from issues in a fully searchable pdf format.

Techniques to Understand and Communicate Complex Issues: Enhancing Skills in Systems Thinking
Prepared by Clive Lightfoot, Reginald Noble (reg.noovle@web.net) and Ricardo Ramirez (rramirez@uoguelph.ca). International Support Group (ISG).

Training Modules: Agricultural Research for Development
ICRA Training Modules CD-ROM. 2000. International Center for Development-Oriented Research in Agriculture.

E-mail Discussion Lists

Actlist-l
A mailing list for discussion of the "action technologies" of action research, action learning, and action science, with some emphasis on management applications. You can subscribe at:

http://www.scu.edu.au/schools/gcm/ar/arr/actlist.html

Arlist-l
A mailing list which provides a forum for discussion of the theory and practice of action research. More than 1000 subscribers. You can subscribe at:

http://www.scu.edu.au/schools/gcm/ar/arr/arlist.html

Armnet-l
A mailing list for discussion of issues related to action research specifically as a research methodology. You can subscribe at:

http://www.scu.edu.au/schools/gcm/ar/arr/armnet.html

Global Participation Net (GP-NET)
This is a discussion list on participatory approaches sponsored by USAID's Participation Initiative. The intention is to provide an opportunity for USAID staff and development practitioners around the world to exchange information, share ideas, and discuss issues related to participatory development. You can subscribe at:

http://www.info.usaid.gov/about/part_devel/gpnet.html

PAR-announce-L
A list that is limited to general announcements (no dialog) of interest to participatory action research (PAR) community like new books, papers, conferences and events. You can subscribe at:

http://www.parnet.org/discussionlists.cfm

Participatory Technology Development-List (ptd-l)
To subscribe to ptd-l, send a message to ptd-l@etcnl.nl containing the word %subscribe in the message header.

PRA-List
An email discussion list devoted to the topic of participatory community development maintained by Participatory Initiatives (PI) at the University of Guelph, Canada. It is not limited to devotees of the PRA approach specifically, but embraces dialogue about any form of intentional change initiated and owned by community members. You can subscribe at:

http://www.gdrc.org/icm/pr-appraisal.html

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Users' Perspectives With Agricultural Research and Development (UPWARD) is a network of Asian agricultural researchers and development workers dedicated to the involvement of farming households, processors, consumers and other users of agricultural technology in rootcrop research and development. It is sponsored by the International Potato Center (CIP) with funding from The Government of The Netherlands.

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