Understanding participatory research in the context of natural resource management- Paradigms, approaches and typologies

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UNDERSTANDING PARTICIPATORY RESEARCH IN THE CONTEXT OF NATURAL RESOURCE MANAGEMENT – PARADIGMS, APPROACHES AND TYPOLOGIES

Kirsten Probst and Jürgen Hagmann, with contributions from Maria Fernandez and Jacqueline A. Ashby

Abstract

In the field of natural resource management (NRM), which emerged as a new integration domain in the agricultural sciences, participatory research is conceptually and operationally still in its infancy and a range of activities are labeled 'participatory research'. The paper aims at shedding some light on this confusion. Based on a review of literature and internet sites, it provides an overview of the CGIAR's current NRM research practice, analysing the impact orientation, research foci, the pathway/strategy to impact and the role of participatory research. The paper also offers a framework which helps to differentiate approaches to innovation development and to 'unpack' the blurred concept of 'participatory research'. Three prototypical approaches to innovation development and their respective attributes are described and used to interpret current practice:

Research findings

- *Many NRM research initiatives define highly aggregated overall goals, but lack a clear strategy of how to reach these impacts and induce changes through research.*
- *The research focus is often derived from a supply-led and discipline-led perspective, and it is widely assumed that research outputs can be fed into an existing and functioning research-development continuum.*
- *'Participatory research' is often limited to 'downstream' applications, being seen as an instrument for applied and adaptive research to improve technology transfer. However, more cases are arising, that facilitate longer term participatory learning and action research processes whilst pursuing strategic research questions in NRM.*
- *To enhance conceptual clarity a framework is suggested which differentiates three prototypical approaches to innovation development: the 'transfer of technology' approach, farmer first, and participatory learning and action research. They can be described along key attributes, such as epistemological assumptions, research objectives, types of participation, roles of different actors as well as processes and research methods.*

Policy implications

- *It is suggested that research managers analyse their NRM research initiatives within the framework presented, and select more systematically between the options at hand to explore anappropriate strategy towards impact.*
- *An analysis of the innovation system within a given context needs to be conducted to verify whether there is a functioning 'research-development continuum', and to review the roles and mandates of international and national research, extension and other development agencies accordingly.*
- *In NRM research, more attention needs to be paid to the potential of participatory learning and action approaches for strategic research – i.e. for generating strategic knowledge, methodological principles and approaches which have significance way beyond local cases.*
- *Participatory learning and action research approaches require a shift in 'professionalism' among some researchers from disciplinary experts towards interdisciplinary facilitators effective in conceptualisation.*

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1 INTRODUCTION

According to Ben-David (1971, in Janssen and Goldsworthy, 1996) the agricultural sciences can be considered to be a 'quasidiscipline', as research topics are defined not by the internal state of the field (as in disciplines such as physics, mathematics, biology, etc.) but rather by problems defined outside of the field. Given that the problems are real-life phenomena with many dimensions, a multidisciplinary research approach is often needed to address them adequately. If new problems occur, different disciplines may be integrated to resolve them. In the last 30 years different integration domains have been pursued in the agricultural sciences: '*By the early 1960s farm management was a very important domain. It included farm economics, engineering, planning, and home economics. By the early 1970s...crop ecology became an important integration domain, including disciplines such as physiology, pathology, entomology, genetics, and agronomy. ...From the mid-1970s to the mid 1980s farming systems research was a prominent integration domain.... By 1985 sustainable production had become a major integration domain.... It has now been redefined as sustainable natural ecosystem management with a larger role for disciplines such as geography, meteorology, ecology, hydrology, and sociology*' (Janssen and Goldsworthy, 1996:264). Obviously, complexity has increased considerably and 'new' approaches, concepts and theoretical perspectives are needed.

Janssen and Goldsworthy (1996) argue that the emergence of new domains depends on two critical factors: (1) an understanding of the interrelations between problems and the ability to deal with these interactions in the research methodology, and (2) public concern about major issues. Indeed the emergence of 'natural resource/ecosystem management' (NRM) as a domain in international agricultural research is paralleled by the appearance of new tools and instruments for data storage and processing such as geographic information systems and modelling. At the same time, worries about food production and global hunger have been modified by increased public concern about the rapid deterioration of the Earth's ecosystems (particularly since the 1992 Earth Summit in Rio) and increasing levels of poverty.

In response to these worldwide concerns, and in recognition of the fact that agriculture depends on and affects the natural resource base[1] (often causing site-effects and environmental externalities), and competes and interferes with other sectors using natural resources, the international agricultural research community has broadened its research agenda (Janssen, 1995). With new thinking on issues such as sustainability and poverty alleviation the CGIAR has altered its mission from a primary focus on agricultural productivity and commodity research to one that encompasses a more '*integrated natural resource management*' (INRM) perspective (TAC, 2001; INRM-Group, 1999, 2000).

The term INRM first entered the CGIAR's vocabulary through a study on priorities for soil and water research (TAC, 1997), which called for an 'integrated' approach to natural resource management. It was suggested that '*INRM can be defined as the responsible and broad-based management of the land, water, forest and biological resources base – including genes – needed to sustain agricultural productivity and avert degradation of potential productivity*'. Definitions of the term INRM are still evolving. The CGIAR's Inter-Center working group on INRM current definition is that '*INRM is an approach to research that aims at improving livelihoods, agroecosystem resilience, agricultural productivity and environmental services.... It aims to augment social, physical, human, natural and financial capital. It does this by helping solve complex real-world problems affecting natural resources in agroecosystems*'[2]. Basically, NRM research claims to take into account various issues beyond classical agronomy: It emphasises spatial and temporal scales and interdependencies, on-site and off-site effects, trade-offs of different management options, the need to involve a wide range of stakeholders – often with conflicting interests – in collective action (Probst, 2000). Equally as important as technical skills and knowledge about biophysical processes, is the social component, i.e. negotiation of rules and sanctions, policy formulation, organisational development, land use planning, conflict and information management. According to Sayer and Campbell (2001) '*research needs to embrace this complexity... by redirecting the objectives toward enhancing adaptive capacity, by incorporating more participatory approaches, by embracing key principles such as multi-scale analysis and intervention, and by the use of a variety of tools (e.g. systems analysis, information management tools, impact assessment tools).*' While the multifaceted nature of INRM is acknowledged, it is also recognised that

international agricultural research centres (IARCs) – whose NRM research approaches are discussed in this paper – cannot deal with all the issues. They tend to focus on natural resources for the production of crop, livestock, forest and fish outputs that have impacts on poverty reduction and food security (TAC, 2001), e.g. integrated water and watershed management, social forestry, living aquatic resource management, soil management, etc.

As human activity is the major destructive force in nature, improving natural resource management primarily requires changing human behaviour at 'grassroots' level (Röling, 1994, 1996, 2000). Today it is widely agreed that local people's perspectives need to be at the centre of research efforts for development and that innovations need to be 'owned' by the local land users, if changes in decision-making and behaviour leading to impact are to be achieved. Such ownership can be created effectively through development and implementation of innovations by local people themselves in cooperation with outsiders (Hagmann and Chuma, 2002). Over the last few decades, a wide variety of participatory research (PR) approaches, concepts and methods has evolved. However, it is still not yet well understood which types of approaches are useful for what kind of research questions, goals and contexts. Especially in the field of INRM, participatory research is conceptually and operationally still in its infancy and a wide range of distinctly different activities is labelled 'participatory research'.

This paper aims at shedding some light on this confusion. It analyses current applications of participatory NRM research in international agricultural research (conducted by IARCs and partners), their weaknesses and sources of inefficiencies. An attempt is made to build a conceptual framework for differentiating approaches to help NRM research managers and practitioners analyse their research context, and make more informed decisions in designing their research approach. Finally some options and challenges for improving the quality and relevance of NRM research are proposed. The paper is based on a review of literature and internet sites, and on the authors' experience gained from a variety of CGIAR-related strategic planning workshops as well as their involvement in programmes between 1996 and 2003. It aims to present critical and constructive thoughts to stimulate discussions among NRM researchers and practitioners.

2 CURRENT PRACTICE IN NRM RESEARCH

Over the past 30 years, the international agricultural research community has significantly contributed to raising agricultural productivity, particularly through its commodity research and germplasm improvement. An expansion of the goals of publicly funded international agricultural research towards poverty reduction, food security and environmental sustainability have increased the complexity of the matter. Reductionist commodity research can no longer deal with this complexity and a reorientation towards INRM and farmer participatory research is gradually being accepted. This change was also fostered by donors who demanded more visible impacts through development-oriented research, especially in smallholder farming.

The following section provides a brief overview of the state of the art in the relatively young NRM research practice. The analysis of recent cases addresses four major issues:

(1) *Impact orientation.* What kind of impact do NRM research projects strive for?
(2) *Research focus.* What is their research focus and who are the intended beneficiaries?
(3) *Pathway/strategy to impact.* What is their pathway or strategy to achieve an impact at the local level?
(4) *Role of Participatory Research.* What is the role of PR in the project strategy?

The following description and assessment of the state of the art is based on a review of literature and internet sites, insights gained from conceptual workshops and project evaluations, and a study of 53 research projects within the CGIAR and its partners (Fernandez, 1999). The latter included participatory research projects covering a broad range of topics in NRM (e.g. soil and water management, crop/livestock management, agroforestry, integrated pest management, conservation of biodiversity, watershed management, etc.). It was carried out during 1999 by the CGIAR Program for Participatory Research and Gender Analysis, using a questionnaire to which projects responded, mostly while attending international workshops on the topic (Fernandez, 1999).

Impact orientation

International agricultural research centres face an apparently paradoxical situation with regard to impact. Some donors want to see impact at the level of resource-poor farmers, while others emphasise that the mandate and comparative advantage of the IARCs is to conduct '*strategic*' research and produce '*international public goods*' that can be extrapolated to other locations at the regional and global level. Basically all centres have responded to the 'impact squeeze' and incorporate highly aggregated development goals such as poverty alleviation, increased income, food security and sustainable resource use into their overall research objectives. Some projects have started engaging in larger scale extension and development activities (e.g. *capacity building, organisational development,* etc.), without necessarily integrating research functions as a continuing part of these development activities. This in turn is being questioned by actors who see strategic research as an 'upstream' phase in the research-development continuum which does not imply an involvement of international researchers in participatory processes at the field level.

The overall goals formulated for NRM research initiatives show that research managers tend to include different impact levels in one sentence without necessarily clarifying what exactly they want to achieve. Some projects[3] put the natural resource system and

technical improvements at the centre of perspectives, e.g.

'To increase farm productivity and arrest resource degradation due to land-use intensification through sustainable short fallow systems' (International Institute of Tropical agriculture (IITA): Short fallow systems).

'Improve the food security and economic well-being of farmers through implementation of diversified and more efficient natural resource use and crop/livestock management options (International Crops Research Institute for the Semi-Arid Tropics (ICRISAT): Crop and livestock systems).

Other initiatives put more emphasis on changes in the management strategies of local resource managers. These projects focus on research impacts that build local capacity for collective action, and foster people's own efforts to improve management systems (adaptive capacity). This includes their ability to articulate interests and demand, to manage conflicts, etc. The following examples are from the International Center for Tropical Agriculture (CIAT) and the Center for International Forest Research (CIFOR):

'Enabling communities and organizations to plan collective action aimed at better management of resources in hillsides' (CIAT: Community Management of Hillside Resources)

'Enabling local communities to achieve more sustainable and equitable management of forest resources and human well-being in a multi-stakeholder environment. Enhancing the ability of forest management systems to be self improving, which will require strengthening the process of management and policy making. The emphasis is on institutionalizing conscious learning.' (CIFOR: Adaptive Co-Management of Forests)

Though most IARC projects show a stronger impact orientation,[4] the goals and objectives leading to the desired impact remain rather diffuse with no clarification of what research can realistically contribute. This is a general pattern observed in many research projects – participatory or non-participatory. 'Hard' impacts related to physical, natural and financial capital and 'soft' impacts related to social/human capital are not clearly separated, even though they would require different strategies. This often results in a diffuse and unclear strategic orientation. Since a clear strategy is needed to connect research outcomes and development impacts it is difficult to imagine how tangible effects can 'fall in place' when the impact strategy is diffuse. This applies particularly to the complex environment in which NRM operates. Participatory NRM research particularly requires a strong impact orientation to guide a flexible and dynamic process of socio-technical development. The research products need to be derived clearly from the strategic orientation.

Research focus

While covering a broad range of topics, the analysis of NRM research projects revealed three major research foci:[5]

(1) *The development and assessment of technologies*
- e.g. to develop and promote productive and profitable alternative land use systems to slash and burn agriculture (Systemwide Program on Alternatives to Slash and Burn, ABS)

(2) *The generation of new theoretical insights into complex NRM systems to contribute to policy or management recommendations (policy research)*
- e.g. to identify and assess NRM problems within major land-use systems in ecoregions, to identify the driving forces behind key processes occurring within these land use systems at different spatial scales (ICRAF: Land use and agroecosystems dynamics)
- e.g. analyzing and disseminating knowledge on the ways that collective action and property rights institutions influence the efficiency, equity, and sustainability of natural resource use (System Wide Program on Property rights and Collective Action, CAPRI)

(3) *Developing approaches for organisational/ institutional innovation*
- e.g. to develop or identify a set of models, institutional arrangements, methods, tools and strategies to enable local communities to achieve a more sustainable and equitable management of forest resources (CIFOR: Adaptive Co-Management of Forests)
- e.g. to develop and institutionalise effective and efficient approaches for sustainable INRM and enhanced productivity in the intensively cultivated highlands (African Highlands Ecoregional Programme, AHI)
- e.g. adaptation of the farmer field school concept to improve livestock systems of the poor, starting with smallholder dairy enterprises (ILRI: Enabling access to innovation, International Livestock Research Institute)

Basically, all centres work on the three research foci, and some projects (including, for instance, AHI and ABS) address more than one aspect. Though the majority of projects focus on technical innovations (improved varieties, farming practices, etc.), developing approaches for organisational innovations and local capacity building has increasingly gained importance as a focus of NRM research (Johnson et al., 2000). In a questionnaire survey (Fernandez, 1999), 88% of the responding projects said that small farmers and communities are supposed to be the beneficiaries of their research. However, the primary intended users of many research products (such as publications, GIS databases, decision-support tools, manuals and guidelines) were often other institutions, e.g. national agricultural research systems (NARS), non-government organisations (NGOs), extension and development agencies, as well as policy makers.

Pathway/strategy to impact

To promote the dissemination of their research products, most IARCs seek collaboration with *'adaptive research and dissemination partners'*, such as NARS, extension services, NGOs, development agencies and farmers' groups. These partners form the focal mechanism through which IARCs attempt to reach out to farmers in pilot development projects. Even though

the linear 'transfer of technology' model to spread innovations is a concept which has been questioned from many sides, it is still widely assumed within the scientific community that research outputs just need to be fed into an existing and assumingly functioning research-development continuum.

Role of participatory research

Participatory approaches in international agricultural research are mostly utilised at the level of applied and adaptive research or even technology transfer, i.e. 'downstream' applications (Becker, 2000). Critics charge that participatory research is unlikely to yield a wealth of data for scientific endeavour. Consequently, it is primarily seen as:

(1) a means to obtain (qualitative) data about local people's knowledge and demand to assimilate and consider this information in scientific research, and
(2) a better way of technology transfer and adaptive research, which is, however, not considered to be the task of IARCs (Becker, 2000).

Those who advocate participatory research as a means of empowerment, equity, and local capacity building are looked upon as 'muddying the waters' by mixing development-driven agendas with research-driven ones (Humphries et al., 2000). Scientists who hold this perspective argue that participatory research should be done by NARS, extension services and NGOs. The field study revealed that projects involving NGOs report higher degrees of local actor involvement (Fernandez, 1999). In agreement with this tendency, Johnson et al. (2000) found that the majority of IARCs report consultative participation, whereas the majority of non-IARC projects report collaborative participation. The same study revealed that women and marginalised groups in particular are brought into the research process at a relatively late stage, when technologies have already been identified and are ready for dissemination (Johnson et al., 2000).

To date, there are very few examples of partnerships between formal researchers and local stakeholders in which the latter are driving the research process at local level, seeking solutions for constraints they have identified. An example of this is, CIFOR's Adaptive Co-Management Project. In this initiative participatory action research approaches are applied in a number of case studies, where researchers facilitate the process of local research and seek answers to more strategic research questions. Another example are CIAT's local agricultural research committees, CIALs (Ashby et al., 2000; Ashby and Sperling, 1995; Braun et al., 2000). Surprisingly, in the field study on participatory research in NRM, most researchers perceived their role as facilitators to strengthen local innovation development (78%), and to strengthen local people's self-help capacities (70%). Local people were considered by 70% to be equal partners in a joint innovation process, whereas 54% regarded the local people's role as receiving innovation packages that they can adopt, refuse or adapt (Fernandez, 1999). However, even though researchers may be familiar with the rhetoric of the participation discourse, scientists with field experience in longer-term participatory research processes are still a minority, and the reward system is largely based on the generation of data and product outputs for use at meso and macro level, instead of impact and process results at local level (INRM-Group, 1999).

Some conclusions on the 'state of the art' of participatory NRM research

Based on the previous rather preliminary analysis and experience, the major challenges to increasing the effectiveness of the IARCs' NRM research can be summarised as follows:

- *Greater impact orientation and strategy.* Many development-oriented research projects define highly aggregated overall goals, but lack a clear strategy to achieve the desired impacts and induce changes through research. The focus is frequently on a technology or land use practices without considering that changes are required at the level of individual and collective resource users to achieve a development impact (i.e. the link between the desired impact and produced output is missing).
- *Less discipline-driven and supply-led research agendas.* The research focus and products are derived from a supply-led and discipline-led perspective rather than from a strategic orientation.
- *Greater integration and operationalisation of interdisciplinarity.* Even though NRM is supposed to be looked at from a holistic perspective, research projects hardly achieve a true integration of different disciplines and stakeholders from different levels. Projects tend to address many compartments of the whole system, rather than the system as a whole and the interaction of its parts.
- *Revising the assumption of a functioning research-development continuum for scaling-up.* It is still widely assumed that the sharing of tasks within a linear research–development continuum (basic/strategic/applied/adaptive research–extension–development) functions and can be taken for granted. In reality, however, there are fewer and fewer cases and countries where this continuum is really functional. Alternative scaling-up strategies are still rare.
- *Use of participatory research beyond 'downstream' applications.* Participatory research is to a large extent considered as a means to improve the conventional technology development process. The role of research institutions as providers of solutions and expert knowledge *for* local people is rarely challenged, and epistemological questions about the theoretical assumptions underlying the understanding of different forms of knowledge have largely been avoided (Becker, 2000). The question of facilitating longer-term participatory learning and action research whilst pursuing strategic research questions has hardly been explored in practice. However, more and more cases are arising: The development of new approaches through systematic learning about conceptual lessons and principles in organising and implementing NRM are examples.

One of the obstacles that appears to have hindered the conceptualisation and strategic use of participatory approaches in NRM research is the considerable confusion associated with these terms. While the term INRM has already been explored in the first part of this paper, the following section seeks to clarify it further by taking research apart, looking at its constituents and 'unpacking' the blurred concept of participatory research.

3 DIFFERENTIATING APPROACHES TO RESEARCH AND INNOVATION

In the following section an attempt is made to build a conceptual framework to differentiate approaches to research and innovation. First, seven attributes will be described which distinguish and describe research approaches. These attributes are then arranged in a continuum to outline three prototypical approaches to innovation development: the 'transfer of technology' approach, farmer first, and participatory learning and action research. In the final part of this section, the typology is applied to interpret current practice in agricultural and NRM research.

Key attributes to describe and differentiate research approaches

Based on a review of cases and experiences with innovation processes the following set of parameters was identified as appropriate to classify different approaches to innovation development. The description of these variables can serve as a checklist to analyse participatory research approaches.

- Epistemological assumptions, values and beliefs;
- Objectives of research;
- Types of participation;
- Stakeholder involvement;
- Roles of external and local actors;
- Procedures/Process;
- Research methods.

Epistemological assumptions, values and beliefs

Scientific investigation is based on certain assumptions[6] about the nature of the world, the humans within it, and the knowledge which can be acquired about both (Bawden, 1995). These assumptions can lead to different paradigms, i.e. basic belief systems or world views within which research is carried out. Two frequently cited epistemological perspectives in the theoretical debate surrounding participatory research are 'positivism' and 'constructivism'.

The positivist scientific research of the Western world has its roots in the 17th century. Like the Enlightenment that gave rise to it, *positivism* can be understood as an endeavour to generate unambiguous, value-neutral and accurate knowledge of the world. Positivist science is grounded in direct empirical evidence (something that is *posited*), that can be observed and measured through scientific methods (Crotty, 1998). The main criticism of positivism has been its claim that it is the path to true knowledge. From the positivist viewpoint objects have meaning prior to, and independent of, any human consciousness. It is assumed that there is an objective, value-free external reality driven by natural laws controlling cause-effect relationships, and that appropriate methods of inquiry can deliver accurate and certain knowledge of the true nature of that reality. Scientists, who are placed outside and separate from the subject of their research, seek to discover and generate objective knowledge about natural and social phenomena. The components of the complex reality are broken down into discrete parts for analysis of the cause-effect relations (reductionism). Systems are considered to be predictable and controllable once the parts are known. The fact that science has brought about technical progress is taken as an indicator of increasing knowledge and the move towards truth. As a result, the knowledge derived from science is perceived as superior to other knowledge systems and considered to be value-free and culturally neutral.

Constructivism emerged as a contraposition, which specifically refutes the positivist notion of objectivism and the discovery of true knowledge (Bawden, 1995; Berger and Luckmann, 1967; von Glasersfeld, 1987; Maturana and Varela, 1992; Watzlawick, 1976). Constructivists are committed to the view that '*contrary to common-sense, there is no unique "real world"*[7] *that pre-exists and is independent of human mental activity and human symbolic language*' (Brunner, 1986:95, in Schwandt 1994:125). Meaning (or truth) is not discovered but is constructed. Through communication and learning processes different social groups develop an inter-subjective system of concepts, beliefs, societal and cultural norms, or a set of theories that they consider to be reality. Under the constructivist paradigm there is no 'objectively' best solution to a problem, as different actors frequently have a divergent sense of what is needed and what can be achieved. Technologies are not value-free, not culturally neutral, and not 'portable' across organisations and cultures (Hagmann, 1999; Röling, 1996).

For the design of a research approach in both participatory research and conventional research, it is critical to be aware of the assumptions one is making. They have implications for the definition of objectives, roles, methods, etc. For example, it might be assumed that there is a 'stock' of uniform, systematised, local knowledge available for assimilation and incorporation into research conducted by 'outsiders'. In contrast, knowledge might be seen as multi-layered, fragmentary and diffuse, and as something that can only be generated as a result of interaction and joint learning among different actors with complementary contributions.

Another assumption could be that innovations are directed towards a rather homogenous social and natural environment where people face the same kinds of challenges, share common goals, values, interests and a common set of conditions (including power). Under such circumstances it is assumed that an innovation might be of equal relevance to all, and that innovations easily diffuse among users based on rational, causal considerations. On the other hand, innovations might be needed in diverse and complex social and natural environments. Actors might have differentiated interests, relationships, values, power and

access to resources, conditions in which rapid and widespread dissemination of a particular innovation is unlikely. Hence, the underlying paradigms will imply the choice of scientists to investigate *for* or *on* their clients' behalf or *with* farmers. Paradigms will influence whether systems are seen as real things that can be studied from outside or as abstract concepts which are socially constructed. The choices will determine whether the process of inquiry is through experimentation or organised as a system of learning, etc.

Objectives of innovation development and the challenges addressed

The NRM challenges to be addressed through research are rather diverse. Inappropriate technologies and methodological approaches, organisational deficits, limited social capital and capacities are challenges to be dealt with at the local level. In the external environment structural problems like policies, land tenure, institutional environment, information management, etc. need to be addressed. Depending on the challenge, different kinds of innovations are required: technical, social/organisational innovations and new methods and approaches. To most of these challenges, research can only contribute, it cannot deal with the entire development dimensions. The expected research outputs might be applicable at different geographical levels and be targeted to different users. Research objectives might, for instance, range from:

- developing a specific technology or (policy / management / methodological) recommendations for widespread dissemination and application *at national or global level*;
- developing solutions to overcome a specific technical constraint which was identified *at local level*;
- *Developing more options* to provide wider choices for resource-poor farmers in diverse environments; or
- *developing approaches* which enable local people to drive their own process of problem solving, experimentation, adaptation and innovation, and their ability to articulate their demands (adaptive management capacity).

In designing research projects, these different levels of objectives need to be distinguished. Depending on the expected output, it should be determined *whose questions have to be answered.* The closer the focus is on solving practical problems at local level, the greater user participation is required (Hagmann and Chuma, 1997).

Types of participation and ownership

A core characteristic of participatory research approaches, is a process of interaction between local and external actors to 'co-create' innovations. Several authors have attempted to define different types of participation (Ashby, 1996; Biggs, 1989; Lilja and Ashby, 1999; Mikkelsen, 1995; Pretty, 1994; White, 1996). We modified Biggs's (1989) classification to describe linkages between different social actors according to varying degrees of involvement in and control over decision-making in the relationship:

- *Contractual participation.* One social actor has sole decision-making power over most of the decisions taken in an innovation process, and can be considered the 'owner' of this process. Others participate in activities defined by the stakeholder group, i.e. they are (formally or informally) 'contracted' to provide services and support.
- *Consultative participation.* Most of the key decisions are kept with one stakeholder group, but emphasis is put on consultation and gathering information from others, especially for identifying constraints and opportunities, priority setting and/or evaluation.
- *Collaborative participation.* Different actors collaborate and are put on an equal footing, emphasising linkage through an exchange of knowledge, different contributions and a sharing of decision-making power during the innovation process.
- *Collegiate participation.* Different actors work together as colleagues or partners. 'Ownership' and responsibility are equally distributed among the partners, and decisions are made by agreement or consensus among all actors.

The key aspect in such classifications is the value of 'ownership': *Who is participating in whose process?* At either extreme, farmers might participate in scientists' research, or researchers participate in a locally-owned innovation process. An innovation process can be triggered by outsiders or requested by local people. From the perspective of international agricultural researchers, participation by farmers in the researchers' process mostly means, farmers participating in, for example, problem analysis or evaluation of technologies. Alternatively, local stakeholders might be driving research and experimentation to solve problems at a local level. In this case, researchers facilitate and document the process and focus on strategic questions, such as: How to initiate and sustain collaborative action for NRM? How to improve self-governance? How to motivate for NRM and/or increase local people's problem-solving capacity?

In recent years most research projects have actively sought local people's participation, but objectives and expected outcomes from such participation are very diverse, ranging from legitimisation to emancipation of local people:

- *Legitimisation*: Participation is evoked to obtain local people's consent for outsiders to do what they perceive as important, or participation may be used because it is 'fashionable' and demanded by donors.
- *Effectiveness and efficiency*: Participation is used to make use of local knowledge and/or to ensure demand-orientation, i.e. that locally-felt needs are addressed.
- *Capacity-building/learning*: Participation is a means to gaining practical experience through working together, and being involved in analysis, planning and decision-making. It leads to personal and professional growth among local people and researchers. It can result in changes in attitude, increased capacity for reflection, improved communication skills, more conscious decision-making, management and organisational capacity, etc.
- *Emancipation/transformation*: Participation is

considered as a means of enhancing local people's capacity for self-directed innovation development (adaptive management). The process is seen to increase capacity for articulation and negotiation of interests, leadership, collective action, as well as critical consciousness, and self-esteem among marginalised social groups.

Differences between the main actors, including social status, perspectives, interests and expectations, influence the way knowledge is generated and shared. They often hinder the development of truly collaborative or equitable relationships, not to mention collegial ones (Sutherland, 1999). Local people may be unaccustomed to articulating their opinions in group meetings and in the presence of professionals, and they may try to anticipate what project staff wants to hear. It is frequently assumed that people know what their problems are, can articulate them and are ready to share them with outsiders in a participatory appraisal. However, since this degree of emancipation is true in very few cases, the quality of the demands expressed is often 'shallow'. Revealing the issues which really matter, presents a challenge to facilitation.

Stakeholder involvement

The outcome of participatory research is affected by both *how* actors relate to each other (types of participation), and the specific characteristics of the participants themselves, i.e. *who* is involved (or excluded). *Who* is involved will determine who obtains direct benefits from the research and learning process (process impact). The *who* will also influence the type, usefulness and social inclusiveness of the products that emerge from research (technology impact). Therefore, an important distinguishing aspect among participatory approaches is the way in which individual or group actors are differentiated, seek to participate in and bring knowledge to an innovation process (Ashby, 1996). One key to determining who the participants are is to look at how they were selected (Johnson et al., 2000), for example:

- Selection based on 'efficiency' criteria such as knowledge, skills or status makes a qualitative difference to the process because of above-average education, literacy or other skills of participants.
- Self-selection of participants is probably the least pro-active and most susceptible approach to gender bias and/or elitism (the better off have time and self-confidence to participate; women and marginalised groups seldom do, etc.).
- Community selection is also likely to bias the process towards the favoured groups in a society, unless good facilitation reaches agreement on specific criteria that promote the inclusion of disadvantaged groups.

Due to the complex nature of NRM, there is usually a large number of different (competing) stakeholders with different perceptions, interests, strategies and knowledge systems. This frequently implies that 'platforms' (e.g. community fora) where stakeholders come together for negotiation and participatory action research are needed to allow for joint learning, i.e. the 'de-construction' and 're-construction' of people's reality (Hagmann et al., 2002). Therefore, inclusiveness is central to stakeholder participation if the focus is on collective action, conflict management, and social learning, whereas 'local expert' participation might be sufficient in the case of developing a specific technological innovation.

Roles of external and local actors

External agents or secondary stakeholders can be differentiated into two sets of actors:

(1) the national agencies or implementers involved in NRM (extension agents, agricultural research, NGO staff, district/provincial/national authorities, etc.), and
(2) the set of actors who support these national implementers (international donors, IARCs, donor NGOs, and development cooperation projects and programmes).

The roles that these external and local actors play in an innovation process vary: local people may be perceived as *clients, beneficiaries, users, target group* or *partners*. External actors may regard themselves as *service providers, advisors, facilitators, stakeholders*, or *partners*.

The roles of different external actors (international/national research, extension, and development agencies) in an innovation system need to be revisited, clarified and well coordinated. According to Hagmann et al. (2002) role clarification is a weak point in many research projects. Often development agents are left facilitating action learning at local level while researchers carry out a totally detached external analysis of these processes. From a constructivist perspective it can be argued that the conceptualisation of knowledge gained in an intervention process requires that the process be experienced and understood emotionally. This notion is in line with the concept of cognition by Maturana and Varela (1992) who explain that cognition is broader than thinking, involving perception, emotion and action (Capra, 1996). From the latter perspective international research scientists would need to get involved at the local level to be able to interpret and conceptualise the research outcomes meaningfully for use at the global level.

Procedures/process

The procedure to be followed in an approach might be described as the way things are done as the research process unfolds. Procedures can be *top-down, bottom-up* or *horizontal* depending on who provides directions and who is accountable to whom. Processes can also be designed to reinforce *linear* information and knowledge flows, or they can prioritise the facilitation of *iterative learning loops*. A linear approach is generally characterised by rigorous planning, fixed roles, clearly defined procedures and stages of research, and an emphasis on the production of clear outputs. Evaluation tends to be done at the end of a project phase (ex-post). On the other hand, an approach characterised by iterative loops of action and reflection in a collective learning process is based on evolving plans and continuous internal monitoring and self-evaluation. The latter, process-oriented approaches

require a higher degree of flexibility in planning and implementation, but help to ensure relevance and ownership.

Research methods

An approach to innovation development might rely on *formal* research methods or on *informal* farmer experimentation. It might look at causal relationships between distinctive elements and events (reductionism) or it might be based on systemic methods. There are two different schools of systemics which are often termed hard and soft respectively (Bawden, 1995: 8). Hard systems approaches attempt to understand entire systems (e.g. cropping enterprises, whole farms, groups of farms, or even communities) by looking at them from outside, assuming that the system variables under study are measurable, that the relationships between cause and effect are consistent and may be discovered by empirical, analytical and experimental methods. Soft systems thinkers argue that systems are creations of the mind or theoretical constructs to understand and make sense of the world. Hence, soft systems methods aim at generating knowledge about processes within systems by stimulating self-reflection, discourse and learning (Hamilton, 1995: 35–36).

In NRM research both research methods are needed: soft participatory action research more on processes of NRM (e.g. organisation, collective management, competence development, conflict management, etc.) and conventional hard research more on technological and social issues (e.g. soil conservation, agronomic practices, socio-economic studies, etc.). Ultimately a meaningful integration is important for reaching the desired output.

Prototypical approaches to innovation development

We suggest three prototypical approaches to innovation development as a framework to analyse participatory approaches. It needs to be stressed that in practice precise boundaries cannot be drawn between them. They constitute prototypes or umbrella terms on a continuum rather than clear-cut procedures:

- transfer of technology;
- farmer first; and
- participatory learning and action research.

Transfer of Technology[8]

This linear and mainly technology-driven model reflects the modernistic development perspective of the 1960s and is based on the positivist science paradigm. It includes three main actors: *Formal researchers* who are responsible for providing scientifically valid research results, *extensionists* who 'transfer' the message to *farmers* or other *clients*, who have the role of the adopters or rejecters of innovations developed by others. The division of research into different categories (basic, strategic, applied, adaptive) – and rather limited institutional mandates reflect that innovations are considered to be the result of a linear process of applying scientific knowledge in practice (Hagmann, 1999).

The green revolution packages which emerged from this process in the 1970s mainly fitted in to areas of high natural potential and standardised, rather controllable growing conditions. The transfer of technology model, aiming at a widespread adoption of technologies, is likely to be successful in relatively homogenous, low-risk, natural and social environments, where farmers live under similar conditions, perceive the same kinds of challenges and share a common set of beliefs and values. The success in adoption of these techniques by small farmers in highly variable areas with low levels of control of growing conditions was limited. Adapting the environment to fit the technology (e.g. through fertiliser application) is economically and socially not feasible in this context. As a response farming systems research emerged and more emphasis was laid on (contractual and consultative) farmer participation to better understand their complex situation and the inter-dependencies among elements of farming systems in order to develop adapted technologies (Biggs, 1989; Farrington and Martin, 1987; Rhoades and Booth, 1982).

Today, the transfer of technology model is often viewed as the antithesis of participatory research. However, the rise of the participation discourse does not imply that earlier approaches have been completely replaced. Rather the new repertoire has been assimilated into the conventional process to achieve optimum results in technology transfer. Much of the present participatory practice can still be classified as an expansion of the transfer of technology model, because information is obtained from farmers, in order to assimilate and incorporate it into scientific research. Participatory methods are used to better meet farmers' needs and to adapt technologies to site-specific circumstances at a relatively late stage of the research process.

Farmer First

The re-thinking of the transfer of technology model started in the mid 1980s. Chambers et al. (1989, 1993) describe a 'family of approaches' summarised under 'Farmers First', including for example Farmer-back-to-Farmer (Rhoades and Booth, 1982), Farmer First and Last (Chambers and Ghildyal, 1985), Farmer Participatory Research (Farrington and Martin, 1987), and Participatory Technology Development (ILEIA, 1989). What they have in common is an emphasis on the participation of farmers in the generation, testing, and evaluation of technology to promote sustainable agricultural production. The main outcome expected from these approaches is the generation and adoption of new, appropriate technologies by small, resource-poor farmers to aid in solving production constraints in order to increase farm productivity and income (Selener, 1997).

The positivist paradigm is still prevalent in these approaches. Local knowledge is often viewed as a uniform 'stock', which is available for assimilation and incorporation. The role of researchers is to collect information, document rural people's knowledge,

Box 1 Testing 'best bet options' in mixed farming systems in West Africa

The contributions of livestock to NRM take place within a complex of biophysical, environmental, social and economic interactions. In order to better address, understand and optimise the contribution of livestock, it is therefore mandatory to develop novel approaches that integrate these multiple aspects and consider the implications at various levels of scale from farm household to regional levels. As an example of such an approach in the context of mixed farming systems in West Africa, a number of international institutions (including the International Institute of Tropical Agriculture (IITA), the International Livestock Research Centre (ILRI) and the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT)) have begun working together to address the dual goals of increased productivity and maintaining environmental stability through the integrated management of resources. The approach, which was to be implemented on-farm, began with a prioritisation of the most binding constraints that research can respond to (competition for nutrients, and the need to increase productivity of both crops and livestock without mining the soil). The introduced technologies were presented as 'best bet options' which include the best of everything that research has produced. The project started small in 1998 with 11 farmers in northern Nigeria; in 1999, a further 36 farmers joined the trials. The farmers themselves, with minimum technical guidance from researchers, carried out all farm operations. The best bet options were tested against current practices used by farmers. The implications and impacts of introducing such best bet options are assessed by researchers taking into account not only grain and fodder yields, but also nutrient cycling, economic/social benefits or disadvantages, and farmers' reactions to and perceptions of the intervention. So far, there has been no attempt to capture environmental implications such as methane emissions, construction of wells and availability of fresh water, etc.

Source: Tarawali et al., 2000 (www.inrm.cgiar.org/Workshop2000/abstract/Tarawali/Tarawali.htm)

provide technology options, plan and manage research interventions. Farmers mainly act as respondents and are involved in planning and on-farm experimentation (Hagmann, 1999). Often formal research methods and controlled comparison are used.

In Boru Douthwaite's 'learning selection approach' to technological change different stakeholders experiment with a new technology (researchers' 'best bet') and carry out the evolutionary roles of novelty generation, selection, and promulgation, i.e. learning selection is seen as analogous to natural selection in Darwinian evolution (Douthwaite, 2002). The innovation process is regarded as a complex adaptive multi-agent system, which leads us to the following category of approaches.

Participatory Learning and Action Research

In Participatory Learning and Action Research, knowledge is developed through critical reflection and experiential learning in an ongoing process of action in a real life context. These approaches are thought to have several advantages. It is expected, for instance, that (i) practical knowledge and solutions can be developed which are directly useful to practitioners and people in the development process, (ii) by directly influencing the construction process of social reality, there is an increased probability that behavioural change and impact can be achieved, (iii) the people's capacity for experimentation and adaptive management can be developed, and last but not least, (iv) scientific knowledge can be generated concerning action-reaction links and factors that influence processes of change in a real life context. Through abstract generalisations that emerge from the study of one or several specific change processes, '*repeatable patterns of development*', approaches, methodological know-how, and '*theories of changing*'[9] can be elaborated. Briefly, learning and action research can be considered as being an integrated process of action (development), education and research (Margulies and Raia, 1978, in Selener 1997: 64); or as Albrecht (1992:125) puts it '*action research entails the integration of research functions as a continuing part of a development programme*'. In *participatory* learning and action research the mandate of science is no longer satisfied by scientists remaining external actors/observers developing knowledge *for* people. Instead, science's mandate includes helping people at different levels of social aggregation to develop knowledge (Röling, 1996) and to enhance their capacity for adaptive management. Operationally this implies that the exposure to new ideas and technologies, farmer experimentation, as well

Box 2 CIFOR's project on Adaptive Collaborative Management (ACM)

This is one example where NRM researchers attempt to put participatory learning and action research into practice. Improving the ability of forest stakeholders to adapt their systems of management and organisation to respond more effectively to dynamic complexity is seen as an urgent task. The research questions addressed through the project are: (1) Can collaboration among stakeholders in forest management, enhanced by processes of conscious and deliberate social learning, lead both to improved human well-being and to the maintenance of forest cover and diversity? If so, under what conditions? (2) What approaches, centred on social learning and collaborative action, can be used to encourage the sustainable use and management of forest resources? (3) In what ways do the processes and outcomes of ACM impact social, economic, political and ecological functioning? The project collaborates with many institutions involved in research, implementation and facilitation of change across a number of case studies in several countries. Researchers see themselves as actors within the system rather than neutral. Since there is no objective or static viewpoint from which the dynamics of management can be observed, forest managers and users at the case study sites are involved actively and 'meaningfully' in research. Findings will be generalised through comparison across sites in different countries. Envisaged research outputs that will be targeted to different users at the local, national and global level are: issue papers, manuals on methods and approaches, a toolbox for development practitioners, case studies of successes and failures, policy briefs, scholarly research papers and software such as simulation models.

Source: http://www.cifor.cgiar.org/acm/projects/acm-par.html (24.04.2003)

as platforms for negotiation and action learning, are facilitated at community level and with service providers (Hagmann et al., 2002). Moreover, participatory monitoring and evaluation (PM&E) is an important instrument to integrate participatory research functions as a continuing part of the social or socio-technical development effort, and to investigate more systematically 'how' and 'why' certain changes are, or are not, taking place (Probst, 2002).

Action learning approaches operate in a constructivist perspective,[10] where informal experimentation and indigenous knowledge are put on a more equal footing with scientific knowledge. They draw from traditions in the applied social sciences, pedagogy (Buckingham, 1926), organisational development (Lewin, 1946), and community development (Freire, 1970 in Selener, 1997).[11] According to Kurt Lewin (1946) complex systems can only be explored through action within the system, because a system's reaction to changes reveals its characteristics ('If you want to know how things really work, just try to change them'), i.e. the really relevant issues frequently only emerge during the process of action, and would be missed through rigid planning (Hagmann et al., 2002).

Table 1 gives an overview of the three prototypical approaches and their respective attributes.

What does this mean in practice?

The previous framework has shown that the design of a research approach goes beyond selecting research methods and tools. There are other variables research managers need to think through in order to position themselves within this framework, such as the underlying epistemological assumptions, research objectives, types of participation, roles of external and local actors, procedure/process used, etc. The typology does not assert that one approach is better than another, and that, as a matter of principle, higher levels of participation lead to better outcomes. Each of them has its strengths, and approaches can complement each other and fulfil different tasks depending on the research objectives and the context for or within which innovations are to be developed (Hoffmann, 1990, 1992). We consider important, however, that researchers select more thoughtfully and consciously between the different options at hand to explore the most appropriate strategy towards impact.

According to the findings presented in Section 2, most of the current NRM research initiatives focus on the generation and provision of technologies, assume a functioning linear research-development continuum, use mostly consultative forms of participation, and consider participatory research as a tool for applied and adaptive research. Therefore, they principally fall into the categories of 'transfer of technology' and 'farmers first' approaches. Longer-term participatory learning and action research approaches are only beginning to be chosen by IARCs as they require a different kind of professionalism, and challenge the mandate, i.e. they are considered to fall under the sphere of development rather than research. The potential of participatory learning and action research for strategic research and approach development is gradually being recognised, particularly since the research system (i.e. 'research on research') has become a focus in institutional research.

Another, frequently discussed issue is the question of *client-orientation* in international agricultural research. Presently, public sector agricultural research is mainly externally initiated, discipline-led and supply-driven – no matter which of the above-mentioned approaches is chosen. Research institutions write proposals according to their strengths and preferences, they manage the funds obtained for development-oriented research, and are accountable and report to donors. Local clients in turn have little power and influence on the research agenda. Currently, new financial mechanisms are under discussion to increase the demand-orientation and accomplish more market-led client-provider relationships. A new concept would, for example, be that local organisations who have appropriate communication channels to institutions or enterprises and who have control over their own and/or donated resources (or competitive funds, vouchers, etc.), initiate contracts with providers of research services to overcome specific constraints. They would act as clients who commission external service providers, and 'buy-in' the research services they need. Each of the three prototypical approaches to innovation development could be chosen under such market-led conditions, i.e. local organisations could demand either the development of a technology or the facilitation of a learning and action research process. This model would put local people in a commanding position, as they could demand accountability, with external actors responding to their requests.

What is frequently ignored in the discussion of such financial arrangements, is that some preconditions need to be in place for their functioning, such as a certain level of local organisational and management capacity, the ability to identify and articulate broad- based demands etc. Otherwise such efforts will be highly susceptible to corruption by local elites, or fall into the trap of 'local people demanding more of the same'. Participatory learning and action research approaches by nature seek to strengthen the capacities of poor farmers in marginal areas ultimately to allow the application of more market-led and demand-oriented approaches.

The following section points out some challenges and structural changes the international agricultural research community needs to deal with to better exploit the potential of participatory learning and action research approaches in NRM research.

4 CONCLUSIONS AND FUTURE CHALLENGES IN NRM RESEARCH

Considering current NRM research practice, it becomes apparent that most initiatives have a weak strategic orientation, and that a high level of uncertainty exists within the international agricultural community as to

Table 1 Approaches to innovation development and their attributes

	Transfer of Technology	Farmer First	Learning and Action Research
Assumptions, values and beliefs	• innovation seen as a result of a linear process by which scientific knowledge is applied in practice (positivist perspective) • homogenous environmental and social systems in which the innovation is of equal relevance to all, where innovations diffuse from 'innovative' farmers to other farmers. • modernistic development perspective	• recognition that farmers have something to contribute to innovation development • a 'stock' of local knowledge available for assimilation and incorporation into research • common goals, interests and power among 'farmers' and 'communities'	• innovation the outcome of a mutual learning process between actors with complementary contributions (constructivist perspective) • inequitable discontinuous interactions and differentiated interests, power, access to resources between 'actors' and 'networks' • 'democratized' research process through broad-based stakeholder involvement (political and social agenda)
Objectives and Challenges	provision and marketing of 'best' technology for widespread adoption (e.g. for national food security, economic growth, natural resource conservation)	provision of wider choices of technologies (basket of options) for resource-poor farmers in complex and diverse environments; finding locally adapted solutions	enhancing adaptive management capacity, emancipation, and social capital at local level Building of stakeholder platforms for negotiations and learning processes strategic research on NRM processes
Types of participation	contractual – consultative	consultative – collaborative	collaborative – collegiate
Actors and Stakeholders	(national) research, public sector extension, individual / 'innovative' farmers	research / extension, 'farmers', communities	multiplicity of local and external stakeholders (e.g. farmers – men/women, research, NGOs, public and private sector, policy makers etc.)
Role of External Actors	development and transfer of messages and technologies	information collector of rural people's knowledge, planner and manager of research intervention more recently facilitator, initiator, catalyst (provider of principles, formal research methods, basket of choices)	facilitator, initiator, catalyst, provider of occasions and methodological support, visible actor/stakeholder in process learning and action ('new professionalism') supporter of farmer-led research
Role of Local Actors	beneficiaries, target group; reactive respondent, provider of labour/land for on-farm research	reactive respondent or active participant	creative investigator, active participant and partner in the process of learning and action
Procedures	• outsiders analyse needs and priorities • static plan, rapid and widespread implementation • 'fixed menu' • linear, clearly defined stages of research • external intermittent evaluation	• farmers analyse needs and priorities facilitated by outsiders • 'menu à la carte' • farmer involvement in planning, implementation and/or evaluation of technologies	• iterative loops of action and reflection in a collective learning process • evolving plan, adaptive management, internal continuous PM&E • collaborative work requiring dialogue, negotiation and conflict mediation between interest groups
Research methods	hard systems research (AEA, FSR, RRA)	mainly formal research methods, FSR, RRA, GA; PRA, FPR, PTD	soft systems learning and action research, stakeholder analysis, PAR, FPR, informal farmer experimentation, comparative case studies

its role and mandate in integrated NRM research and the relevance of participatory research in this field. When deciding on their research approach, scientists usually draw on disciplinary measurement habits, use tools that are in vogue and make choices that seem relevant to their research questions. They rarely embark on a research initiative by systematically clarifying their assumptions, the desired impact, vision and values, research objectives, roles of different actors, types of participation and the process used, etc. As agricultural research has long been dominated by the positivist paradigm, it is still widely assumed that the sharing of tasks within a linear research–development continuum (from basic, strategic, applied and adaptive research to extension and development) can be taken for granted. Participatory research merely fits into the area of applied and adaptive research as a means to improve the conventional technology development process. Participatory learning and action research approaches, however, require a different framework of thinking and structural changes. This is why their potential has, so far, hardly been explored. We consider the following issues as major challenges to make NRM research more efficient and effective:

- We suggest that research managers analyse their research initiatives within the framework presented in Section 3, to explore the most suitable research approach and select consciously between the different options at hand. It needs to be stressed that these decisions are never purely technical, but rest to a large degree on a foundation of assumptions and values that should be uncovered. Positive experiences have been made in a series of workshops that helped to clarify researchers' visions of the outcomes of effective research and made explicit the meaning of the guiding values of the research process, such as problem orientation, self-reliance, self-organisation, sustainability, ownership of the research process, client-orientation, inclusiveness, continuous adaptation, genuine partnerships, etc.[12]
- The mandate of research cannot be satisfied by scientists remaining external actors developing knowledge for people and assuming that their products will be taken up by a functioning institutional arrangement. Without addressing the functioning and performance of the whole innovation system with its different actors, roles, mandates, and responsibilities, research is bound to have a limited effectiveness. An analysis of the innovation system within a given context should be conducted. The roles and narrow mandates of international and national research, extension and other development agencies need to be redefined, well coordinated and new institutional arrangements and multi-stakeholder partnerships for innovation development need to be actively explored. The following set of key questions can help research managers to identify the appropriate research strategy departing from the impact which should be achieved (Hagmann et al., 2002).
  - What do we want to achieve, and what is achievable at all? (*impact*)
  - Who should do what differently, if our research was successful? (*vision of behavioural change*)
  - What is required to support this behavioural change?
  - What is the role of research and what are the research outputs in enhancing these factors? What is the role of other actors?
  - **What are the research questions leading to the research output?**
  - **How can these research questions be best dealt with? (*approaches and methodologies*)**
  - **With whom and how does NRM research have to collaborate to be effective?**
- In order to make a more significant contribution to innovation in complex settings where socio-technical change processes are involved, such as in NRM, the scientific agricultural community needs to increase the emphasis currently placed on action research and the systematic evaluation and analysis of case studies in close collaboration with development practitioners and local actors. Such participatory research can be considered as *strategic* research – not in the sense of the linear research-development continuum – but by answering strategic questions which have significance way beyond local cases (Hagmann et al., 2001). Participatory learning and action research should be recognised not only as a way to achieve local impact, but also to generate strategic knowledge, methodological principles and approaches through the systematisation and conceptualisation of the lived experiences. Researchers should be aware that, in order to be able to conceptualise knowledge from intervention processes, they need to get involved in such processes at the local level. A shift in 'professionalism' would therefore be required among some (not all) researchers from disciplinary experts towards more interdisciplinary facilitators who are effective in conceptualisation. New quality criteria need to be developed for participatory learning and action research processes (i.e. not only for 'scientifically valid' final research outputs) to give guidance to implementers and facilitators.

There is no doubt that the implementation of participatory approaches is frequently difficult and unpredictable in outcome. As extensively discussed in Cooke and Kothari (2001) and Collinson (2001) they are often constrained by and clash with organisational structures and cultures, bureaucratic goals to be met, and unequal power relationships. These are the key challenges for the development of good cases and in particular for scaling-up such approaches. Much depends on the quality of implementation and the competences in facilitation of such processes. A great level of self-reflection, critical awareness (Chambers, 2002) and continuous learning/improving on the part of researchers and other implementers is therefore a key success factor to exploit the potential of these approaches while preventing their misuse.

REFERENCES

Albrecht, H. (1992) 'Sozialwissenschaftliche Aktionsforschung in Entwicklungsprogrammen: Bedeutung und Bedingungen' in Hoffmann, V. (ed.): Beratung als Lebenshilfe. Humane Konzepte für eine Ländliche Entwicklung, pp. 113–28, Weikersheim: Margraf Verlag.

Ashby, J.A. and Sperling, L. (1995) Institutionalizing participatory, client-driven research and technology development in agriculture. *Development and Change*, Vol. 26, No.4, pp. 753–70.

Ashby, J.A. (1996) 'What do we mean by participatory research in agriculture?' in *New frontiers in Participatory Research and Gender Analysis.* Proceedings of the International Seminar on Participatory Research and Gender Analysis for Technology Development, September 9–14, 1996. CIAT Publication No. 294, pp. 15–22, Cali, Colombia: CIAT.

Ashby, J.A, Braun, A., Gracia, T., Guerrero, M.D.P., Hernández, L.A., Quiros, C.A. and Roa, J.I. (2000) *Investing in farmers as researchers: Experience with Local Agricultural Research Committees in Latin America.* Cali, Colombia: CIAT.

Ashby, J.A. (2002) Innovation and scaling-up: some basics. Presentation delivered at CIAT Seminar Series, International Center for Tropical Agriculture (CIAT). May. Cali, Colombia.

Bawden, R. (1995) 'On the systems dimension in FSR', *Journal for Farming Systems Research-Extension* Vol. 5, No. 2, pp. 1–18.

Becker, T. (2000) 'Participatory Research in the CGIAR' in Proceedings Deutscher Tropentag. *International agricultural research – A contribution to crisis prevention*, October 11–12, 2000. Stuttgart, Germany: University of Hohenheim.

Ben-David, J. (1971) *The scientist's role in society: a comparative study.* Englewood Cliffs, NJ: Prentice-Hall.

Bennis, W.G., Benne, K.D., Chin, R. (1974) *The planning of change.* London: Holt, Rinehart and Winston.

Berger, P.L. and Luckmann, T. (1967) *The social construction of reality. A treatise in sociology of knowledge.* Garden City, NY: Anchor Books.

Biggs, S. (1989) 'Resource-poor farmer participation in research: a synthesis of experiences from nine National Agricultural Research Systems. OFCOR Comparative Study Paper'. The Hague: ISNAR. pp. 3–37.

Biggs, S. (1990) 'A multiple source of innovation model of agricultural research and technology promotion'. *World Development,* Vol. 18, No. 11, pp. 1481–99.

Braun, A.R., Thiele, G. and Fernández, M. (2000) 'Farmer field schools and local agricultural research committees: Complementary platforms for integrated decision-making in sustainable agriculture'. *Agricultural Research and Extension Network Paper* No. 105. London: Overseas Development Institute.

Brunner, J. (1986) *Actual minds, possible worlds.* Cambridge, MA.: Harvard University Press.

Buckingham, B.R. (1926) *Research for teachers.* New York: Burdett and Co.

Burrel, W.G. and Morgan, G.(1979) *Sociological Paradigms and Organisational Analysis.* London: Heinemann

Capra, F. (1996) *The web of life. A new synthesis of mind and matter.* London: Harper Collins Publishers (Flamingo).

Chambers, R. and Ghildyal, B.P. (1985) 'Agricultural research for resource poor farmers – the farmer first and last model'. *Agricultural Administration and Extension,* No. 20, pp. 1–30.

Chambers, R., Pacey, A. and Thrupp, L.A. (eds) (1989) *Farmer first. Farmer innovation and agricultural research.* London: Intermediate Technology Publications.

Chambers, R. (1993) *Challenging the professions. Frontiers for rural development.* London: Intermediate Technology Publications.

Chambers, R. (2002) 'Professional error, critical awareness and good science'. Paper presented at the International Conference 'Why has impact assessment research not made more of a difference?', 4–7 February 2002, San José, Costa Rica.

Checkland, P.B. (1981) *Systems thinking, systems practice.* Chichester: Wiley.

Checkland, P.B. (1985) 'From optimising to learning: A development of systems thinking for the 1990s'. *Journal of Operational Research and Society,* Vol. 36, No. 9, pp. 757–67.

Collinson, M. (2001) Institutional and professional obstacles to a more effective research process for smallholder agriculture. *Agricultural Systems,* No. 96, pp. 27–36.

Cooke, B. and Kothari, U. (eds) (2001) *Participation: The new tyranny?* London, New York: Zed Books.

Cornwall, A., Guijt, I. and Welbourn, A. (1994) 'Acknowledging process: Challenges for agricultural research and extension methodology' in I. Scoones, and J. Thompson, (eds). *Beyond farmer first. Rural people's knowledge, agricultural research and extension practice.* London: Intermediate Technology Publications. pp. 98–117.

Crotty, M. (1998) *The foundations of social research. Meaning and perspective in the research process.* London/Thousand Oaks/New Delhi: Sage Publications.

Douthwaite, B. (2002) *Enabling innovation. A practical guide to understanding and fostering technological change.* New York and London: Zed Books.

Engel, P.G.H. (1997) *The social organization of innovation. A focus on stakeholder interaction.* Amsterdam: Royal Tropical Institute KIT.

Farrington, J. and Martin, N. (1987) 'Farmer participatory research: A review of concepts and practices'. *ODI Discussion Paper* No. 19. London: Overseas Development Institute.

Fernandez, M. (1999) Field study of 53 cases on the use of participatory research in international agricultural research. Study commissioned by the CGIAR System-wide Program of Participatory Research and Gender Analysis. Results of the SPSS Analysis. Unpublished paper, Cali, Colombia: CIAT.

Freire, P. (1970) *Pedagogy of the oppressed.* New York: Seabury Press.

Gaventa, J., Blauert, J. (2000) 'Learning *to* change by learning *from* change: Going to scale with Participatory Monitoring and Evaluation' in M. Estrella, (ed.) J. Blauert, D. Campilan, J. Gaventa, J. Gonsalves, I. Guijt, D. Johnson, R. Ricafort, *Learning from change: issues and experiences in participatory monitoring and evaluation,* pp. 229–43, London: Intermediate Technology Publications.

Hagmann, J. (1999) 'Learning together for change. Facilitating innovation in natural resource management through learning process approaches in rural livelihoods in Zimbabwe'. *Kommunikation und Beratung* No. 29. Weikersheim, Germany: Margraf Verlag.

Hagmann, J. and Chuma, E. (1997) 'Issue of research design: Free experimentation versus controlled experimentation involving user participation' in New frontiers in Participatory Research and Gender Analysis. Proceedings of the International Seminar on Participatory Research and Gender Analysis for Technology Development, September 9–14, 1996. CIAT Publication No. 294, pp. 245–50, Cali: CIAT.

Hagmann, J., Kirkby, R., Bantilan, C. and Stroud, A. (2001) 'Some thoughts about strategic research in the CGIAR' in J. Hagmann, and E. Feleke, (eds) Documentation of a workshop on 'Integration of CGIAR activities in Eastern and Southern Africa' held in Nairobi, March 14–16, 2001. CGIAR Sub-Saharan African Committee.

Hagmann, J., Chuma, E., Murwira, K., Connolly, M. and Ficarelli, P. (2002) 'Success factors in integrated natural resource management R & D – Lessons from Practice' *Conservation Ecology,* Vol. 5, No. 2, pp.29. www.consecol.org/vol5/iss2/art29 [31.10.2002]

Hagmann, J. and Chuma, E. (2002) 'Enhancing the adaptive capacity of the resource users in natural resource management'. *Agricultural Systems* Vol. 73, No. 1, pp. 23–39.

Hamilton, N.A. (1995) Learning to learn with farmers. A case study on an adult learning project conducted in Queensland, Australia *1990–5.* Unpublished PhD. Thesis. Wageningen, The Netherlands: WAU.

Hoffmann, V. (1990) 'Extension approaches between blueprints and approach development' in L. Cammann (ed.) 'Peasant household systems'. Proceedings of an International Workshop held in Feldafing, April 3–5, 1990. Feldafing, Germany: DSE. pp. 169–77.

Hoffmann, V. (1992) 'Beratungsansätze: von der Uniform zum Maßanzug' in V. Hoffmann, (ed.) Beratung als Lebenshilfe. Humane Konzepte für eine ländliche Entwicklung. Weikersheim, Germany: Markgraf. pp. 271–6.

Humphries, S., Gonzales, J., Jimenez, J. and Sierra, F. (2000) 'Searching for sustainable land use in Honduras: Lessons from a programme of participatory research with hillside farmers'. *Agricultural Research and Extension Network Paper,* No. 104. London: Overseas Development Institute.

ILEIA (1989). *Participatory technology development: A selection of publications.* Leusden: ILEIA.

INRM-Group (1999) 'Integrated natural resource management. The Bilderberg Consensus'. Summary Report of the INRM workshop held at Bilderberg, The Netherlands, 3–5 September 1999. www.inrm.cgiar.org/documents/bb_meeting.htm [31.10.2002]

INRM-Group (2000) 'Integrated natural resource management in the CGIAR'. A Report on the INRM Workshops held in Penang, Malaysia, 21–25 August 2000.www.inrm.cgiar.org/documents/workshop_2000.htm [31.10.2002]

Janssen, W. (1995) 'Characteristics of NRM research: Institutional and management implications'. Paper presented at an ISNAR Workshop, December 6–9, 1994. *IRD Currents,* No. 9, pp. 22–9. Uppsala, Sweden: International Rural Development Center (IRDC), Swedish University of Agricultural Sciences.

Janssen, W., Goldsworthy, P. (1996) 'Multidisciplinary research for natural resource management: Conceptual and practical implications' *Agricultural Systems,* Vol. 51, pp. 259–79.

Johnson, N., Lilja, N. and Ashby, J.A. (2000) 'Using participatory research and gender analysis in natural resource management: A preliminary analysis of the PRGA Inventory'. *PRGA Working Document* No. 10. Cali, Colombia: CIAT.

Kolb, D.A. (1976) *The Learning Style Inventory: Technical Manual,* Boston, Ma.: McBer

Kolb, D. A. (1984). *Experiential Learning: Experience as the Source of Learning and Development.* New Jersey: Prentice Hall.

Lewin, K. (1946) 'Action Research and Minority Problems'. *Journal of Social Issues,* No. 2, pp. 34–46.

Lilja, N. and Ashby, J.A. (1999) 'Types of participatory research based on the locus of decision-making'. *PRGA Working Paper* No. 6. Cali, Colombia: CIAT.

Margulies, N., Raia, A.P. (1978) *Conceptual foundations of organisational development.* New York: Mc.Graw-Hill.

Maturana, H.R., Varela, F.J. (1987) (revised edition 1992) *The tree of knowledge, the biological roots of human understanding.* Boston, Massachusetts: Shambala Publications.

Mikkelsen, B. (1995) *Methods for development work and research. A guide for practitioners.* New Delhi/ Thousand Oaks/London: SAGE Publications.

Pretty, J.N. (1994) 'Alternative systems of inquiry for sustainable agriculture'. *IDS Bulletin,* Vol. 25, No. 2, pp. 37–48.

Probst, K. (2000) 'Success factors in natural resource management research. Dissection of a complex discourse' in N. Lilja, J.A. Ashby and L. Sperling (eds) *Assessing the impact of Participatory Research and Gender Analysis. CGIAR Program on Participatory Research and Gender Analysis.* Cali, Colombia: CIAT.

Probst, K. (2002) 'Participatory monitoring and evaluation: A Promising concept in participatory research? -Lessons from two case studies in

Honduras'. *Kommunikation und Beratung* No. 49. Weikersheim, Germany: Margraf Verlag.

Rhoades, R.E. and Booth, R.H. (1982) 'Farmer back to farmer: A model for generating acceptable agricultural technology'. *Agricultural Administration*, No. 11, pp. 127–37.

Röling, N.G. (1995) 'Creative resource management: The application of the ecological imperative'. Paper presented at a workshop on 'Extension Intervention and Local Strategies in Resource Management: New Perspectives on Agricultural Innovation in Zimbabwe', held January 10–12, 1995, Harare, Zimbabwe. Harare: Department of Agricultural Economics and Extension, University of Zimbabwe.

Röling, N., (1994) 'Facilitating sustainable agriculture: Turning policy models upside down' in I. Scoones, and J. Thompson (eds) *Beyond farmer first. Rural people's knowledge, agricultural research and extension practice*. London: Intermediate Technology Publications. pp. 245–248.

Röling, N.G. (1996) 'Towards an interactive agricultural science'. *European Journal of Agricultural Education and Extension*, Vol. 2, No. 4, pp. 35–48.

Röling, N.G. (2000) 'Gateway to the global garden. Beta/gamma science for dealing with ecological rationality'. 8th Annual Hopper Lecture, October 24, 2000. Canada: University of Guelph.

Sayer, J.A. and Campbell, B. (2001) 'Research to integrate productivity enhancement, environmental protection, and human development'. *Conservation Ecology*, Vol. 5, No. 2, pp. 32. www.consecol.org/vol5/iss2/art32

Schwandt, T.A. (1994) 'Constructivist, interpretivist approaches to human inquiry' in N.K. Denzin and Y.S. Lincoln (eds) *Handbook of qualitative research*. Chapter 7, pp. 118–37, Thousand Oaks/London/ New Delhi: Sage Publications.

Selener, D. (1997) *Participatory action research and social change*. Cornell Participatory Action Research Network, Ithaca, New York: Cornell University.

Sutherland, A. (1999) 'Linkages between farmer-oriented and formal research and development approaches'. *Agricultural Research and Extension Network Paper*, No. 92a. London: Overseas Development Institute.

Stroud, A., Hagmann, J. (2002): Analysis and processing of the field assessment of participatory research and feedback of the results to EARO management, held at EARO in Addis Ababa, Ethiopia, June 17–21 2002. Unpublished workshop documentation, African Highlands Initiative, Kampala, Uganda.

Stroud, A., Hagmann, J. (2002): Analysis and processing of the field assessment of participatory research and feedback of the results to DRD management, held at Courtyard Hotel in Dar es Salaam, Tanzania, January 21–26, 2002. Unpublished workshop documentation, African Highlands Initiative, Kampala, Uganda.

TAC (1997) *Priorities and strategies for soil and water aspects of natural resources management research in the CGIAR (AGR/TAC:IAR/96/2.1)*. Rome: TAC Secretariat, FAO.

TAC (2001) *NRM research in the CGIAR: A framework for programme design and evaluation (SDR/ TAC:IAR/01/24 Rev.1)*. Rome: TAC Secretariat, FAO.

Tarawali, S.A., Smith, J.W., Hiernaux, P. (2000) 'Integrated natural resource management – putting livestock in the picture'. Paper presented at the international workshop 'Integrated Natural Resource Management in the CGIAR: Approaches and Lessons'. 21–25 August 2000, Penang, Malaysia. www.inrm.cgiar.org/Workshop2000/abstract/ Tarawali/Tarawali.htm [25.05.2003]

Thiele, G., van de Fliert, E., and Campilan, D. (2001) 'What happened to participatory research at the International Potato Center?' *Agriculture and Human Values*, No. 18, pp. 429–46.

von Glasersfeld, E. (1987) Wissen, Sprache und Wirklichkeit. Arbeiten zum radikalen Konstruktivismus. Braunschweig, Wiesbaden: Vieweg.

Watzlawick, P. (1976) Wie wirklich ist die Wirklichkeit? – Wahn, Täuschung, Verstehen. München, Zürich: Serie Piper.

White, S.C. (1996). 'Depoliticising development: The uses and abuses of participation'. *Development in Practice*, Vol. 6, No. 1. UK and Ireland: Oxfam.

ENDNOTES

1 Agroecosystems occupy more than a quarter of the earth's total land area, but two-thirds of this area has been degraded in the past 50 years through erosion, salinisation, compaction, nutrient depletion, and pollution. Nearly 40% of the world's agricultural land has been seriously degraded (PRGA Program 2000,7).

2 www.inrm.cgiar.org In this paper the terms NRM and '*integrated*' NRM (INRM) are used interchangeably.

3 Examples throughout the paper were selected randomly for illustration. Many other cases could be found in the CGIAR's work.

4 An increasing commitment towards development impact is also reflected in the new term 'Research *for* Development' (R4D), which has come to be used instead of R&D (Research *and* Development) and 'development-oriented research'.

5 Examples from IARC websites: www.asb.cgiar.org, www.icraf.cgiar.org, www.capri.cgiar.org, www.cifor.cgiar.org/acm/projects/acm-par.html (20.05.2000); www.asareca.org/ahi/index.htm, www.cgiar.org/ilri/about/theme1_5.htm#P46_4880 (29.05.2003)

6 Assumptions about the nature of reality (ontology), the nature of knowing about reality (epistemology), ways of inquiry into the nature of reality (methodology), and the way human beings are (human nature) (Burrel and Morgan, 1979, in Bawden, 1995: 7).

7 This does not imply that constructivists need to be antirealist: One can plausibly hold the view that concepts and ideas are constructed (rather than discovered), whilst maintaining that these constructions correspond to something in the real world (Schwandt, 1994).

8 The 'transfer of technology' approach does probably correspond with what has been described more recently as the 'central source model' (Biggs, 1990, in Thiele et al., 2001: 429), or the 'pipeline model' of innovation (Ashby, 2002).

9 Bennis, Benne and Chin, 1974, in: Albrecht, 1992 make a distinction between 'theories of change' that are suitable for observers of social change, and 'theories of *changing*' that are suitable for practitioners. Similarly Gaventa and Blauert, 2000 chose the heading 'Learning *to* Change by Learning *from* Change'.

10 If (discovery) learning process approaches are used as an instrument to convince local people of a preconceived version of reality (e.g. in farmers' field schools), they take a positivist rather than a constructivist epistemology. The constructivist paradigm requires mutual learning, flexibility and process-orientation.

11 Action learning, experiential learning (Cornwall et al., 1994; Kolb, 1976, 1984), social learning and soft systems methodology (Checkland, 1981, 1985; Engel, 1997; Röling, 1995, 1996), as well as discovery learning (Hamilton, 1995) are all approaches which build on the potential of 'learning by doing' in a cycle of action and reflection in order to create practical knowledge (Hagmann and Chuma, 2002).

12 This is revealed strongly in the work of Hagmann and Stroud on institutionalisation of participatory research in the national agricultural research institutes of Ethiopia and Tanzania where participatory research pilots were self-evaluated by the researchers and managers (unpublished workshop reports 2000–2002, CGIAR 'African Highlands Initiative', see www.asareca.org/ahi/index.htm).

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