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Enhancing the adaptive capacity of the resource users in natural resource management

Jürgen Hagmann[a,*], Edward Chuma[b]

[a] *Talstrasse 129, D-79194 Gundelfingen, Germany*
[b] *University of Zimbabwe, Institute of Environmental Studies, PO Box MP 167, Harare, Zimbabwe*

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Abstract

The paper focuses on the role of learning tools in enhancing the capacity of resource users to innovate and manage their land in an adaptive manner. Based on experiences in Zimbabwe, core elements of a learning process approach to innovation in natural resource management using "learning tools" is described and analysed. The approach is centred around socio-organisational strengthening and farmer learning through experimentation and discovery, both integrated into a coherent intervention process design. High quality process facilitation led by strong vision, empathy and a 'culture of inquiry' is considered fundamental to unleash the potential of learning tools and process approaches. The experiences of the case study presented in the paper reveal that learning tools can only be highly effective if applied within a coherent learning process. Dissemination or scaling-up of this type of capacity building through learning tools therefore needs to focus on promoting of the process of learning rather than simply recommending certain tools or technologies which have been developed. This requires the development of facilitation skills of development agencies and farmer organisations. © 2002 Elsevier Science Ltd. All rights reserved.

Keywords: Adaptive capacity; Natural resource management; Process facilitation; Farmer experimentation; Participation; Extension; Experiential learning; Learning tools

* Corresponding author.
E-mail address: JHagmann@aol.com (J. Hagmann).

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1. Introduction

The common goal of all agents who engage in natural resource management (NRM) in rural areas is to make an impact that benefits the rural livelihoods and enhances their management of the natural resources in a sustainable way. This is a trivial statement, but its real implications are deep. Impact orientation automatically puts people as resource managers and therefore as determining factors for success in the forefront. A ‘fight’ between schools of thought in terms of ‘soft’ or ‘hard’ perspectives or how much participation is required is rather irrelevant within the impact perspective. In the end, the reality and the decisions of the local actors (and not the interventionists) will determine whether they will change in the way they manage the resources or not. Thus, any approach geared towards sustainable NRM and development can only be effective if it manages to influence peoples own decisions and capacities in natural resource management. It is evident, that this requires to work within the complex realities of rural livelihoods in a constructivist perspective in a learning paradigm (Röling and de Jong, 1998), through negotiation, facilitation and through appropriate methods and tools to inform the decision making processes. The core challenge in R&D interventions in natural resource management is thus to enhance the resource users’ and other stakeholders’ own learning and capabilities so that they can make well-informed decisions and adaptively manage their land.

The objective of this paper is to provide some insights on how this learning can be fostered in practice. The experience is based on a case in smallholder farming in a semi-arid area in Southern Zimbabwe, a programme initially called ‘conservation tillage project (‘ConTill’) which at the start was designed as a conventional applied research project on one technology—conservation tillage. Guided by a strong vision of rural people who are able to develop and optimally use their own potentials in development and an ultimate goal of making a real impact at farmers’ level, the programme tried to react to the events which were happening at farmer level. Through regular self-evaluation of successes and failures the intervention process design and the programme strategy was continually adapted. This opened up the technological focus which then became much broader in soil and water management and NRM in general, and it changed the focus from technology development to facilitating farmers’ capacity to innovate. After several years of adaptation through action research the programme came up with a learning process approach to innovation development and extension in integrated natural resource management which was much more successful than conventional technology transfer approaches. A process of enhancing the adaptive capacity of farmers themselves through experiential learning supported by effective learning tools was central to this success. Without a quality process, however, the effect of learning tools would have been minimal.

The first part of the paper provides an overview of the evolution of this programme and the insights which emerged from this development (Hagmann, 1999). The second part elaborates on the approach, processes and tools to enhance farmers’ learning and the third part describes some of the impacts and the challenges to scaling up.

2. Evolution of a learning process approach to NRM

Our own learning process in Zimbabwe as well as the learning process at farmers level from 1990 to 1995 and actually up to now has been highly iterative. Phases with several cycles of action and reflection revealed technical and institutional insights and propelled continual re-adjustments and re-orientations of the programme focus. At the beginning and even in the middle we were not sure where we were going, but the vision helped us to steer the process. Besides the vision this process was mainly driven by intuition, common sense and empathy, However, without the vision, the intuition and empathy would have had no reference against which one can make decisions.

Conventional on-station research was started in 1988, looking at the development of a single technology (conservation tillage) and later to spread this through extension. The obvious limitations of this type of research convinced then the major stakeholders to shift the focus towards adaptive on-farm research on one conservation tillage technology in 1990. By 1992 the experience taught us that this approach also proved far too limited and too linear to make a difference. However, the interaction with farmers produced crucial insights in terms of the social environment for innovation and in terms of individual and collective learning about innovations, which challenged the effectiveness of the whole linear system of research–extension–farmer. Thus, a participatory approach was developed including elements of Paolo Freire's 'pedagogy of liberation' in the form of 'Training for Transformation' (Hope and Timmel, 1984) to conscientise farmers for a self-reliant development. It also addressed more diverse stakeholders and accepted that innovation is rather a social process than a technology transfer issue. We learnt that unless farmers themselves learn about and develop technologies together with researchers one would hardly ever overcome the low adoption rates which all actors were complaining of. Numerous tools and methods for enhancing participation, learning, exploring and discovering ecological and social issues were developed.

Farmers' own experimentation, dialogue and sharing of the gained knowledge from farmer to farmer in a frame of participatory technology development and extension became the crucial focus. This led to a variety of technologies being tested and developed successfully. However, most activities remained individual farmers' activities. The dimension of collective action in a broader sense was not yet reached, which led us to develop a more integrated concept for community-based innovation development and extension in NRM. Our aim was to facilitate social, economical, ecological and organisational innovations through experiential learning which would enable people to manage their environment adaptively (de Boef, 2000). This explains why a broader social context than just a farmer group needs to be addressed and motivated to engage in collective action and reflection. Testing the operationalisation of the new approach to innovation in INRM became the main research focus while continuing with technical research. Collective issues like local organisational development, conflict management etc. became central for the innovation process in NRM (this evolution is described in detail in Hagmann et al., 1997).

Based on a substantial impact, the scaling up of this approach at institutional level became central in order to get out of the pilot phase. For this, conceptualisation of the intervention experience and the development of individual and organisational capacities was fundamental. So, competency development and organisational development became the main action research focus as from 1996 and by 1998 a promising approach to competence development had been tested and conceptualised and training materials had been developed (Moyo & Hagmann, 2000). Large scale training of extension staff had been started. The learning process is still on-going and is likely to challenge with new dimensions to be explored.

The form and functions of the programme changed over time. Once it was one project, then a more informal strategic alliance between projects, then one field project came to an end and the lessons were integrated into another institutionally focussed project, while other actors came in and continued field research work and created networks at NGO level. So, through this dynamics it has been possible to continue the work at different levels over more than 10 years. The strategies have changed but the ultimate vision and values of the interventions remained largely the same.

3. Core elements in learning for adaptive management

In the conceptualisation of the experiences and lessons learnt from the case study described above, three pillars for learning processes in NRM revealed to be elementary to enhance farmers' adaptive management capacities. These were:

1. a clear design of the intervention process, where the innovation process is embedded in a broader community development process including local organisational development. Innovation is considered a social process rather than solely technology-focused;
2. process facilitation, which proved to be key determinant for success; and
3. farmer experimentation as a methodology for operationalisation of experiential and discovery learning (Kolb, 1984; Hamilton, 1995).

In all the three pillars, learning tools were essential ingredients in the process.

3.1. Intervention process design

The systematisation of the learning process is a kind of 'model' which serves as a guiding framework, but which should not be taken as a blueprint and implemented in a mechanical way. The core of the conceptualised community intervention for innovation in NRM is the socio-organisational strengthening on one side and farmer learning through experimentation and discovery on the other side within a negotiation process. The major phases of this broad learning process which was named 'Participatory Extension Approach' (PEA) were defined as social mobilisation, action planning, experimentation/implementation, sharing experiences and self-evaluation. Each of these broad phases of the process contain concrete process steps (Fig. 1).

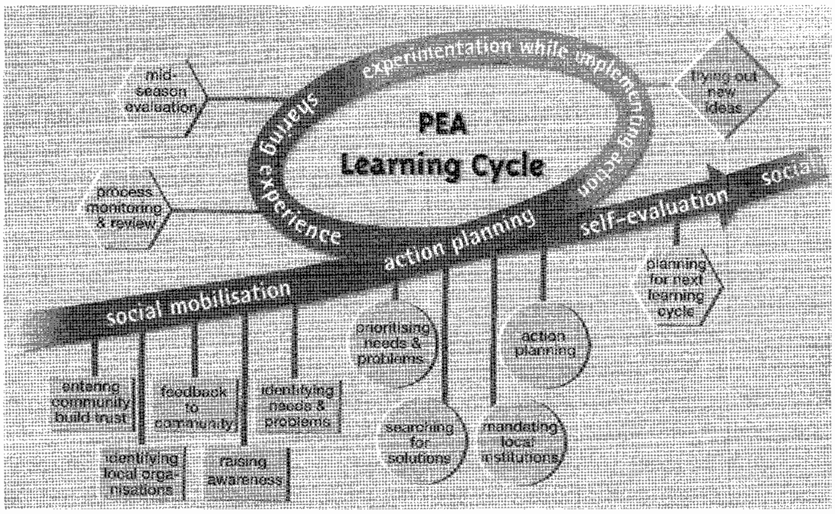

Fig. 1. The cycle of action and reflection in participatory extension approach (PEA; Hagmann et al., 1999).

For farmer learning in NRM the major steps are 'awareness raising' (environmental issues might reveal to be important), 'problem/needs analysis', 'searching for solutions' (exposure visits to other innovators might be undertaken) and the 'experimentation phase' when farmers explored their environment through trying out ideas and technologies and analysed their performance. The self-evaluation was the most critical step to close the 'learning loop' and re-plan on a more informed basis. 'Land literacy' and the related learning tools are built into this learning frame. This is key to success as the diffuse implementation of different tools without a clear and consistent process owned by the people themselves can hardly ever lead to sustained changes and improvement. Facilitation then plays a key role.

3.2. Process facilitation

Experiential learning processes need to be facilitated and managed well. Good facilitation skills are more important than any particular participatory tool or learning aid. However, due to the multi-facetted nature of facilitation, it was the biggest challenge to build the development agents' capability in facilitation. In our case, the process was facilitated by the researchers in the piloting phase. Later extension agents and farmers were trained in facilitation. Ultimately facilitation skills should be developed within the rural communities (Groot and Marleveld, 2000).

Facilitation is about asking the 'right' questions at the 'right' time in order to enhance peoples' critical self-reflection, discovery and self-awareness without preempting the responses. Facilitators lead the process but not the outcome and direction. The major difficulty is the 'steering' of the facilitation process which means to recognise and empathise situations, moods, group dynamics etc. and react with the right question and pattern to it. This requires a number of capabilities:

1. *The facilitator requires a clear orientation, vision and values as a 'lighthouse' to where the process should lead to.* The orientation is mostly value-based. For example, participation, ownership, inclusiveness, peoples self-development, self-reliance, openness, transparency and accountability are some of the driving values and criteria of learning processes. It is the deep vision of development based on those values which serves as a reference base to handle situations in facilitation flexibly and to be able to come up with the 'right' questions leading to advance the joint learning. So, in a certain way, the facilitator needs to be a step ahead and leading the process, but in a non-instrumental way. Often, this orientation can be enhanced through exposure to successful cases which provide a real and concrete example of such a vision.
2. *Another important steering element is empathy and the 'culture of inquiry'.* The facilitator requires the ability to 'feel' how the group members feel and think so that he/she can react appropriately in terms of group dynamics and connecting to peoples mind frames and maps and patterns. Empathy goes beyond knowledge about group dynamics as it is a personality dependent skill. This is linked to the 'culture of inquiry' which is required to question apparently simple things, concepts and patterns and to get down to the details. Often the real problems are the divergent perspectives and understandings which are hidden. They need to be 'unpacked', disclosed and negotiated towards a common understanding before a solution can be developed.
3. *A clear understanding of the process design and steps has shown to be a core element in facilitation.* Unless the process design was defined in a tangible way, the facilitators had major problems to guide the process in our case. In the frame of conceptualising the process (Fig. 1) an 'operational framework' defining objectives, key questions and issues, the core methodologies and partners for each major process step was developed. Only after a thorough training in those process steps were the facilitators able to conceive the process and to implement confidently and flexibly the different steps. It also helped to buffer the frustrations of the normal ups and downs of such a learning process as it provided a perspective.

These are just a few core capabilities and conditions required for facilitation of any learning process. The specifics in facilitating learning in NRM are mainly related to the knowledge about ecological principles and practices, where the learning tools play a crucial role (see below).

3.3. Farmer experimentation as a catalyser for learning

The third core element, farmer experimentation, has been central to the learning process in NRM. Although the programme started with 'adaptive trials', it revealed soon that experimentation is much more than testing a certain technology. It

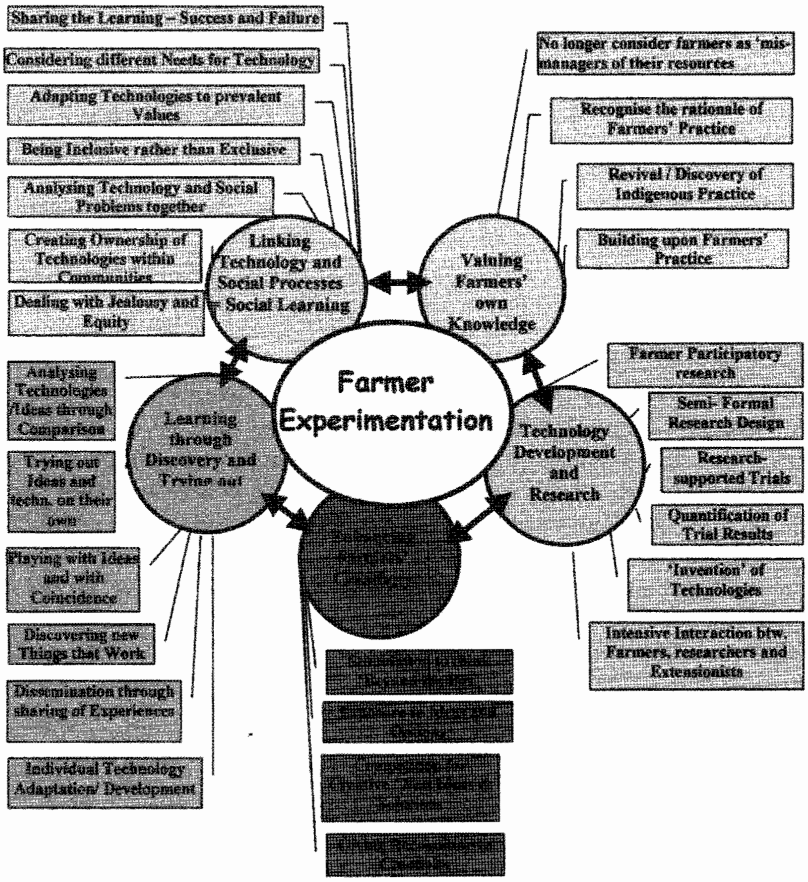

Fig. 2. Key elements of farmer experimentation within an innovation process.

positively affected a number of other important areas which were not primarily intended, but which turned out to be determining factors for success or failure. Five key elements and /or areas of impact of farmer experimentation were experienced (Fig. 2):

1. *a methodology for discovery and experiential learning*. It creates curiosity and a spirit of trying and discovering.
2. *as a way to value farmers own knowledge*. It improves the understanding of biophysical processes by farmers (land literacy), it reveals the interrelation between farmers knowledge and the scientific knowledge and so contributes to a better mutual understanding and raises the status of farmers knowledge which in turn raises the confidence in one's own solutions.
3. *a way to enhance farmers creativity*. The curiosity and the confidence which is created normally triggers creativity in finding solutions. People engage in solution finding while no longer waiting for the solutions from outside.

4. *as a methodology which in itself is able to link technical and social processes and to generate social learning*. A collective experimentation process automatically brings up technical and social issues. Any technology will be related to the social conditions if farmers are trying them out and share their experiences with others.
5. *as a methodology to research and develop technology*. It helps researchers and farmers to work effectively together and develop hard technologies. In this part, research normally has its major role to play.

The term 'farmer experimentation' does not just relate to farmers and farming technologies in the narrow sense. it relates to rural people and their problems and is geared towards problem solving rather than the technologies per se.

The diagram shows the complexity of farmer experimentation. Conventionally, farmer experimentation is mainly understood as a tool in research and technology development, while the other elements and impacts are not recognised. It was always rather difficult to communicate the other dimensions to people who had not experienced this way of working before. Exposure visits to these experimenting farmers were most effective to demonstrate that in terms of land literacy and NRM in general, farmer experimentation is the core methodology in enhancing farmers understanding of their resource system. Learning tools as described below helped to trigger experimentation, understanding and to operationalise the concept of experiential learning and farmer experimentation.

4. The tools for learning

Learning tools or aids were central in facilitating and operationalising farmer learning and experimentation in NRM. A variety of tools and methods to stimulate the process of group exploration, discovery were developed and utilised in Zimbabwe. They consist of three main sets:

1. tools for learning about visions and values;
2. tools for learning to understand key natural and social processes; and
3. tools to enhance the experimentation process through exposure to options.

This paper is limited to tools related to land literacy and does not specify other participatory tools which were used.

4.1. Tools for mobilisation and learning about visions and values

The insight that peoples vision and values are central as unifying points in the social mobilisation phase revealed already in 1992. Later we found that the value base is one of the most powerful success factors in NRM. Once we were able to facilitate debates on values (see above 'facilitation') which often triggered new social norms (e.g. 'everybody is responsible that no water leaves their fields', 'we are all part of the school of trying', 'nobody knows everything, everybody knows something', etc.), peoples motivation to commit themselves enthusiastically in NRM activities increased substantially, more than through economic incentives (e.g. 10% more yield etc.).

In community workshops we initiated this learning process by stimulating debates on the past and on people's visions of development. With questions such as "If you came back as a spirit in 100 years time, what would you like to see in your village?" people were stimulated to think about non material values. The subsequent discussions often reflected farmer's concern for environmental issues. These debates were guided towards retrospection (for example, mapping) and to exploring the reasons for environmental and social change and also scenarios for the future. Raising awareness through debate, codes, symbols (many of them emanated from 'Training for Transformation'; Hope and Timmel, 1984) and the joint analysis of change combined with social learning activates negotiations on values and social norms and creates interest in working towards the visions formulated in the group.

4.2. Tools for learning to understand key bio-physical processes

The key in adaptive management is to understand better the processes underlying visible symptoms in NRM. We faced real problems to help farmers understand these bio-physical processes in both, the awareness raising step and in the experimentation phase. For example, initially we communicated soil loss figures (t/ha) which farmers never understood. The increasing understanding of farmers' way of thinking through intensive dialogue allowed us to get honest feedback from farmers which made us more creative. Many learning tools were developed out of a 'hard' science focus. For example, rainfall simulator experiments and aggregate stability measurements were carried out on the research station which triggered the idea of using the same principles in a much simpler way for communication. Simple trays and a watering to demonstrate the effects of different soil management practices to farmers were highly effective as were the simple soil profiles (see later). After feedback of farmers to the first models they were further improved to better simulate farmers' conditions and to match the language in facilitation. They were not scientific, but brought out the principles. Farmers modified and further developed some of those tools, e.g. through little fields on the ground, to show the effect of runoff instead of metal trays. Most of the tools are a form of experiential science, translated vividly into popular and visible language (Fig. 3).

4.2.1. Comparing soils

Two simulated soil profiles contained in glass boxes with an outlet at the bottom are compared. One profile is eroded and as a result has a shallow topsoil. The other profile mimics well managed, non- eroded soil. An equal amount of water is poured into the two soil columns. The shallow, eroded soil has a lower water retention capacity and half of the water immediately flows away. The non eroded profile is able to hold water. Having observed this simple experiment, the farmers learning process is facilitated by such questions as "What happened?", "Why did it happen?",

Fig. 3. Learning through models which mimic bio-physical processes.

"What effect has this on plants growing on these soils?", "Have you seen this happen in your fields?", "What is the effect in your field and has this changed over the last few decades?". In this way farmers discover and analyse bio-physical principles and relate them to their situation. The analysis reveals the link between the (man-made) drought and soil erosion.

4.2.2. *The rainfall simulator*

Three fields—one ploughed, one ridged and one mulched—are compared during a 'rainstorm' induced by a watering can. In reality these fields are boxes (based on Elwell, 1986), measuring $0.3 \times 0.5 \times 0.1$ m with an outlet in the bottom and a chute in the top. Runoff, soil loss and groundwater outflow are collected in glass beakers from the three "fields". High runoff and soil loss occurs on the ploughed field, whereas on the mulched and ridged fields runoff and soil losses were low and groundwater outflow was high. Questions similar to those mentioned above were asked to encourage farmers to analyse these observations and relate them to their own environment and practices (Fig. 4).

4.2.3. *Organic matter scale*

A simple scale with two trays is filled with soil poor in organic matter on one side and with high organic matter on the other side to the same weight. Then both are soaked into water and after pulling out the one rich in organic matter is heavier. This reveals the link between organic matter management and drought (water holding capacity).

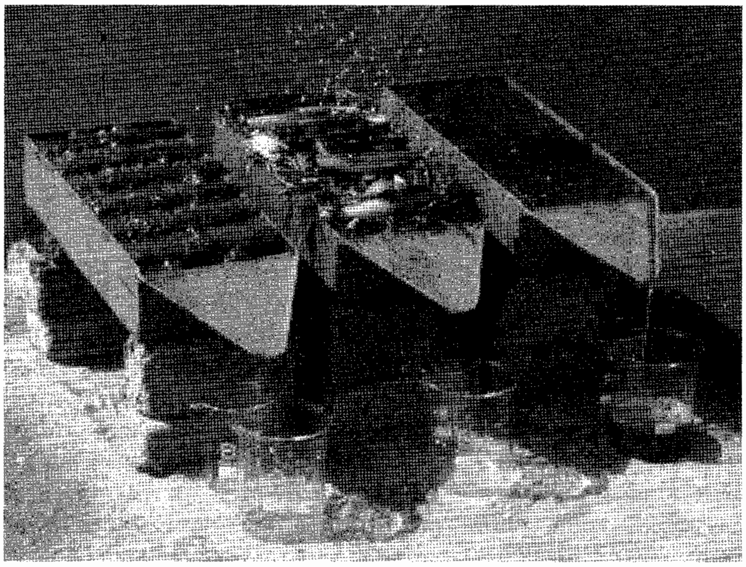

Fig. 4. Rainfall simulation trays.

4.2.4. Aggregate stability

Aggregates of a soil rich in organic matter and aggregates of poor soil are put in two different glass beakers filled with water. After a few minutes, the aggregates of the poor soil have dissolved in the water and fine particles remain, whereas the good soil aggregates remain stable (can also be put on an overhead projector). This demonstration reveals the value of organic matter in soil conservation. Again the same questions as above need to be facilitated to make farmers discover the symptoms in their fields related to this phenomena (method based on Elwell, 1986).

4.2.5. Metaphors and codes

In the discussions the use of an imaginative language derived from the farmers' life world is encouraged. For example, a farmer compared the dynamics of water in the soil to the workings of blood in the body; a gully becomes a wound which allows blood to drain away. This is related to the drying up of wetlands through gullies. Such metaphors together with songs, stories, proverbs and dances are used to relate environmental processes to the farmers' everyday reality. Pictures of degraded landscape, for example, with people struggling to get firewood or games such as the nuts game which simulate the use of common resources are also important. Role play depicting situations in play form help rural people to analyse their own situation from a distance. These codes provide an entry for a debate on farmers' perceptions. The type of facilitation that takes place, however, is extremely important. First, questions on the situation depicted in the picture/game/role play are asked and these are then developed into questions that create links with the 'real life' situation. Farmers then discuss the various answers generated by the group. The facilitator's function is to question and challenge farmers views, summarise the discussions and guide the process in a participatory way without providing any answers ('teaching through questions and problem posing').

4.3. Tools to enhance the experimentation process

The experimentation process was difficult to trigger initially. Farmers were discouraged to experiment actively by extension geared towards adoption of blueprint package solution for too long. However, experimentation was the backbone to move farmers from a focus on technological standards to understanding of bio-physical NRM processes through observation and experiential learning. So, a set of tools to motivate and inspire farmers was required.

The general shift from soil erosion research on-station to a 'think tank of technical options' as we called the research station later, as well as the drastic shift of on-farm research from 'hard' research-oriented trials to the 'soft' facilitation of negotiation on innovation showed our own transformation in thinking. Even the research design on-farm (paired design) changed from a 'hard' statistical method to a 'soft' farmer learning tool through comparison.

4.3.1. Simple experimental designs for comparison

Conventional practice and new ideas are compared by placing them side by side in one field. The possibility of making comparisons in this way allows farmers to continually monitor and analyse what they see. This leads to an understanding of the processes and factors that influence the performance of technologies (learning by experimenting).

With regard to collection of quantitative data in the research process, it was possible by means of frequent interaction and observations to merge the participatory innovation process with quantitative research. The quality of the data improved with the building up of farmers experimental capacities. Variability in soil and fertility was so high, that reasonable results were obtainable only when closely spaced paired checkplots were utilised. Provided farmers had fully understood the basics of small scale experimentation and provided enough observation during critical times (e.g. planting, harvest) is guaranteed by researchers, checkplots cater for data quality satisfying scientific standards. Data quality in farmer managed/implemented trials without frequent contact with farmers proved to be highly questionable. The same applied to farmers' records, which were only of good quality (for researchers) if the researcher showed strong interest and requests them on a weekly basis.

4.3.2. 'Think tanks' of option

Think tanks where numerous technical options are shown in the field are used to expose representatives selected by communities to the technical options open in land husbandry. In our case the source of these innovations are creative farmers, training centres and research stations. Visits to 'think tanks' have become so popular that farmers, on their own initiative hire and pay for buses to visit these locations themselves. Feedback to the community after such excursions is an extremely important step in encouraging other community members to experiment with new ideas. Visits by farmers have also had the effect of introducing changes at research-station level. Farmers' feedback has encouraged researchers to test and demonstrate farmer-generated technologies on station. Later we tried to develop such think tanks in a more decentralised form as 'village or area experiment stations' in places along roads etc. so that more people could access them easily.

4.3.3. Competitions for the best ideas

Farmers own way of experimentation was further encouraged in a "competition for the best ideas" and used as technology and idea pool to be screened every season. The experimentation process was titled as "kuturaya" (meaning: let's try). About half of the innovative ideas were adaptations and modifications to externally introduced ideas and options. The other half originated from farmers. In several cases ideas from outside were brought in, farmers modified the techniques and then the innovation was jointly further developed to a stage where it could be promoted. In other cases, researchers were inspired by farmers' practices and ideas and then further developed the innovation together with farmers. Farmers' trials/experiments were jointly evaluated by the farmer groups, researchers and extensionists during the growing season in a qualitative manner and quantitatively in feedback/planning meetings after the results had been analysed. As many farmer-initiated trials and ideas showed high potential but did not allow a quantitative comparison, they were jointly screened for either further testing and development using the simple paired design, for further testing on the research station or for promotion if the idea was extremely successful and clear. Such competitions help revive farmers' own knowledge and generates a willingness to try out new things. In many communities trying out has become a new, positive social norm and the fear of failure in an experiment has been minimised. This spirit has replaced the tendency to wait for outsiders' solutions and has re-valued farmers' knowledge. To avoid innovators being victimised by fellow villages, a two-way competition has been introduced: individuals in a community compete, but different communities compete against each other. In this way innovators are accorded more respect by their community, whilst it is also in their interest, if they are to win, that as many 'ordinary' farmers copy their ideas as possible. Criteria for judging the competitions are set by farmers in co operation with extension workers.

4.3.4. Sharing know how and experiences

The experience gained during field days, farmer evaluations, exposure visits and workshops, for example, are extremely important tools in facilitating group/social learning. They also ensure that most community members have equal access to knowledge. The presentation of a farmer's own experiments and experiences to others can strengthen his or her confidence and pride.

All these tools were used in different stages and some of them were used again after a year to facilitate the review of the learning process. Despite our transformation towards 'soft' issues, we kept on carrying out both, 'hard' and 'soft' quantitative and qualitative experiments until the end of the project. We used the hard science and in contrast farmers perspective together to deeply explain bio-physical processes and to convince people who do not believe in 'soft issues'. For example, we once carried out a scientific study on soil erosion in a catchment which proved that standardised soil protection measures were not effective and that adaptive management approaches are required (Hagmann, 1996).

5. Impact

The impact of the learning tools on farmers adaptive capacity can not be clearly separated from the impact of the whole PEA process which was measured through our evaluations, farmer self-assessments, and qualitative assessments of outsiders and extension staff. General impacts of the process were high. More than 20 technologies had been developed and spread fast among farmers (for details see Hagmann et al., 1997). Certain aspects however, could be related to the different set of learning tools. The mobilisation tools had the strongest impact in community development aspects and for collective management of natural resources. They helped to motivate farmers through bringing up touchy issues, to discuss leadership and organisational development and many codes and symbols became reference points in discussions and conflicts. So, in terms of creating a conducive environment for innovation they were the foundation for learning.

The tools to learn about bio-physical processes made a major impact in the deepening of the analysis and understanding of the environment by farmers which was particularly observed by extension staff and also evaluated by farmers themselves as a major difference. The facilitation was geared towards relating these simplified 'models' to their real life experience and so became a reference point among farmers. For example, when talking about soil erosion in their fields during 'mid-season evaluations', farmers often referred back to the model situation as a way to explain what happened in their own field. During rainstorms farmers went out in their fields to observe whether the similar processes happen in their field. They observed where the water was flowing and identified the points where they needed to put check dams or close rills. This curiosity was mainly triggered by the learning tools which provided a technical and analytical understanding but also a peer pressure to conserve the resources. This pressure resulted in a kind of new 'social norms' in resource management. The knowledge gained by farmers showed in the discussions and in the creativity with regard to new ideas which emanated from the combination of interactions and processes.

The tools to enhance experimentation were reinforced by the mobilisation tools which had a strong role in creating social norms and tapping values. The proverbs etc. consolidated the learning. For example, the 'norm' that 'no drop of water should leave your field' or the 'spirit of experimentation' which also became a kind of social norm oriented farmers and created an atmosphere of trying out as many techniques as possible to reach these norms. Competitions for 'the best ideas' were another incentive to motivate the experiential learning process as from 1994. This triggered community-wide experimentation processes (many farmers had more than 10 self-initiated trials and hardly anybody in the community had less than three trials). The experiments per farmer but also the experimenting farmers per community increased manyfold. The total spread of certain technologies reached up to 80% of the households in some communities. Resource management as a whole improved substantially. Farmers evaluated that springs re-emerged due to water conservation upstream, rills closed up due to conservation measures and productivity rose due to better and timely management as well as effective technologies. Farm households of different levels were closely monitored as from 1991. By 1995 a major improvement in productivity in the farms which were poorest in 1991 was assessed. They had reached almost the level of the best farmers of 1991. The best of 1991 could not improve their productivity very much, but improved their risk management through diversity and through better water management. Their major motivation became social prestige as they became natural leaders and promoters of experimentation.

What is special in our case, is the fact that we have continued to use both, soft and hard approaches across the 10 years. The hard data approach is still being used to convince other levels of staff (e.g. the researchers and the hard believers' of the validity of some technologies etc. and had its own impact. Sometimes it has also helped a lot to explain a bit deeper the underlying bio-physical processes and so was very beneficial to the learning process itself.

6. Scaling-up of the learning process

As for scaling up, we started with small groups of experimenting farmers with whom we developed most of these tools. Then the process was scaled up to whole communities where the tools were applied successfully. Since 1996, training extension agents who implement the PEA approach without external resources has been part of the institutionalisation of PEA within the extension department (Moyo and Hagmann, 2000).

With regard to scaling up from farmer experimentor groups to communities, the focus on farmers understanding their resource system and experimenting with technical options remained the same. The major difference is that we no longer can clearly distinguish between research and extension processes. Our emphasis was clearly in scaling up the farmer learning and understanding rather than technologies. This is the key of our efforts as only through this process farmers at large scale will be able to practice effective adaptive management which is the foundation to use their resources effectively in a semi-arid complex, diverse and risk prone area. Technological options are crucial, but without a broad learning and experimentation process one ends up in the same dilemma than conventional extension efforts.

The scaling up within the extension organisation has been and still is a highly challenging and complex process (Hagmann et al., 1998). It involves the development of competencies to facilitate and manage learning processes. Most of the learning tools are being used by extension workers who are exposed to them during the iterative, on-site–off-site training in PEA. However, it has been difficult to maintain both equally, the technical focus and the focus on social and facilitation skills. Initially more training and support in process facilitation is required as this is the new discipline technically oriented extension agents struggle with. Later, the technical focus has gained again.

Until now, more then 400 extension agents in Zimbabwe have been exposed and trained in facilitation of PEA through a large-scale competence development programme. The approach has created a lot of interest in the neighbouring countries. For example, in South Africa it has also been adapted since 1998 and now has been accepted as the major extension approach in the Northern Province. Other Provinces are already keen to develop their own competence in PEA.

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