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Participatory Action Research and Integrated Soil Fertility Management

1. PARTICIPATORY ACTION RESEARCH AND INTEGRATED SOIL FERTILITY MANAGEMENT

This document is one of a series of factsheets that aim to share practical experience of how Participatory Action Research (PAR) can be used to trigger technological, social and institutional innovation in Africa to enhance smallholders' adaptive capacity in the face of climate change and increased climate variability. The uniqueness of this approach is the integration of the "what" (the technologies) with the "how" (PAR) and the "why" (increased capacity of smallholders to cope with climate change).

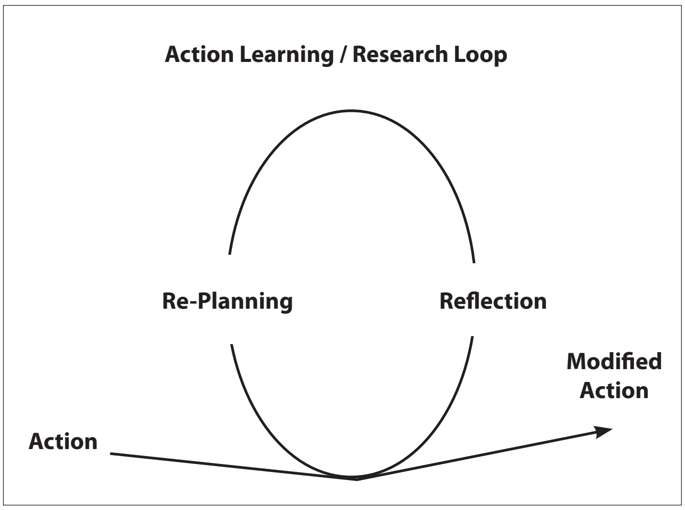
In Africa, widespread poverty, fragile ecosystems, weak institutions, and other issues compound the effects of climate change. For millions of people, food and water security, livelihoods, shelter and health are all at risk. There is a clear need to better understand the determinants of vulnerability, the adaptive capacity needed to cope with new challenges, and the learning process these imply – recognizing also the need to address considerable uncertainty and accommodate nonlinear processes.

Increasingly, Participatory Action Research is seen to offer significant advantages over the conventional research model whereby research products are passively transferred to smallholders via extension workers. The PAR approach enables smallholders, extension agents, researchers, the private sector, policy makers and other stakeholders to jointly identify problems and then select, test and refine options. This greatly increases the likelihood of reaching appropriate and sustainable solutions.

The factsheets draw upon practical experience and lessons learnt from 26 projects undertaken between 2007 and 2011 in 17 countries. These projects were supported by the Climate Change Adaptation in Africa (CCAA) research and capacity development program.

CCAA is a joint program of the International Development Research Centre (IDRC), Canada, and the Department for International Development (DFID), UK. It aimed to improve the capacity of African countries to adapt to climate change in ways that benefit the most vulnerable. Building on existing initiatives and past experience, the CCAA program worked to establish a self-sustained and skilled body of expertise in Africa.

This factsheet aims to share the CCAA projects' experience of and lessons from PAR that focused on Integrated Soil Fertility Management with a wider audience. This includes rural development practitioners, non-governmental organizations, civil society organizations, farmers' organizations and extension services. The purpose is also to inform policy- and decision makers, donors and researchers. Another factsheet in this series covers Seasonal Climate Forecasting.



What is Participatory Action Research?

Within the CCAA program, PAR has been defined as a process of social learning and change carried out by local development actors themselves (including villagers, extensionists, local leaders and policy makers, private sector and researchers), which is operationalized through an iterative process of planning, action, reflection and re-planning (see diagram).

PAR relies heavily on skilled facilitation to enable a process that involves:

Getting started: team building, partnership, mobilization

Understanding the starting points and aims: participatory action planning, action research planning

Managing change: supporting the implementation of planned actions, monitoring, evaluation and adjustment

Including empirical research inputs: deeper analysis of the system, impact assessment

PAR does not operate in isolation. It builds on results of empirical research (e.g. technology development; characterizing past, present and future situations) and complements researcher-led action research, which helps to develop and share broader lessons. These can be from local impact assessments and between site comparisons and process documentation, and facilitate scaling up and mainstreaming results into policies.

This fact sheet draws on examples of how PAR was used to facilitate adoption of Integrated Soil Fertility Management (ISFM) to solve problems that undermined the capacity of communities to adapt to climate change and variability, especially in the CCAA-funded projects in Ghana, Tanzania and Zimbabwe.

THE PROBLEM: Low and declining soil fertility is exacerbated by climate change and compounded by low awareness of the linkages between soil fertility and efficient water usage by crops.

Low and declining soil fertility is a major cause of hunger and food insecurity in Africa's predominantly smallholder and rainfed agricultural sector. There are emerging negative impacts of climate change and variability, such as trends towards reduced rainfall that is less reliable and predictable and with greater spatial and temporal variability, more frequent extreme weather events, especially drought, but also flooding. These trends exacerbate the already precarious situation of Africa's smallholders and its agricultural sector. A major challenge is the lack of awareness among affected communities of the links between soil fertility and the diverse livelihood problems that they are facing as they struggle to adapt to climate change. Yet it has long been recognized by many experts that poor soil fertility is the overriding constraint to the efficient use of available water by crops.

For the three projects on which this factsheet is based, the linkages between soil fertility and climate change adaptation proved to be less obvious to farmers than were other factors, such as the linkages between water management or crop/variety choice and climate change. And it was not just farmers who had difficulty seeing this linkage; extension agencies and local leaders also often needed to be convinced that soil fertility and climate change adaption were linked.

In Zimbabwe, for example, communities simply did not believe that high maize yields could be attained on sandy soils, which were well known to be some of the country's worst. Nor was the role of phosphorus fertilization and soil organic carbon management in increasing crop yields and enhancing water use efficiency generally apparent to farmers and several other stakeholders.

THE SOLUTION: Enable farmers, extension agents and local leaders to see for themselves the beneficial impacts of Integrated Soil Fertility Management measures through facilitation of participatory on-farm adaptive experiments.

A common objective in all communities was to achieve high crop yields in favourable seasons and to intensify productivity. Integrated Soil Fertility Management (ISFM) was therefore used as a key entry point.

Integrated Soil Fertility Management is the combination of a proven set of concepts, principles and practices that lead to the efficient use of available organic and inorganic resources to maintain or improve soil fertility, thus leading to sustainable crop production for household food and income security, as well as enhanced livelihoods.

Examples of ISFM measures used in these projects included:

- **Intercropping and rotations systems** that integrate legumes with staple food crops, such as maize and groundnuts, soybean, cowpea or pigeonpea, to enhance soil fertility by biological fixation of atmospheric nitrogen.
- **Mineral fertilizers used in combination with locally available organic nutrient resources**, such as livestock manures, compost, crop residues and woodland litter. Phosphorus (P) fertilization was a critical component of these combinations as most organic resources were derived from low-P soil environments.
- ***Zaï,*** a series of planting pits (diameter 20–40 cm; depth 10–20 cm) dug during the dry season, with 12,000 to 25,000 per hectare (up to 5 pits per 2 square metres). Excavated earth is ridged around the pit to further improve its water retention capacity. Composted organic matter is added to the pits (0.6 kg per pit); after the first rainfall this is covered with a thin layer of soil and the seeds are sown in the middle of the pit. Zaï s benefits include: capturing rain and surface/run-off water; preventing seeds and organic matter from being washed away; concentrating nutrients and water availability at the beginning of the rainy season; increasing yields; and reactivating biological activities in the soil, eventually leading to an improvement in soil structure.

THE STEPS TAKEN: The approach used in these CCAA projects involved mobilization, diagnosis, conceptualization of change, participatory action planning, planning of research actions, implementation and participatory monitoring and evaluation. For the final step, impact evaluation, the project timeframe proved too short.

1. **Mobilization:** *securing the active participation of stakeholders*

Based on outcomes of stakeholder consultations, literature reviews and past experiences of the research teams, they identified climate change-induced agricultural constraints affecting the livelihoods of farmers in the study areas. The research team convened meetings to which major stakeholders involved with communities on agricultural and livelihood issues were invited. Among them were private seed and fertilizer companies, agro-input suppliers/traders, national extension agencies, farmers' organizations, and policy makers at local, regional and national levels. With facilitation from the core research team, the meetings evolved into platforms to develop partnerships around a common "vision of change" towards enhanced climate change adaptation.

2. **Diagnosis:** *identifying the problem*

The resultant partnership of stakeholders enabled discussions with beneficiary communities to deepen their understanding of major climate- and soil-related problems and challenges that constrained their livelihoods. The initial discussions culminated in a formal survey by the research team to establish a baseline. Extension agencies were excluded from administering the questionnaire surveys to eliminate bias, but were involved in participatory characterization of the farming systems to identify trends and patterns in soil and crop productivity that related to emerging climatic factors.

After a common understanding of the underlying causes for the identified livelihood problems had been established, stakeholders discussed and reviewed these problems in relation to soil fertility as well as to climate change and variability. In almost all cases, the linkages between soil fertility and climate change adaptation were less obvious to farmers than were other factors; extension agencies and local leaders also often needed to be convinced of such linkages. It therefore became necessary to establish participatory diagnostic on-farm experiments and draw on the scientific expertise of the research teams to perform the necessary laboratory-based soil tests. Strong involvement of communities in the design, establishment and monitoring of the experiments brought about the much-needed understanding of limiting soil and crop management factors. Discussions were then held with partners and communities to share the diagnostic results and potential solutions.

Some specific local problems identified during the diagnostic phase included:

Breakdown of Zunde raMambo, a local safety net that has traditionally protected vulnerable groups under local chieftainships in Zimbabwe. Communities in eastern Zimbabwe clearly recognized the loss of Zunde raMambo and the lack of community cohesion as factors increasing the vulnerability of their members to increasing incidences of adverse climatic conditions (particularly poor rainfall distribution and droughts), but could not readily link these factors to poor soil fertility. Under the traditional Zunde raMambo, a chief would set aside a large field for production of staple grain to build a strategic grain reserve from which vulnerable groups, including widows, orphans, the sick, the elderly and those affected by unforeseen disasters, would be assisted. Traditionally the community worked collectively on the Zunde raMambo field, but interest in this traditional safety net was waning due to poor grain yields and failure to meet the community goal.

Conflict between native and migrant farmers in Wenchi District in the Brong Ahafo Region of Ghana: Here, migrant farmers can access land only through arrangements such as sharecropping and renting, in which payment is made in the form of a share of the maize harvest. With low crop yields arising from declining soil fertility due to continuous cropping under poor management, exacerbated by climate change and increasing climate variability, migrant farmers struggle to pay the rent, especially when there is crop failure. This can lead to conflict between landowners and migrant tenant farmers. Farmers had, however, not realized that the low productivity and their inability to meet their contractual obligation were largely due to poor and declining soil fertility.

3. **Conceptualization of change :** *envisioning the future*

In the different project locations, local leaders, local government authorities, or government extension officers mobilized communities to discuss with researchers and private agro-companies possible solutions to the problems and any knowledge gaps identified during the diagnosis process. Techniques for identifying the desired changes included focus group discussions and also role-play by community members.

For example, communities in eastern Zimbabwe wanted to achieve high yields during favourable cropping seasons that could offset shortages experienced during poor seasons. Achieving high crop yields would also increase the viability of Zunde raMambo.

In Ghana, local leaders saw a need to minimize conflicts between the native and migrant farmers.

In both cases, farmers wanted to be able to organize themselves for timely and ready access to organic and mineral nutrient sources, seed for short-season crop varieties, and stress-tolerant crops.

Various options for improving soil fertility were proposed, some of which were prioritized for evaluation with the communities. Most favoured was rotation of maize with grain legumes (groundnut, soybean, cowpea, pigeonpea) coupled with strategic application of mineral fertilizers.

The main indicators of change were explored and agreed upon. New potential players that would be needed to achieve the desired change were also identified.

4. Participatory action planning : *who will do what?*

The participation of district and regional authorities, community leaders and communities at action planning meetings emerged as a critical factor for sustaining the agreed interventions for change.

In Zimbabwe, farmers required maize seed for varieties with different maturation characteristics to spread risk, and also phosphorus-rich fertilizers to improve performance of legume–cereal rotations. This in turn stimulated the interest of private companies producing seed and fertilizer; during the earlier phases they had participated only as observers on the learning platforms. At the same time, the local chief realized this was an emerging opportunity for community members to rally behind his leadership and to act collectively to protect vulnerable community members (scoring a political success in the process).

In Ghana, the participatory action planning meetings provided a forum for both migrant farmers and native landlords to articulate their concerns and agree on ways to settle conflict with the support of extension agents and local authorities.

In all cases, the partners and communities together identified and prioritized the key action points, discussed roles and responsibilities, and agreed on milestones and timeframes. Farmers organized themselves into groups to address specific action points that had been identified during the conceptualization of change stage. Implementation committees were formed at the village level in both Ghana and Zimbabwe, and also at the district level in the latter. These committees worked with contact persons that had been identified from each of the participating institutions, or nominated coordinators for each of the major action points.

In Zimbabwe and Ghana the "Learning Centre" approach was adopted (see box).

The farmers selected the soil fertility management options that they wanted to evaluate. A major outcome of the participatory action planning meetings was the agreement on how progress would be assessed and on a monitoring and evaluation plan.

Learning Centres are strategically located farmers' plots where the PAR comparative trials of technologies took place. The concept was developed in recognition of two key factors. First of these was the acknowledgement that the flow of knowledge on ISFM, crop diversity, natural resource management, and climate information was not unidirectional, and that it therefore demanded formation of platforms for information and knowledge exchange, co-learning on emerging experiences, and joint testing and evaluation of promising technologies and practices. Secondly, farmers would be better able to adapt to climate change and variability if they had access to agricultural technologies and practices that "best fit" their socio-economic and biophysical environments/ circumstances.

Learning Centres were identified as a suitable platform for identifying, exchanging and joint testing of both new and old technologies rendered necessary by emerging climatic scenarios and soil fertility challenges. The Centres are hosted in the fields of farmers well known for their local leadership roles; other important factors are accessibility, representation of particular social groups and vulnerability status.

In the CCAA project sites, farmers initially established the Learning Centres, with facilitation from researchers and participation of national extension services. In the second season, following training of extension agents and farmers on the principles and concepts of ISFM and climate change adaptation, Communities formed committees, a process facilitated by local extension officers. The local committees then took over the championing of the Centres; researchers played a catalytic role and provided technical backstopping. Private seed and agro-chemical companies, which had participated only as observers during the diagnostic, envisioning and action planning phases of the PAR process, became more active during the main implementation phase by providing prioritized crop varieties, cultivars and fertilizers, and taking part in farmer training. The number of Learning Centres had increased 10-fold by the third season. Local leaders and higher level policy makers attended learning fora and also used Learning Centre gatherings to discuss community development and other issues.

A contribution by P Mapfumo

5. Planning of research activities: *designing comparative experiments in farmers' fields:*

Multi-disciplinary research teams undertook the action research planning. These comprised socio-economists, agronomists, soil scientists, agricultural and rural development specialists, and extensionists. They discussed and used knowledge and technical gaps in designing the empirical research. Team members agreed on responsibilities for data collection and how both the process and results would be documented. Communities also participated in the data collection. The team developed a monitoring and evaluation plan, identifying how and where communities would be involved.

6. Implementation and participatory monitoring-evaluation: *who did what and what happened?*

Learning Centres served to create awareness and to evaluate ISFM technologies, provided a platform for information and knowledge sharing, and enabled different social groups (including the socially disadvantaged) to be involved in participatory technology development. At the Centres, these groups were able to evaluate different rotations involving common grain legumes, cassava and maize, and their effects on the yield of the subsequent maize crop, with and without mineral nitrogen.

Productivity of different varieties of maize and cassava was evaluated according to different planting times and/or combinations of organic and mineral fertilizer sources. Research teams trained farmer group leaders, committee members and extension personnel in principles and concepts of ISFM and climate change adaptation, facilitation, data collection, and monitoring and evaluation. These trained teams became the champions of the implementation process, particularly during the second season.

Private companies complemented the PAR process by providing seed and fertilizers for the Learning Centres and training materials for communities. Research teams provided extension agents and communities with the necessary materials for data collection and record keeping. In Zimbabwe, private companies went from being mere observers at the outset to active participants during the second season of implementation by providing a market for legume grains and surplus maize produced by farmers.

With the facilitation of the district and regional platforms by the research team, the different farmers' groups and alliances together with extension workers jointly organized field days, tours and exchange visits around Learning Centres. Crop nutrient deficiencies and yield benefits from different ISFM technology options were jointly assessed and discussed among communities and partners.

In Zimbabwe, the district platform, coordinated by the district head of agricultural extension, organized and facilitated dialogue meetings among key stakeholders, including policy makers.

Overall, progress was reviewed at the end of every season with communities and partners and, as necessary, modifications were then made to implement plans or new milestones were set. Stakeholders shared among themselves the key results, lessons (both positive and negative) and achievements for each implementation cycle, and the research team documented these.

7. Impact evaluation: *objective assessments of change*

Stakeholders discussed and identified the main indicators of impact against the baseline information, but in these examples the project cycle was too short for a meaningful impact assessment to be performed.

WHAT HAPPENED? PAR enhanced understanding and created effective and diverse partnerships.

Based on these case studies, it was concluded that PAR enabled effective partnerships among community members, extension agents, policy makers and researchers. Soil fertility problems and the ISFM technologies that address them are both complex, but PAR enhanced the diverse stakeholders' understanding of the processes involved. It also ensured the participation and engagement of diverse social groups, through the Learning Centres, for example.

At a practical level, the evolving role of the private sector in Zimbabwe was interesting. Starting out as mere observers, the private sector actors became more engaged as opportunities arose, initially by providing inputs and later by providing markets for surplus legumes and cereals. It is difficult for private companies to reach large numbers of very small-scale and widely dispersed potential customers, often in remote areas with poor infrastructure. However, the increased capacity of farmers to mobilize and organize themselves — which reduced or removed many of these constraints — apparently attracted the participation of private companies.

WHAT WORKED WELL? Effective mobilization of stakeholders combined with effective facilitation enabled stakeholder meetings to evolve into "platforms" for identifying and solving problems.

Effective mobilization of diverse stakeholders, including private seed and fertilizer companies, agro-input suppliers/traders, national extension agencies, farmers' organizations, and policy makers at local, regional and national levels, as well as effective facilitation of the change process, led to deeper understanding of the problems and challenges, adoption of a common vision of change, and the identification and prioritization of adaptation options for evaluation with communities.

Effective facilitation of stakeholders by core research teams also enabled the stakeholders to develop "platforms" that further evolved with clear roles emerging. For example:

- Researchers used their convening power to bring stakeholders together, undertook formal surveys to establish baselines, provided expert knowledge and technical backstopping, and played a catalytic role.
- Extension agents led participatory characterization of farming systems to identify trends, and mobilized local leaders and local government authorities.
- The private sector provided input and output markets, and helped in farmer training.
- Local leaders recognized opportunities to mobilize communities to protect vulnerable groups, and also to advance their political ambitions.
- Communities and farmers formed implementation committees at the village level; farmers hosted Learning Centres in their fields, and farmers organized themselves to develop and improve their access to markets.

WHAT WERE THE CHALLENGES? Effective linkages to input and output markets and insecure land tenure were key limitations, and "success" brought its own challenges.

Some major challenges emerged during the implementation of PAR in the context of ISFM as an adaptation tool for smallholders confronted with climate change. The main challenges experienced in the projects in Ghana and Zimbabwe were:

- low availability of organic resources, especially for the most resource-constrained farmers
- how to provide timely access to seeds and mineral fertilizers in sufficient quantities
- in Zimbabwe, increased productivity and higher yields presented new challenges:
    - for individual farmers, this involved marketing the surplus to generate income
    - under Zunde raMambo, some of the high yields of maize were marketed to generate income, but the money earned was not always appropriately managed by the chief
- insecure land tenure systems; for example, in Ghana, once soil productivity improved, migrant farmers risked losing the land to their landlords, and increased productivity stimulated interest from local government authorities that considered taxing the farmers

So "success" brought its own problems: surplus crops needed effective and equitable marketing arrangements, and insecure land tenure meant that improving soil fertility was a double-edged sword. This highlights a missing step in the PAR process as implemented, namely anticipating and mitigating against risks and unintended consequences.

Although private companies became important players, it was observed that in these projects there was limited involvement of NGOs during implementation, apparently because of a mismatch in objectives and the approaches used.

KEY LESSONS: PAR was effective in a project setting, but institutionalizing the approach remains a challenge.

The major lesson from the CCAA-funded projects addressing Integrated Soil Fertility Management was that PAR can trigger institutional innovations that, in turn, can drive uptake of technical solutions as communities better understand their problems and potential solutions. In general, use of PAR brought about very different but positive outcomes at the various sites, which compared favourably to the "failures" often reported from alternative approaches in the past.

The major challenge was to sustain the level of engagement and support needed to facilitate a transformation of extension, local leaders and service providers towards institutionalization of the approach. There is scope for PAR to drive more lasting institutional processes towards changes desired by communities. The timeframes for PAR implementation, however, require critical attention during the planning phase.

This factsheet draws on experience gained through the implementation of the following CCAA projects:

- Lack of Resilience in African Smallholder Farming Systems project (Ghana, Mali, Mozambique, Tanzania, Uganda, Zambia, Zimbabwe)
- Strengthening Local Agricultural Innovation Systems in Tanzania and Malawi to Adapt to the Challenges and Opportunities Arising from Climate Change and Variability
- Managing Risk and Reducing Vulnerability and Enhancing Agricultural Productivity under a Changing Climate (Tanzania, Kenya, Ethiopia, Sudan)

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